[Paper]

Intellectual Functioning and Adaptive Behavior in Special Needs Students: Insights from Revised Suzuki-Binet Intelligence Scale and the Social Maturity Scale Third Edition

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Abstract

This study explores the relationship between intellectual functioning and adaptive behavior in students with intellectual disabilities at a special-needs school in Tokyo. Studies using the Revised Suzuki-Binet Intelligence Scale and the Social Maturity Scale-Third Edition found moderate to strong correlations between the Intelligence Quotient and Social Quotient and between both assessments' subscales. Significant differences emerged across educational divisions, with students in the elementary division displaying lower scores than those in the secondary and high school divisions. A substantial proportion of students demonstrated severe to moderate intellectual functioning and adaptive behavior limitations, underscoring the need for individualized support strategies. These findings highlight the importance of tailored educational interventions. Further research with a more extensive and diverse sample is recommended to validate and extend these results.

Keywords: Intellectual Disabilities, Intellectual Functioning, Adaptive Behavior, Educational Support

1. Introduction

1.1 Definition of Intellectual Disability

The American Association on Intellectual and Developmental Disabilities (AAIDD) defines intellectual disability in its 12th edition as being "characterized by significant limitations in both intellectual functioning and adaptive behavior, which are expressed in conceptual, social, and practical adaptive skills." Intellectual disability originates during the developmental period and is operationally defined as occurring before age 22. Nevertheless, the developmental period is typically understood as occurring before age 18. Additionally, the criteria for intellectual functioning and adaptive behavior limitations require standardized measures yielding scores approximately two standard deviations

below the mean (Schalock, Luckasson, & Tassé, 2021).

1.2 Basic Assumptions in Implementing the Definition

There are five basic assumptions guiding the implementation of this definition. One key principle emphasizes that "the essential purpose of describing limitations is to develop a profile of needed support." This principle underscores the significance of assessing each individual's intellectual functioning and adaptive behavior using standardized measures to devise effective intervention strategies and support systems tailored to their limitations. Another foundational assumption highlights that "with appropriate, individualized, and sustained support over an extended period, the life functioning of individuals with intellectual disabilities generally improves." This perspective shifts the focus from viewing intellectual disability as a fixed "impairment" to recognizing it as a "limitation" that can be mitigated through effective and responsive support customized to individual needs.

1.3 Theoretical Framework for Understanding Intellectual Limitations

Intellectual limitations are typically associated with difficulties in reasoning, learning, problem-solving, planning, and acquiring knowledge from experience. One influential theoretical model addressing these aspects is the Cattell-Horn-Carroll (CHC) theory of intelligence (Cattell, 1941; Cattell, 1963; Horn & Cattell, 1967). Carroll (1993) conducted a meta-analysis of CHC intelligence theory, proposing a hierarchical intelligence structure. In this model, intelligence is conceptualized as comprising three levels: the first level consists of over 70 narrow abilities; the second level includes eight broad cognitive abilities, although some researchers suggest 10 to 16 broad abilities; and the third and highest level represents general intelligence. In recent years, intelligence test batteries have increasingly aligned with the broad abilities at the second level of the CHC theory (Flanagan & Kaufman, 2009; McGrew, 2009).

1.4 Assessment and Support for Children with Intellectual Disabilities

To develop a comprehensive and multi-faceted understanding of a child's intellectual abilities in daily life and to design more effective and responsive support strategies, it is crucial to employ assessment tools focusing on specific cognitive aspects and categorizing cognitive abilities into broader domains. In Japan, intelligence tests such as the Japanese versions of the Wechsler Intelligence Scale for Children-Fifth Edition (WISC-V), Wechsler Adult Intelligence Scale-Fourth Edition (WAIS-IV), and Kaufman Assessment Battery for Children-Second Edition (KABC-II) are widely used to assess overall intellectual development in children, following the CHC theory.

However, the Revised Suzuki-Binet Intelligence Scale (SB-R; Furuichi Publishing, 2007) is considered a viable alternative for individuals with moderate to severe intellectual disabilities who may struggle with task execution or score computation. Additionally, the Social Maturity Scale-Third Edition (S-M Scale; Ueno, Nagoshi, & Asahide Gakuen Educational Research Institute, 2016) is widely utilized as an adaptive behavior assessment reflecting Japanese cultural and daily life contexts.

1.5 Importance of Support Profiles for Children with Intellectual Disabilities

As outlined in the basic assumptions of the AAIDD definition, creating a support profile is essential when assisting children with intellectual disabilities. This profile involves identifying their strengths and areas of significant limitation, which can inform two key educational and support approaches: (1) a strength-based approach that emphasizes and nurtures their areas of

competence and (2) an intervention-focused approach aimed at compensating for and improving areas of significant limitation through targeted training and support (Mizuta, 1978; Hashimoto, 2010). However, current standardized assessments vary in categorizing developmental domains, and some do not explicitly define specific domains. Consequently, conducting a detailed profile analysis of a child's intellectual characteristics and developmental areas can be challenging.

1.6 Purpose of This Study

This study aims to examine the functions assessed by the SB-R and to explore the relationship between intellectual functioning and adaptive behavior in children with intellectual disabilities. The study classifies test items based on the content and scope of the CHC theory to achieve this. It also investigates the relationship between intellectual functioning and adaptive behavior in students attending a special-needs Tokyo school, using the SB-R and the S-M Third Edition.

2. Research Methods

2.1 Participants

The study included 54 students (29 boys and 25 girls) and their parents. We selected students from three educational divisions at a special-needs school located in the suburbs of Tokyo: the elementary school division (n = 14), the secondary school division (n = 18), and the high school division (n = 22). All participants voluntarily agreed to participate in the study to gather norms for adaptive behaviors and intellectual abilities.

2.2 Procedure

Data were collected between December 2024 and January 2025 using two main methods: (1) administration of the SB-R (Komiya, Shiomi, Sueoka, & Okita, 2007) and several supplementary tasks to the 54 students, and (2) a parent survey using the S-M Scale Third Edition (S-M; Ueno, Nagoshi, & Asahide Gakuen Educational Research Institute, 2016). A graduate clinical psychology student from Tokyo Gakugei University administered the SB-R under the supervision of a professor. Each assessment session lasted approximately 20-30 minutes.

Before participation, the study protocol, including ethical considerations, was thoroughly explained to the participants, and informed consent was obtained. We assured the participants that their confidentiality would be protected and that their data would be used solely for anonymous statistical analysis. The Research Ethics Committee of the institution affiliated with the first author approved the study.

2.3 Measurements

2.3.1 Revised Suzuki-Binet Intelligence Scale-Revised (the SB-R)

The SB-R, revised in 2007, includes 72 tasks initially developed by Suzuki (1936). Participating students were instructed to complete the tasks as quickly as possible. Responses were recorded as "Pass" or "No Pass" and then converted into Mental Age (MA) and Intelligence Quotient (IQ) scores according to the SB-R manual. In addition to the SB-R, we administered several supplementary tasks to further assess the students' intellectual abilities. The goal was to develop intellectual ability profiles for each participant, categorized into four subscales: Knowledge-Language (KL), Perception-Operation (PO), Memory-Recollection (MR), and Concept-Mathematics (CM).

2.3.2 Social Maturity Scale Third Edition (the S-M)

The S-M Scale consists of 129 items that evaluate social maturity and adaptive behaviors in children aged 1-13 years. The scale includes six subscales: Self-Help (SH), Locomotion (L), Occupation (O), Communication (C), Socialization (S), and Self-Direction (SD). Parents of the participating students completed the survey via Google Forms, selecting items relevant to their children. Parents' responses were scored and then converted into Social Age (SA) and Social Quotient (SQ) scores according to the guidelines in the S-M Scale manual.

All statistical tests were conducted at a significance level of $p < .05$. Statistical analyses were performed using IBM SPSS Statistics software version 27.

3. Result

3.1 Demographic Data

After accounting for missing values, we included data from 52 special-needs school students and their parents in the analysis. The mean chronological age (CA) of the students was 9 years and 7 months (SD = 20.87) for the elementary school division, 14 years and 2 months (SD = 10.10) for the secondary school division, and 17 years and 3 months (SD = 10.87) for the high school division. Medical diagnosis data, including Intellectual Developmental Disabilities (IDD), Down Syndrome (DS), Autism Spectrum Disorder (ASD), and other conditions, are presented in Table 1.

3.2 Correlation Between Intellectual Abilities and Adaptive Behaviors

IQ and MA were calculated based on the SB-R test scores, while the four subscale scores were derived from the SB-R and additional intellectual abilities tasks. The S-M Scale obtained the SQ, SA, and the six subscale scores. Tables 2 and 3 present the means and standard deviations for IQ, MA, SQ, and SA.

The results indicated a statistically significant moderate Pearson correlation between IQ and SQ ($r = .55$, $p < .01$). Additionally, we observed moderate to strong correlations between the four subscales of the SB-R and the six subscales of the S-M Scale ($r = .57$ to $.78$). A stronger correlation

Table 1 Number of responses by disability types

	IDD	DS	ASD	Others	Total
Elementary school division	4	6	3	1	14
Secondary school division	6	5	2	4	17
High school division	5	11	2	3	21

Table 2 Average MA, and SA for each school division

	MA		SA	
	Average	SD	Average	SD
Elementary school	48.86	17.48	44.00	10.88
Secondary school	72.35	21.75	84.94	28.82
High school	85.19	25.35	98.52	26.79

Table 3 Average IQ, and SQ

IQ		SQ	
Average	SD	Average	SD
42.21	13.55	46.31	14.27

Table 4 Correlation between subscales of SB-R and S-M

	KL score	PO score	MR score	CM score	SH score	L score	O score	C score	S score
PO score	.800**								
MR score	.851**	.859**							
CM score	.884**	.841**	.893**						
SH score	.583**	.574**	.592**	.570**					
L score	.724**	.694**	.708**	.679**	.814**				
O score	.660**	.738**	.717**	.677**	.847**	.863**			
C score	.779**	.696**	.745**	.743**	.755**	.847**	.770**		
S score	.696**	.582**	.633**	.683**	.758**	.828**	.734**	.814**	
SD score	.658**	.615**	.680**	.636**	.819**	.824**	.733**	.848**	.805**

All correlations are significant at the 0. 001 level.

was found between tasks within the same test (Table 4).

3.3 Comparison of Educational Divisions on SB-R and S-M Scale Subscales

To examine differences in the mean SB-R scores across the three educational divisions (elementary: n = 14; secondary: n = 17; high school: n = 21), a one-way analysis of variance (ANOVA) was conducted. The independent variable was educational division, and the dependent variables were the four subscales of the SB-R. The results showed statistically significant main effects of educational division ($F(2; 49) = 11.6$, $p<.001$) ; with the elementary school division (M=12.79, SE=2.17) presented significantly lower scores on the four subscales than the secondary (M=23.65, SE=2.4) and high school divisions (M=28.9, SE=2.31).

A similar analysis was conducted for the six subscales of the S-M Scale, with educational division as the independent variable. The results showed a significant main effect of educational division ($F(2; 49) = 22.77$, $p<.001$) and a lower score of elementary school divisions (M=55.43, SE=3.3) than the other two divisions (M=88.18, SE=5.2 for secondary and M=97.48, SE=4.25 for high school division). A similar pattern was observed for IQ and SQ across the three educational divisions.

3.4 Intellectual Abilities and Adaptive Behavior Levels

Intellectual abilities and adaptive behaviors were measured using well-standardized methods, incorporating the standard error of measurement (SEM). SEM quantifies score variability and provides a statistical confidence interval within which an individual's actual score is likely to fall (AAIDD, 2021). In this study, significant intellectual abilities and adaptive behavior limitations were operationally defined as scores approximately two standard deviations below the population average on both measurements

IQ (representing intellectual abilities) and SQ (representing adaptive behavior) were categorized into four levels: profound (IQ ≤ 19, SQ ≤ 24), severe (IQ 20-35, SQ 25-45), moderate (IQ 36-50, SQ 46-55), and mild (IQ 51-70, SQ 56-75) (Table 5). A chi-square test revealed a significant association between intellectual abilities and adaptive behavior ($\chi^2(9) = 43.61$, $p < .001$). The

Table 5 Classification of Limitations in Intellectual Ability and Adaptive Behavior

IQ \ SQ		Profound	Severe	Moderate	Mild	Total
Profound	Number	2	0	0	0	2
	Percentage	3.84	0	0	0	3.84
Severe	Number	2	9	6	0	17
	Percentage	3.84	17.31	11.54	0	32.7
Moderate	Number	0	8	8	5	21
	Percentage	0	15.84	15.84	0	40.38
Mild	Number	0	3	1	8	12
	Percentage	0	7.77	1.92	13.39	23.08

results also indicated a substantial number of students with severe to moderate intellectual abilities and adaptive behavior limitations.

4. Discussion

This study explored the relationship between intellectual abilities and adaptive behavior in Japanese students attending special-needs schools, using the SB-R and S-M Scale assessments along with supplementary tasks to examine their developmental characteristics and educational needs.

4.1 The Relationship Between Intellectual Abilities and Adaptive Behavior

The study found a statistically significant moderate correlation between intellectual abilities and adaptive behavior, consistent with previous research findings (Alexander & Reynolds, 2020; Harrison, 1987; Saleem et al., 2019). However, the moderate correlation suggests that intellectual abilities and adaptive behavior should be considered equally when diagnosing intellectual disabilities.

Moderate to strong correlations were observed between the subscales of the two measures, particularly between the KL subscale of the SB-R and the C subscale of the S-M, as well as between the PO subscale of the SB-R and the O subscale of the S-M. KL, analogous to the Comprehension-Knowledge factor in the CHC model, represents an individual's breadth and depth of acquired knowledge of language, information, and cultural concepts, as well as the application of this knowledge (McGrew, 2009). This ability is closely linked to verbal communication skills, including reading, writing, and other verbal interpersonal abilities.

PO, similar to the Fluid Reasoning factor in the CHC model, involves the ability to engage in deliberate and controlled mental operations to solve novel problems that cannot be resolved automatically (McGrew, 2009). Occupation behaviors may correspond to PO abilities, ranging from simple physical movements (e.g., finger gripping) to more complex internal operations (e.g., using a personal computer). However, Occupation behaviors could be viewed as the aggregation of various intellectual abilities, potentially leading to pseudo-correlations between these subscales.

4.2 Intellectual Abilities and Adaptive Behavior in Three Educational Divisions

Significant differences were observed in SB-R and S-M Scale scores across the three educational divisions, particularly between the elementary and other divisions. The elementary school division showed statistically lower scores on both tests, suggesting that the six-year curriculum positively

influences students' development in both intellectual abilities and adaptive behaviors. These improvements may be reflected in increased task completion on the SB-R related to specific academic subjects and enhanced adaptive behaviors in daily life contexts, including school and home environments.

In contrast, no significant differences were found in SB-R and S-M Scale scores between the secondary and high school divisions, suggesting that the curriculum's impact on students' development may have already occurred by this stage. This could indicate a slower rate of change in intellectual abilities and adaptive behaviors in later educational stages.

4.3 Classification of Limitations in Intellectual Ability and Adaptive Behavior

Using the concept of the standard error of measurement (SEM), limitations in intellectual abilities and adaptive behavior were categorized into four levels for each measurement. The results revealed a significant proportion of students with moderate to severe limitations in both areas, emphasizing the need for appropriate support strategies. Additionally, some students displayed mild limitations in intellectual abilities but moderate to severe limitations in adaptive behavior, indicating the necessity for individualized and context-specific support within the school environment and in other settings.

4.4 Study Limitations and Future Directions

This study focused on a relatively small sample of students from a single special-needs school in Tokyo, which may limit the generalizability of the findings. Variations in educational curriculum, school culture, and local education systems could significantly influence the characteristics of the study's sample. Furthermore, the participants were not exclusively students with IDD; some had coexisting conditions, such as ASD. Consequently, the study could not fully explore the relationships between disorder characteristics, intellectual abilities, and adaptive behaviors.

Future research should involve more extensive and diverse samples to enhance the reliability and generalizability of the findings. It is also essential to distinguish clearly between specific disorders to better understand the complex interactions between intellectual abilities and adaptive behavior in children with varying developmental profiles.

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