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IMPROVING SPEECH-IN-NOISE PERCEPTION IN NIGERIAN PUPILS WITH AUDITORY PROCESSING DISORDER: EFFECTS OF AUDITORY CLOSURE TRAINING AND DIALOGIC READING

BY

Barnabas Bem Vangerwua; Department of Audiology, Federal University of Health Sciences, Ila-Orangun, Nigeria

Ajibola Abdulrahman Ishola: Department of Audiology, Federal University of Health Sciences, Ila-Orangun, Nigeria
&
Ibraheem Abiodun Salako: Department of Audiology, Federal University of Health Sciences, Ila-Orangun, Nigeria

Abstract

Auditory Processing Disorder (APD) manifests in significant difficulties understanding speech in noise, critically impairing classroom learning. This study evaluated the comparative efficacy of two non-technological, school-based interventions, a bottom-up Auditory Closure Training (ACT) and a top-down Dialogic Reading Approach (DRA), for improving this "cocktail party effect" in Nigerian pupils with APD. A quasi-experimental, pretest posttest control group design was employed with 60 pupils (aged 8 to 12 years) in Osun State. Participants were randomized to ACT, DRA, or a wait list control. Interventions were delivered for 45 minutes, three times weekly, over 10 weeks. Speech in noise perception was the primary outcome. Analysis of Covariance revealed a significant, large main effect for treatment ($F(2, 47) = 112.83$, $p < .001$, partial $\eta^2 = .828$). Post hoc analyses confirmed both ACT (adj. $M = 10.26$, $SE = 0.39$) and DRA (adj. $M = 11.25$, $SE = 0.36$) groups significantly outperformed the control group (adj. $M = 4.31$, $SE = 0.35$) ($p < .001$), with no significant difference between active interventions. No significant main effects for gender or school type, nor any interaction effects, were found. Both targeted auditory training and language enriched cognitive intervention are highly effective for remediating speech in noise deficits in APD. The equivalent efficacy of the low cost, scalable DRA is particularly significant for resource constrained educational systems, offering a practical pathway for inclusive education.

Keywords: Auditory processing disorder, Cocktail party, Speech in noise, Auditory closure training, Dialogic reading and Intervention

Introduction

Auditory Processing Disorder (APD) is a complex neurodevelopmental condition characterized by deficits in the perceptual processing of auditory information within the central auditory nervous system, despite normal peripheral hearing acuity (American Speech Language Hearing Association, 2005). Children with APD do not struggle to hear sound but to interpret it, particularly under challenging acoustic conditions. Among the most debilitating manifestations is a pronounced impairment in understanding speech in the presence of competing background noise, a critical auditory function essential for communication and learning, often referred to as the "cocktail party effect" (Moore et al., 2013). In the dynamic auditory environment of a typical classroom, characterized by reverberation, peer chatter, and environmental sounds, this deficit acts as a direct barrier to educational access, leading to missed instructions, academic underachievement, and increased risks of social isolation and diminished self esteem (Kuk et al., 2008).

Globally, the reported prevalence of APD in school aged children is variable but significant, estimated to affect between 2% and 7% of the population (Moore et al., 2013). In Nigeria, and specifically within states like Osun, professional awareness and diagnostic capacity for APD remain in a nascent stage. The significant burden of unaddressed communication disorders in low and middle income countries is well documented, yet specialist resources for the assessment and management of conditions like APD are critically scarce. This service delivery gap results in children being misdiagnosed with attentional or behavioral disorders or, more commonly, receiving no targeted support at all, thereby exacerbating educational inequalities. Consequently, research that develops and validates feasible, context appropriate interventions is not merely an academic exercise but an urgent public health and educational imperative. The theoretical underpinning for APD intervention is rooted in the principle of experience dependent neuroplasticity, the brain's inherent capacity to reorganize its functional architecture in response to targeted, repetitive stimulation (Musiek et al., 2002). Traditional management frameworks advocate a multi pronged approach, typically encompassing: (1) environmental modifications (e.g., acoustic treatment of classrooms, use of assistive listening devices), (2) compensatory strategy training (teaching metacognitive and metalinguistic workarounds), and (3) direct therapeutic remediation of the auditory deficit itself (Chermak & Musiek, 2007). It is this third avenue, direct remediation, that has generated both significant interest and controversy.

Historically, direct remediation has focused on "bottom up" auditory training (AT), which aims to improve the fidelity of the acoustic signal as it is processed through the central auditory pathways. Protocols often target specific auditory skills such as temporal processing, dichotic listening, and auditory closure, the ability to fill in missing or masked portions of a speech signal using contextual cues (Weihing et al., 2015). However, the evidence base for such training has been questioned. Systematic reviews note that while AT can improve performance on trained auditory tasks, its transfer to real world functional outcomes,

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such as academic performance or generalized speech understanding, is inconsistent and often limited (Fey et al., 2011). This has led to a paradigm shift toward "top down" interventions that strengthen the cognitive, linguistic, and attentional systems that support listening comprehension. The contemporary consensus advocates for integrated approaches that combine bottom up and top down strategies, recognizing that listening in noise is not a purely auditory task but a complex cognitive communicative endeavor (Bigras et al., 2024; Fey et al., 2011).

Within the Nigerian context, emerging research provides a promising foundation for this integrated approach. Recent randomized controlled trials have demonstrated the efficacy of structured interventions. For instance, Osisanya and Adewunmi (2018) found that programs involving dichotic listening training, compensatory strategies, and combined therapies all significantly improved listening in noise and sound localization, with the combined approach yielding the greatest gains. Similarly, Adewunmi et al. (2022) reported that a metacognitive "think aloud" strategy significantly enhanced cocktail party performance. These studies confirm that structured, school implemented interventions are both feasible and effective in Nigeria. However, a critical gap remains: no study has directly compared a "pure" bottom up auditory training protocol with a "pure" top down language based intervention within the same experimental design in this setting. Furthermore, the generalizability of such interventions across gender and different school environments (urban vs. peri urban) within Nigeria's diverse educational landscape is unexplored.

This study was designed to address these gaps. It investigates two theoretically distinct, non technological, and culturally adaptable interventions suitable for the Nigerian primary school system:

1. Auditory Closure Training (ACT): A structured, drill based bottom up protocol explicitly targeting the perceptual skill of auditory closure, fundamental for understanding degraded speech in noise.
2. Dialogic Reading Approach (DRA): A top down, cognitively and linguistically enriching intervention that uses interactive storybook reading to strengthen vocabulary, narrative comprehension, inferential reasoning, and the use of contextual prediction.

Research Objectives

The broad objective of this study was to test the comparative efficacy of ACT and DRA for improving the cocktail party effect in pupils with APD in Osun State, Nigeria. The specific objectives were to:

1. Compare the effects of ACT and DRA against a passive control condition on speech in noise perception.
2. Investigate the main effects of pupil gender and school type (urban vs. peri urban) on intervention outcomes.
3. Examine the two way and three way interaction effects between treatment type, gender, and school type.

Hypotheses

Based on these objectives, the following null hypotheses were tested:

- **$H0_1$:** There is no significant main effect of treatment on speech in noise scores.
- **$H0_2$:** There is no significant main effect of gender on speech in noise scores.
- **$H0_3$:** There is no significant main effect of school type on speech in noise scores.
- **$H0_4$:** There is no significant interaction effect between treatment and gender.
- **$H0_5$:** There is no significant interaction effect between treatment and school type.
- **$H0_6$:** There is no significant interaction effect between gender and school type.
- **$H0_7$:** There is no significant three way interaction effect between treatment, gender, and school type.

Literature Review

Evolving Conceptualization of APD and Its Management

The definition and diagnosis of APD have been subjects of prolonged professional debate. The American Speech Language Hearing Association (2005) defines it operationally as difficulties in specific auditory behaviors, such as sound localization, auditory discrimination, and listening in competing signals. This "auditory centric" view has been challenged by perspectives arguing that deficits identified on standard APD test batteries are often inseparable from broader language and cognitive impairments. Critics contend that APD may not be a distinct diagnostic entity but rather a descriptor for listening difficulties that stem from varied underlying causes in attention, memory, or language processing (Fey et al., 2011). This controversy directly impacts intervention: if the core deficit is auditory, bottom-up training is logical; if it is linguistic or cognitive, top down approaches are more appropriate. This debate is reflected in the intervention literature. A recent scoping review by Bigras et al. (2024) analyzed 42 intervention studies for school aged children with APD. Their findings highlight the heterogeneity of approaches but note a prevailing focus on cognitive and metacognitive training (evident in over 50% of studies) alongside computer based auditory training. Crucially, they concluded that the most effective programs appeared to be those that adopted a multi component approach, integrating auditory training with language and cognitive communicative

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strategies. This aligns with the findings of Fey et al. (2011), whose systematic review noted that interventions targeting both auditory and language skills showed more promise than those focusing on auditory processing alone.

Evidence for Speech in Noise and Auditory Training

Improving the ability to understand speech in noise is a central goal of APD intervention. Studies directly targeting this skill have shown positive results. Kumar et al. (2021) demonstrated that a speech in noise training program led to significant improvements not only in auditory performance but also in related cognitive skills in children with APD, suggesting a transfer of training benefits. Similarly, Singh et al. (2021) found that targeted speech in noise training enhanced both auditory and cognitive abilities. These studies support the plasticity of the auditory system and the potential for targeted drills to induce functional change, a principle long articulated in foundational work on auditory training (Musiek et al., 2002; Weihing et al., 2015). However, the limitations of isolated auditory training are increasingly recognized. The transfer of skills from the training environment to the complex, real world listening situations a child faces daily, the problem of "ecological validity," remains a significant hurdle. Performance gains on computerized auditory tasks do not automatically translate to improved classroom listening, reading comprehension, or academic grades.

Role of Top Down, Language Based Interventions

In contrast, top-down interventions aim to bolster the higher order systems that support listening comprehension. The Dialogic Reading Approach is a prime example. Based on the work of Whitehurst et al. (1988), DRA transforms passive read aloud sessions into interactive, language building conversations. By using prompts, expansions, and open ended questions, the facilitator actively engages the child's vocabulary, narrative understanding, and inferential reasoning. This method does not directly train the ear but strengthens the cognitive linguistic "software" needed to extract meaning from an imperfect acoustic signal. This approach is congruent with the finding by Adewunmi et al. (2022) that a metacognitive "think aloud" strategy improved cocktail party performance, highlighting the power of engaging cognitive and metalinguistic processes. For resource constrained settings like Nigeria, the practical advantages of a DRA are substantial. It requires no specialized equipment, utilizes existing literacy blocks within the curriculum, can be delivered by trained teachers rather than highly specialized clinicians, and has the added benefit of promoting foundational literacy skills. Its scalability and sustainability potential are high.

Contextualizing the Research: The Nigerian Educational Landscape

Research on APD in Nigeria is growing but still limited, though foundational studies demonstrate the feasibility and effectiveness of localized interventions. The work by Osisanya and Afolabi (2016) on auditory training for children with hearing loss in Ibadan provides an early model for structured aural rehabilitation within the Nigerian context, showing that specific interventions can significantly improve speech perception. Building on this, the study by Osisanya and Adewunmi (2018) is particularly salient as it provides direct evidence of successful school-based auditory and cognitive intervention for APD. Their finding that a combined therapy (integrating dichotic listening training and compensatory strategies) was most effective underscores the value of integrated, multi-component models that may be well-suited to address complex listening challenges. However, translating these evidence-based interventions into widespread practice requires navigating the unique challenges of the Nigerian educational system. These include large class sizes, variable classroom acoustics, limited specialist support, and a diverse range of school environments, from well-resourced urban private schools to under-resourced peri-urban and rural public schools. The significant interactions found between treatment type and disability-specific factors, such as the degree of hearing loss (Osisanya & Afolabi, 2016), highlight that an intervention's efficacy and equity across broader demographic contexts cannot be assumed. Therefore, understanding whether an intervention works equally well for boys and girls, and in both urban and peri-urban schools, is essential for ethical and effective system-wide implementation planning. This study's explicit inclusion of gender and school type as moderating factors directly addresses this critical need for contextual generalizability data, aiming to ensure that proven interventions can benefit all pupils, regardless of their gender or educational setting.

Methodology

This study employed a quasi-experimental, pretest posttest control group design. To maximize internal validity within the constraints of field based educational research, random assignment of participants to groups was implemented. The statistical control of pretest scores as a covariate in the primary analysis was used to adjust for baseline differences and increase statistical power. The study was conducted in Osun State, southwestern Nigeria. Participants were recruited from public primary schools in two distinct locales: Osogbo, the state capital and a major urban center with tertiary institutions, and Ikire, a representative peri urban town. This purposive sampling allowed for testing the interventions' applicability across different resource and environmental contexts. Ethical approval was obtained from the Osun State Ministry of Health Ethical Review Committee and relevant Local Government Education Authorities. Written informed assent was obtained from all pupils, and written informed consent was secured from their parents or guardians. All assessment and intervention sessions were conducted in the quietest available rooms within the participating schools.

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A total of 60 primary school pupils (Primary 4 to Primary 6, ages 8 to 12 years) participated. Strict inclusion criteria were applied:

1. Normal peripheral hearing sensitivity, defined as pure tone air conduction thresholds of ≤20 dB HL at octave frequencies from 500 to 4000 Hz in both ears.
2. A confirmed diagnosis of APD, established by a certified audiologist using a standardized behavioral battery (e.g., the SCAN 3 or a locally validated equivalent), with a significant deficit (performance below 2 standard deviations from the mean for age) on at least one speech in noise and one auditory closure subtest.
3. Normal nonverbal intellectual ability, screened using the Raven's Coloured Progressive Matrices (score at or above the 25th percentile for age).

Exclusion criteria included known neurological disorders (e.g., epilepsy, cerebral palsy), autism spectrum condition, significant intellectual disability, or uncorrected visual impairment. Eligible participants were randomly assigned to one of three groups (n = 20 per group): the Auditory Closure Training (ACT) group, the Dialogic Reading Approach (DRA) group, or a Wait List Control group. Random assignment was stratified by gender and school location to ensure balanced group composition on these variables. Both active interventions were delivered by trained research assistants (postgraduate students in audiology or speech language pathology) who underwent a standardized two week training program. Sessions were conducted in small groups of 4 to 5 pupils, three times per week for 45 minutes per session, over a continuous 10-week period. Fidelity of implementation was monitored weekly using a standardized checklist.

Auditory Closure Training (ACT): This structured, bottom-up protocol utilized a laptop with customized audio software and calibrated headphones. Activities were organized hierarchically, increasing in difficulty based on performance.

- Tasks: Included (a) identifying monosyllabic words with final consonants progressively masked by speech shaped noise; (b) repeating sentences where a key word was replaced by a pure tone or time compressed noise burst; and (c) answering questions about short narrative paragraphs presented with multi talker babble background noise at adaptive signal to noise ratios (starting at +10 dB).
- Focus: The exclusive focus was on enhancing auditory perceptual accuracy and closure abilities through repetitive drill.

Dialogic Reading Approach (DRA): This top down, language enriched intervention was adapted from the established PEER (Prompt, Evaluate, Expand, Repeat) sequence (Whitehurst et al., 1988). Culturally appropriate Nigerian storybooks were selected.

- Procedure: Facilitators avoided simply reading text aloud. Instead, they used open ended prompts ("What's happening on this page?"), completion prompts ("The lion opened his mouth to..."), and recall prompts. They evaluated the child's response, expanded it with richer vocabulary and syntax, and encouraged the child to repeat the expansion.
- Focus: Explicitly targeted vocabulary development, narrative structure comprehension, prediction, and inferential thinking within a meaningful communicative context.

Control Group: Participants assigned to the wait list control group continued with their regular classroom instruction and received no additional auditory, language, or cognitive training during the 10-week study period. To uphold ethical obligations, these pupils were offered a condensed, 4-week version of the DRA intervention upon completion of post testing.

The primary outcome measure was the change in performance on a culturally and linguistically adapted Speech in Noise (SPIN) test. Developed and piloted for this study, the test presented target words (familiar bisyllabic Yoruba and English words) through headphones, embedded in a constant multi talker babble masker at a fixed +5 dB signal to noise ratio. The child's task was to repeat the target word. Responses were scored as correct or incorrect by an assessor blinded to group allocation. The total percentage of correctly identified words served as the direct behavioral metric for the "cocktail party effect." This assessment was administered individually in a quiet school room at two time points: a pretest (one week prior to intervention) and a posttest (one week following the final intervention session). All statistical analyses were conducted using IBM SPSS Statistics (Version 28). The primary inferential analysis was a 3 (Treatment: ACT, DRA, Control) × 2 (Gender: Male, Female) × 2 (School Type: Urban, Peri Urban) between subjects Univariate Analysis of Covariance (ANCOVA). The dependent variable was the posttest SPIN score, with the pretest SPIN score included as a covariate. This model controlled for baseline differences and increased statistical power. Assumptions of normality, homogeneity of variance, and homogeneity of regression slopes were tested and met. In the event of a significant main effect for the Treatment factor, Bonferroni corrected post hoc pairwise comparisons were conducted to identify specific group differences. Partial eta squared (ηp^2) values were calculated as measures of effect size, interpreted as: .01 (small), .06 (medium), and .14 (large) (Cohen, 1988). The alpha level was set at .05.

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Results

Data screening confirmed that assumptions of normality, homogeneity of variance (Levene's test, p> .05), and homogeneity of regression slopes (non-significant Treatment × Pretest interaction, p> .05) were met for the ANCOVA.

Hypothesis Testing

The ANCOVA results are summarized in Table 1.

Table 1: Summary of 3 x 2 x 2 Analysis of Covariance (ANCOVA) on Post-test Speech-in-Noise Scores

Source	SS	df	MS	F	p	partial η^2
Pre-test (Covariate)	37.360	1	37.360	17.40	**.000**	.270
Treatment	**484.662**	**2**	**242.331**	**112.83**	**< .001**	**.828**
Gender	1.319	1	1.319	0.614	.437	.013
School Type	0.287	1	0.287	0.134	.716	.003
Treatment x Gender	1.568	2	0.784	0.365	.696	.015
Treatment x School Type	0.553	2	0.277	0.129	.879	.005
Gender x School Type	2.626	1	2.626	1.223	.274	.025
Treatment x Gender x School Type	0.952	2	0.476	0.222	.802	.009
Error	100.944	47	2.148			
Corrected Total	732.983	59				

Note. Significant effects are highlighted in bold.

Hypothesis One ($H0_1$): Main Effect of Treatment

The ANCOVA revealed a statistically significant and very large main effect of treatment on posttest SPIN scores, after controlling for pretest scores, $F(2, 47) = 112.83$, p< .001, partial $\eta^2 = .828$. Therefore, the null hypothesis was rejected. The type of intervention received had a substantial impact on speech in noise performance. Estimated marginal means, controlling for the pretest covariate, are presented in Table 2.

Table 2: Estimated Marginal Means of Posttest Speech in Noise Scores by Treatment Group

Treatment Group	Mean	SE	95% Confidence Interval
Auditory Closure Training (ACT)	10.26	0.39	[9.48, 11.03]
Control Group	4.31	0.35	[3.61, 5.01]
Dialogic Reading Approach (DRA)	11.25	0.36	[10.53, 11.98]

Bonferroni adjusted pairwise comparisons confirmed that the ACT group (adj. $M = 10.26$, $SE = 0.39$) significantly outperformed the Control group (adj. $M = 4.31$, $SE = 0.35$), Mean Difference = -5.95, p< .001. The DRA group (adj. $M = 11.25$, $SE = 0.36$) significantly outperformed the Control group, Mean Difference = -6.94, p< .001. The difference between the ACT and DRA groups was not statistically significant, Mean Difference = 0.99, p= .104. Therefore as concluded. the null hypothesis was rejected

Hypothesis Two ($H0_2$): Main Effect of Gender

The analysis revealed that gender did not have a significant main effect on the outcome. The statistical evidence, $F(1, 47) = 0.614$, p= .437, with a very small effect size (partial $\eta^2 = .013$), led to the retention of the null hypothesis.

Hypothesis Three ($H0_3$): Main Effect of School Type

Similarly, the type of school a participant attended showed no significant main effect. With $F(1, 47) = 0.134$, p= .716, and a negligible effect size (partial $\eta^2 = .003$), the null hypothesis was retained.

Hypothesis Four ($H0_4$): Treatment × Gender Interaction

The way participants responded to the treatment was not meaningfully different between men and women. This two-way interaction was not statistically significant, $F(2, 47) = 0.365$, p= .696, partial $\eta^2 = .015$, so the null hypothesis was retained.

Hypothesis Five ($H0_5$): Treatment × School Type Interaction

The treatment's effectiveness did not depend on school type. The non-significant interaction, $F(2, 47) = 0.129$, p= .879, partial $\eta^2 = .005$, indicated the null hypothesis should be retained.

Hypothesis Six ($H0_6$): Gender × School Type Interaction

There was no significant interaction between gender and school type. The statistical test, $F(1, 47) = 1.223$, p= .274, partial $\eta^2 = .025$, supported retaining the null hypothesis.

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Hypothesis Seven ($H0_7$): Three-Way Interaction
The combined influence of treatment, gender, and school type did not produce a unique effect. The three-way interaction was not significant, $F(2, 47) = 0.222$, $p = .802$, partial $\eta^2 = .009$, leading to the retention of the null hypothesis.

Discussion of the Findings
This study provides robust evidence that structured, non-technological interventions implemented within the Nigerian school system can produce substantial improvements in the cocktail party effect among pupils diagnosed with APD. The significant and equivalent superiority of both ACT and DRA over the control condition confirms their efficacy and offers novel insights for both theory and practice in low resource settings. The rejection of the first null hypothesis and the very large associated effect size provides strong support for the efficacy of both interventions. The success of the bottom-up ACT protocol aligns with the principle of auditory neuroplasticity (Musiek et al., 2002) and corroborates international evidence that targeted auditory training can improve specific auditory skills, including speech in noise perception (Kumar et al., 2021; Weihing et al., 2015). It directly extends the findings of Nigerian auditory training studies (Osisanya & Adewunmi, 2018) by demonstrating the specific effectiveness of an auditory closure paradigm.

The equivalent efficacy of the top-down DRA is arguably the study's most significant finding. It demonstrates that enhancing cognitive linguistic scaffolding through interactive, language rich dialogue can be as effective as direct auditory drills for improving functional listening in noise. This finding powerfully supports contemporary models that advocate for interventions integrating bottom up and top-down processes (Bigras et al., 2024; Fey et al., 2011). It suggests that for children with APD, strengthening the brain's ability to predict, infer, and reconstruct meaning from an imperfect signal can compensate for weaknesses in the initial perceptual analysis of that signal. This result is congruent with the work of Adewunmi et al. (2022), which found benefits from a metacognitive strategy, and underscores the interconnected nature of auditory and cognitive processing. secondly, we found that gender did not change the treatment results. This means both boys and girls benefited equally. This finding is similar to another study that used a "think-aloud" strategy and also found no gender difference (Adewunmi et al., 2022).

However, other research has shown that boys and girls sometimes have different starting points in their auditory skills. For example, one study found boys did better on the cocktail party effect before any treatment began (Osisanya & Adewunmi, 2018). Our results suggest that even if boys and girls start at different levels, a good treatment can help them both improve similarly. Thirdly. , the type of school a student attended also did not matter. The treatment worked just as well in different school environments. This is good news for using the treatment in many places. It matches other research where treatments were successfully used in both homes and schools (Osisanya & Adewunmi, 2018).

We checked if combinations of these factors mattered. We tested if the treatment worked differently for boys compared to girls (the Treatment x Gender interaction). The result was not significant. This tells us that boys and girls benefited from the training equally. This finding makes sense when we look at other research. One study using a similar "think-aloud" cognitive strategy also found no difference in how boys and girls responded to treatment (Adewunmi et al., 2022). This supports the idea that this type of thinking-based training helps all students in a similar way. Next, the study examined if the treatment was more effective in one type of school than in another (the Treatment x School Type interaction). Again, this result was not significant. Students improved regardless of their school environment. This is an important practical finding. It suggests that teachers in different schools can use this treatment and expect similar success. It aligns with other intervention studies that have been successfully carried out in various settings (Osisanya & Adewunmi, 2018). We also checked if just being a boy or a girl in a certain school type was linked to different outcomes, even without the treatment (the Gender x School Type interaction). This result was also not significant. This means that in our study, there was no evidence that, for example, boys in public schools started with different skills than boys in private schools, or girls in one setting versus another. The baseline scores were similar across these groups.

We tested if the treatment work best for a *specific combination* of gender and school type. This result was not significant. This final test confirms the overall pattern: the treatment's effectiveness was robust and straightforward. A student's specific mix of gender and school type did not create a special advantage or disadvantage. Finding no interactions is a positive and important result. It means the treatment has wide applicability. A teacher or clinician does not need to worry that it will only work for a specific group, like only for girls or only in private schools. This makes the treatment much easier to recommend and use widely. The fact that broad factors like gender and school type did not matter contrasts with other areas of hearing research. For example, studies on children with hearing loss have found that specific medical factors, like the degree of a child's hearing loss, can change how well a treatment works (Osisanya & Afolabi, 2016). This difference is instructive. It suggests that for our cognitive-based listening treatment, general personal and environmental factors are less important. However, future research could investigate if more specific factors, like a child's exact auditory processing profile, might influence the results.

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Conclusion

This study makes a significant contribution to the field of APD intervention, particularly within the context of low- and middle-income countries. It demonstrates that both a bottom-up Auditory Closure Training and a top-down Dialogic Reading Approach are potent, feasible, and equitable interventions for ameliorating the debilitating cocktail party effect in Nigerian pupils with APD. The equivalent efficacy of these two theoretically distinct pathways validates an integrated, multi-dimensional view of auditory processing disorders and their remediation.

Recommendations

The findings have clear and actionable implications:

1. Audiologists, speech language therapists, and special needs educators in Nigeria and similar settings can confidently adopt and adapt these protocols. The DRA, in particular, should be promoted as a first line, low-cost intervention that can be integrated into mainstream teaching.
2. Pre service teacher training colleges and in service professional development programs should incorporate modules on the recognition of listening difficulties and the implementation of strategy based interventions like the Dialogic Reading Approach.
3. The Osun State Ministry of Education, and similar bodies across Nigeria, should consider embedding guidelines for teacher led auditory and language support strategies into the broader framework for inclusive and special needs education.

References

Adewunmi, A. T., Olusanya, O. A., Amosun, M. D., & Osisanya, A. (2022). Efficacy of think aloud strategy on the cocktail party effect of pupils with auditory processing disorders. *Hearing, Balance and Communication, 20*(2), 89 95. https://doi.org/10.1080/21695717.2022.2069975

Bigras, J., Lagacé, J., Mawazini, A., & Lessard Dostie, H. (2024). Interventions for School Aged Children with Auditory Processing Disorder: A Scoping Review. *Healthcare*, 12, 1161.

Bronkhorst, A. W. (2015). The cocktail party problem revisited: Early processing and selection of multi talker speech. *Attention, Perception, & Psychophysics*, *77*(5), 1465–1487. https://doi.org/10.3758/s13414 015 0882 9

Chermak, G. D., & Musiek, F. E. (2007). *Handbook of (central) auditory processing disorder: Comprehensive intervention.* Plural Publishing.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences (2nd ed.).* Lawrence Erlbaum Associates.

Fey, M. E., Richard, G. J., Geffner, D., Kamhi, A. G., Medwetsky, L., Paul, D., Ross Swain, D., Wallach, G. P., Frymark, T., & Schooling, T. (2011). Auditory processing disorder and auditory/language interventions: An evidence based systematic review. *Language, Speech, and Hearing Services in Schools*, 42(3), 246–264.

Kuk, F., Jackson, A., Keenan, D., & Lau, C. (2008). Personal amplification for school age children with auditory processing disorders. *Journal of the American Academy of Audiology*, 19, 465–480.

Kumar, P., Singh, N. K., & Hussain, R. O. (2021). Effect of speech in noise training in the auditory and cognitive skills in children with auditory processing disorders. *International Journal of Pediatric Otorhinolaryngology*, 146, 110735.

Moore, D. R., Ferguson, M. A., Edmondson Jones, A. M., Ratib, S., & Riley, A. (2018). Nature of auditory processing disorder in children. *Pediatrics, 126*(2), e382 e390. https://doi.org/10.1542/peds.2009 2826

Musiek, F. E., Shinn, J. B., & Hare, C. (2002). Plasticity, auditory training, and auditory processing disorders. *Seminars in Hearing*, 23, 263–276.

Osisanya, A., & Adewunmi, A. T. (2018). Evidence based interventions of dichotic listening training, compensatory strategies and combined therapies in managing pupils with auditory processing disorders. *International Journal of Audiology, 57*(2), 115 123. https://doi.org/10.1080/14992027.2017.1386331

Osisanya, A., & Afolabi, M. C. (2016). Effect of auditory training and aided language stimulation on speech perception of children with hearing loss in Ibadan, Oyo State, Nigeria. *Research on Humanities and Social Sciences, 6*(24), 1 12.

Weihing, J., Chermak, G., & Musiek, F. (2015). Auditory Training for Central Auditory Processing Disorder. *Seminars in Hearing*, 36, 199–215.

Whitehurst, G. J., Falco, F. L., Lonigan, C. J., Fischel, J. E., DeBaryshe, B. D., Valdez Menchaca, M. C., & Caulfield, M. (1988). Accelerating language development through picture book reading. *Developmental Psychology*, 24, 552–559.