Non-verbal Intelligence is a Better Predictor of Cognitive Flexibility in Adolescents with Autism Compared to Adolescents with Intellectual Developmental Disabilities

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INTRODUCTION

Children and adolescents with Autism Spectrum Disorder (ASD) often have more difficulties with cognitive flexibility compared to their typically developing (TD) peers [1]. Cognitive flexibility is part of executive functioning (EF) skills and involves the ability to switch cognitive strategies in response to changing contexts [2].

Abundant research has examined autistic individuals with high IQ to better understand cognitive flexibility deficits using the Wisconsin Card Sorting Test (WCST), a widely-used neuro-psychological test of EF. Autistic individuals show lower WCST performance compared to their typically developing counterparts [3, 4] and predictive relationships where their non-verbal abilities predicted WCST performance [5].

Yet, cognitive flexibility deficits and its relationship with non-verbal abilities is less understood in autistic individuals with low IQ (AL), a population that exhibits more pronounced cognitive and behavioural inflexibility [6].

RESEARCH OBJECTIVES

The present study aimed to (1) Delineate the unique impact of ASD on cognitive flexibility by examining WCST performance between autistic adolescents with IQ and age matched adolescents with Intellectual Developmental Disability (IDD),
(2) Explore the relationships between verbal and non-verbal intelligence and WCST performance between groups.
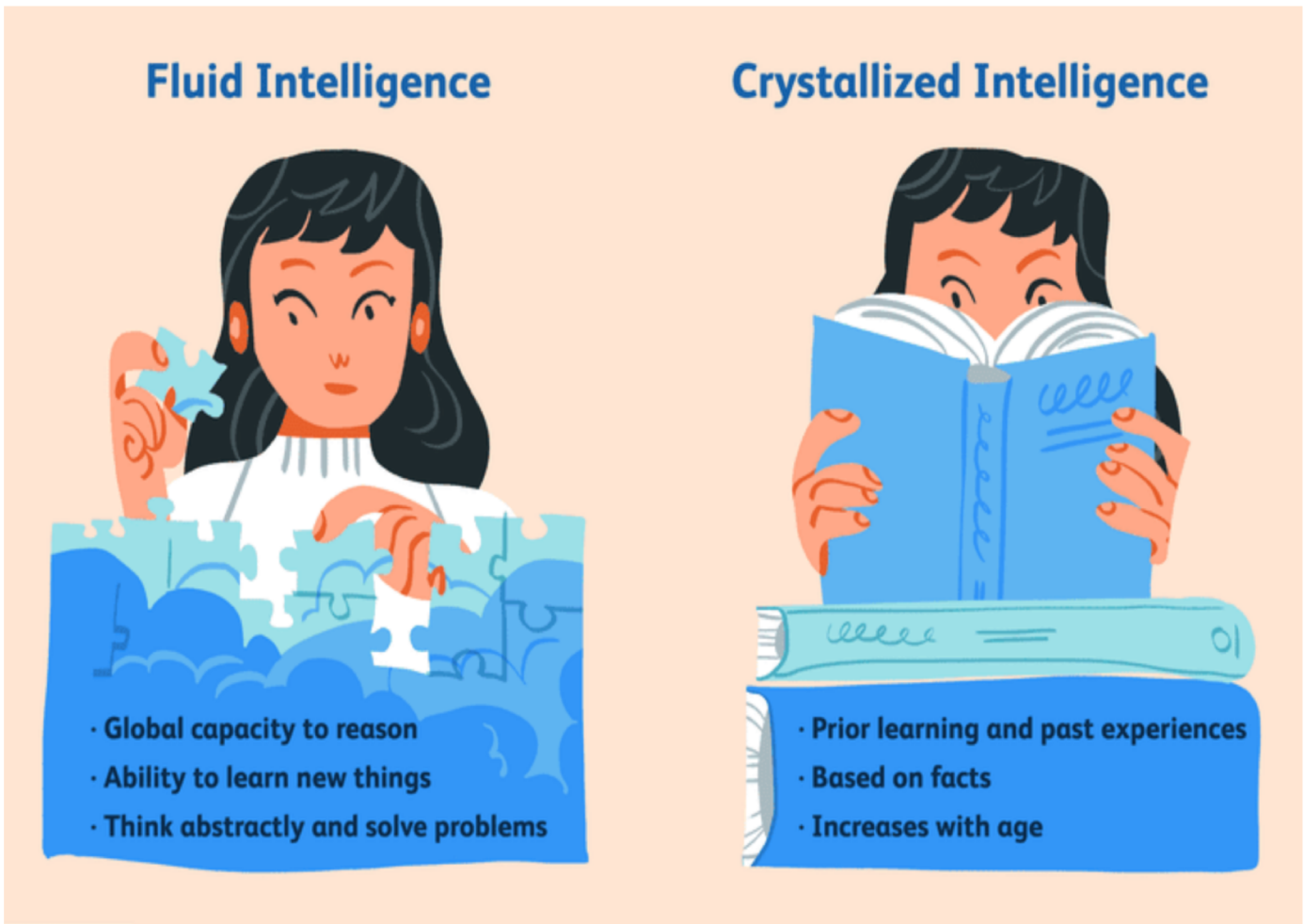
METHODS

Participants:

Fifty-seven participants (38 males, 19 females; 12-16 years) with a primary diagnosis of either ASD (n= 20) or IDD (n= 37) participated in the study. All participants were recruited at the Summit Centre for Education Research and Training (SCERT) in Montreal.

Measures:

Wechsler Abbreviated Scale of Intelligence – 2nd Edition [7]
WASI-II was administered to all adolescent participants to obtain a global measure of IQ. The Verbal Comprehension Index (VCI) is a measure of verbal and crystalized abilities, and the Perceptual Reasoning Index (PRI) is a measure of nonverbal and fluid abilities.
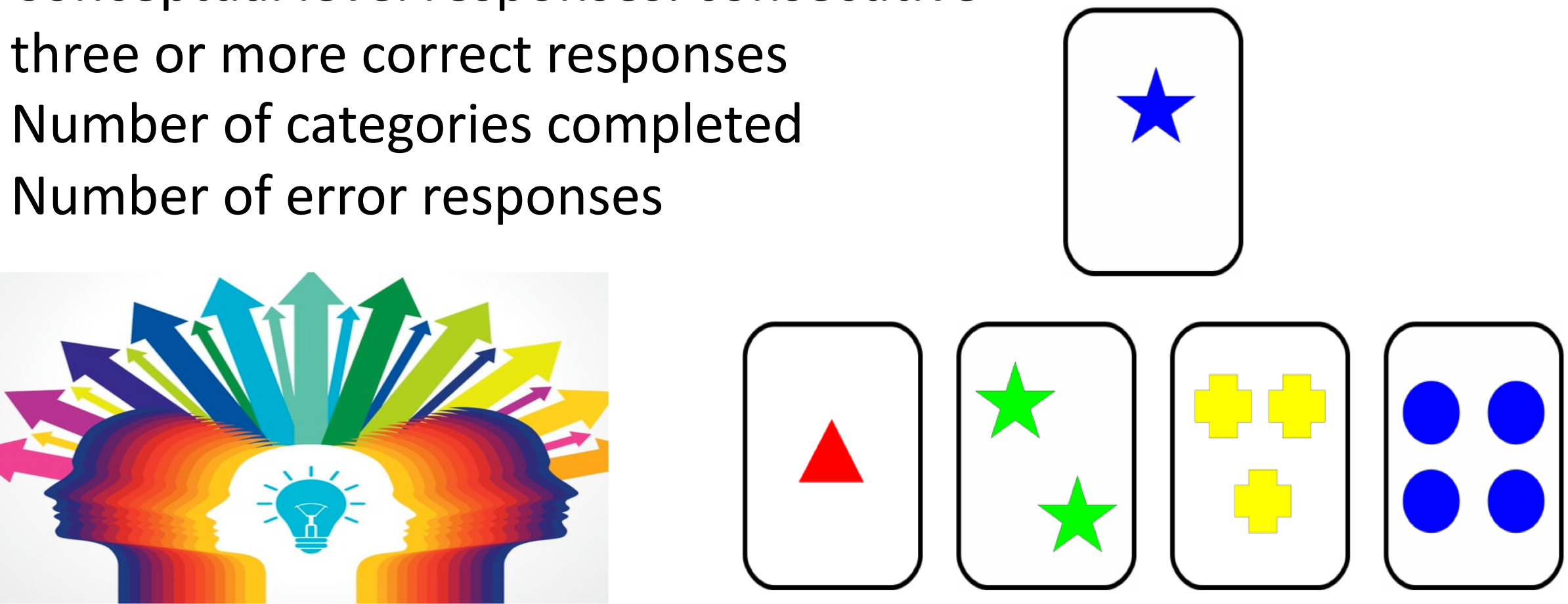
Fluid Intelligence
- Global capacity to reason
- Ability to learn new things
- Think abstractly and solve problems

Crystallized Intelligence
- Prior learning and past experiences
- Based on facts
- Increases with age

WASI-II
WECHSLER ABBREVIATED SCALE OF INTELLIGENCE® — SECOND EDITION

METHODS cont'd

Wisconsin Card Sorting Test [2]
The WCST is a neuropsychological test that measures the ability to shift mindsets flexibly in changing contexts. In each trial, the participant is presented with four cards aligned in a row, with those cards varying in colors, shapes, and number of shapes. The participant is required to match a single card to one of the cards presented and receives feedback on whether the match is right or wrong. An adapted digital computer-based of WCST was used, consisting of a total of 128 trials. Three scores were derived from the test:

(1) Conceptual level responses: consecutive three or more correct responses
(2) Number of categories completed
(3) Number of error responses

RESULTS

An independent samples t-test revealed no significant group difference between AL and IDD participants on all three measures of WCST performance, FSIQ, or VCI. However, the AL group scored significantly higher on the PRI (M = 65.6, SD = 15.3) compared to the IDD group (M = 56.78, SD = 9.26), $t(56)$ = 2.72, p <.01.
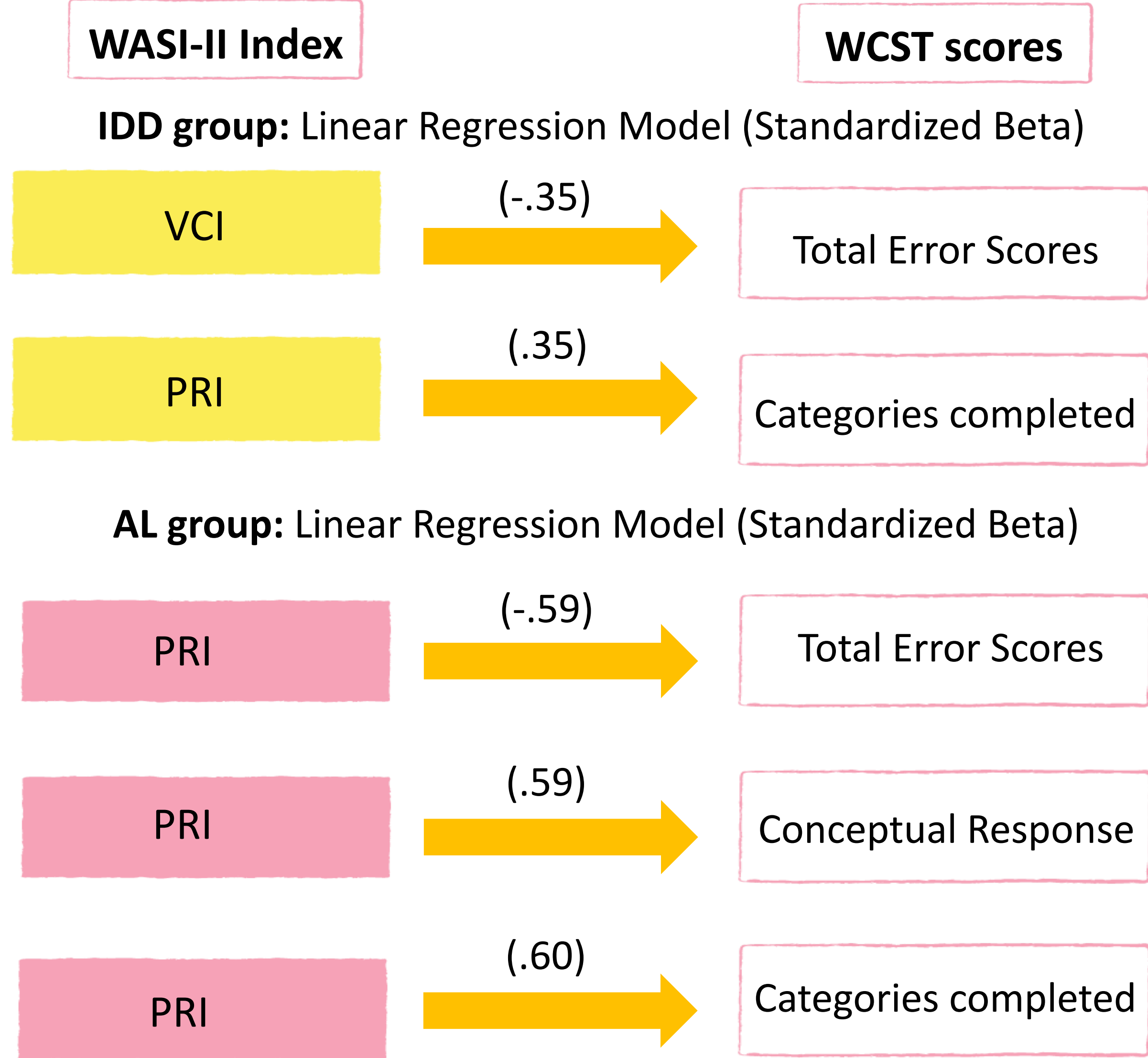
Table 1. Descriptive statistics and independent samples t-test

Participant Characteristics	AL Mean (SD)	IDD Mean (SD)	p
Age	14.62 (1.17)	14.81 (1.06)	p = .54
FSIQ	57.05 (11.39)	52.54 (9.50)	p = .12
PRI	65.60 (15.26)	56.78 (9.29)	p < .01*
VCI	53.35 (11.14)	53.64 (10.91)	p = .92
Completed categories	1.15 (1.04)	1.27 (1.07)	p = .68
Total Errors	75.70 (17.16)	76.22 (13.6)	p = .90
Conceptual Response	36.05 (5.70)	35.70 (4.74)	p = .81

VCI and PRI were entered separately in a linear regression model with WCST measures for each group. VCI did not predict conceptual scores and number of completed categories for both AL and IDD groups, but significantly predicted total error scores for the IDD group only, explaining 12% of the variance (p = .03).

RESULTS cont'd

For the AL group only, PRI significantly predicted total error scores (p = .006), explaining 35% of the variance, and conceptual response (p = .005), explaining 59% of the variance. PRI explained 35% of the variance in categories completed scores for the ASD group (p = .006) while explaining 11% of the variance for the IDD group (p = .02).

WASI-II Index → **WCST scores**

IDD group: Linear Regression Model (Standardized Beta)

VCI —(-.35)→ Total Error Scores

PRI —(.35)→ Categories completed

AL group: Linear Regression Model (Standardized Beta)

PRI —(-.59)→ Total Error Scores

PRI —(.59)→ Conceptual Response

PRI —(.60)→ Categories completed

DISCUSSION

Non-verbal intelligence (PRI) was a better predictor of WCST performance in adolescents with AL compared to those with IDD. It is important to note that this relationship was present despite similar WCST performance across groups.

Our study corroborates previous studies with autistic individuals with high IQ [3, 4] and highlights the unique role of non-verbal intelligence in ASD when explaining cognitive flexibility.

In addition, the relative non-verbal strength observed in our ASD sample suggests that individuals with ASD may solve cognitive flexibility tasks by relying on their non-verbal intelligence.

REFERENCES

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