

## Original research

**Comprehensive Abstract: The Effectiveness of Linguistic Games on the Reading Performance of Students with Down Syndrome**

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**Abstract**

**Introduction:** Reading is one of the key skills in children's cognitive and academic development, often associated with significant challenges in children with Down syndrome. This study aimed to determine the effect of linguistic games on the reading performance and social skills of students with Down syndrome.

**Research Methods:** The statistical population consisted of all male and female students with Down syndrome in the second to fourth grades of special schools in Tehran during the academic year 1402-1403 (n = 120). Using purposive sampling, 40 of these students were selected and randomly assigned to two experimental groups (20 people) and a control group (20 people). The data collection tool was the Reading and Dyslexia Questionnaire (NAMA). The experimental group participated in 15 sessions of linguistic games training, while the control group did not receive any intervention. Data analysis was performed using SPSS software and the Correlation Analysis test.

**Findings:** Statistical analysis showed that there was a significant difference between the reading performance scores of the two groups in the post-test phase ( $p < 0.05$ ), and linguistic games were able to explain about 31% of the variance in reading performance.

**Conclusion:** The findings show that linguistic games, by activating phonological processes, working memory, and language skills, significantly improve the reading performance of students with Down syndrome. Therefore, the design and application of these games in educational and rehabilitation centers for children with special needs can be recommended as part of effective clinical interventions.

**Keywords:** Down syndrome, Linguistic games, reading performance, phonological awareness, working memory

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**Introduction:**

Down syndrome (DS), the most common genetic cause of intellectual disability, occurs in approximately 1 in 700 to 800 live births. Primarily caused by trisomy 21, DS is associated with significant cognitive, linguistic, motor, and social challenges. Children with DS often struggle with expressive and receptive language skills, attention, working memory, and social interaction. Among their most prominent challenges are difficulties in reading, which consists of two key components: decoding (converting written symbols into spoken words) and comprehension (deriving meaning from text). Previous research highlights the effectiveness of psychological interventions, particularly cognitive-behavioral and language-based approaches, in empowering children with DS. Linguistic games have emerged as a novel and evidence-based tool in this domain, leveraging interaction, intrinsic motivation, and structured goals to enhance phonological awareness, working memory, and social skills. However, fewer studies have focused on specialized reading components such as rapid automatized naming, text comprehension, and letter-sound correspondence in children with DS.

This study aimed to investigate the impact of structured linguistic games on the reading performance of students with DS, addressing the question: Do linguistic games significantly improve reading performance and its subcomponents in children with DS?

**Research Method:**

This applied study employed a quasi-experimental design with an unbalanced control group. The statistical population included all 2nd- to 4th-grade students with DS (N=120) attending special schools in Tehran during the 2023–2024 academic year. Using purposive sampling, 40 students (20 boys, 20 girls) were selected and randomly assigned to experimental (n=20) and control (n=20) groups. Tools and Intervention:

- Reading and Dyslexia Test (NAMA): A standardized assessment with a Cronbach's alpha of 0.82, measuring subskills like word reading, nonsense word decoding, text comprehension, and phoneme deletion.
- Linguistic Games Program: The experimental group participated in 15 one-hour sessions (twice weekly) featuring games targeting:
  - Phonological awareness (e.g., rhyming, sound identification).
  - Working memory (e.g., word repetition, sequencing).
  - Social interaction (e.g., turn-taking, role-playing).
  - Visual perception (e.g., letter matching, word reconstruction).

The control group received no intervention. Data were analyzed using SPSS 24 and ANCOVA, controlling for pre-test scores.

**Findings:****1. Overall Reading Performance:**

- A significant difference was observed between the experimental and control groups in post-test scores ( $F=6.791$ ,  $p=0.025$ ). Linguistic games accounted for 31% of the variance in reading performance ( $\eta^2=0.315$ ).

**2. Subcomponents of Reading:**

- Multivariate analysis revealed significant improvements in:
  - Word reading ( $p<0.01$ ).      - Picture naming ( $p<0.01$ ).
  - Text comprehension ( $p<0.01$ ).
  - Phoneme deletion ( $p<0.01$ ).
- The games explained 62% of the variance in these subskills ( $\eta^2=0.620$ ).

The results of this quasi-experimental study demonstrated that linguistic games significantly improve the reading performance of students with Down syndrome. Analysis of covariance showed a statistically significant difference between the experimental and control groups' post-test reading scores ( $F = 6.791$ ,  $p = 0.025$ ), with linguistic games accounting for approximately 31% ( $\eta^2 = 0.315$ ) of the variance in reading performance. The experimental group outperformed the control group, indicating that participation in linguistic games enhanced their reading abilities. Multivariate analysis of covariance (MANCOVA) revealed a significant effect of linguistic games on the components of reading performance, including word reading, picture naming, text comprehension, word comprehension, phoneme deletion, and letter recognition ( $F = 7.632$ ,  $p < 0.001$ ), explaining 62% ( $\eta^2 = 0.620$ ) of variance in these sub-skills. The data indicate that linguistic games positively influence multiple facets of reading in students with Down syndrome.

**Discussion and conclusion:**

Discussion of these findings highlights that linguistic games foster phonological awareness, working memory, auditory processing, and vocabulary development—key areas underlying reading success. By engaging students in interactive, motivating, and socially supportive contexts, these games improve decoding accuracy, fluency, and comprehension. This aligns with previous research supporting play- and language-based interventions for cognitive and linguistic enhancement in children with developmental disabilities. Given the effectiveness demonstrated, linguistic games are recommended as practical tools in educational and therapeutic settings for children with Down syndrome to promote literacy skills. Future research should consider larger samples and longitudinal designs to examine the durability of these improvements. The results align with Vygotsky's theory of cognitive development, emphasizing the role of social interaction and scaffolded learning within the zone of proximal development (ZPD). Linguistic games provided a dynamic environment for children with DS to:

- Strengthen phonological processing through sound manipulation tasks.

- Enhance vocabulary via semantic games (e.g., word categorization).
- Improve working memory via repetition and sequencing activities.
- Foster social skills through collaborative play (e.g., role-playing).

These findings corroborate studies by Wang et al. (2021) and Alvarez et al. (2024), which demonstrated the efficacy of game-based interventions in language and cognitive development.

Linguistic games significantly improve reading performance in children with DS by activating phonological, memory, and language systems. Their structured yet engaging nature makes them a viable tool for clinical and educational settings.

**Limitations:**

- Restricted to 9–10-year-olds in Tehran, limiting generalizability.
- No long-term follow-up due to time constraints.
- Some participants required additional clarification for test items.

**Recommendations:**

1. Practical: Integrate linguistic games into special education curricula for children with DS.
2. Training: Provide teachers with workshops on game-based intervention strategies.
3. Research: Conduct longitudinal studies with larger samples and explore digital game applications.