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ORIGINAL ARTICLE

Efficacy of think-aloud strategy on the cocktail party effect of pupils with auditory processing disorders

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ABSTRACT

Objective: This study was done to determine the effects of think-aloud strategy on the cocktail party effect of pupils with a single profile of APD against no-treatment group. The study also sought to develop a means of managing pupils with auditory processing disorders using the intervention package.

Design: Participants were randomly selected to each group (intervention group and no-intervention group). A therapeutic intervention session on the cocktail party effect was carried out for 8 weeks which lasted 30 min three times per week in the school environment.

Study sample: The study consisted of 40 pupils (8–12 years) with a single profile of APD.

Results: The treatment was effective in enhancing the cocktail party effect of pupils with APD and there was no significant main effect of gender in the cocktail party effect of the participants.

Conclusion: The pupils with APD in the intervention group benefitted from the treatment process, therefore treatment should be adopted by teachers of pupils with APD.

KEYWORDS

Think-aloud strategy; auditory processing disorder; cocktail party effect; pupils with APD

Introduction

Many factors can affect an individual's listening ability among which is the physiological factor such as Auditory Processing Disorder. Jerger and Musiek [1] submitted that an auditory processing disorder (APD) may be broadly defined as a deficit in the processing of information that is specific to auditory modality. It may be associated with difficulties in listening, speech understanding, language development and learning. APD is a hearing problem that affects about 5% of school-aged children. Difficulties in auditory processing do not affect what is heard by the ear but do affect how the information is interpreted or processed by the brain. Consequently, the common areas of difficulty of the disorder include phonological awareness, auditory discrimination, audition memory, auditory sequencing and auditory blending [2], and particular difficulty in listening in a noisy environment [3], which is the aptly named cocktail party problem [4].

The cocktail party problem is the ability to focus one's listening attention on a single talker among a cacophony of conversations and background noises, ignoring other conversations. The cocktail party problem has been found to be a problem in human auditory scene analysis [4]. Getzmann et al. [5] opined that listeners have the ability to segregate different stimuli into different streams, and subsequently decide which streams are more pertinent to them. Thus, it has been proposed that one's sensory memory subconsciously parses all stimuli and identifies discrete pieces of information by classifying them by salience [6]. The cocktail party effect is also called selective auditory attention or selective hearing or speech-in-noise ability. First introduced in the works of Cherry [7], it is the phenomenon of being able to focus one's auditory attention on a particular stimulus while filtering out a range of other stimuli, much the same way that a partygoer can focus on a single conversation in a noisy room. Alternately, the listener may be trying to identify one or several talkers amidst a background of surrounding noise, such as the clatter of dishes, doors slamming, other talkers and background music in a busy restaurant. A third situation may be that of trying to understand speech amidst a background of non-voice competing low frequency sound, such as following a conversation on a busy street, in a car or in an aeroplane [8].

Strategies have been developed to enhance the listening abilities of pupils with listening difficulties among which is the think-aloud strategy. Think-

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Aloud Strategy (TAS) is a method used in reading comprehension and appropriate for listening studies. It comprises the ability to use this advantage which depends on the intertextual listening. According to Price [9], TAS can be described as eavesdropping on someone's thinking. With this strategy, teachers verbalise aloud while reading a text selection orally. The verbalisation includes describing things they are doing as they read to monitor their comprehension. The purpose of the think-aloud strategy is to model for students how skilled readers construct meaning from a text. It allows students to guess what the teacher will tell next in the classroom, summarise what has been told, silently question the teachings and transform what they have listened to into their own thinking [10].

TAS protocols involve the teacher and students vocalising the internal thinking that they employ when engaged in literacy practices or other areas of learning. Afflerbach and Johnston [11] set the groundwork for the development of the think-aloud strategy, first as a method of measuring cognitive reading process then as an application in the metacognitive realm in which readers use the tool to monitor comprehension. Presley et al. [12] cited think-aloud as one of the transactional strategies because it is a joint process of teachers and students working together to construct understanding of text as they interact with it.

Through the interactions that think-aloud strategy promotes, a better understanding of the texts may emerge in the classroom. Think-aloud strategy is also a process in which readers report their thoughts while reading [13]. The strategy helps students to reflect upon their own reading process. In a similar way, Keene and Zimmerman [14] declared that TAS is a technique in which students verbalise their thoughts as they read. Whereas readers independently derive meaning from any text by using background knowledge, interests, motivations, and purposes for reading, group reading using TAS allows a small interpretive community to explore other view points and to negotiate understanding. Kucan and Beck [15] noted that think-aloud achieves three goals of providing a method of inquiry to understand cognitive processing related to reading research, serving as a method of instruction; and an aspect of social interaction.

In the clinical environment, stimuli (speech or non-speech) can be delivered through multiple speakers set at various vertical and horizontal planes. Signals can be delivered either in isolation, or in the presence of competing noise, or multi-talker babble. The child's task is simply to point to the speaker from which the target signal came. Sound could be presented to subjects in two different ways which are through free-field presentation and through headphone presentation of sounds. Free-field presentation is when sounds are presented by speakers located around the listener's head in a dark room. The listener can indicate location by pointing or by giving azimuth and elevation coordinates. Headphone presentation of sounds is where the listener uses a headphone and the sound is concentrated on the listener's ears, and the cues from the outer ear are lost [16].

Classrooms are often noisy places, and children with APD have a harder time than adults while listening to speech in noisy environment, thus necessitating intervention for pupils with APD [17]. Available interventions for pupils with APD are inferred from other population such as Dyslexia and Attention Deficit Hyperactive Disorder (ADHD). Thus, the current study aimed at investigating the effectiveness of the use of the TAS in enhancing the cocktail party effect of children with APD. Also, the study sought to determine the gender effect in the cocktail party effect among pupils with APD and examine interactions of treatment and gender on the cocktail party effect. The whole hypotheses tested were (1) the main effect of treatment (TAS) on the cocktail party effect of pupils with APD (participants), (2) main effect of gender, (3) interaction effect of treatment and gender on the cocktail party effect of the pupils with APD.

Materials and methods

Participants

The sample consisted of 40 pupils (male and female), who were classified as having APD without co-morbid conditions such as hearing loss, any ear infection, intellectual impairment, reading disorder and attention deficit in primary schools in Ibadan, Nigeria was used in the study. Initially, 364 pupils were nominated by the class teachers in schools located close to sources of environmental sounds, as presenting with listening difficulties significant enough to interfere with academic activities. These were then subjected to audiological tests of otoscopy, audiometry and tympanometry. 139 pupils passed the tests and 225 were able to advance to the next stage of screening. Two pupils left the schools at this stage, and we were left with 223, who were then assessed with the Children's Auditory Processing Performance Scale, to determine

their listening abilities on day-to-day use. 38 pupils (> -0.05) failed the test.

Further assessment procedures include the test of auditory processing disorders in children (SCAN 3:C) and the random gap detection test expanded (RGDT-Expanded), using a diagnostic criteria of at least one ear on at least two tests of auditory processing, and an aberration on at least one linguistic test. 44 pupils were further left out in the study (31 through SCAN, 13 through RGDT).

Thus, 141 pupils qualified for a diagnosis of APD, who were further tested using the Wechsler Intelligence Scale for Children, fourth edition (WISC IV), for intelligence, verbal intelligence and non-verbal intelligence; 26 pupils (14 FSIQ & VCI <90; 12 FSIQ & PRI <90) were dropped at this stage.

The 115 pupils were further assessed with a self-developed reading comprehension test, where 39 (<50%) were dropped from further assessment; and 28 pupils had attention problems, using the Canadian ADHD resource checklist. There were 26 females with a single profile of APD, and 22 males with a single profile of APD. These were then randomly put into either the experimental group or the control group, where the pupils were asked to pick from cardboard cut-outs of 'T's (to represent treatments) and 'C's (to represent control), per gender classification, where there were 13 'T's and 13Cs for the females, and there were 11 'T's and 11 'C's for males.

These were then further reduced to 10 per gender classification through balloting, where 10 'Yes' and 3 'No' of cardboard cuts were put in a box for the female gender per treatment group, and 10 'Yes' and 1 'No' were put in a box for the male gender per treatment group as well. Pupils who picked 'Yes' per group per gender became the final participants for that group. The participants were exposed to 8 weeks of therapeutic intervention sessions (one week for pre-test measure, six weeks of treatment and one week for post-test measure), except for the control group that were only pre tested and post tested. The participants were quizzed based on the comprehension passages taken from the reading text used for the intervention.

Five questions each were asked at the end of the sessional activities. Each question carried 1 mark and participants were required to give verbal response to the questions. For the pre and posttests, there was a multi-talker babble as a background noise, where non-participants played in the background as distractor variable, the researchers then read a text to the participants and asked questions from the text.

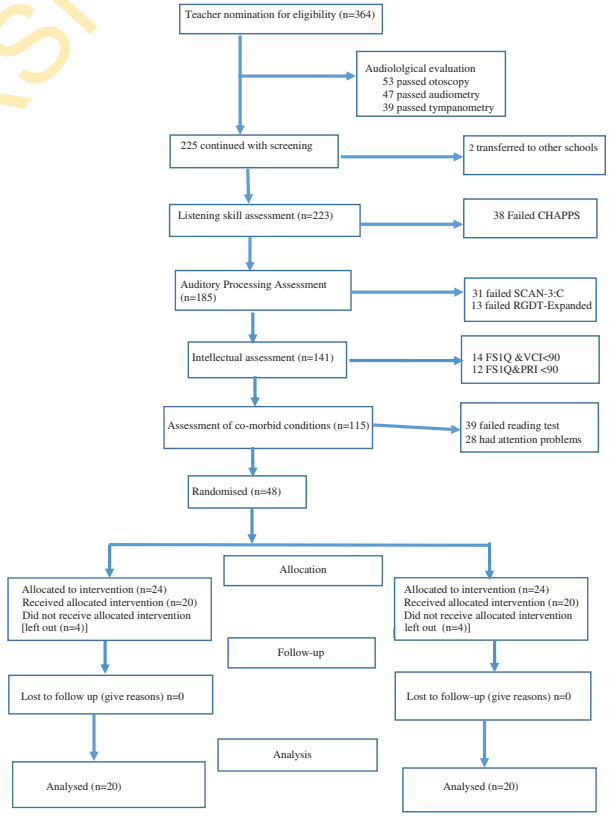
Table 1. Baseline data of the participants.

	Think aloud strategy		Control	
Age ($\bar{x}$)	10.32		10.66	
Gender	Male	Female	Male	Female
	10	10	10	10
Ethnic origin				
Yoruba	6	5	5	7
Hausa	1	0	0	0
Igbo	3	2	2	2
Others	1	3	3	1
EA				
LEA	6	7	4	5
Atypical REA	4	3	6	5

Key. EA: Ear advantage. LEA: Left ear advantage. REA: Right ear advantage.

There were five (5) questions in all and each participant was asked to give a verbal response to the questions. All correctly answered question attracted one mark each. The answers were recorded per participant and summed up based on group allocation. The participants' flow chart is presented below and Table 1 provides information on the baseline data of the participants.

Participants' Flow Chart



Intervention plan

The intervention plan used was think-aloud strategy; the think aloud program selected for this study was

Table 2. Summary of 2 × 2 Analysis of Covariance (ANCOVA) showing the effect of treatment and gender on the cocktail party effect of participants exposed to TAS and control group.

Source	Type III Sum of Squares	*df*	Mean Square	*F*	Sig.	$\eta^2_{partial}$
Pre-test	18.263	1	18.263	12.403	.001	.262
Treatment	22.904	1	22.904	15.555	.000	.308
Gender	.452	1	.452	.307	.583	.009
Treatment* Gender	.479	1	.479	.325	.572	.009
Error	51.537	35	1.472			
Corrected Total	84.400	39				

done by making the participants listen to stories from selected book chapter from the government-approved English Language textbook of the pupils, which is the Macmillan Primary English Course.

Procedure

The comprehension passages used during the therapeutic sections were adopted from the Macmillan Primary English Course for Basics (Primary 4), which was a year below the present class of the pupils. The pupils were, at the time of the study in Basic 5. This supports the submission of Diagnostics and Statistician Manual of Mental Disorders, fifth edition–DSM 5 [18], that the severity criterion in the diagnosis of learning disorder will require the individual to perform significantly lower than most individuals of the same age. The TAS followed a free-field presentation format. The TAS followed a free-field presentation format.

The think-aloud strategy comprised three main training process;

i. Modelling
ii. Guided practice
iii. Reflection

Modelling

The modelling was done in the classroom, where the researchers showed their thinking process and how their thoughts occur during reading and listening. The researchers provided the pupils with a recorded content to listen to the verbalisation of stories and ask the pupils to say what they hear and think about the story. There was multi-talker babble as a background noise, consisting of non-participants playing in the background and taking several positions. This background noise was repeated for the guided practice and the reflection stages of the experiment.

Guided practice

This session consisted of content delivery done through verbal presentation. The researchers encouraged pupils to practice the TAS under independent control during the guided phase with the help of research assistants. This made the participants play more active roles and were engaged in the application required for working alone or in small groups.

Reflection

The researchers promoted collective reflection on the activity so that pupils could share their experience and co-operate to accomplish the goal.

Procedure for the control group

Twenty children were randomly assigned to this group. The participants in the control group were not exposed to any intervention package during the period of therapeutic treatment but were pretested and posttested.

Research design

The research design was a pre-test posttest quasi experimental research design with a 2 × 2 factorial matrix.

Statistical analysis

The analysis of co-variance (ANCOVA) was used to determine the effectiveness of the treatment, while the Fisher's LSD was used to compare the performance of the intervention.

Results

There was a significant main effect of TAS on the cocktail party effect of the participants $F_{(1,35)} = 15.55$, $p < .05$ (Table 2). The experimental group exposed to the TAS had a higher mean score ($\bar{x} = 16.01$), compared to the control group ($\bar{x} = 14.39$) (Table 3, Figure 1), with the difference being statistically significant (LSD = 1.623, $p < .05$) (see Table 4). Gender did not have a significant impact on the cocktail party effect of the participants $F_{(1,35)} = 0.31$,

$p > .05$) (Table 2). No significant interaction effect of TAS and gender existed in the coctkail party effect ($F(1, 35) = .33$, $p > .05$) (Table 2).

Discussion

The results of the analysis of the first hypothesis on the significant main effect of treatment shows that there was a significant main effect of treatment. This suggests that the treatment under study was effective in managing listening ability in children with auditory processing disorders as participants in the experimental group performed better than those in control group. The effect size reported in the findings is .31 which is translated as 31%. Effect sizes represent the size of the experimental effect after a significant effect has been obtained, that is, after the null hypotheses is rejected. Therefore, the participants in treatment group were 31% better than participants in control group.

Cohen [19] outlined the criteria for gauging small, medium and large effect sizes. The .31 going by Cohen's *d* is in between small and medium. Technically, this means that there was an effect in the treatment and the size of the effect was comparatively medium. There was a significant effect between the TAS group and the control group when the Fisher's test was run on results of the cocktail party effect of children with APD. This means that the experiment is

Table 3. Descriptive statistics shows the difference between the control and experimental group in the cocktail party effect of the participants.

			95% Confidence interval	
Treatment	Mean	Std. error	Lower Bound	Upper Bound
Control	14.389	.281	13.818	14.960
TAS	16.011	.281	15.440	16.582

Table 4. LSD post hoc analysis of mean differences in the cocktail party effect based on treatment.

	Groups		
		LSD	Sig
Cocktail party effect	Control group TAS group	1.623*	.000

*Pairs significantly different at $p < 0.05$.

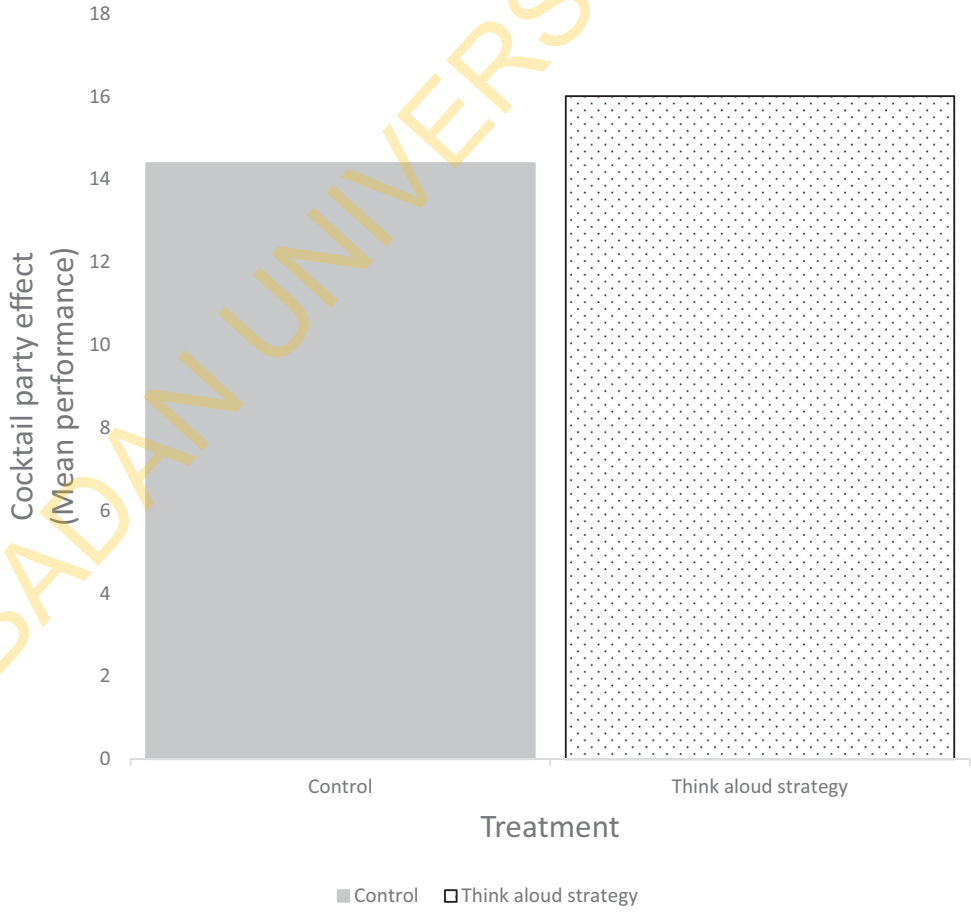


Figure 1. Bar graph showing the comparison between treatment and control groups based on cocktail party effect of the participants.

recommendable for enhancing listening in the cocktail party. This finding corroborates earlier finding of Sonnez and Sulak [20], where a statistically significant difference was found between the pre-test and the posttest scores of pupils with reading comprehension problems exposed to the Think Aloud Strategy.

There was no significant main effect of gender in the cocktail party effect of the participants. The main effect of gender on this listening ability was tested, and the summary of the result displayed revealed that the influence of gender on the cocktail party effect among pupils with auditory processing disorder was not significant. This means that males and females do not differ in performance in a listening session, when background noise is present. This result could be because the TAS closely aligns with the cognitive theory, where there is emphasis on an individual's ability to think actively about any learning activity, and where an individual's active participation in the learning process is recognised. This finding contradicts the earlier finding of Osisanya and Adewunmi [21], where gender difference was realised in the cocktail party effect to the extent that the male participants in the study were found to be better listeners. Interestingly, the participants (8 years 0 months through 12 years 0 months) in the present study and that of Osisanya and Adewunmi study (7 years 0 months through 11 years 11 months) were of similar age group academically. The differences in sample sizes might have accounted for the differences in finding. The present study had 40 participants in 2 groups (1 intervention group and 1 control group), while the Osisanya and Adewunmi study had 80 participants in 4 groups (3 intervention groups and one control group).

Also, the present result contradicts the earlier finding of Akintemi [22] , who while examining the effect of storytelling on the listening skills of primary one pupils, noticed that females, with a mean score of 25.07 were better listeners than males, who had a mean score of 18.41. Also, the finding did not acquiesce the earlier finding of Welch and Mickelson [23], where a gender difference in therapeutic listening was found with female managers indicating they use more therapeutic listening than male counterparts. Therapeutic listening involves emotional understanding whereby individuals often act as sounding boards to allow another person to vent.

The study hypothesis that says there is no significant interaction effect of TAS and gender on the cocktail party effect of pupils with auditory processing disorders in the study was confirmed. This could be interpreted that the no gender-effect for children with APD in the study eroded on the TAS effect on the cocktail, bringing about an eventual no interaction effect. Thus, the finding acquieces that of Akintemi [22], who did not notice any interaction between story-telling and gender of the participants, meaning that story-telling as an intervention plan is not gender-sensitive in enhancing listening skills of pupils.

Conclusion and further direction

The study was limited in many areas. Only pupils between ages 8 years 0 months through 12 years without co-morbid conditions were considered. The study did not categorise the disorder into specifics. The study also used the natural environment of the participants for the experiment, therefore future researchers should conduct the experiment in a clinical setting. The study shows that the variables identified and implications consequent of the study to clinicians, teachers and therapists. Teachers should put the pupils in front seats where they can face them.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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