

Validation of the Teacher Perception of High Intellectual Ability Inventory: Validity and Reliability

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ABSTRACT:

In Ibero- America, the initial identification of students with high intellectual ability is limited by a scarcity of robust, culturally relevant psychometric instruments and a predominance of measures focused on cognitive and academic indicators, with less integration of creative and socioemotional aspects, associated difficulties, and pedagogical responses. This instrumental study analyzed evidence regarding the content validity, internal structure, and reliability of the Inventory of Teacher Perceptions of High Intellectual Ability, which comprises 31 items distributed across six dimensions: cognitive aspects, creativity, socioemotional aspects, difficulties, pedagogical intervention, and methodologies. Content validity was assessed by experts using Aiken's V, I-CVI and S-CVI/ Ave. The inventory was then administered to 589 participants including teachers from schools and universities in Ecuador, as university students. Exploratory and confirmatory factor analyses were performed using independent samples, polychoric correlations, and WLSMV estimation. Content validity was high (S-CVI/Ave = 0.968), and all items achieved an I-CVI > 0.80. The six- factor model explained 80.8% of the variance; the confirmatory model demonstrated excellent fit. Reliability and evidence of convergent and discriminant validity were satisfactory. It is concluded that the IACI offers a valid and reliable multidimensional measure for the initial educational screening of indicators of ACI

Keywords: High abilities, perception, Psychometric validation, , Educational inclusion.

Introduction

High intellectual abilities (ACI) are defined as a set of outstanding cognitive skills, creativity, socio-emotional and personality characteristics in certain individuals. Both cognitive and psychosocial characteristics play an essential role in the manifestation of high ability. These abilities are malleable and need to be potentiated. (Tourón, 2020, p.7). In addition to general intellectual capacity, specific abilities and a good number of non-intellectual factors contribute decisively to shaping a trajectory of success in the most capable young people. (Pfeiffer, 2012, p. 6).

Between 2003 and 2010, the Gifted Rating Scales (GRS) incorporated multidimensional teacher assessment as a complement to intelligence tests (Pfeiffer & Jarosewich 2003). The GRS-S assesses intellectual and academic ability, creativity, artistic talent, leadership, and motivation. (Pfeiffer et al., 2007). Its adaptation to the Chinese context confirmed the six-factor structure and provided evidence of cross-cultural reliability and validity (Li et al. 2008). The GRS-P favored early identification, extending the assessment of potential beyond IQ (Pfeiffer et al., 2007).

In the period between 263-284, the cross-cultural validation of teacher assessment scales for the identification of high abilities was strengthened. In Argentina, the GRS-S showed properties that supported its application in the Spanish-speaking population (Pérez et. al., 2012). In Turkey, a teacher nomination scale was developed and validated to identify high abilities in children aged 3 to 6 years based on the Renzulli Model (Bildiren & Bikmaz, 2019). Subsequently, the Slovenian adaptation of the GRS-S presented high internal consistency, criterion validity, and adequate factor structure, being considered by teachers to be more appropriate for identification processes than the instrument previously applied in this context (Lep & Bucik, 2020).

During the period 263-284, various instruments were developed and updated to improve the identification of gifted students, as the focus on cognitive tests was expanded and teacher and

family assessments were incorporated. The Teacher's Gifted Rating Screening Scale (TRGSS) assesses five dimensions: general intellectual skills, leadership, creativity, specific academic skills, and artistic talent (Nakano & Peixoto, 2023). In early childhood education, Idsøe et al. (2022) proposed nomination scales for teachers and families aimed at the early detection of high academic potential. The Teacher Attitude Scale (TAS) analyzes teachers' attitudes towards gifted students (Cheung et al., 2022). The Greek validation of the GRS-S confirmed six dimensions: intellectual ability, academics, creativity, artistic talent, leadership, and motivation (Sofologi et al., 2023). GRS-2 updated this approach through new standards, a wider age range, family participation, and indicators to detect inconsistent responses, maintaining six dimensions of assessment (Pfeiffer and Jarosewich 2024; Tourón et al., 2024).

Structured teacher observation and nomination scales allow the recognition of cognitive, creative, and socio-emotional manifestations associated with high intellectual abilities. Instruments such as the GRS-2 and the GCI systematize the indicators observed in the classroom and complement cognitive tests in multidimensional identification processes (Delgado, et al., 2025). In addition, instruments based on teacher perception can be aimed at identifying and nominating students, as well as assessing teachers' attitudes, beliefs, and knowledge (Cheung et al., 2022; Nakano et al., 2023).

In the educational field, the identification of students with high intellectual abilities is often invisible or ignored, since there is the mistaken belief that it is not necessary to meet their specific needs, since it is assumed that they have fully developed all their capacities. As a consequence, early detection and the implementation of intervention strategies are relegated to the background.

High intellectual abilities (ACI) represent between 3% and 5% of the school population, although in Ibero-American education systems documented identification rates are

systematically below this threshold (Tourón et al. 2022). More than 90% of the most capable students are not detected, This problem is not limited to the lack of identification in educational contexts, but also includes the high cost of high potential psychopedagogy, the lack of teacher training to recognize ICA indicators in the classroom.

Teacher perception emerges as a critical mediating variable in early detection processes, since teachers are the first agents of systematic observation of students' cognitive, creative and socio-emotional skills. However, teachers' beliefs about high abilities are often influenced by stereotypes, prejudices, myths and implicit conceptions that hinder accurate identification, which is even more worrying.

These criteria could make invisible students with atypical or doubly exceptional profiles, who combine above-average abilities with learning and behavioral difficulties. (Assouline, et al., 2010; Bianco & Leach, 2010). The identification of the creative talent of students whose potential remains hidden due to poor academic performance could be limited (Baum et al., 2017).

In the Ecuadorian context, the problem is exacerbated by the fact that current regulations recognize students with ICA as subjects of special educational needs, but teachers lack initial detection tools, adapted to their cultural and educational reality. The instruments available in Spanish for the evaluation of teachers' perception of high abilities are scarce and mostly of Anglo-Saxon scales.

The available instruments allow students with high abilities to be evaluated from a pedagogical and psychological perspective. However, the contribution of this research lies in the availability of a psychometrically sound screening instrument that allows for a multidimensional, valid, and reliable evaluation of teachers' perceptions of the indicators associated with high intellectual abilities. In response to the need, this study analyzes the evidence of validity of the content, internal structure, and reliability of the proposed

instrument. Consequently, the following research questions are raised.

Research Questions

What evidence of content validity does the teacher perception instrument on high intellectual abilities present based on expert judgment?

To what extent does the factor structure of the teacher perception inventory adequately represent the construct of high intellectual abilities?

What levels of reliability and internal consistency does the Teacher Perception of High Intellectual Abilities inventory present?

The objective of this study was to validate an instrument called "Teacher Perception Inventory on High Intellectual Abilities".

This instrument aims to become a support tool for teachers to have relevant and systematized information on the characteristics and needs of students with ICA, favoring the planning of curricular enrichment strategies and educational attention more relevant to their needs and interests. In addition, it will provide reliable information that allows teachers to prepare reports aimed at the corresponding departments and professionals with the purpose of carrying out specialized evaluations in cases that require it.

Theoretical framework

High intellectual abilities have evolved from conceptions focused mainly on cognitive ability to multidimensional models that incorporate creative, motivational, socio-emotional, and contextual components. In this sense, Renzulli (1978 and 2012) proposes giftedness based on the interaction between superior ability, creativity, and commitment to the task; later he broadens his approach to incorporate cognitive traits, leadership, and civic responsibility. Sternberg (1987 and 1995) proposes a triarchic conception based on the analytical, creative, and practical dimensions; later he incorporates the criteria of excellence, rarity, demonstrability, productivity, and value within his pentagonal theory.

Tannenbaum (1986) integrates intellectual, environmental and talent development dimensions. From this perspective applied to the Spanish context, Ferrándiz (2010) applied the DAT Test to assess verbal, numerical, abstract, spatial reasoning, mechanical comprehension, attention and gifts, perspectives and spelling, the Torrance Creativity Test, the BFQ-NA, aimed at assessing dimensions of personality and emotional stability. Castelló (1998 and 2008) proposes a multi-aptitude perspective that differentiates giftedness from simple and complex talents, while Sastre-Riba (2008) emphasizes neurodevelopment, executive functions and the existence of a differential cognitive profile.

In a complementary way, Hernández and Gutiérrez (2014) incorporate neuropsychological, cognitive, socio-emotional aspects and asynchronies. For his part, Gagné (2010), through the Differentiated Model of Giftedness and Talent (DMGT), establishes a differentiation between gifts and talents and incorporates catalysts that intervene in their development, considering different domains.

Contemporary proposals conceive ICAs as specific, evolutionary and contextual. Miguel and Moya (2011) articulate the cognitive, creative and socio-emotional dimensions, while Tirri (2012) incorporates intellectual, moral and spiritual components related to giftedness with wisdom and character. Stoeger et al. (2017) highlight talent in diverse domains and extracurricular contexts; Olszewski Kubilius (2016) its development towards creative eminence and Plucker and Callahan (2014) creativity, performance and identification. Steenbergen-Hu et al. (2016) analyze acceleration and clustering while Wai, Lubinski and Benbow (2009), spatial, verbal and quantitative abilities. These contributions support a multidimensional understanding of ICAs, linked to psychosocial factors and developmental opportunities.

Dimensions of the ICA Teacher Perception Inventory

Teacher perception is a key element in the initial identification of students with high intellectual abilities, although they may be influenced by beliefs, stereotypes, biases and training limitations (Ferrándiz et al., 2025, p.1). The dimensions of high abilities considered in the perception inventory are:

- 1) The cognitive dimension is fundamental in the identification of high intellectual abilities; however, teachers tend to associate it mainly with visible academic performance, which can limit the recognition of indicators such as abstract reasoning, metacognition, self-regulation, expanded working memory, cognitive flexibility, and the ability to generalize, which can affect the detection of heterogeneous and double exceptionality profiles (Ferrándiz, et al., 2025, pp. 263-284).
- 2) Creativity is a relevant dimension of high abilities. It is essential that teachers recognize creative potential and promote educational strategies that stimulate curiosity, divergent thinking, flexibility, fluidity of ideas, originality, and the development of talent (Kalobo & Setlalentoa, 2024, pp. 263-284). This is stated by Piske et al. (2023) highlighting the importance of integrating creativity into teaching through strategies that favor its development in different academic areas, especially through open, investigative, and enrichment experiences (p. 225).
- 3) The socio-emotional dimension is one of the areas least recognized by teachers in the identification of high intellectual abilities, due to the tendency to associate them with adequate social and emotional adaptation. However, these characteristics can influence different areas of student development. "Given the existence of an associated neurological and socio-emotional basis, this can have a negative impact on the self-esteem and motivation of these students, as well as on their self-perception, academic performance, and social integration" (García et al., 2021, p.2).

Current research shows an interest in low performance, socio-emotional needs, and contextual factors that intervene in the

development of students with high abilities. (Nannings, 2025).

Another relevant aspect, according to Heller (2004), points out that problems can range from "asynchrony between the acceleration of intelligence development and immature feelings, appropriate for chronological age" to behavioral difficulties and social isolation (p.308).

4) The dimension of the perception of the difficulties associated with ICAs can be conditioned by the stereotype of the self-sufficient and high-achieving student, making their cognitive, social, and emotional needs invisible, which makes it difficult to recognize profiles of low performance and double exceptionality. Low performance is one of the least recognized difficulties, since it contradicts the traditional image of the student with ICA, interventions aimed at these cases still have limitations in their quality (García, M et al., 2021). The perception is even more complex when ICAs coexist with ADHD, and learning or behavioral difficulties, because their manifestations can be compensated or masked, causing confusion between the indicators of ICAs and associated disorders (Francois, S., et al., 2022 cited by Checa, F., et al., 2025). Therefore, identification must adopt a multidimensional approach that considers their difficulties. (García, M., et al., 2021).

5) Teachers' knowledge of ICA care programs is essential to identify needs, direct resources, and adapt methodological strategies. Various studies point to the existence of multiple tools and intervention models; among them, the School Enrichment Model (SEM) stands out, aimed at the development of strengths and talents through enriched learning experiences.

A recent meta-analysis found large effects on cognitive skills, moderate on personal affective skills, and small on social affective skills (Gül & Ayık, 2025). It has been shown that interventions that articulate cognitive, creative, and socio-emotional components can produce improvements in attention, creativity, communication, emotional expression, assertiveness, self-regulation, and collaboration.

These results support the systematic incorporation of socio-emotional components into care programs, along with individualized, evidence-based planning (García, M., et al 2021).

However, its application is limited by insufficient teacher training, lack of time, resources, difficulties in adapting the curriculum, and the predominance of traditional practices (Kalobo & Setlatentoa, 2024). Therefore, specialized training and institutional planning must accompany the identification, educational programs, curricular enrichment, flexible groupings, and technological resources that respond to the diversity of the student body (General Directorate of Attention to Diversity and Educational Quality, 2019; Baccassino, et al 2023).

6) The dimension of methodological strategies for the educational care of students with ICA assesses the teachers' perception of the use of differentiated active practices adjusted to the characteristics of these students. Research indicates that active methodologies such as programming, the flipped classroom, active learning supported by technology, project-based learning, flexible groupings, favor the development of cognitive, creative, critical, problem-solving, academic collaboration, and self-regulation skills in students with high abilities (Grimaldo & Chávez, 2021; Maba & Sakar, 2025; Nacaroglu & Bektas, 2023; Nicholas et al., 2024; Rehman et al., 2023, 2024; Reis et al., 2021).

Consequently, this dimension of the ICA Teacher Perception Inventory allows us to identify the extent to which teachers know, value, and consider these strategies applicable to respond to the educational needs of students with ICA.

Methodology

Design

For the validation of the Teacher Perception of High Intellectual Abilities (IACI) inventory. The study adopted a cross-sectional instrumental design (Ato et al., 2013), with a mixed approach and psychometric scope aimed at validating the content and construct of the instrument. The construction of the instrument was based on an

exhaustive systematic review of scientific literature on the differential characteristics of students with high abilities and instruments for identifying ICA, generating an initial bank of items organized in eight dimensions, each dimension operationalizes conceptual components of the previously referenced theoretical models.

Participants

Panel of experts.

The validation of the content was carried out through expert judgment, in accordance with the protocol established by Lynn, M. (1986) and Polit and Beck (2006). A panel of nine (9) experts with doctoral training and accredited experience in special education, educational psychology, psychopedagogy, pedagogy and research methodology, from academic institutions of national and international recognition (University of Salamanca, University of Guayaquil, National University of Education, University of Specialties Espiritu Santo, University of Salamanca) was convened. Their experience ranges from 10 to 30 years of service.

Members of the pilot

For the validation of the construct of the instrument (IACI), an intentional non-probabilistic sample was selected. The members of the pilot were made up of $N = 626$ participants with informed consent, of which $N = 589$ (analytical retention rate = 94.1%) passed the data quality filters. The distribution by sex was 71.6% women ($n = 448$) and 28.4% men ($n = 178$). Age ranged from 18 to 77 years ($M = 37.28$, $SD = 14.26$, $Mdn = 37$). Regarding occupation, 66% were practicing teachers at the primary, secondary and higher levels ($n = 413$), 34.0% were students of pedagogical careers ($n = 213$).

The participants were selected from among those who participated in the focus groups and MOOC courses of Teacher Training of High Intellectual Abilities: University of Guayaquil (UG), University of Specialties Espiritu Santo (UEES), National University of Ecuador (UNAE), Minerva School of Basic Education, Francisco Huerta Rendón Educational Unit. They work

with a diverse population of children and adolescents, among which are those who have high intellectual abilities.

Strategies and Instrument:

For the validation of the IACI, qualitative and quantitative techniques were combined to strengthen the content and construct validity of the instrument. The study was carried out between April and November 2025.

A process of validation of the content of the instrument (IACI) was carried out using the expert judgment technique. Each expert was provided with an evaluation matrix, in which each of the inventory items was asked to assess according to the criteria of clarity, coherence, and tendentiousness (Universidad de Guayaquil, (2022). The evaluations were recorded using a dichotomous scale (YES/NO), accompanied by a space for qualitative observations and suggestions for reformulation.

With the data obtained, the Content Validity Coefficient (CVC) and Aiken V were calculated for each item, considering acceptable those values equal to or greater than 80. The items that did not reach the minimum criterion established, or that received relevant observations from the experts, were reformulated, merged or eliminated, giving rise to the version of the inventory that was subsequently submitted to piloting.

A focus group was formed composed of teachers from different universities, belonging to pedagogical careers, technology, psychology, special education, with the purpose of qualitatively exploring the perceptions, training needs and challenges associated with the educational care of students with ICA. The discussion was oriented to five questions referring to the pedagogical intervention programs implemented, the challenges faced by teachers and families, the teacher training needs, and the topics that should be considered in a teacher training program in ICA. Prior to the development of the focus group, the participants answered the inventory in its pilot version, applied through a form designed in Google

Forms, which allowed a first empirical approach to their psychometric behavior.

Subsequently, with the purpose of expanding the sample and strengthening the construct validation process, the pilot instrument was again administered to teachers and students of pedagogical and psychological careers, participants of a MOOC training course in ICA, replicating the same digital form. This double application in the framework of the focus group and the MOOC course, data that were used for the analysis of the factorial structure of the inventory and the estimation of its reliability indicators, thus contributing to establish validity evidence based on the content and the internal structure of the instrument.

For the statistical processing and analysis of the data, the SPSS version 27 software was used, through which the reliability analyses, the exploratory factor analysis and the corresponding descriptive statistics were executed. In addition, the statistical software R version 4.60 was used, through which all the psychometric analyses of the study were performed, including factor analysis (EFA) and the calculation of Cronbach's alpha and McDonald's omega reliability coefficients, using the "psych" package, confirmatory factor analysis (CFA) using the "lavaan" package; the extraction and rotation of factors with the "GPArotation" package; and the estimation of additional indicators of reliability and construct validity, using the "semTools" package. Similarly, for the processing of the expert judgment and calculation of the content validity coefficient (Aiken's V), a personalized function in R was developed that automated this calculation from the evaluations recorded by the nine experts.

Procedure

This research was carried out in two sequential phases. Phase 1 includes the construction of the instrument and its content validation through expert judgment. Phase 2 corresponds to the validation of the construct with empirical piloting. The study had informed consent.

Phase 1. Content validation by expert

judgement

The original Teacher Perception of High Intellectual Abilities (IACI) inventory comprised 46 items in eight theoretical dimensions: Cognitive (6), Creativity (5), Socio-emotional (6), Motivations and interests (5), Difficulties (6), Pedagogical intervention (5), Didactic resources (4) and Methodologies (9) (Miguel, 2011; Castelló, 2008; Renzulli, 2012; Gómez, 2022; Quintero, 2024; Fernández, 2025; Kalobo, 2024; García, 2021, Baccassino, 2023; Grimaldo, 2021; Maba, 2025; Nacaroglu, 2022). All items were formulated on a five-anchor Likert scale (1= Strongly disagree, 5= Strongly agree).

The experts evaluated each item of the instrument based on three fundamental criteria: (a) theoretical congruence, which refers to the level of alignment between the item and the construct to be measured, (b) semantic clarity, referring to the degree of precision, comprehensibility, and univocity of the statements formulated, (c) tendentiousness, understood as the absence of biases or elements that may induce predetermined responses. The validation was carried out in a matrix with a dichotomous scale (yes/no) that allowed the collection of observations aimed at improving the instrument. (University of Guayaquil [UG], 2022). Of the participating experts: four completed the quantitative evaluation and five provided qualitative observations.

The index calculations for the quantitative analysis of the validity of the content and the assessments were dichotomously recoded (0 = scores 263-284; 1 = scores 3 -4) following the standard procedure in instrumental validation studies. The Content Validity Index per item (I-CVI) and the Validity Index of the overall content of the scale (S-CVI/ave) were calculated.

Aiken's V was calculated by item and criterion, the I-CVI (proportion of judges assigning a value of 1) and the S-CVI/Ave (mean of the I-CVI of all the items on the scale), following the formulas of Polit and Beck (2006). The threshold of acceptability was $I-CVI \geq 0.80$ per item and $S-CVI/Ave \geq .90$ at the scale level. The overall

agreement of judges was estimated using Kendall's W coefficient, which provides an ordinal measure of inter-judge agreement (Gómez-Gallegos et al., 2022). The qualitative suggestions were analyzed thematically and translated into decisions to preserve, modify or revise each item.

Phase 2: Construct validation

The instrument, structured by dimensions and blocks of items, was administered through Google forms to teachers and students. Previously, instructions were provided for its correct completion and its exclusively research purpose was clarified.

The analyses were performed with R 4.6.0 (R Core Team, 2025) using the psych (Revelle, 2024), lavaan (Rosseel, 2012) and Sem Tools (Jorgensen et al., 2024) packages. After the 50/50 splithalf partition ($n_{AFE} = 294$; $n_{CFA} = 295$), the EFA used maximum likelihood with oblimin rotation and polychoric correlation. The number of factors was determined by Horn's parallel analysis (20 iterations) and the theoretical criterion of the instrument. The iterative debugging of items followed the criteria: factor load $\lambda \geq .40$ and minimum difference between primary and secondary load $\geq .15$ (maximum 15

iterations). The CFA with WLSMV on ordinal data (ordered = TRUE, std.lv = TRUE) evaluated the indices: CFI, TLI, RMSEA scaled [90% CI] and SRMR. The modification indices ($MI > 10$; $|EPC_std| > .20$) were inspected for intra-factor modifications with theoretical justification. Reliability was evaluated with Cronbach's alpha coefficient and McDonald's ω . Convergent validity with CR and AVE, and discriminant validity with the Fornell-Larcker criterion ($\sqrt{AVE} > |\varphi_{ij}|$ for all $j \neq i$)

Data analysis

Content validation: expert matching

Content validity indices at the scale level were excellent (Table 1). The overall S-CVI/AVE reached 0.968, exceeding the threshold of ≥ 0.90 in the three criteria evaluated. The Congruence criterion was the highest (S-CVI/AVE = 0.976), followed by Clarity (0.973) and Non-Bias (0.957). All 46 items exceeded I-CVI ≥ 0.80 , indicating that no item should be eliminated for content validity reasons. The Difficulties dimension concentrated the most critical evaluations: three items presented some criterion with Aiken's $V < 0.80$ (items 23, 26, 28), all related to indicators of double exceptionality, and were classified for priority modification.

Table 1 Content validity indices by dimensions

Dimension	k	V Cong.	V Clar.	V No-T.	V Global	ICVI med.	Dec.
Cognitive Domain	6	0.979	0.979	0.927	0.961	0.961	Store
Creativity	5	1.00	1.00	0.950	0.983	0.983	Store
Social-emotional	6	0.938	0.917	0.938	0.931	0.931	Edit (2)
Motivations and interests	5	1.00	0.975	1.00	0.992	0.992	Store
Difficulties	6	0.896	0.917	0.854	0.889	0.889	Modify (3)
Pedagogical intervention	5	1.00	1.00	1.00	1.00	1.00	Store
Teaching resources	4	1.00	1.00	1.00	1.00	1.00	Store
Methodologies	9	1.00	1.00	1.00	1.00	1.00	Store

Global Scale (S-CVI/Ave)	46	0.976	0.973	0.957	0.968	0.968	—
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Note. K = number of items. VCong. = V of Aiken in the criterion Congruence; V Clar. = Clarity; V Non-Biasedness; I-CVI med. = mean Content Validity index; Dec. = Decision.

The qualitative analysis of the experts' observations identified three recurring thematic categories: (a) stereotypic profile bias, of several items in the Cognitive and Creativity dimensions tending to represent linguistic and mathematical ACI profiles, excluding artistic and technical talents; (b) questioning of the Difficulties dimension, since they do not apply universally but specifically to profiles of double exceptionality; and (c) proposal for extension, with suggestions to incorporate metacognition and executive function items. These observations were integrated into the revision of the wording of eleven items and the decision to retain the Difficulties dimension with explicit indication in the application instructions.

Descriptive statistics of the items

Table 2 presents the descriptive statistics of the 31 items retained in the CFA. The mean scores reflect a clear pattern: The dimensions of pedagogical response present higher values (Methodologies: $M = 4.46$, $SD = 0.78$; Creativity: $M = 4.39$, $SD = 0.82$) while Difficulties shows the lowest means ($M = 2.55$, $SD = 1.16$), consisting of their nature as indicators of atypical profiles. Five items exceeded the threshold of asymmetry $|asim| \geq 2$ (CRE 5, MOT 5, MET5, MET6), although all meet the criterion of kurtosis $|Kurt| \leq 7$, which does not invalidate them (Finney & DiStefano, 2013) but reinforces the relevance of the WLSMV estimator.

Table 2 Descriptive statistics of the items retained in the final model (N = 589)

Item	Abbreviated content	M	OF	Min	Max	Asim	Curt
Cognitive (COG)							
cog1	Easily understand new information	4.35	1.11	1	5	-1.89	2.73
cog3	They show great knowledge in topics of interest	4.26	1.10	1	5	-1.64	2.01
cog4	Learn easily and quickly	4.31	1.07	1	5	-1.72	2.29
cog5	No repetition needed to learn	3.99	1.13	1	5	-1.10	0.50
cog6	Possesses superior linguistic resources	3.94	1.10	1	5	-0.99	0.38
Creativity (CRE)							
cre1	Originality in combining ideas and expressions	4.39	0.94	1	5	-1.83	3.24
cre2	Create or adapt games and activities autonomously	4.33	0.99	1	5	-1.71	2.71
cre3	Ask varied and quality questions	4.40	0.93	1	5	-1.87	3.55
cre4	Critical thinking about oneself and the environment	4.37	0.97	1	5	-1.83	3.17
cre5a	Interest in research and innovation	4.47	0.93	1	5	-2.13	4.48
Social-Emotional (SOC)							

soc3	Rambunctious behavior, restlessness, or rebellious behavior	3.01	1.43	1	5	-0.05	- 1.31
soc4	Sense of humor: humorous comments	3.50	1.19	1	5	-0.44	- 0.65
soc6	Difficulty accepting unreasoned norms	3.72	1.25	1	5	-0.75	- 0.41
Difficulties (DIF)							
dif1	Low reading and writing performance	2.61	1.36	1	5	0.28	- 1.18
dif2	Passive, aggressive, or disruptive behavior	2.71	1.38	1	5	0.14	- 1.26
dif3	No interest in school or college	2.44	1.41	1	5	0.42	- 1.24
dif4	Poor family relationships	2.62	1.36	1	5	0.24	- 1.23
dif5	Poor psychomotor skills	2.35	1.33	1	5	0.53	- 0.98
dif6	Great social and emotional immaturity	2.60	1.42	1	5	0.26	- 1.30
Pedagogical Intervention (INT)							
int1	Curriculum Enrichment	4.33	0.94	1	5	-1.54	2.17
int3	More productive and motivating activities	4.48	0.88	1	5	-1.95	3.85
int5	Specific talent programs	4.26	1.01	1	5	-1.37	1.31
Methodologies (MET)							
met1a	Flipped classroom	4.34	0.98	1	5	-1.60	2.20
with2	Thinking-Based Learning	4.49	0.84	1	5	-1.94	3.96
met3a	Project-based learning	4.54	0.88	1	5	-2.26	5.20
with4	Gamification	4.39	0.95	1	5	-1.75	2.91
with5a	Learning based on creative thinking	4.58	0.85	1	5	-2.53	6.72
met6a	Challenge-based learning	4.49	0.88	1	5	-2.02	4.06
with7	Problem- or case-based learning	4.41	1.00	1	5	-1.89	3.09

Note: Likert scale 263-284. ^a Items with $| \text{asymmetry} | \geq 2$; all meet $| \text{kurtosis} | < 7$ (Finney & DiStefano criterion, 2013).

Exploratory Factor Analysis (EFA)

The reliability analysis using Cronbach's alpha coefficient revealed indices higher than 0.87 in all dimensions, while McDonald's omega ranged

between 0.88 and 0.93, evidencing excellent internal consistency.

The sample adequacy for the EFA (Table 3) was evaluated with the KMO measure = 0.316, a value that reflects the interdimensional

heterogeneity of the instrument (especially the independence of the DIF dimension with respect to the others). Bartlett's sphericity test was significant [$X^2(861) = 27072.9, p < 0.001$], confirming the presence of sufficient correlations for factor analysis. The parallel analysis (20 iterations) suggested 6 factors; the Kaiser criterion identified 4; and the theoretical criterion established 8. The final 6-factor solution with 31 items responds to the convergence between the parallel analysis and the structure that emerged after iterative debugging.

Iterative debugging eliminated 11 items in 12 iterations: soc 1, soc2 (low loads in SCO), mot1-mot5 (cross-loads or low, suggesting that motivation acts as a cross-traversal trait), int2, int4 (low loads in INT), rec 1 (cross-load between INT and MET) and rec4 (negative item, $M = 2.53, \lambda = 0.28$). The items rec2 and rec3 loaded on the MET factor. The total variance explained by the six factors was 80.8%.

Table 3 Matrix of factor loads of the AFE ($n=294$) oblimin solution with polychoric correlations

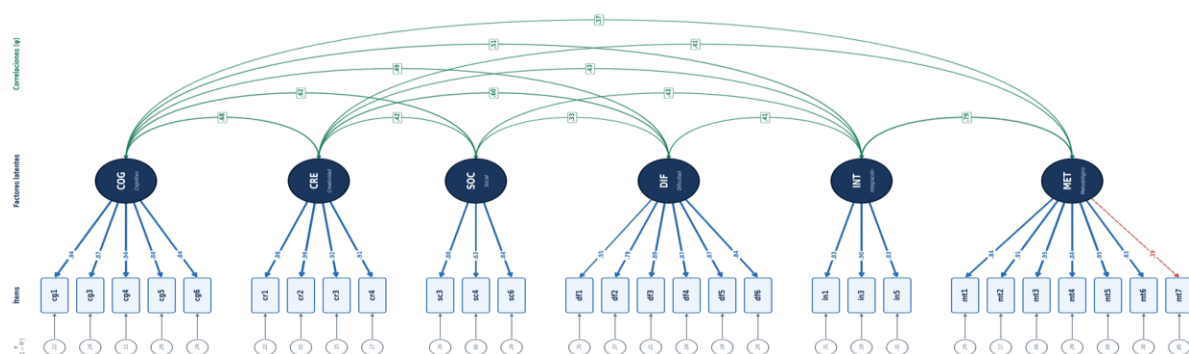
Item	WITH	COG	DIF	CRE	INT	SOC	DIF2	H2
with1	0.858							0.724
with2	0.779							0.855
with3	0.846							0.878
with4	0.853							0.767
with5	0.878							0.959
with6	0.824							0.810
with7	0.822							0.756
rec2	0.714							0.756
rec3	0.598							0.760
cog1		0.918						0.871
cog3		0.865						0.776
cog4		0.936						0.931
cog5		0.841						0.770
cog6		0.44						0.743
dif1			0.754					0.682
dif2			0.869					0.649
dif3			0.897					0.835
dif4			0.868					0.851
dif5			0.870					0.886
dif6			0.838					0.786
cre1				0.882				0.889
cre2				0.865				0.773
cr3				0.925			0.332	0.870
cr4				0.910				0.814
cr5				0.909				0.722

int1	0.835	0.768
int3	0.898	0.995
int5	0.826	0.756
soc3	0.797	0.995
soc4	0.631	0.545
soc6	0.842	0.570

Note: Only loads ≥ 0.40 are shown with their value; loads < 0.40 are indicated with a -, h^2 = final communality. The DIF2 column shows the secondary load of dif2 on a residual factor. Oblimin rotation; polychoric correlations ($n=294$). Total variance explained = 80.8%.

Figure 1

Diagram of the LACI Confirmatory Factor Analysis



Note: Standardized factor loads (λ). All parameters are statistically significant ($p < .001$). The thickness of the arrows is proportional to the magnitude of the charge. Blue color: latent factor; light blue color observed item; light blue color: standardized factor load; green color: correlation between factors (φ).

Factor loads were high in all dimensions, ranging from 0.73 to 0.96, indicating that the items adequately represent the constructs evaluated. The most solid dimensions were Methodologies (MET) and Cognitive (COG), while difficulties

(DIF) presented the most moderate loads, although within acceptable levels. The correlations between factors were positive and moderate ($r = 0.33$ to 0.79), evidencing that the dimensions are related, but measure, differentiated aspects of the teachers' perception of high intellectual abilities. The highest association was observed between Pedagogical Intervention and Methodologies ($r \approx 0.79$), which reflects their close relationship within the educational response to students with high abilities.

Table 4 Factor-explained variance in the EFA – rotated solution ($n= 294$)

<i>Factor</i>	<i>Dimension</i>	<i>K items</i>	<i>SS Loads</i>	<i>% Var.</i>	<i>% Var.acum</i>	<i>% Var. explained</i>
F1 (ML1)	Methodologies (WTH)	9	7.03	22.7	22.7	28.1
F2	Cognitive Domain	5	4.32	13.9	36.6	17.3

(ML5)	(COG)					
F3	Difficulties	6	4.11	13.3	49.9	16.4
(ML3)	(DIF)					
F4	Creativity	5	3.76	12.1	62.0	15.0
(ML6)	(CRE)					
F5	Pedagogical	3	2.41	7.8	69.8	9.6
(ML4)	Intervention					
	(INT)					
F6	Socio-emotional	3	2.06	6.6	76.4	8.2
(ML2)	l (SOC)					
-	Residual factors (	—	1.36	4.4	80.8	5.4
	F7 F8)					
Total	6-factor model	31	25.09	80.8	80.8	94.6

Note. **K** = number of items retained per factor. SS loads = sum of squares of the factor loads.

Confirmatory factor analysis (CFA)

The CFA (table of the six-factor model on the confirmatory subsample (n= 295) showed an excellent fit in all the indices evaluated (Table 5). The CFI = 0.85 and TLI = 0.983 values exceed the threshold of 0.95 considering good (Hu & Bentler, 1999). The RMSEA = 0.043 [90% CI: 0.036, 0.050] is below 0.06, indicating excellent fit

(Hair et al., 2019). The SRMR = 0.053 is below the threshold of 0.08. The inspection of modification indices identified two theoretically justified intrafactor error covariances: soc3 ~ soc4 (MI= 16.0) and cre1 ~ cre2 (MI= 13.0), whose incorporation into the refined model significantly improved the fit [$\Delta X^2(2) = 27.02$, $p < 0.001$] reducing the RMSEA to 0.040.

Table 5 CFA fit index base model and refined model (n CFA = 295, WLSMV estimator

Model	$\chi^2(gl)$	χ^2/gl	CFI	TLI	RMSEA	IC RMSEA	90% SRMR
M1: Base (6 factors)	561.51(362)	1.55	0.985	0.983	0.043	[0.036, 0.050]	0.053
M2: Refined (+2MLs) ^a	—	—	0.987	0.985	0.040	[0.033, 0.047]	0.052
Good $\geq$ threshold	—	< 3.0	≥ 0.95	≥ 0.95	< 0.06	IC ≤ 0.10	< 0.08
Acceptable threshold	$\geq$	< 5.0	≥ 0.90	≥ 0.90	< 0.08	—	< 0.10

Note. WLSMV = Weighted Least Squares estimator with mean and variance correction; all indices are robust (scaled), gl = degrees of freedom. χ^2/gl = chi-square ratio scaled to degrees of freedom. CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Mean Square Approximation Error; SRMR = Standardized Residual Mean Square.

Standardized Factor Loads and Reliability

Table 6 presents the standardized factor loads of the CFA along with the reliability and convergent validity indices. The 29 loads range from 0.631 (soc4) to 0.954 (met 5), with 28 of them classified as "Good" ($\lambda \geq 0.70$) and one as "Acceptable" (soc4, $\lambda = 0.631$). All loads are statistically significant ($p < 0.001$). The Cronbach α (0.740 – 0.945) and McDonald's ω (0.735 – 0.949) indices exceed the threshold of 0.70 in all dimensions. The composite reliability (CR: 0.804 – 0.968) and the mean variance extracted (AVE: 0.581 – 0.814) confirm the convergent validity of the instrument in the six dimensions. The SOC dimension presents the most conservative values, attributable to its small number of items ($K=3$) after debugging.

Table 6 Standardized factor loads of the CFA and properties of the measurement model (n CFA = 295)

Factor/Item	I	EE	Z	a	Oh	CR	AVE	√AVE
COG - Cognitive Domain				0.922	0.928	0.948	0.785	0.886
cog1	0.938	0.017	53.82					
cog3	0.865	0.24	35.41					
cog4	0.937	0.014	65.18					
cog5	0.841	0.021	41.01					
cog6	0.884	0.022	38.38					
CRE- Creativity				0.925	0.930	0.947	0.782	0.884
cre1	0.882	0.023	38.71					
cre2	0.789	0.032	24.58					
cre3	0.925	0.17	53.61					
cre4	0.910	0.017	54.62					
cre5	0.909	0.020	45.09					
SOC - Social-Emotional				0.740	0.753	0.804	0.581	0.762
soc3	0.797	0.041	19.69					
soc4b	0.631	0.044	14.41					
soc6	0.842	0.042	20.29					

DIF - Difficulties				0.914	0.919	0.940	0.723	0.851
dif1	0.754	0.028	27.20					
dif2	0.869	0.017	50.99					
dif3	0.897	0.015	60.85					
dif4	0.868	0.016	54.71					
dif5	0.870	0.018	47.92					
dif6	0.838	0.020	42.34					
INT – pedagogical intervention				0.837	0.844	0.889	0.728	0.853
int1	0.835	0.027	31.23					
int3	0.898	0.024	37.58					
int5	0.826	0.029	28.88					
MET - Methodologies				0.945	0.949	0.968	0.814	0.902
with1	0.835	0.025	33.99					
with2	0.908	0.017	54.62					
with3	0.953	0.012	78.08					
with4	0.844	0.022	38,22					

Note. λ = standardized factor load; EE= standard error; Z = statistical z.a= Cronbach's alpha (Cronbach, 1951); ω = McDonal's total omega (McDonal, 1999); CR = composite reliability; AVE = extended mean variance; $\sqrt{\text{AVE}}$ = square root of the AVE.

Discriminant validity: Fornell – Larcker criterion

Table 7 presents the Fornell-Larcker matrix (1981). The diagonal shows the $\sqrt{\text{AVE}}$ of each factor; the lower triangle, the absolute correlations between latent factors. In the 15 possible pairs, the $\sqrt{\text{AVE}}$ of each factor exceeds its correlation with all the others, confirming the discriminant validity of the instrument. The high correlation corresponds to the INT-MET pair ($\varphi = 0.786$), still lower than $\sqrt{\text{AVE}}_{\text{INT}} = 0.853$. The DIF dimension presents practically zero correlations with the cognitive factor ($\varphi = 0.006$), CRE ($\varphi = 0.028$) and MET ($\varphi = 0.004$), reflecting the independence of the indicators of difficulties with respect to the positive profile of ACI, which is theoretically consistent with the profile of double exceptionality (Baum et al., 2021)

Table 7 Fornell-Larcker matrix: $\sqrt{\text{AVE}}$ (diagonal) and correlations between latent factors (n_CFA= 295)

<i>Factor</i>	<i>COG</i>	<i>CRE</i>	<i>SOC</i>	<i>DIF</i>	<i>INT</i>	<i>WTH</i>
<i>Cognitive (COG)</i>	(0.886)					
<i>Creativity (CRE)</i>	0.676	(0.884)				
<i>Social-Emotional (SOC)</i>	0.428	0.328	(0.762)			
<i>Difficulties (DIF)</i>	0.006	0.028	0.428	(0.851)		
<i>Interv. pedagogue. (INT)</i>	0.617	0.596	0.408	0.060	(0.853)	
<i>Methodologies (MET)</i>	0.491	0.506	0.370	0.004	0.786	(0.902)

Note: *Diagonal:* $\sqrt{\text{AVE}}$ of each factor. Lower triangle: absolute correlations between latent factors $|\varphi_{ij}|$ of the CFA (WLSMV; n= 295), All latent correlations are statistically significant ($p < 0.001$).

Measurement invariance

Multigroup analyses supported configural, metric, and scalar invariance according to gender, age, occupation, self-perception, teaching experience, and MBI-proxy with a sample of between 592 and 626 participants. With favorable fit indices ($\text{CFI} = .984-.989$; $\text{RMSEA} = .044-.050$) and minimal changes when introducing equality constraints ($\Delta\text{CFI} = -.002-.000$; $\Delta\text{RMSEA} = -.001-.002$), as well as with scalar constraints ($\Delta\text{CFI} = .000-.002$; $\Delta\text{RMSEA} = -.005--.001$) These results support the comparison of latent means between the groups evaluated. On the other hand, the models corresponding to education level, career, socioeconomic and family status with ACI did not converge, so the invariance in these variables remained undetermined.

Discussion

Evidence of content validity

In response to the first research question, the

overall S-CVI/AVE of 0.968 exceeded the value of 0.90 recommended to consider excellent content validity of a scale (Polit et al., 2007). All the items reached an I-CVI ≥ 0.80 , reflecting a high degree of agreement among the nine experts regarding their relevance and representativeness. These results support the correspondence between the items and the multidimensional definition assumed for ICAs.

Critical observations focused mainly on the Difficulties dimension, due to the heterogeneity of the double exceptionality profiles, in which cognitive strengths coexist with learning, attention, self-regulation or social adaptation difficulties that may be mutually hidden (Baum et al., 2017). Therefore, this dimension should not be interpreted as a set of characteristics attributable to all students with ICA, but as warning indicators applicable to specific profiles.

The inventory proposes a multidimensional understanding of high intellectual abilities through six dimensions: cognitive, socio-

emotional aspects, creativity, difficulties, methodology, and intervention. This structure partially coincides with the psychometric scales that have prioritized the assessment of intellectual skills, creativity, leadership, motivation, artistic, academic skills, (Renzulli, et al., 2002; Marland, 1972; Cheung et al., 2022; Nakano & Peixoto, 2023; Sofologi et al., 2023;), which contribute to systematizing the indicators observed in the classroom and complementing cognitive tests (Delgado, V. et al., 2025). However, the inventory broadens this perspective by incorporating difficulties that may affect student identification and development. This dimension makes it possible to overcome the homogeneous representation of the gifted student as necessarily successful and without specific educational needs. In addition, the areas of methodologies and intervention constitute a differential contribution compared to scales focused exclusively on the characteristics of the student. Their inclusion allows us to assess teachers' perceptions of methodological strategies, resources and educational actions aimed at meeting high potential. Therefore, the instrument not only examines how teachers recognize potential, but also how to understand and guide the pedagogical response.

IACI Internal Structure

In relation to the second research question, the APE identified a six-factor solution, later supported by CFA, the factor reorganization is interpretable from the theoretical point of view. The integration of didactic resources in the Methodologies dimension indicates that participants do not perceive them as independent components, but as means, associated with the implementation of active strategies. This interpretation coincides with the pedagogy of enrichment, in which resources acquire meaning when they are articulated with curricular differentiation, project-based learning, open choice, and creative production (Reis et al., 2021).

The absence of motivations and interests as an independent factor is another relevant finding. These indicators seem to be distributed transversally between the cognitive, creative, and

methodological dimensions. This configuration is consistent with the conception of motivation or commitment to the task as a dynamic quality that manifests itself in interaction with opportunities, resources, and the educational context (Ries & Peters, 2021; Renzulli, 2021).

Reliability and relationships between dimensions

Regarding the third research question, Cronbach's alpha (0.740 – 0.945), McDonald's omega (0.753 – 0.949) and composite reliability (0.804 – 0.968) coefficients showed adequate internal consistency in the six dimensions. The convergence between these indicators strengthens the interpretation of reliability, since alpha can be affected by the number of items and by restrictive assumptions such as equivalence; therefore, it is advisable to complement it with omega and composite reliability (McNeish, 2018). These results are consistent with the multidimensional conception of high intellectual abilities proposed by Renzulli (1978), Sternberg (1985), Tannenbaum (1986) and Gagné (2010), who integrate cognitive and creative abilities with personal, socio-emotional and contextual factors. They also coincide with applied models that incorporate cognitive, motivational, and socio-emotional components in talent identification (Sánchez et al., 2008; Hernández & Gutiérrez, 2014; Olszewski-Kubilius et al., 2016).

The Socio-emotional dimension showed the most conservative values ($\alpha = 0.740$; $\omega = 0.753$). Although they exceed the conventional threshold of 0.70, their magnitude could be related to the small number of items and the conceptual diversity of their contents is consistent with the socio-emotional complexity and possible dyssynchrony associated with high abilities (Hernández & Gutiérrez, 2014; Quinteros & Aguirre, 2024). This result does not justify the elimination of the dimension, but it does suggest expanding and revising its indicators in future versions, especially those related to emotional regulation, interpersonal relationships, sensitivity, sense of humor, and school adaptation.

On the other hand, the correlation between

Interventions and Methodologies ($\omega = 0.786$) shows an expected conceptual proximity, because intervention decisions are made through strategies, didactic resources, techniques, and methodologies. This relationship is supported by the models of Tannenbaum (1986); Gagné (2010) and Stoeger et al. (2017), which attributes the context and educational opportunities to being a catalyst in human development.

Conclusion:

The objective of this research was to analyze the evidence of content validity, internal structure, and reliability of the inventory of Teacher Perception of High Intellectual Abilities (IACI), conceived from a multidimensional perspective that integrates cognitive, creative, and socio-emotional dimensions, associated difficulties, pedagogical intervention, and methodologies. The results respond favorably to the three research questions: expert judgment provided solid evidence of content validity; factor analyses supported a six-dimensional structure; and the internal consistency and composite reliability coefficients reached adequate values. These findings support the use of the IACI as a screening instrument for teachers' perceptions of ICA, capable of supporting decision-making, but not replacing a specialized assessment.

In the practical field, the IACI can be used in initial and continuing training processes to identify knowledge, stereotypes, and training needs of teachers. It can also guide institutional

programs aimed at strengthening early detection, curricular enrichment, active methodologies, and the attention to profiles of double exceptionality. Its multidimensional nature and potential open access could favor its application in educational contexts with limited resources.

Limitations of the research:

Future studies should replicate the factor structure in probabilistic samples of teachers from different educational levels and regions of Ecuador, study temporal stability, incorporate evidence of predictive and concurrent validity, apply HTMT and analyze the relationship of the scores with observed pedagogical practices and real identification processes. These actions will allow to specify the scope of the instrument and strengthen its generalization to other Ibero-American contexts. Future studies should guarantee a more balanced sample representation in these moderators to complete the assessment of invariance.

Artificial Intelligence (AI) Use Statement

During the preparation of this work, the authors used Claude AI used as an assistant for the review, correction and optimization of the statistical code for R, which allowed minimizing programming errors and ensuring the correct execution of the procedures. The interpretation of the results and the methodological decisions were made entirely by the research team, using AI only as technical support in the debugging of the code.

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