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Machine Learning–Based Prediction of Reading Comprehension Deficits from Attention Control, Processing Speed, Phonological Awareness, and Academic Anxiety in Children with Dyslexia

Kamran. Ganji[1], Mandana. Roostaee Hosein Abade[1*]

1. Department of Educational Psychology, Mal.C., Islamic Azad University, Malayer, Iran

*** Corresponding author email address**: mandanaroostaee5@gmail.com

Editor	Reviewers
Asoke Kumar Saha Professor Department of Psychology, Jagannath University, Dhaka, Bangladesh drasoke@psychology.jnu.ac.bd	**Reviewer 1:** Stephen C. L. Lau Professor (Assistant) at Washington University in St, Louis, United States. Email: lauc@wustl.edu **Reviewer 2:** Taher Tizdast Assistant Professor, Department of Psychology, Tonekabon Branch, Islamic Azad University, Tonekabon, Iran. Email: taher.tizdast@toniau.ac.ir

1. Round 1

1.1. Reviewer 1

Reviewer:

The Introduction provides a broad overview of dyslexia and machine learning applications; however, the theoretical integration among attention control, processing speed, phonological awareness, and academic anxiety remains insufficiently operationalized. For example, the paragraph beginning with “Current neurocognitive models of dyslexia emphasize…” would benefit from a conceptual framework or hypothesized predictive pathway demonstrating how these variables interact within the proposed machine learning architecture.

The authors repeatedly describe dyslexia as a “multidimensional neurocognitive disorder,” yet no diagnostic framework or criteria are specified. In the paragraph stating “Children who had previously received a formal diagnosis of dyslexia…” the manuscript fails to indicate whether diagnoses were based on DSM-5 criteria, ICD-11 standards, or educational screening protocols. This omission weakens the diagnostic validity and reproducibility of the sample selection process.

The use of an 80/20 train-test split with a sample size of only 240 participants raises concerns regarding model stability and overfitting. Given the relatively small dataset, the authors should justify why nested cross-validation, repeated k-fold validation, or bootstrapping procedures were not used. The current validation strategy may inflate predictive performance estimates.

The machine learning methodology is insufficiently transparent. The manuscript states that "Random Forest, Support Vector Machine, Gradient Boosting, and Artificial Neural Network models were implemented," yet no hyperparameter settings, optimization procedures, activation functions, kernel types, tree depths, learning rates, or regularization strategies are reported. Without these details, the analyses are not reproducible.

Authors revised the manuscript and uploaded the document.

1.2. Reviewer 2

Reviewer:

The sampling strategy described as "multistage cluster sampling and purposive screening procedures" requires considerably greater methodological precision. The manuscript does not explain how many districts, schools, or learning disability centers were selected, nor how clusters were randomized. The lack of detailed sampling stages raises concerns regarding sampling bias and representativeness.

The study reports that "normal intellectual functioning" was confirmed using school psychological records, but no objective intelligence assessment procedure is described. Because dyslexia diagnosis conventionally requires exclusion of intellectual disability using standardized cognitive measures, the authors should report which IQ instrument was used, cutoff criteria, and whether testing was recent or archival.

The description of the Attention Control Scale raises psychometric concerns regarding age appropriateness. The manuscript states that children aged 8–12 completed a self-report instrument assessing attentional regulation. However, no justification is provided regarding the developmental suitability of self-report attentional assessment in younger children, especially those with reading difficulties. The authors should discuss whether items were orally administered or adapted for comprehension limitations.

The Measures section lacks essential psychometric information for the present sample. Although the manuscript repeatedly states that instruments demonstrated "acceptable reliability and validity," no Cronbach's alpha coefficients, composite reliability values, or construct validity indices are reported for the current dataset. Psychometric properties must be reported for each measure within the studied population.

The paragraph describing data preprocessing procedures is too vague for replication purposes. The sentence "data preprocessing procedures including normalization, missing data treatment, and feature standardization were performed" should specify the exact normalization methods, missing data imputation strategy, and whether preprocessing occurred before or after train-test splitting to avoid data leakage.

The manuscript does not explain how reading comprehension deficits were transformed into a machine learning target variable. Since the Gray Oral Reading Test produces continuous standardized scores, the authors must clarify whether scores were dichotomized into deficit/non-deficit categories, categorized into severity groups, or modeled continuously. This issue fundamentally affects interpretation of all predictive metrics.

Authors revised the manuscript and uploaded the document.

2. Revised

Editor's decision: Accepted.
Editor in Chief's decision: Accepted.

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