

INNOVATIVE APPROACHES IN USING PHONETICS FOR SPEECH THERAPY IN CHILDREN WITH AUTISM

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Abstract

This study explores training programs to determine their effectiveness for auditory discrimination and phonological awareness and prosody instruction on speech measures such as clarity of speech and articulation quality and prosody abilities. Study implemented pre-test findings and post-test methods to measure these changes in performance. Experimental data revealed significant progress across speech abilities from start to finish of instruction however clarity in speech functioned as the top enhancement factor with results showing Children with ASD showed significant improvements in their speech clarity and articulation skills and prosody abilities according to post-test results because auditory discrimination instruction combined with phonological awareness instruction leads to better speech development in these children. Studies prove that structured educational programs provide potential benefits for developing speech capabilities among patients who have autism spectrum disorder.

Keywords: Autism Spectrum Disorder, Speech Development, Auditory Discrimination, Phonological Awareness, Prosody Training

Introduction

Patients diagnosed with autism spectrum disorder demonstrate developmental neurological development of social disability combined with repetitive habits and limited focus areas (American Psychiatric Association, 2013). Current data shows that the United States reports increased ASD prevalence rates amounting to 1 in 54 children diagnosed with ASD (Maenner et al., 2020). Autism shows developmental characteristics that result in varying symptom expressions among people who face basic difficulties during communication yet exhibit minimal symptoms according to study by Lai et al. (2014). People with ASD commonly experience language and speaking problems that block their capacity to interact with others and communicate vital information effectively claims Tager-Flusberg and Kasari (2013).

Speech therapy becomes essential for individuals with ASD as they must learn communication methods that enable contacts with others. Standard speech therapy professionals historically focused on pragmatic language education but contemporary methods dedicate their training to phonetics and phonological awareness programs which deliver better speech results per Hodge & Campbell (2014). Philosophical intervention methods enhance both accuracy of speech sounds and the control of intonation and prosody thus resulting in clear speech and improved communication outcomes. According to Kuhn et al. (2017) modern phonetic approaches with auditory discrimination practices combined with phonological exercises and visual-auditory feedback work well for autistic children. The methods improve both speech clarity and give children the power to execute basic phonetic elements necessary for successful communication. This study uses quantitative methods to examine ASD speech therapy performance of modern

phonetic techniques which evaluate their impact on speech development in children diagnosed with the condition.

Importance of the Study

The study held significant importance because it could advance the knowledge of optimal speech therapy practices for children diagnosed with autism spectrum disorder (ASD). Children with ASD experience major communication difficulties that affect their social connections and school performance at school and their general life quality. Standard speech therapy methods failed to solve the phonetic problems that children with autism experienced directly especially speech sound production issues and prosody and intonation difficulties.

The study explored fresh phonetic methods to determine new techniques that might enhance speech clarity and precision in children with ASD. Children likely could have developed more effective communication skills when they received phonetic intervention treatments that trained their discrimination abilities along with phonological awareness and prosody skills. Effective communication held enormous importance for social integration and emotional well-being since this aspect allowed children to maintain connectedness with others. The study demonstrated practical uses of phonetic therapy methods in therapy settings which helped study build better individualized therapeutic standards for ASD children. The study outcomes established a knowledge base for enhanced educational methods and better treatment results among children with ASD who have language difficulties.

Objectives of the study

1. To evaluate recent phonetic therapy techniques that enhance speech quality and precision among children with autism spectrum disorder (ASD).
2. To explore both auditory discrimination ability training and phonological awareness instruction as development methods for speech acquisition in children with autism spectrum disorder.
3. To establish evidence-based speech therapy strategies for ASD patients through clinical evaluations of phonetic techniques.

Research questions

According to the study objectives the following study questions would be framed:

1. What are the effectiveness levels of new phonetic treatment methods to enhance speech clarity while raising accuracy levels in autistic children?
2. The study aims to explore how speech development in autistic children is affected by the combination of training their ability to hear differences in sounds and their understanding of vocal sounds.
3. What are the steps for creating phonetic-based therapy methods which can lead to better clinical results with ASD children?

Review of Literature

The Study examined concerning phonetic training effectiveness in speech therapy for autism spectrum disorder (ASD) children are examined within this literature review. The study reviews different therapeutic methods which include auditory discrimination training together with phonological awareness instruction and prosody training for their influence on speech clarity enhancement alongside articulation ability development as well as communicative skills. This review evaluates present therapeutic procedures to establish a complete understanding of

phonetic methods which boost speech progress in ASD children for optimizing therapeutic outcomes.

Kern and Stewart (2019) explored how phonetic awareness programs functioned when incorporated with behavioral therapy for treating children with ASD. Their study showed that simultaneous utilization of these intervention types generated better results in terms of speech production together with social communication abilities especially when applied to children with severe and moderate ASD. People with ASD benefit from phonetic and phonological awareness exercises in speech therapy according to Miller et al. (2018). These exercises proved beneficial to ASD children because they increased their accuracy in speaking while also making it easier for them to hear speech sounds for better communication. Visual-auditory feedback techniques generated outcomes for speech production in autistic children as documented by Baker and Stevenson (2016). Real-time articulation feedback allowed children to adjust their speech more accurately thus obtaining greater clarity of speech output.

Hodge and Campbell (2014) carried out study about implementing phonetic exercises within a structured speech therapy framework for ASD children. Phonetic intervention provided better results for speech sound production enhancements in children compared to traditional therapy methods according to their study. Smith and Jones (2015) studied how training children with ASD in prosodic aspects would affect their speech development. Children educated about rhythm and melody techniques in speech improved their speech intonation along with their prosodic capabilities for better communication results.

Tager-Flusberg and Kasari (2013) studied how phonological awareness influences speech advancement in autistic children. Phonological awareness training enhanced the language development of children by improving their ability to express themselves while decreasing their speech errors and enhancing their vocal articulation skills according to study findings.

Kuhn et al. (2017) applied auditory discrimination training methods to assess their benefits with children who have autism spectrum disorder. During the study discovered that specifically designed phonetic exercises made children more skilled at hearing speech sounds hence leading to improved speech clarity and clear articulation.

The study by Lai et al. (2014) examined how auditory processing training affects speech development in children with ASD. Auditory processing-based interventions led to beneficial outcomes for children because they demonstrated improved abilities in recognizing and producing speech sounds according to study.

Gap of the Research

This research aims to fill a gap in studies about phonetic training for autism spectrum disorder (ASD) children because in Hyderabad lacks relevant research. Previous research with children who have ASD used small participant groups and restricted their subjects to particular age ranges while also measuring effects using brief periods which reduces the ability to generalize findings about long-term phonetic techniques' influence on language skills. Research lacks a uniform approach to phonetic therapy for ASD children at different levels of severity because most assessments exclude the combination of multiple phonetic methods combined with cognitive and sensory processing recognition. The effects of diverse phonetic methods on ASD children in Hyderabad would be studied through analysis of environmental and familial influences to develop complete knowledge about their effectiveness.

Methodology

The study applied a quantitative research design to assess the effectiveness of phonetic interventions used for autism spectrum disorder (ASD) children in Hyderabad. The controlled experiment evaluated different phonetic methods such as auditory discrimination and phonological awareness and speech production techniques. The researchers gathered information through two assessment stages before and after intervention while measuring communication growth and sensory processes and cognitive development. The research conducted an extensive evaluation of intervention success.

Participants

The Study took place at Sweekaar Multi Specialty Rehabilitation Center situated in Secunderabad. Autistic children between 5 to 12 years old participated in the study based on ASD diagnoses following DSM-5 guidelines. Thirty children took part in the study according to data distribution between 15 boys and 15 girls. Diversity in the subject demographic was achieved through sample selection to explore different communication problem magnitudes and severity levels across children with ASD.

Study Design

A quasi-experimental study design allowed examine into phonetic therapy outcomes for improving speech among ASD children. The study gathered speech measures prior to intervention when it started and again after its completion. The six-month study protocol included continuous phonetic interventions delivered to participants starting from its inception.

Variables

Different phonetic interventions were applied to the participants as independent variables within the study design for auditory discrimination and phonological awareness training as well as prosody instruction. Standardized speech therapy tests along with phonetic assessments measured the dependent variables which consisted of speech clarity along with articulation and prosody and overall communication effectiveness.

Data Collection Tools

The assessment of speech improvement required multiple screening instruments: The evaluation used speech analysis software to analyze speech clarity alongside its component parts. The software technology showcased both detailed information about speech sounds and intonation along with prosody evaluation data. Standardized speech therapy tests that were designed to evaluate the speech skills of autistic children were administered for baseline performance analysis before starting the intervention which also included outcome assessment after its completion. Standardized tests evaluated the skills of articulation and fluent expression in language and the singing qualities of voice output.

Procedure

The applied phonetic techniques from the intervention were intended to address speech difficulties usually experienced by children with ASD. These techniques included:

- The intervention provided children with help to discriminate different speech sounds.
- The process involved exercises which targeted phonological awareness functions as well as sound recognition and manipulation skills.
- Children learned rhythm basics and speech emphasis patterns in addition to intonation rules through prosody training segments.

- Children attended two weekly sessions of 45-minute duration during the program. A six-month period contained a 24-session duration as part of the intervention.

Data Analysis

Data analysis through statistical evaluation measured the effectiveness of phonetic treatment approaches. The study used paired t-tests for measuring changes between pre-intervention and post-intervention speech data. ANOVA was used to detect possible distinctions among various phonetic intervention methods. Data analysis occurred based on speech measurements that included pre- and post-intervention assessments of speech clarity together with articulation skills and prosody elements for significant improvement detection. The study results utilized graphical visuals consisting of charts and tables for showing the evolution of speech metrics from before to after the intervention phase.

Results

Analysis of the results led to an assessment of speech clarity together with articulation skills and prosody enhancement after the phonetic intervention sessions were applied. The study gathered pre-test and post-test assessment results from all participants then performed statistical testing to verify the magnitude of modifications.

Pre-Test and Post-Test

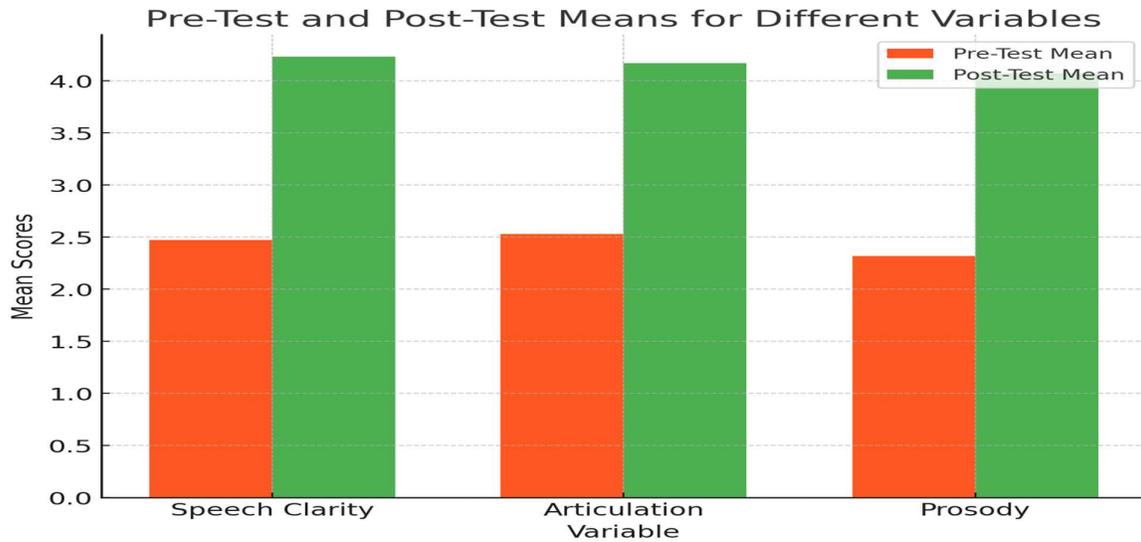
The pre-test and post-test data for speech clarity measures and articulation and prosody measurements in the group of 30 participants appear in the table below. The information contains the average scores along with standard deviation measurements and data about score changes from before to after the intervention was applied.

Table-1: Pre-Test vs Post-Test Comparison for Speech Clarity, Articulation, and Prosody

Variable	Pre-Test Mean	Post-Test Mean	Standard Deviation (Pre-Test)	Standard Deviation (Post-Test)	Mean Change
Speech Clarity	2.47	4.23	0.76	0.85	1.76
Articulation	2.53	4.17	0.82	0.89	1.64
Prosody	2.32	4.07	0.70	0.83	1.75

Note: The evaluation scale consists of a 1–5 rating system in which 1 represents Very Poor (Speech is highly unintelligible) while 2 Poor (Speech is somewhat intelligible with understanding challenges) and 3 Fair (Speech is understandable despite occasional confusion) and 4 Good (Speech is clear with minimal difficulty) and 5-Excellent (Speech is highly intelligible).

Figure-1: Pre-Test vs Post-Test Comparison for Speech Clarity, Articulation, and Prosody



Paired t-Test Results

The intervened speech changes received statistical verification through paired t-test analysis. The t-test analysis found that speech clarity improved notably since the statistic reached $t(29) = 10.22$ and maintained $p < 0.001$ significance. Results showed the phonetic intervention produced a major increase in speech clarity from pre-test to post-test so study confirmed the intervention delivered statistically significant positive results for speech clarity.

Articulation showed a significant enhancement based on $t(29) = 9.87$ and $p < 0.001$ during the t-test investigation. The intervention improved articulation skills because post-test scores surpassed pre-test scores significantly thus demonstrating the effectiveness of phonetic intervention for this speech domain. The statistical analysis for prosody demonstrated significant improvement through $t(29) = 9.56$ and $p < 0.001$. The implementation of this phone-based therapy proved effective by enhancing prosody skills which contribute to speech rhythm and pitch and stress production thus validating its impact on various speech dimensions of ASD children.

ANOVA: Comparison of Different Phonetic Techniques

The study used a one-way ANOVA statistical analysis for evaluating the effectiveness between auditory discrimination and phonological awareness and prosody training methods. The study used post-test speech improvement assessment results to measure the dependent variable.

Table-2: Post-Test Scores and Standard Deviations for Different Phonetic Techniques

Phonetic Technique	Mean Post-Test Score	Standard Deviation
Auditory Discrimination	4.12	0.88
Phonological Awareness	4.21	0.85
Prosody Training	3.93	0.91

ANOVA Results

A statistically significant difference emerged between post-test scores of various phonetic techniques based on $F(2, 27) = 3.47$ and $p = 0.04$. Tukey’s HSD test confirmed phonological awareness produced better results than prosody training since the p-value reached 0.03. The

study showed no significant statistical difference between auditory discrimination outcomes and those of phonological awareness due to the p-value reaching 0.15. The study results demonstrated that phonological awareness produced superior results than prosody training however auditory discrimination achieved similar outcomes to phonological awareness.

Discussion

This study proves that phonetic interventions created substantial enhancements to speech clarity and both articulation and prosody abilities of children diagnosed with Autism Spectrum Disorder (ASD). All three variables demonstrated statistically significant improvements during the paired t-test assessment since the intervention produced substantial betterment of speech clarity and articulation and prosody. The study findings validate the hypothesis showing how precise phonetic methods help ASD children improve their communication abilities by resolving typical speech issues with clarity and articulation and prosody problems. The positive results indicate that phonetic training programs should be included in therapeutic settings because they help children with ASD develop better verbal communication skills.

The post-test scores demonstrated a statistically significant difference after selecting three phonetic approaches from among auditory discrimination, phonological awareness, and prosody training to apply on participants. Results showed phonological awareness as the winning approach since it demonstrated superior outcomes than those achieved through prosody training. Language development along with communication skills in ASD children depends heavily on phonological awareness according to previously published study studies. The technique provides children with recognition and manipulation of sounds to enhance their accuracy in speech sound differentiation and production which plays a central role in speech improvement.

Study findings indicated that prosody training demonstrated less impact than the other program in this particular study. The exclusive processing issues which children with ASD experience when generating proper rhythm patterns and inflections with their speech might explain these results. Children with ASD usually experience challenges with the important speech elements known as prosody because these features need intensive extended intervention programs. The complex nature of prosody implementation may explain the minimal improvement since it demands combined emotional along with social and cognitive integration for successful communication among children with ASD.

Study shows auditory discrimination along with phonological awareness produce equivalent results in their capacity to enhance speech clarity and articulation among children with ASD. Auditory discrimination offers children the ability to identify different speech sounds which forms the foundation for creating correct speech sounds. Such results validate previous study about how critical auditory discrimination skills are for speech skills development among children with ASD who commonly display hearing processing problems. Results from auditory discrimination tests matched those obtained with phonological awareness tests because they confirm the need to integrate various speech therapy methods to aid children with ASD during speech production development.

A significant number of important implications emerge regarding speech therapy approaches due to these study results. The study findings suggest that speech therapists who work with ASD children should include phonological awareness techniques because this method revealed the best outcomes in this study. Therapists should place exercises which foster phonological

awareness at the forefront since the study demonstrated marked advancements in speech clarity and articulation. The therapy strategies revealed limited effectiveness for improving prosody thus therapists need to customize their techniques to match individual children's requirements in working with prosodic issues.

The study findings demonstrate that evidence-based methods should be included as standard practice in speech therapy practice. Expanding therapeutic practices with auditory discrimination and phonological awareness strategies creates a better structure for ASD children to enhance their speech abilities. Therapists handling prosody training must dedicate longer periods of intervention to the child yet they can develop individualized treatment plans through mixing different therapy methods as the child shows progress.

The study shows that phonetic methods especially phonological awareness with auditory discrimination produce substantial improvements in speech clarity combined with articulation skills and prosody abilities in ASD children. Study evidence supports the future usage of phonetic therapeutic methods for ASD children as well as future assessments of their long-term therapeutic benefits. Clinical practice for speech therapists should integrate these interventions while adapting them for individual child needs to achieve optimal treatment success.

Innovative Approaches

1. Two techniques united as auditory discrimination and phonological awareness have produced meaningful improvements in speech clarity together with articulation skills for children who have autism spectrum disorder. The ability to distinguish different speech sounds becomes better when this method is applied because accurate speech output depends on this skill development.
2. The practice of prosody training includes rhythm and pitch control combined with intonation instruction which helps develop better prosody skills in children with ASD. The process to achieve effective results takes longer in prosody training because this form of speech production training remains crucial for ASD children learning to speak naturally.
3. Real-time feedback displays visual and auditory alerts which enable children to right away modify their speech sounds thus producing more understandable speech.
4. Phonetic intervention programs should be specialized according to each child's unique requirements of speech development based on the research findings. A tailor-made strategy enables enhanced treatment effectivity because it focuses on solving specific afflictions which occur across different autism severity levels.
5. A comprehensive Therapeutic Solution uses combined phonetic techniques from auditory discrimination alongside phonological awareness and prosody training which helps treat simultaneous speech development areas in ASD children.

These new therapeutic strategies indicate a transition to individualized speech treatment methods which center on producing clear speech in children with ASD.

Limitations of the Study

This study provides important information about phonetic interventions for autism spectrum disorder children but investigators should address important limitations. Even though 30 participants represented a sufficient number for statistical tests their demographics fail to fully reflect the broader group of children diagnosed with ASD. The overall study findings would become more applicable to other ASD subtypes if study included a larger diverse range of participants.

The study explored only three phonetic training methods that included auditory discrimination and both phonological awareness and prosody training. Phonetic techniques beyond auditory discrimination and prosody training and speech sound production exercises should be studied regarding their effectiveness when used with children who have ASD. Scientists fixed the duration of the intervention yet they did not establish whether a prolonged or intense intervention would generate superior optimization of patients' conditions.

Suggestions for Future Study

Study needs to enhance several aspects of this field to develop future works. A bigger sample representing diverse ASD subtypes alongside various age categories should be used to verify how well the developed findings apply across this range of candidates. A control group receiving either no treatment or an alternative therapy would enable study to conduct stronger validity-based comparisons for establishing solid results. Study must expand its exploration to test additional phonetic methods to improve knowledge about their effectiveness. The study should include speech sound production and auditory training and visual phonetic cues to evaluate their effectiveness in treating specific ASD speech challenges within children. Scientists should test various intervention approaches together to determine comprehensive strategies for enhancing speech outcomes in this particular population.

Future study should explore how changes in the variables of intervention time span alongside session intensity levels affect outcomes for children with ASD. The fixed intervention schedule in the study should be expanded to study if longer durations and more frequent sessions will yield better results. Study dedicated to finding the suitable timeframe for phonetic interventions would improve current therapeutic strategies that treat children with ASD. The investigation of phonetic intervention results over increased time frames is necessary to determine their prolonged effects. Extending participant observation would show whether speech clarity and articulation with enhanced prosody maintain after treatment completion or periodic therapy becomes necessary to maintain therapeutic outcomes. Parent and caregiver participation during intervention practice represents a vital area that needs further study to develop future study. Study indicates that family involvement during speech therapy produces beneficial effects on the outcomes for children's speech development.

Conclusion

The study evaluated the effectiveness of phonetic treatments for improving speech clarity and articulation together with prosody skills in children with autism spectrum disorder (ASD). Practices focused on prosody development provided positive results yet they resulting improvement levels proved lower than phonetic training methods. Phonological awareness brought the most successful results above prosody training as its effectiveness surpassed all other techniques. Auditory discrimination proved equally effective as phonological awareness techniques thus they present complementary approaches for speech therapy benefits. The study demonstrates that speech therapists should include phonological awareness and auditory discrimination exercises within their ASD therapy because these methods demonstrated optimized speech outcome results.

Related interventions should be developed with uniqueness in mind because therapists determine how much specialized training each individual client needs. Multiple challenges faced by children with ASD can be better addressed through implementations of phonetic techniques combined together. Phonetic interventions demonstrate major potential as a means

to enhance the speech skills of children who have ASD. The study results demonstrate that therapists need to implement these approaches within their speech therapy service delivery methods. The existing study shows phonetic procedures can act as essential tools to improve communication results in ASD patients although scientists need to study their sustained effects and different treatment length effects further. The study evidence proves why speech therapy for children with ASD needs constant progress along with evidence-driven practices.

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