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Examination of the Colorful Semantic Approach via Telepractice for Children who are Deaf or Hard of Hearing

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Examination of the Colorful Semantic Approach via Telepractice for Children who are Deaf or Hard of Hearing

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by

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ABSTRACT

Introduction: Hearing loss, deafness or hard of hearing are considered to be the inability of perceiving sounds beyond 20 dB. Due to a direct impact of a hearing loss, a developing brain undergoes difficulties in acquiring age-appropriate syntax and speech sounds. As a result, children with hearing loss present language, speech, and literacy disabilities. The current study discusses the efficacy of the colorful semantics approach in order to see its impact on sentence structure development. *Methodology*: A single subject withdrawal experimental study conducted following ABAB model. Two participants (6 years and 10 years) were recruited to the study following an inclusion and exclusion criteria. The participants were administered colorful semantic therapy sessions for 12 weeks via zoom. The virtual sessions were 45 to 60 minutes long and were administered two times per week. The pre and post language skills and conversational skills were compared using cottage acquisition scales for language, listening and speech (CASLLS) and systematic analysis of language transcripts (SALT). *Results*: Both participants showed statistically significant improvements at the end of the intervention period. Drastic improvements were observed in four main sentence structures along with improvements in prepositions and pronouns,tenses and negations, verbs and modals and nouns and noun modifiers. The overall clarity of speech in conversations was identified according to the decline in number of mazes (participant 1- pre intervention 11 and post intervention 7, Participant 2- pre intervention 4 and post intervention 3), number of maze words (participant 1- pre intervention 32 and post intervention 7, Participant 2- pre intervention 5 and post intervention 3). Both participants were able to generalize conversational skills such as clarify information by repeating, using descriptions to clarifying information, using long detailed conversations and using primitive narratives in to many dif-

ferent contexts. The improvements in the mentioned language areas imply the effectiveness of the approach even within the virtual mode of delivery. More investigations should be done with a larger participant group to generalize the findings. Key words: Hearing Loss, Colourful Semantics, Literacy, Syntax, Language development.

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1 Introduction

Hearing is the ability to detect sounds and it is a crucial sensation in human physiology. According to the World Health Organization (WHO), hearing impairment, deafness, or hearing loss refers to the total or partial inability to hear sounds. A hearing loss could be congenital or acquired, progressive or sudden, unilateral or bilateral. Further hearing loss has identified as the forth highest diagnosed disability in the world (WHO, 2018). Moreover, it has been identified that one in every five individuals in the world presents and bears the consequences of hearing loss (WHO, 2018). Regardless of the type or the severity of the hearing loss, children with hearing loss often have difficulty in developing age-appropriate syntax.

1.1 Hearing Loss and Its Manifestations

Speech and language learning is a natural process where the environmental stimuli play a massive role. There are a several language learning theories that talk about the importance of environmental exposure. Behaviorists explain the importance of the events in child's environment towards language learning. They believe that children will only learn what they exposed to. As cognitive theory explains, a child must acquire concepts to produce wards, meaning children should be exposed to a variety of environments to learn concepts (Rosa-Lugo, Mihai & Nutta, 2019). Similarly information processing theory explains that human beings encode stimuli from environment and store that knowledge and the stored

knowledge is useful to learn language gradually with the development (Rosa-Lugo, Mihai Nutta, 2019).

Typically, a developing child as a newborn, starts there communication with raspberries, cries and cooing. They are oriented to sounds and learns by hearing, touching, and seeing things in the environment (Sharma, Cockerill & Sanctuary, 2021). This gradual development turns into sounds and then words with the support of external language stimuli. At the age of 6 months, a typically developing child will start babbling, and the babbling develops in to reduplicated babbling at the age of 9 months (Sharma & Cockerill, 2014). With this progression, babies at around the age of 12 months utter the first word within the jargon of speech (Sharma, Cockerill & Sanctuary, 2021). At the age of two, children start to combine words and produce phrases. They continue to develop sentence structures with active participation with the environment (Mayer & Trezek, 2017). Balanced development of five domains (phonology, morphology, syntax, semantics and pragmatics) of language have a direct impact on successful communication outcomes (Mayer & Trezek, 2017).

As a result of limited auditory access to spoken language, a child with hearing loss may not be able to experience adequate spoken linguistic input (Runnion & Gray, 2019). Consequently, due to inaccurate and insufficient input, children with hearing loss confront problems in early language and literacy skills. Phonological awareness, alphabet knowledge, and print awareness are some of the greatly affected skills in the early stage of academic life.

1.2 Intervention and Communication Options

Auditory verbal therapy (AVT), Auditory Oral Therapy (AOT) are considered as main treatment approaches (Scott & Dostal, 2019. Cued Speech, sign language support,

and Total Communication (TC) can be identified as currently available main communication options for children with hearing loss (Scott & Dostal, 2019). Among these, AVT has been identified as one of the most effective therapy approaches for children with amplification devices . Further, it is a specially designed family based treatment approach for children with hearing loss (Kaipa & Danser, 2016). It employs the complete support of the caregiver. The use of an amplification device is crucial in this program. Moreover, AVT is a systematic hierarchical treatment program that will be conducted by a specialized and certified clinicians (Kaipa & Danser, 2016). Hence, the approach has its own limitation when it comes to the management of children who mainly rely on non verbal communication modalities and who do not use amplification devices (Percy-Smith et al., 2017).

Cued speech is another communication method that can be used to enhance communication skills of children who are deaf or hard of hearing. Cued Speech is a visual mode of communication that incorporates lip movements of verbal language with a cuing system in order to identify different phonemes in spoken languages. Cued speech has been adapted into 63 different languages. Visual manual component and visual non manual articulatory components are the main two components of cued speech (Leybaert & LaSasso, 2010). Cuing allows individuals who are deaf, hard of hearing, or who have language and/or communication disorders to access basic properties of spoken languages using visual modalities ("National Cued Speech Association", 2021).

Sign language is a visual mode of communication. However, sign language does not use mouth movements of spoken language with cues to make sounds particularly. Instead, it has different signs representing words and letters in a language (Sandler & Lillo-Martin, 2009). Sign language most of the times natural for the people who are deaf or heard of

hearing. Similar to other languages, sign language varied from country to country. In some countries, sign language has a considerable number of different dialects according to different regions. However, there is a debate about the accuracy of sign language usage as a main mode of communication. Even though some researchers argued that sign language can compromise the language learning skills, there is scientific evidence regarding better language skills of those who still use sign language predominantly (Hall et al., 2019).

In addition, as a combination of all these methods, total communication is a way of using all forms of language modalities in communication. Total communication employs combination of different modalities such as writing, signing, cued speech, and finger spelling. Moreover, this approach is mainly used in educational settings of children who are deaf or heard of hearing. The concept of total communication has been originated and used in the deaf education system in late 1960's (Gregory et al., 1998). Some schools that are dedicated for deaf education use this approach for children with their students as it gives a wide variety of access to language components and subject matters using multiple modalities.

Most of the clinical and educational settings tend to use single method predominantly, or all these approaches as a combination when providing education for children with hearing loss. The effectiveness of the selected therapy approach tends to show variations with the type and the effectiveness of the amplification device, age of amplification, cognitive, pre-linguistic skills, motivation, and family support (Kaipa & Danser, 2016).

Auditory verbal therapy, auditory oral therapy, total communication, sign language and cued speech are approaches that enable language access. They improve skills to access language . In addition, there are approaches to develop language skills, that are equally important since the approaches enrich language skills in terms of semantics and syntax. The

concept of semantic bootstrapping explains the process of acquisition of semantics to develop syntax.Colourful semantics approach is one of the approaches explains this theory. Therefor, it enables the developing brain to first acquire semantics and build syntax gradually (Abend et al., 2017).

1.3 The Colorful Semantics Approach

The colorful semantics approach (Bryan, 1997) is one of the widely used visually assisted speech and language therapy approaches in the United Kingdom. This approach was developed and based on theories of bootstrapping (Abend et al., 2017). Moreover, in this approach, elements of a sentence are used to develop syntax in expanded sentences. Further, the colorful semantics approach explains in detail the semantic role of each grammatical component of a sentence. Colorful semantics users build up sentences adhering to the syntax rules while responding to key questions including who, what, when,and were effectively (Hettiarachchi & Ranaweera, 2019).

1.3.1 The Colorful Semantics Structure

The colorful semantics approach has four main levels. These levels represent different thematic roles of a sentence. Apart from these stages, this approach can be further developed to add adverbs, adjectives, conjunctions and negatives to formulate complex sentences. The sentence construction has arranged in a way where the user has to answer "wh" questions while arranging the sentence according to the given colors ("Colourful Semantics - Integrated Treatment Services", 2021). The allocation of the colors can be seen as follows:

- WHO – Orange
- WHAT DOING – Yellow
- WHAT – Green
- WHERE – Blue

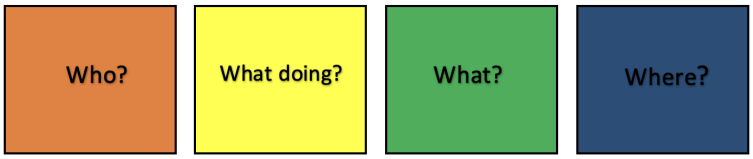


Figure 1.1: Colorful semantics sentence structure [Adapted from: Colourful Semantics - Integrated Treatment Services, 2021]

Colorful semantics approach can be used with children who have Specific Language Impairments, developmental delays and disorders, Autism Spectrum Disorder, Down Syndrome, and literacy difficulties. There is a wide variety of benefits associate with this approach including expanding vocabulary, making longer sentences, help answering "wh" questions, improving comfortable use of nouns, verbs, adjectives, correct use of different tenses and improving story telling skills can be identified as main factors that contribute towards the development of language and communication skills of children with communication and/or language disabilities. The colorful semantics approach can be conducted as individual or small groups sessions. Depending on the child's progress, the approach allows to add more complex syntax to familiarize the child with advance linguistic units.

Moreover, the approach has been shown to provide a range of associated benefits such as vocabulary expansion and improvement in language comprehension (Bryan, 1997). The Colourful Semantics approach differs from other color-coded therapy approaches such as shape coding (Ebbels, 2007), and other visual coding teaching methods (Lea, 1965, 1970; Kaldor et al., 2001) due to its unique identification of using the semantic route to access the syntax and use of predicate argument structure (Hettiarachchi & Ranaweera, 2019). These factors are helpful to organize the sentences in a more comprehensive manner, and it is easy to visualize when teaching language to children with hearing loss.

With the outbreak of COVID-19 most of the services and teaching moved to the virtual platforms. The technology advanced, and awareness was built among the public regarding virtual options. According to the American Speech-Language- Hearing association (ASHA), telepractice or virtual services delivery can be considered as a valid and effective mode of service delivery when it is administered with available modern technology ("Telepractice Services and Coronavirus/COVID-19", 2022). The current study also used the virtual platforms to conduct therapy sessions, adding another new feature to the colorful semantic approach.

The colorful semantics approach has been used to improve language, literacy, and communication skills in children with various disabilities. However, there is limited literature available to support the effectiveness of the colorful semantics approach for children with hearing loss. Moreover, there is no scientific evidence to support the possibility or the effectiveness of delivering the approach via virtual modalities. This study will be helpful to understand the effectiveness of the approach for children with hearing loss. Further, this

study will also be applicable to identify the possibilities of virtual delivery of the colorful semantics approach.

1.4 Objectives

1.4.1 General objective

Discuss the effectiveness of colorful semantic approach for children who are deaf or heard of hearing.

1.4.2 Specific objectives

1. Discuss the impact of colorful semantics approach on the development of sentence structure
2. Discuss the changes that the approach has made on participants on language and communication.
3. Discuss the parental perspectives about the treatment approach.

2 Literature Review

Hearing sensation is a crucial factor for speech, language and syntax development. Even though there are many other possible factors that can hinder the accurate speech, language, and syntax development, hearing sensitivity consider as one of the main causes for language, speech and literacy disabilities (Mayer & Trezek, 2018). Further, the impact of a hearing loss will sustain throughout the life of a child, if left untreated (Mayer & Trezek, 2018). Unlike any other communication modalities of living species, human language is generative, recursive and it uses large number of symbols to convey meaningful messages. Due to these unique features human languages need to be learnt (Wierzbicka, 2004). The skill of verbal communication there for contains a collection of advanced skills that need to be incorporated in a cohesive manner.

2.1 Language Learning

Major theories of language acquisition discuss the influence of the environment and cognition and biological arrangement that support language acquisition. As B.F Skinner (1957) explains, language learning relies heavily on imitation and positive reinforcements or in another words operant conditioning. However, Vygotsky (1962) explains language acquisition mainly as social learning or the zone of proximal development. He further explained the interaction between abstract concepts that do not have physical reference, logical reasoning, and the establishment of communication through social interaction. Moreover, Chomsky (1975), believed that, all languages have common rules when it comes to the construction,

and those constructing elements which are consider as innate.He identify these innate abilities as language acquisition device. Further, he highlights, that the parameters that are different across language, should be learned. This learning process need the environmental influences. When analyzing all these factors, it is evident that the environmental influence and the cognitive development is highly influential in language acquisition. The importance of hearing sensitivity cannot be ruled out in this scenario, as hearing sensitivity is a significant requirement to access the environmental simulations. These simulations feed the cognition to achieve the necessary skills to acquire language skills and ultimately to become an effective communicator. Similarly, rehabilitation of hearing disabilities is essential to support children with hearing loss to access the environment.

2.2 Language Domains

Phonology, morphology, syntax, semantics, and pragmatics are considered the building blocks of language. A cohesiveness of these domains has a direct impact on successful communication. A proper construction of phonology, morphology, and syntax or the "form" language lays a strong foundation to study the speech sounds in a language (Scott & Dostal, 2019). In addition, the form of language explains the rules to combining and use speech sounds in a proper manner. Semantics or the "content" of language, and pragmatics or the "function" of language helps to understand the rules associated with the proper language use in conversation and in broader social situations. Also pragmatics play a huge role in addressing cultural and regional variations of a language (Mayer & Trezek, 2018; Runnion Gray, 2019).Sound production and reception, decoding and encoding of language Incorporated with proper use of language prosody, highly rely on the proper and accurate hearing

thresholds. The healthy anatomy and the physiology of functional acoustic areas in the brain also have a similar role to play in terms of speech and language development (Runnion & Gray, 2019).

2.3 Impact of Hearing Loss

Not only spoken linguistics, but also written linguistics, including reading and writing, are also key components of a successful academic life of any student. Letter-sound correspondence is a key component of the development of reading skills ("Phonological and Phonemic Awareness", 2021). The reader matches the letter with the corresponding sound to get a complete understanding of a word (Mayer & Trezek, 2017). Decoding words and working memory build the pathway to reading comprehension. However, hearing loss reduces the ability to use the fine neural acoustic cues and it reduces the spectral characteristics of auditory signals. The acoustic cues such as the duration of the sound and the rise time at onset provide information about manner of articulation, which is important to distinguish sounds from each other (Runnion & Gray, 2019). Inaccurate access to the neural acoustic structures creates significant information redundancy, which leads to experience complications with language acquisition and ultimately literacy development (Runnion & Gray, 2019).

Therefore, due to inaccurate and insufficient input, children with hearing impairments confront problems in the early stages of development of language and literacy skills. Under such conditions, phonological awareness, knowledge of the alphabet, and print awareness get affected to a greater extent (Mayer & Trezek, 2017). These skills will be the building blocks of better academic skills in later life. In addition, hearing impairment leads to several language and communication-related difficulties. such as: the slow development of vocabulary and

its limited variety, continue to make simple sentence structures, significant difficulties in using morphological markers, marked difficulty in comprehending complex sentences, and difficulties in information processing ("Phonological and Phonemic Awareness", 2021).

2.3.1 Hearing Loss and Its Manifestation on Literacy

Early literacy skills like phonological awareness, alphabet knowledge, and print awareness can be identified as different concepts, but these concepts have a strong interaction with each other ("Phonological and Phonemic Awareness", 2021). Thus, a deficiency of a single component can have a direct or indirect negative effect on individual or all the other components. To become a fluent reader, all the above-mentioned abilities need to be automatic (Runnion & Gray, 2019). Late or disordered development of early literacy skills combined with inaccurate vocabulary, short phrases, limited complex grammar or grammatical errors, and the cohesiveness of written expressions are strong enough to hinder the overall academic performance of these children (Wolbers, Dostal & Bowers, 2012).Such situations create adverse effects on academic skills of children with hearing loss, which often result in poor academic performance.

2.4 Available Intervention Approaches

Currently, there are two main intervention methods that have been identified with positive outcomes.Oral rehabilitation via Auditory verbal Therapy (AVT), Auditory Oral Therapy (AOT), a Among these, Auditory verbal therapy has been identified as one of the most effective therapy approaches for individuals with cochlear implants. Further it has been identified the importance of the multidisciplinary team involvement in rehabilitating

individuals with proper amplification devices (Glade, Taylor & Culbertson, 2020). However, AVT also has its own pros and cons (Scott & Dostal, 2019). According to Kaipa & Danser (2016), The limited literature support for the effectiveness of the AVT shows the need of more investigations regarding the efficacy of AVT as a therapy approach.

2.5 Communication Options

Communication restoration via Total Communication (TC), Cued Speech and Sign Language can be identified as the main communication options that are available among individuals with hearing loss. Cued speech is helpful to visualize spoken languages and it uses different hand signs to represent different sounds. Cued speech uses different placements in the face along with hand shapes to represent different sounds.In contrast, sign language uses hand shapes, facial expressions and also the body posture to convey ideas to the communication partner("National Cued Speech Association", 2021). Moreover, it is a well-known fact that sign language as an alternative way of communication, has been used in the society. However, the lack of uniformity between different signing cultures and the subjective nature of language usage make sign language more difficult to use as a common language in day-to-day communication (Hall et al., 2019).Every and each approach has its own strengths and weaknesses. The applicability of these approaches can be varied from person to person. Clinicians and parents need work together to identify the best approach to get the optimum outcome at the end.

2.6 The Colorful Semantics Approach

The colorful semantics approach (Bryan, 1997) is a language therapy treatment protocols that had been originated and widely used in the United Kingdom. This particular approach aims to develop sentence structure (syntax) using the semantics route. The colorful semantics intervention protocol has been effectively used by speech pathologists and special education teachers since 1997. The colorful semantics has been nourished by three main structures: the functional, argumentative, and non-argumentative structures (Hettiarachchi & Ranaweera, 2019). This approach has been proven, to have positive impacts on language impairments with many other developmental disabilities and acquired conditions such as aphasia and traumatic brain injuries (Hettiarachchi & Ranaweera, 2019). The colorful semantic approach comprehensively describes the semantic role of each element of a sentence. The underlying logical basis has been explained in detail by associating a salient color to each of the components of the sentence (Subject + Verb+ object) ("Colourful Semantics - Integrated Treatment Services", 2021).

Colorful semantics approach navigates its users to build sentences following syntax rules. Also, this approach train the user to respond to "wh" questions such as when, why who, and where effectively. The complete protocol justifies and gives an in-depth logical understanding of the accurate usage of each mentioned elements, using less demanding visual modes (Hettiarachchi & Ranaweera, 2019). Additionally, the approach provides a range of associated benefits such as expanding vocabulary, improving language comprehension and communication (Brian, 1997). The colorful semantics approach has been effectively administered and tested with children with many other disabilities such as Autism Spectrum Dis-

order, Cerebral Palsy, Specific Language Impairment. However, it has a limited application on children with hearing impairments (Hettiarachchi & Ranaweera, 2019). The importance of conducting more research on this intervention approach has been raised by several authors during the past couple of decades (Hettiarachchi & Ranaweera, 2019).

2.6.1 Application of Colorful Semantics Approach

Apart from using the colorful semantics in its original format, many studies have been conducted based on the logical foundation of the approach. Randomized controlled trials have suggested that the argumentative structure of a sentence reduces the difficulty of understanding the syntax rule when it is paired with semantics (Ebbels, 2007; Ebbels & van der Lely, 2001). In addition, the colorful semantics approach has its own nature to use in many different entities in the society. Colorful semantics was used by one of the Australian projects of Oral Language Supporting Early Literacy (OLSEL) in eight schools (Snow et al., 2014). The aim of this initiative was to enhance the early oral language skills of students to improve literacy performance. This project concluded with positive outcomes due to the proper administration of colorful semantics approach (Snow et al., 2014). It has been suggested that the colorful semantics approach is effective in improving language and syntax (Bolderson et. al., 2011; Hettiarachchi & Ranaweera, 2019), and mean length of utterance as well (Bolderson et al., 2011). These findings identify the positive outcomes, establishing the validity of the approach in different types of disorders. However, majority of these studies were conducted with children with other disabilities such as intellectual impairments, autism spectrum disorders, dyslexia and learning disabilities. It is yet to be determined if this approach can be as effective for children with hearing loss.

2.7 Teletherapy

Even though teletherapy was popular among clinicians to a certain extend, it has not widely been used prior to the pandemic. With the spread of the COVID- 19 pandemic, the delivery of intervention massively employed virtual platforms. Even though the virtual platforms have considerable limitations with regards to Speech and Language therapy service delivery, these services have been greatly accustomed to virtual features addressing the limitations, while adhering to the strict rules imposed by the health officials (Tohidast et al., 2020). Moreover, according to ASHA, (2022) and Grogan-Johnson et.al. (2010), telepractice is considered to be effective and can be successfully used to deliver therapy services.

With the wide use of these virtual platforms, new technology and facilities developed, and they expanded in sound manner. Associations like ASHA have directly has involved to these services to support clinicians to develop their skills. As a result, conducting sessions virtually became more flexible for parents as well. However, inadequate but promising evidence is available to support the mode of telehealth for delivering speech and language intervention services for individuals with disabilities (Tohidast et al., 2020).

Since visual modalities were found to be more effective in the provision of intervention for children with hearing loss the colorful semantics approach provides accurate and effective support to develop language skills. The development of language skills along with syntax in children with hearing loss is one of the most important communication skills, as literacy skills contribute towards effective communication (Runnion & Gray, 2019).

Given the success of the colorful semantic semantic approach in Australia and in Europe, it remains to be seen if this approach is effective for the children with communication disorders and hearing loss in the Untied States.

3 Methodology

The current study was conducted with the general objective of examining the colorful semantics approach via telepractice for children who are deaf or hard of hearing. Apart from its general objective, three specific objectives were addressed: examining the impact of the sentence structure development, examining the changes that have been made after following the colorful semantic intervention and finally, the parental perspectives about the program in terms of logistics, content, and material. In order to address these specific objectives, a single subject withdrawal-experimental study design was conducted following an ABAB model. The study was conducted through Zoom for 12 weeks. Two 45-60 minute sessions were conducted per week with the intention of giving the maximum exposure to the participants.

3.1 Participants

Participants' characteristics were determined by following an inclusion and exclusion criteria.

3.1.1 Inclusion Criteria:

1. Diagnosed with moderate (41- 55dB) or profound hearing loss (above 91dB).
2. Age between 5 to 10 years.
3. Need to be amplified.
4. Should have started verbal communication

3.1.2 Exclusion Criteria:

1. Participants who have associated conditions such as Attention Deficit/Hyper- activity Disorder (ADHD) or Autism Spectrum Disorder (ASD) were excluded from the study.

Two participants were recruited to the study after close consideration of the mentioned participant characteristics.

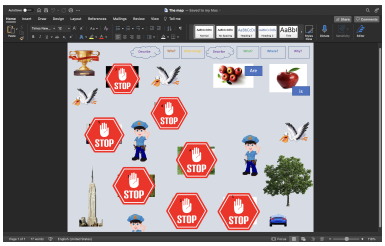
3.2 Study Materials

3.2.1 Participant recruitment material:

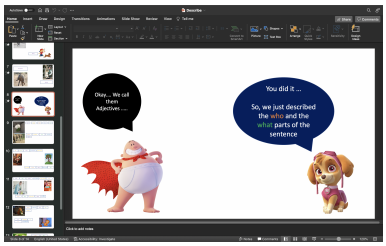
A virtual flyer (please refer to Appendix C) used to inform potential participants about the study and its requirements. It included the information about the nature, requirements, and benefits of being a participant of the study. Google Forms were used to gather demographic data and other important information like medical history. Parent consent form and participant consent forms (please refer to the Appendix B) were provided prior to recruitment in order to obtain written consent.

3.2.2 Test Materials:

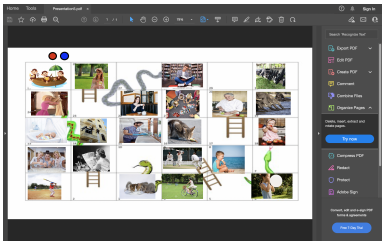
Two informal complex pictures (please refer to Appendix D) were used to collect the language samples. One of the pictures used to familiarize the child with the test (please refer to Appendix D.2) and the other picture used as the main stimulus (please refer to Appendix D.1). Cottage Acquisition Scale for Listening, Language, and Speech were used to establish the baseline measurements.



(a) Activities based on Microsoft Word



(b) Activity based on Microsoft PowerPoint



(c) Interactive Activity based on Microsoft PowerPoint

Figure 3.1: Intervention materials using different computer based applications. [Source: All images in these activities are from Google Images]

3.2.3 Intervention Material:

The intervention was delivered via Zoom virtual platform. Most of the latest features of the Zoom software, such as, white board, remote control option, screen share options, and polls were used to deliver the intervention program. In addition to Zoom features, Googles documents, Microsoft PowerPoint, Microsoft Word,and online games, quizzes, story book readings were used to give the near normal experience of an in-person session [Refer Fig. 3.1].

3.3 Procedure

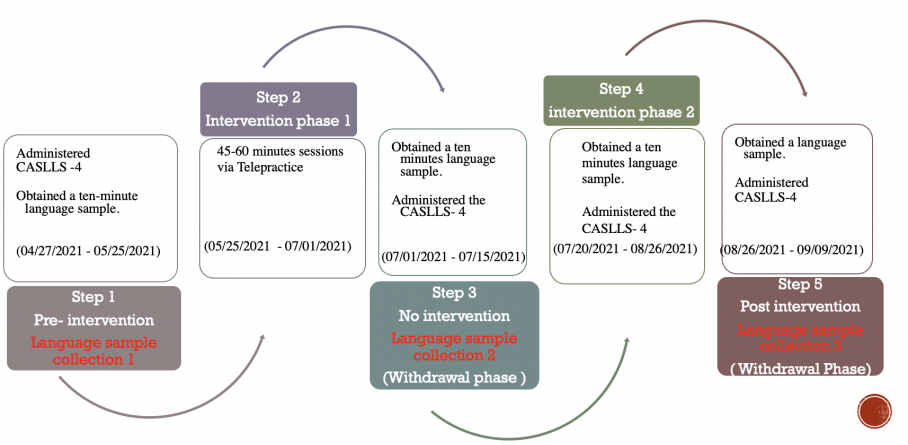
Participant criteria include that the child must be in the pre-determined age range, use spoken language, and have a diagnosed hearing loss. Participants were provided a $100

incentive for completing the study. The study was voluntary, and participants could elect to cease participation in the study at any time with no repercussions. Confidentiality was maintained and only the research team had access to data gathered. In addition, the study protocols were reviewed by the University of Arkansas Institutional Review Board (IRB) (Please refer to Appendix E) and received the approval to continue as a scientific research study. The study consisted of five main phases (Refer to Fig. 3.2). The intervention phases were conducted by the principal investigator under the supervision of thesis advisers.

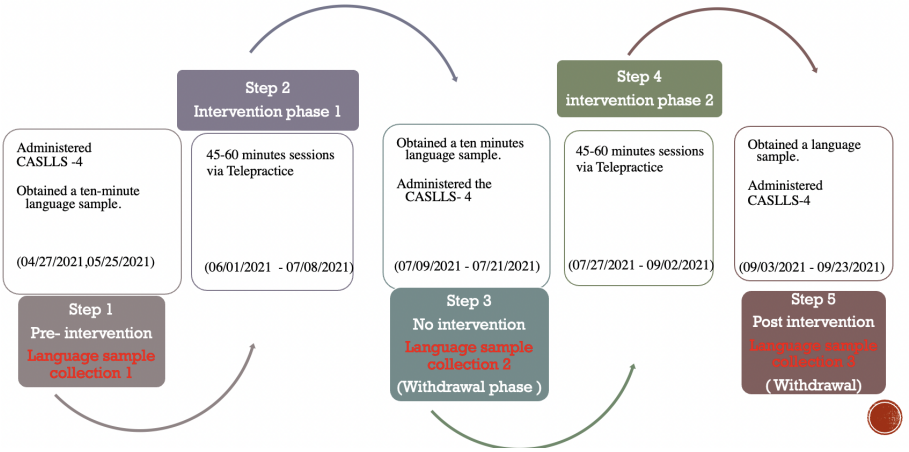
Phase I- PRE-INTERVENTION PHASE: Participants completed the Cottage Acquisition Scales for Listening, Language and Speech (CASLLS-4). This test was administered to the primary caregiver of the child participating in the study. A ten-minute language sample was to be obtained apart from the CASLLS-4 for further analysis using an informal complex picture (see Appendix D.1). The same procedure was conducted after a two-week break to establish a soiled baseline.

Phase II- INTERVENTION PHASE I: Recruited participants continued to complete intervention sessions using the colorful semantic approach via Telepractice two times per week for six weeks. All interventions were conducted via Zoom for 45- 60 minutes. The participants were given assistance by the caregivers when necessary.

Phase III- TWO-WEEK BREAK (no intervention): A ten minute language sample was collected using the same complex picture that was used to establish baseline measures, and the CASLLS- 4 was completed using primary observations, primary caregiver comments, and language samples.



(a) Participant 1



(b) Participant 2

Figure 3.2: Procedure and Timelines of the Participants

Phase IV- INTERVENTION PHASE II: Recruited participants continued to complete intervention sessions using the colorful semantic approach via telepractice two times per week for six weeks.

Phase V- POST-INTERVENTION PHASE: After two weeks from the final session, another language sample was collected using the same complex picture and CASLLS-4 was completed using primary observations, primary caregiver comments, and language samples.

3.4 Data Analysis

The language samples were analysed using Systematic Analysis of Language Transcripts (SALT) software. The SALT software has been widely used in many different studies, showing its high reliability for having accurate results (Heilmann et al., 2010). The SALT database users can accurately compare the language abilities of a child that has been tested as the language transcripts are being compared with provided databases in the program (Paul, Norbury & Gosse, 2017). Careful reliability measures were taken during language sample analysis to ensure the accuracy of the results in the study.

SALT analysis was conducted in a descriptive and comprehensive manner. Three team members from the research team collected language samples from the participants. The language samples were then transcribed fallowing the instruction of SALT software. The third member's transcription was used to get the iterator reliability. All language transcriptions were compared with third member's transcription to identify discrepancies. The team came to a consensus after listening to language sample recordings again regarding the discrepancies. Necessary changes were made to the transcriptions and finalize a commonly agreed language sample transcriptions to run the SALT analysis.

The Cottage forms were analysed by the principal investigator, closely observing changes in each critical skill immediately after the completion of intervention phase 1, and during the post intervention phase. The Cottage forms were marked using different colored pens to indicate the different phases of the study. At the end of all phases, the data was transferred into an Excel datasheet to visually compare the changes of participants throughout different intervention phases.

In addition, the Tau-U Non-Parametric Test was performed to identify the statistical significance of the pre and post interventions. This test provides opportunities to identify the treatment effect of both between subjects and within subjects (Parker et al., 2011).

4 Results

4.1 Demographic Data

According to Table 4.1 both participants have met the inclusion criteria. Another positive aspect of the participants was both of them were amplified soon after the diagnosis. Both participants had strong, supportive and knowledgeable families. The main difference of the participants was their first language. English was not the first language of participant 2. However, participant 2 had started learning English as her second language and she had been studying English for 2 years. In terms of previous speech and language therapy services, both participants have had reasonable interventions soon after the amplification4.1. These similarities were critical when considering the homogeneous nature of participants.

Table 4.1: Demographic Data

	Participant 1	**Participant 2**
Birth year	2010	2015
School grade	Grade 5	K2
Degree and the type of the hearing loss	B/L Severe to Profound sensory neural hearing loss	B/L Profound sensory neural hearing loss
Mode of amplification	B/L cochlear Implants	B/L cochlear Implants
Age of amplification	2 years	2.5 years
First language	English	Indonesian
Nature of the Speech and Language therapy services	General language stimulation and auditory verbal therapy started at the age of 2.4 years	Started Auditory verbal therapy at the age of 2.5 years.

Dissimilar to participant 2, participant 1 had behavioral issues as a result of a demanding personality. Participant 1 faced difficulties in engaging discussions or attempting things that were hard or unfamiliar to him. He also had difficulties attending to new tasks by himself. In addition, participant 1 had difficulties in changing steady and straightforward routines. He was given maximum support from the caregiver during the sessions. This

behavior was not consistent, and occurred mostly during introduction of a new topic or concept.

4.2 Objective 1: The Development in Sentence Structures

The mean length of utterance, verbs, models and emerging complexity sections of CASLLS combined with language sample analysis were used to get reliable and accurate results. According to the assessment findings both participants have made visible improvements with regards to sentence structure. These improvements were identified in four main sentence structures. The sentence structures and the colourful semantics levels were decided according to the baseline measurements.

The three main parameters (emerging, mastered in some contexts, generalized in many contexts) of the first objective represent three different levels of performance of the participants. "Emerging" represents the occurrence of the targeted response observed at least once during communication. " Mastered in some contexts" indicates that the participant used the targeted response accurately, but perhaps only in class or therapy. The term "generalized in many contexts" indicates that the target response is used easily and in wide variety of the settings in a consistent manner ("Sunshine Cottage Educational Products", 2021).

Structure I: Subject+ cupola be+ verb+ object. This sentence structure was targeted initially as the basic sentence structure. For instance, "the girl is drinking milk" can be identified as a complete sentence of this structure. Figure 4.1 demonstrates the base line of both participants and how they have improved during the course of intervention.

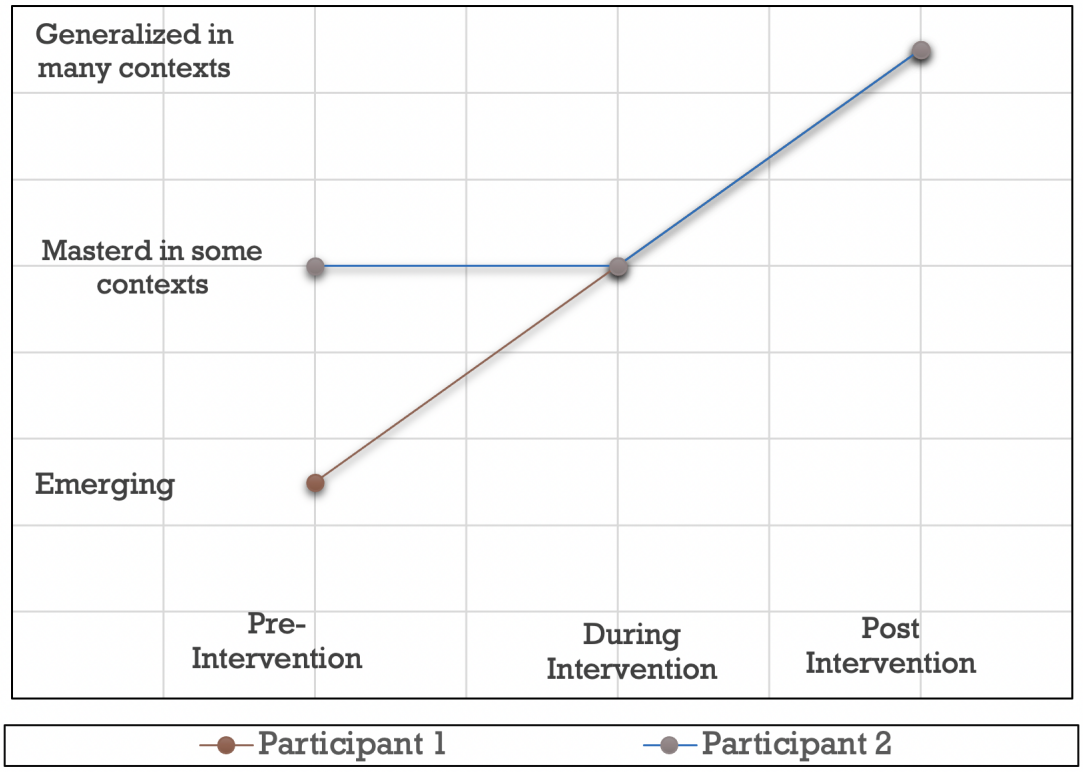


Figure 4.1: Improvements of the participants in *Sentence Structure: Subject + Cupola be + Verb + Object*

Structure II: Adjective+ Subject+ Cupola+ Verb. This sentence structure is considered as the next stage of the expansion of the sentences. The adjective is considered as the description of a noun. The participants were exposed to variety of describing words such as colors, sizes and qualities. According to figure 4.2, even though the participants started the intervention with different baseline measures, they were able to make gradual improvements of using the sentences with adjectives. "The tall girl is drinking milk" is one of the example sentences for this particular sentence structure. As the figure demonstrates, the participants were able to achieve the generalization of the skill at the end of the intervention program.

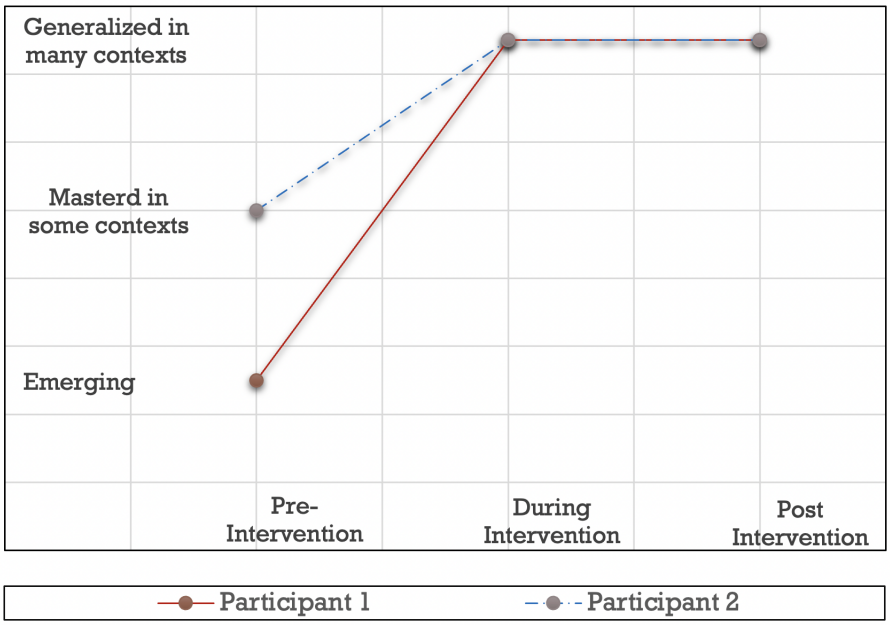


Figure 4.2: Improvements of the participants in *Sentence Structure: Adjective + Subject + Cupola be + Verb + Object*

Structure III: Subject + Cupola be+ Verb + Object + location. This combination was another significant sentence structure that the participants have demonstrated improvements. In addition, adding the location made the sentence complex and comprehensive. According to figure 4.3 it is evident that both participants have the same baseline measurement but participants improved in different phases. As the figure indicates participant 2 shows a gradual improvement while participant 1 shows a sharp rise. However, both participants were able to generalize the skill into many different contexts at the conclusion of the intervention session.

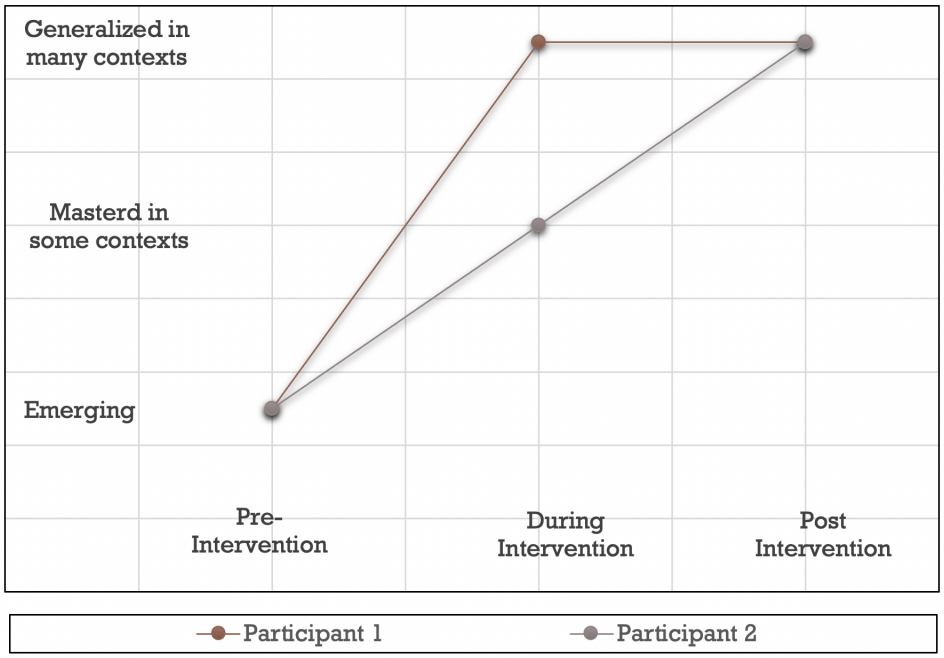


Figure 4.3: Improvements of the participants in *Sentence Structure: Subject + Cupola be + Verb + Object + Location*

Structure IV: Subject + copula be + verb + object + reason. This sentence structure was complex and it contained more comprehensive and advanced thinking apart from the sentence construction. Since the reasoning skills were involved in this level, more activities and emphasis were given to establish this particular sentence structure. Participants used a variety of words to give reasons in a comprehensive manner. According to the figure 4.4 it is evident that the participants baselines and outcome measurements are different. According to the figure4.4, participant 2 shows a gradual improvement and generalized the skill into many different contexts, while participant 1 shows a slight improvement during intervention and remains stable till post intervention at the level of mastering the skill in some contexts.

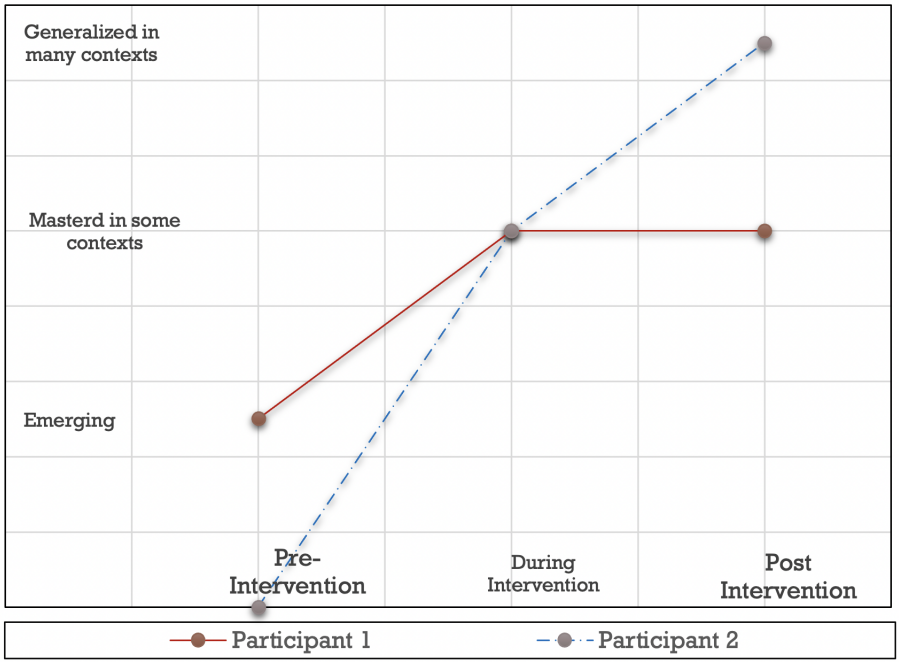


Figure 4.4: Improvements of the participants in *Sentence Structure: Subject + Cupola be + Verb + Object + Reason*

These sentence structures were helpful for participants to develop their communication skills. Indirectly they were able to improve their vocabulary by learning new words and using them appropriately when building these sentences.

4.3 Specific Objective 2: Overall changes that the approach has made in the participants

Overall changes that the participants have made can be discussed under improvements in the syntax and conversational skills. Past and present tense, singular and plural forms of nouns, and pronouns were analyzed by looking at the nouns and noun modifiers section, prepositions and pronouns section and tenses and negations section of CASLLS. In addition the the mean length of utterances (MLU) in words and mean length of utterances

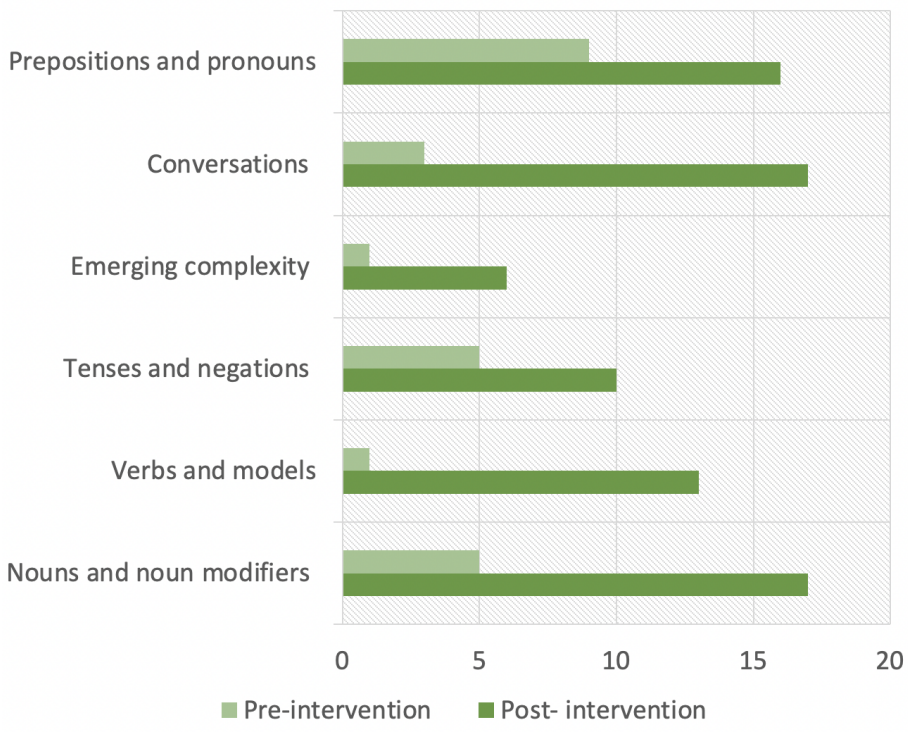
in morphemes were analyzed using SALT software.More over, the clarity of the speech in conversations were identified by analyzing the conversation skills section of CASLLS, and percentage of intelligible utterances, number of maze words and abandoned utterances in SALT analysis. At the end of the analysis, it was identified that the participants showed improvement in six main areas of language and communication.

According to figure 4.5 part (a) and (b) it is evident that both participants have improved knowledge on prepositions and pronouns, conversations,tenses and negations, verbs and models, nouns and noun modifiers. The increased number of skills shows the significant improvements in overall language and conversational skills of the participants at the end of the treatment program.

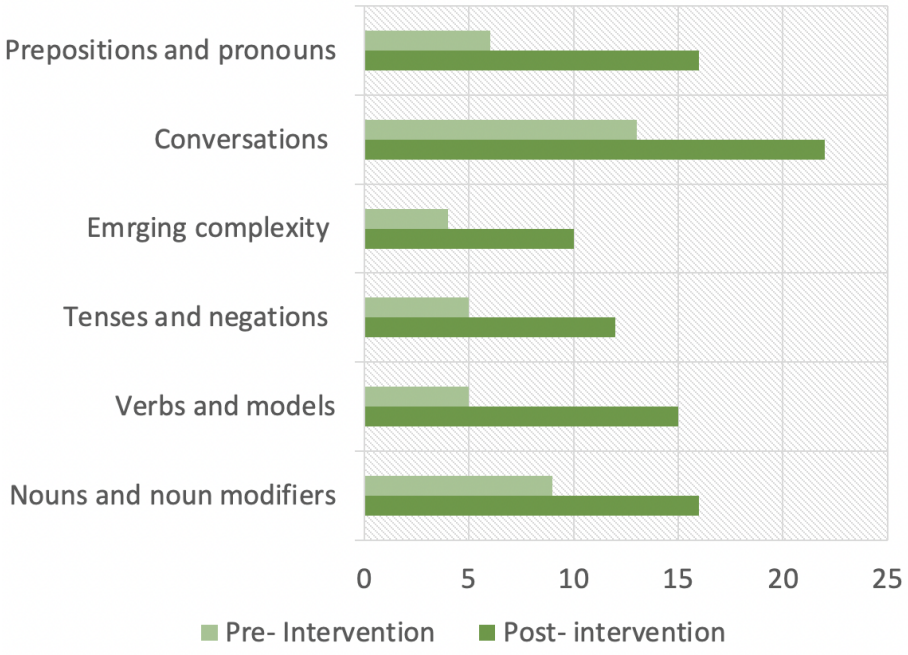
Improvements in the sentence structures and language skills have positively impacted the improvements of conversational skills of both participants. Figure 4.6 part (a) and (b) show the drastic improvements in both participants. At the end of the intervention program they were able to clarify information by repeating, continued to use descriptions to clarify information, started using long detailed conversations and primitive narratives. These improvements show visible advancement in improved confidence in communication.

4.3.1 SALT Analysis:

Another significant analysis of the current study was the SALT analysis. Table 4.2 demonstrates the improvements of language skills in different dimensions. According to the table, there were significant improvements in mean length of utterances in words, mean length of utterances in morphemes, number of total words, number of different words and

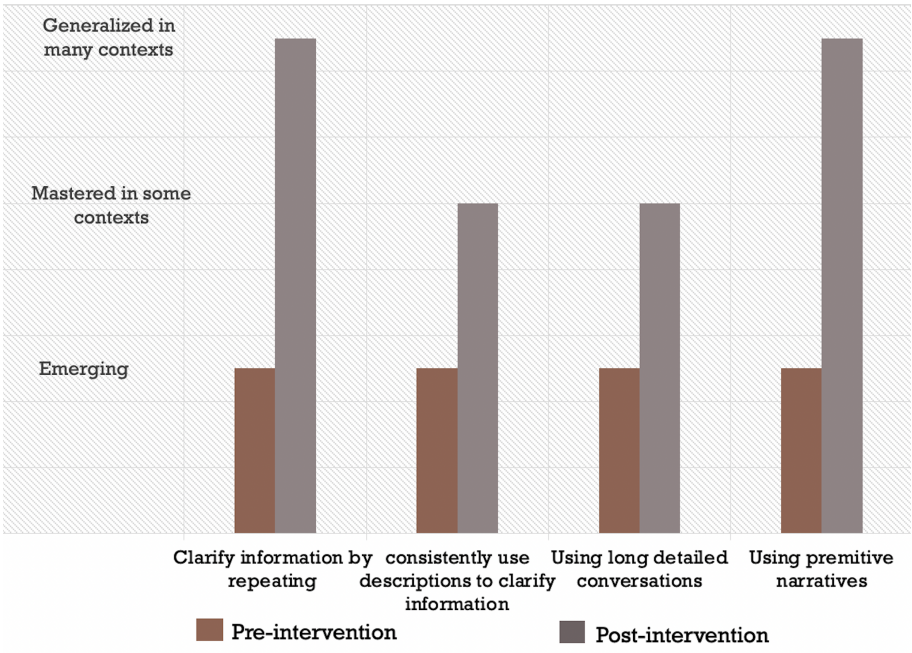


(a) Participant 1

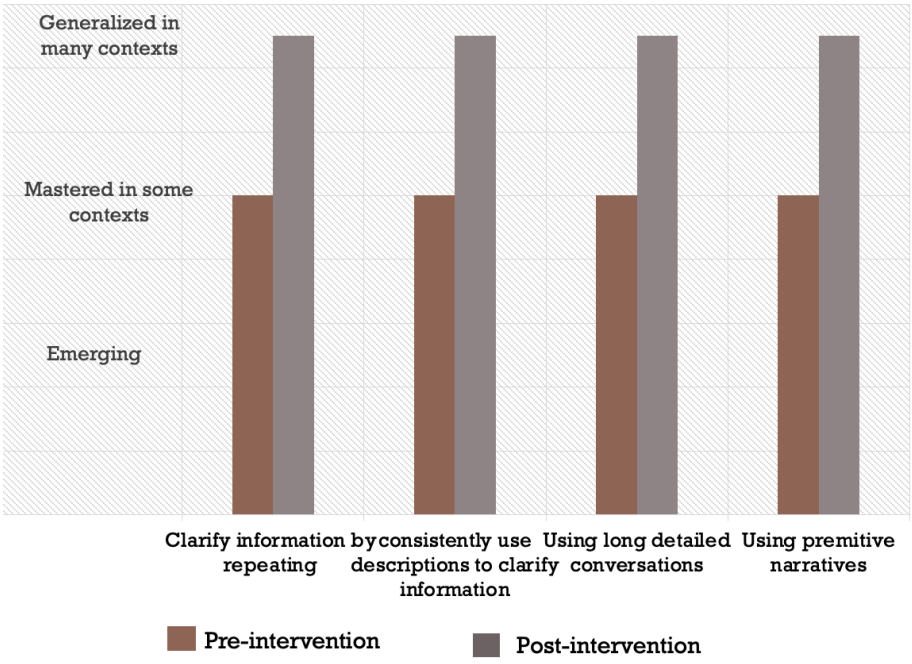


(b) Participant 2

Figure 4.5: Overall development in language skills of both participants.



(a) Participant 1



(b) Participant 2

Figure 4.6: Overall development in conversation skills of both participants.

total complete words. These improvement replicates the improvements in vocabulary, syntax and overall communication.

Table 4.2: SALT Analysis

Skills	Participant 1		Participant 2	
	Pre intervention	**Post intervention**	**Pre intervention**	**Post intervention**
Mean length of utterance in words	3.09	7.16	5.67	6.50
Number of total words	198	272	85	104
Number of different words	106	89	39	52
Total completed words	294	303	96	118
Number of mazes	11	7	4	3
Number of maze words	32	7	5	3
Maze words as a percentage of total words	14%	3%	6%	3%

The maze utterances referred to incomplete series of words, initial parts of words or unattached fragments which contained no meaningful information (Thordardottir & Weismer, 2002). These utterances do not contribute to the meaningful flow of a conversation. The reduction of the maze words of the post intervention phase shows the improvement in sentence construction with clear improvement in vocabulary ("SALT Home Page," 2021). However, it is evident that, there was a minute decline in the number of different words of participant 1. The reason for this decline was he formed complete sentences using the same set of words during the time of assessment. In addition, this situation can also be interpreted as the participant used relevant and meaningful words instead of saying random words with no meaning to the conversation.

4.3.2 Statistical Analysis: Tau-U calculation

The Tau-U calculation was also conducted to see the statistical significance of pre and post intervention measurements of the study. The Tau-U test has been designed especially for the single subject study designs to examine treatment effects on both, between- phase

differences and within-phase trends (Parker et al., 2011). The overall impact of the program in terms of syntax and conversational skills was analysed using the Tau-U analysis.

Table 4.3: Tau-U Calculation

	TAU	**SD**	**P Value**	**CI 90%**
P1 BL Vs P1 I	0.875	6.9282	0.433	0.163<>1
P2 BL Vs P2 I	1	6.9282	0.0209	0.288<>1

***P indicates participants, *BL indicates base line and *I indicates Intervention**

According to the Tau-U calculation shows in the table 4.3 there is a statistically significant improvement in the syntax and conversational skills with the Tau-U value of 0.875 (p 0.0433) for participant 1 and Tau-U value of value of 1 (p 0.209)for participant 2. Syntax and conversational skills have been compared with the baseline measures and the post intervention outcomes of the participants. The significant improvements in the mentioned areas show the positive impact of the colorful semantics approach.

4.4 Specific Objective 3: Parental Perspectives

Parental perspectives were obtained via an online survey. The survey was consisted of questions that were formulated to gather parent perspectives regarding the treatment material, duration, treatment delivery, customization and the challenges. The parents were requested to complete the survey at the end of the treatment program. The responses were qualitatively analyzed.

Table 4.4, discusses parental perspectives about the treatment program. As parents closely worked with the kids, especially with the remote delivery, understanding their opinion was needed to improve the online mode of the therapy protocol in the future by minimizing weaknesses.

Table 4.4: Parent feedback

Criteria	Participant 1			Participant 2		
	Satisfied	**Unsatisfied**	**Undecided**	**Satisfied**	**Unsatisfied**	**Undecided**
Frequency of the intervention	✓			✓		
Materials used	✓			✓		
Use of appropriate activities	✓			✓		
Satisfaction about child's improvements in language and communication	✓			✓		
The most liked component	The modifications that have been done to personalize the program and the materials.			The use of visuals and child friendly arrangements of the program.		
The challenges they faced	The grammar component was difficult			No Difficulty		

According to table 4.4, it was clear that the parents are satisfied about both the logistics and the content of the treatment approach. The most preferable component of the treatment program is the customized way the program was delivered. Parent 1 said " I like the customized way it was delivered to my child" Parent 2 mentioned "I really liked the method. As I know, children with hearing loss are good at visual. By using colors to identify the words makes it easier for them to understand the lesson"

Further, it is also evident that the two parents have different opinions about the challenges that they faced while practicing the treatment approach.Participant 1 said "Grammar comprehension was the challenge". Participant 2 said "There was no significant challenge that happened during the treatment program. It went very well." This discrepancy has occurred mainly because of the different levels of performance of the children. This finding further proves the importance of personalization of the treatment program according to the level of performs of the participants.

In addition, both parents had positive overall impressions about the program. Parent 1 said "It was awesome. We can't wait to continue to work with the team" Parent 2 said

"This program is wonderful. My child and I got lots of benefits through this program. In my opinion, it proved to help children with hearing loss to develop their language and grammar structure. I also learned on how to teach my child better. I will keep practicing it in the daily conversation. I strongly recommend this program to parents who have children with hearing loss out there." These positive responses further support the positive impact of the treatment program not only on the participants but also on the parents, as they are willing to make changes to their teaching methods and willing to continue the treatment program in home settings.

5 Discussion

Speech and language difficulties of children with hearing loss is a common issue around the world. However, these difficulties can be effectively managed and improve the academic success and communication competencies with appropriate and relevant treatments (Albertini et al., 2016). Late identification and late amplification along with lack of appropriate treatment programs bring significant difficulties for these children. The persistence of these difficulties can have long-term impact in both social and academic lives of the children with hearing loss if left untreated (Hettiarachchi & Ranaweera, 2019).

All the current available therapy approaches such as auditory oral therapy, auditory verbal therapy, and communication approaches such as total communication, cued speech and sign language have proven effective outcomes (Dornan et al., 2010). There is a strong literature support to scientifically prove the positive impact that these approaches can make. However, the colorful semantic approach has similar effects, but it is different from other approaches due to the constructive nature of the approach. Moreover, unlike other popular speech therapy approaches colorful semantic approach cannot be used to improve speech sounds or speech production. It can only be served as a language therapy approach (Bolderson et. al., 2011). Nevertheless, colorful semantic approach is highly beneficial to improve syntax and semantics. Similarly it also can be used to improve literacy skills of children with various disabilities (Bolderson et al., 2011). The other main difference is, unlike AVT or any other popular therapy approaches, the colourful semantics approach is not developed

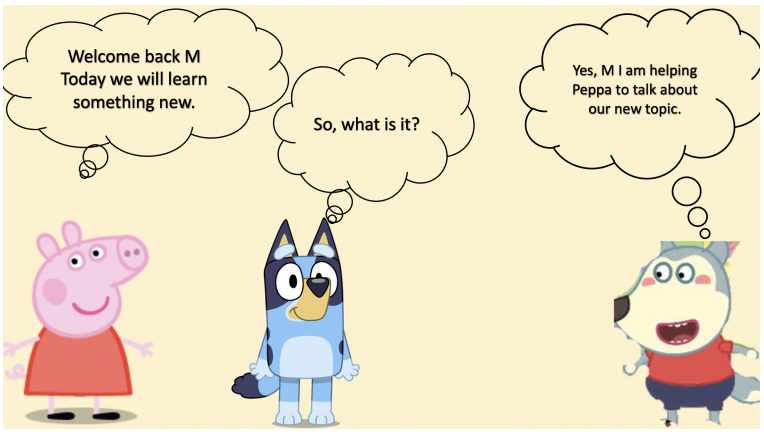
to treat children with hearing loss specifically. It was created to serve children with language disabilities in general (Hettiarachchi & Ranaweera, 2019).

The current study has many special and unique features as it employs the virtual platform to deliver a popular therapy program. Almost all previous studies that used the colorful semantics approach have used the traditional one to one in person mode of delivery with or without parental participation (Ebbels et al., 2007; Hettiarachchi & Ranaweera, 2019; Bolderson et al., 2011). However, the current study delivered the original features of the therapy approach with careful modification to the mode of delivery. The investigators took the necessary steps to keep the original format of the approach while changing a few logistics when delivering the program.looking at the overall improvements of the participants, it is evident that the colourful semantics approach has been effective for the participants. Similar to previous studies that have been conducted on colorful semantic approach (Bryan, 1997; Ebbels et al., 2007; Ebbels & van der Lely, 2001; Hettiarachchi, 2013; Morrissy, 2010; Spooner, 2002) this particular study also shows the similar findings, even though the current study has used the virtual platform. It is true that the virtual service delivery has some specific disadvantages. However, the similar results shows the possibility of modifying this approach to be used via telepractice without harming the scientific basis of it.

Further, the current study used all four levels of the program as the participant showed gradual improvements throughout the intervention program. The virtual platform Zoom was used in comprehensive manner to deliver all intervention sessions. The use of different options in the Zoom has been positively contributed to the participant's improvements. According to the Mccaslin (2021) "The Benefits and Challenges of Virtual Speech, Language, and Aural Therapies", the online therapy delivery via platforms like Zoom have shown to be effective

similar to traditional intervention methods. He further explains the impact of the different user-friendly features in Zoom. Among these options, the remote-control option was one of the most frequently used option in the current study. It allowed the participant to work together with the principal investigator. This feature also created a near normal classroom experience for the participants and for the investigator, accessing the same window at the same time (Dhawan, 2020). Apart from that, white board, screen share and annotations were equally used. These options made the intervention smooth while adding live interaction to the sessions. In addition, these options made sessions more productive due to active participation of the participants (Dhawan, 2020).

The Cottage Scales for Language listening and Speech (CASLLS) and the Systematic Analysis of Language Transcriptions (SALT) was helpful to establish an accurate baseline. The two baseline measures of the current study remain with no variability. This phenomena further implies no systematic trend in the behaviour of participants.In addition, correct baseline measures were helpful to develop the intervention program in an effective manner. The intervention materials 3.1 included pictures, symbols and reinforcements. The materials were selected according to the participant's level of performance. All these selections positively contributed to the successful intervention delivery, as appropriate materials are a main and a compulsory element of an intervention (Cagatay et al., 2012). The investigators carefully decided the appropriate tools, pictures, slides,online games, Google Forms and all other therapy material by closely identifying the participants motivations and preferences. Participant 1 had favorite cartoon and movie characters like "Rapunzel,Captain Underpants, Mr. Han from Karate Kid and Gene from Aladdin". Participant 2 had favorite characters



(a) Personalization 1

(b) Personalization 2

Figure 5.1: Personalization of materials according to the participant's desires. [source: Google Images]

like "Peppa Pig, Bluey" and animals like elephants, rabbits, cats and dogs. The sessions were conducted using these characters and desired animals refer to Fig. 5.1

The participants engaged well with the activities as they were able to enjoy their favorite characters. It has been identified that children engaged well with academic activities when they were given desired activities, including favorite cartoon or movie characters (Holyfield et al., 2019). Apart from their favorite characters, more interactive activities such as online games and quizzes were used to make the sessions more interactive. These games were helpful to improve the attentiveness and also motivation of participants. Most of the

games were programmed at the end of the session or in the middle of the session. In order to play games, the participants worked hard and completed the tasks. This concept had been scientifically proven and widely incorporated in practice (Cagatay et al., 2012).

Considering participant characteristics in Table 4.1, participants were represented with different baselines. Even though they had different baseline measures, at the end of the treatment program, both the participants were able to reach the same level of performance. For instance, according to the Fig. 4.1, considering the sentence structure of subject+ copula+ verb+object, participant 1 was at the "emerging" level and participant 2 was at "master the skill in to some contexts". However, at the end of the treatment program they have improved into similar levels as it shows in the Fig. 4.1 and Fig. 4.2 the participants were able to generalize the skill into many different contexts. The main reason the study had these positive outcomes is the personalizing activities according to each participant. The importance of personalization has been discussed throughout many studies and proven to be effective when given proper identification of the skills and the weaknesses of the children with disabilities (Tumanova & Filicheva, 2020).

Another important factor that should be discussed is the drastic improvements of participant 2 compared to participant 1. Even being second language English speaker, participant 2's drastic improvements demonstrate another important aspect of the impact of behavior in the learning process. Participant 1 presented with particular behaviors that hinder his abilities to improve. Even though the behaviors were more towards personality factors, his rejections of unfamiliar or demanding context restricted his opportunities to be exposed to more complex activities. Participant 1's mood changes affected his service provisions in many ways. On one hand his activities were limited to his comfortable levels

for most of the sessions and moved forward gradually. It was time consuming and he did not have enough time to complete the activities that were prepared for him. On the other hand even though he had the potential to achieve higher goals, his behavior hindered the ability of achieving the higher targets. This has been further proven by the study of Hallam (2009) discussed the importance of behavioral management in improving skills of children with disabilities. The behavior modifications have a direct impact on improved speech, language and communication skills and the results of the current study provide some evidence for the behavior challenges that affect learning processes.

Colorful semantics as an intervention approach showed advanced use of different concepts of bootstrapping (Abend et al., 2017) and argumentative and non-argumentative structure (Hettiarachchi & Ranaweera, 2019) with provision of color coding. This specific structural nature supported the development of the language and communication skills of the participants. This has been proven by previous studies of Hettiarachchi (2013) , Hettiarachchi & Ranaweera (2019) Spooner (2002). Further, according to the Bolderson et al. (2011); Ebbels et al. (2007) the argumentative structure of this approach helps the children to understand the logical arrangement of a sentence by understanding the role of each component of a sentence. This has been discussed since the early 1960's by the studies of Lea (1965, 1970); Kaldor et al. (2001). These studies further discuss allocating a colour coding to each thematic component of sentences and arranging different parts of the sentences in a logical manner. These case studies further prove the positive outcomes of the colorful semantics approach on its participants.

The long duration of the study (2 times per week for 12 weeks) compared to the previous studies of Bolderson et. al.2011 (2 times per week for 9 weeks) and Hettiarachchi &

Ranaweera, 2019 (2 times per week for 6 week) was a positive move of this particular study and it has positively contributed to the improvements of the participants. As mentioned in table 4.1, both participants have two different backgrounds with completely different English language exposures. Thus, the participants had equally high doses of intervention to give them time to adjust, grasp and retain the concept. A study by Johnston (2005) found treatment results were better when duration was over eight weeks. However, the duration of the treatment program always depends on the severity and the nature of the disability. This notion has been contradicted by the studies of Spooner (2002) and Guendouzi (2003) Their data shows less improvements even with the longer duration of intervention. In conclusion, longer duration should pair with careful planning of activities with achievable, realistic goals to see successful outcomes.

Positive parental support impacts positively towards the improvements of the children with disabilities. The goals can be easily achieved with the appropriate and the correct guidance of the parents (Roberts & Kaiser, 2011). The service provision in terms of intervention has been more family-centered lately with the improved awareness and attention towards parental participation in terms of delivering home therapy activities (Roberts & Kaiser, 2011). The informed and accurate support from the parents during the virtual treatment delivery is more important to achieve targets as the clinician is not physically present with the clients .The active participation of parents in the current study contributed massively towards the improvements of the participants, as both participant's parents had the desire to help their children to engage with activities. The parental support was a major contribution in terms of troubleshooting, consistent attendance, getting attention of the participants,

provision of new ideas and completion of therapeutic activities (Becker et al., 2015; Butler & Titus, 2015).

It has been identified that the colorful semantics approach improves receptive and expressive language skills along with communication and narrative skills (Hettiarachchi & Ranaweera, 2019, Bolderson et al., 2011). Similar effects can be identified in the current study as well. With the expansion of the sentence length and the vocabulary, the participants became more confident in general conversations. Refer to the SALT analysis which catalogues the reduction of mazes utterances and improvement in mean length of utterances and mean length of utterance in morphemes, improvements of total number of complete words and total words. In addition, when looking at the Fig. 4.5 and Fig.4.6 the improvements in speech clarity, improvement in conversational speech and improvement in syntax and semantics show the overall improvements in language skills. These improvements have positively impacted on confidence in day to day communication, showing the importance of language skills to improve communication effectiveness.

6 Conclusion

As a language therapy approach for children with language and learning disabilities, colourful semantics approach has been identified and used for many years by professionals. The logical arrangement and the allocation of specific colour coding system has helped the kids with hearing loss to capture the language concepts when using this approach. The visually appealing nature of the colorful semantics approach is especially beneficial for children with hearing loss. The program duration and the penalization of materials further added a meaning and support to grasp the teaching of the colourful semantics. Positive parental feedback is an immense addition to the success of a treatment program. Since the current study has been conducted via virtual platforms, the advantage of positive parental involvement become an added advantage to come to a successful end. According to the results of the current study it is clear that the colourful semantics approach can be used as a language therapy approach for children with hearing loss. However, further investigations should be done with more participants to enhance the validity and the reliability of this study.

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A Consent Form for Parents

PARENT CONSENT

Examination of the Colorful Semantic Approach via Telepractice for Children who are Deaf or Hard of Hearing

Investigators:
Samadhi Pusuba Devayalage
Graduate Student
Communication Sciences and Disorders
University of Arkansas

Rachel Glade, Ph.D., CCC-SLP, LSLS Cert. AVT
Research Mentor, CDIS Program Director
Communication Sciences and Disorders
University of Arkansas

INVITATION TO PARTICIPATE

Your child is invited to participate in a graduate student's research study about Examination of the Colorful Semantic Approach via Telepractice for Children who are Deaf or Hard of Hearing. Your child is being asked to participate in this study because they are school age students with hearing loss who may benefit from this intervention.

WHAT YOU SHOULD KNOW ABOUT THE RESEARCH STUDY

Who is the Principal Researcher?
Samadhi Pusuba Devayalage
Phone: 479- 684-1838
Email: sppusuba@uark.edu

What is the purpose of this research study?

Limited vocabulary and short sentence patterns could bring difficulties communicating with other people in the society. Children with hearing loss are often good at visual learning; therefore, activities and programs with a lot of pictures and videos could improve speech and language skills better than using traditional teaching methods. This particular study will use a therapy technique called colorful semantics which uses a lot of colored pictures to teach language. This study is looking at the effectiveness of the colorful semantics approach to develop speech and language skills in child with hearing loss.

Who will participate in this study?

School-age children with hearing loss. A limited number of spots to participate in this program are available.

What am I being asked to do?

Your child will meet with this researcher (remotely) to participate in weekly therapy sessions twice a week for 60 minutes each session. Starting the next session, your child will be provided set of picture cards via computer software and you child will identify the picture cards and complete sentences. A language sample (video recording of the child's spontaneous speech) will be gathered at the beginning and end of this study.

What are the possible risks or discomforts?

It is unlikely that your child will be exposed to risks; however, if your child does feel any discomfort as a result of participating with the activities, they may discontinue the program immediately. You and your child can withdraw from this study at any point of time and it will not affect the benefits or services that we would provide.

What are the possible benefits of this study?

Your child will be getting well planned therapy program which may be helpful to develop speech and language skills. In addition the findings of the study will be helpful to develop the intervention methods that your child is already engaged.

How long will the study last?

Your child will enroll in 60 minutes sessions two times per week. This procedure will be continued for 12 weeks.

Will your child receive compensation for time and inconvenience if he or she chooses to participate in this study?

Yes. Your child will earn $50 gift card when they complete the program.

Will your child have to pay for anything?

No, there will be no cost associated with your child's participation.

What are the options if I do not want my child to be in the study?

Participation is completely voluntary. If you do not want your child to be in this study, you may refuse to allow them participate. Also, you are allow to withdraw from the study you want. There will be no repercussions if you choose not to participate in this study.

How will my child's confidentiality be protected?

All information will be kept confidential according to the State and Federal law. Each recording will be stored in a password protected computer. All the other written documents: progress records and daily session plans will be maintained on a password protected computer to which only the research team has access. No personal identifying information such as name of your child, school or parents name will not report in research papers or presentations that result from this study. All data and reports will be in a password protected computer only the researchers of this study will have access.

Will we know the results of the study?
At the end of the study, you or your child will have the right to request feedback about the results. You may contact my research mentor, Dr. Rachel Glade (rglade@uark.edu, 479-575-3575). You can receive a copy of this form for your files if you want.

What do I do if I have questions about the research study?
You have the right to contact the Principal Researcher as listed above for any concerns that you may have.

You may also contact the University of Arkansas Research Compliance office listed below if you have questions about your rights as a participant, or to discuss any concerns about, or problems with the research.

Ro Windwalker, CIP
Institutional Review Board Coordinator
Research Compliance
University of Arkansas
109 MLKG Building
Fayetteville, AR 72701-1201
479-575-2208
irb@uark.edu

By keeping your signature below, I consent for my child to participate in this study (Electronic signature will be accepted).

Name of child:

Caregiver Signature

Date _____

B Consent Form for Kids

What should I do?

First you will look at pictures on the computer and we will talk about it. I will take notes and record our meeting to review it later.

Then…….

We will learn a fun way to make sentences using colors and pictures. We will be looking at a few pictures and you will make sentences using them. We will do this together while meeting on the computer.

We will meet 2 times each week for around 1 hour each meeting.

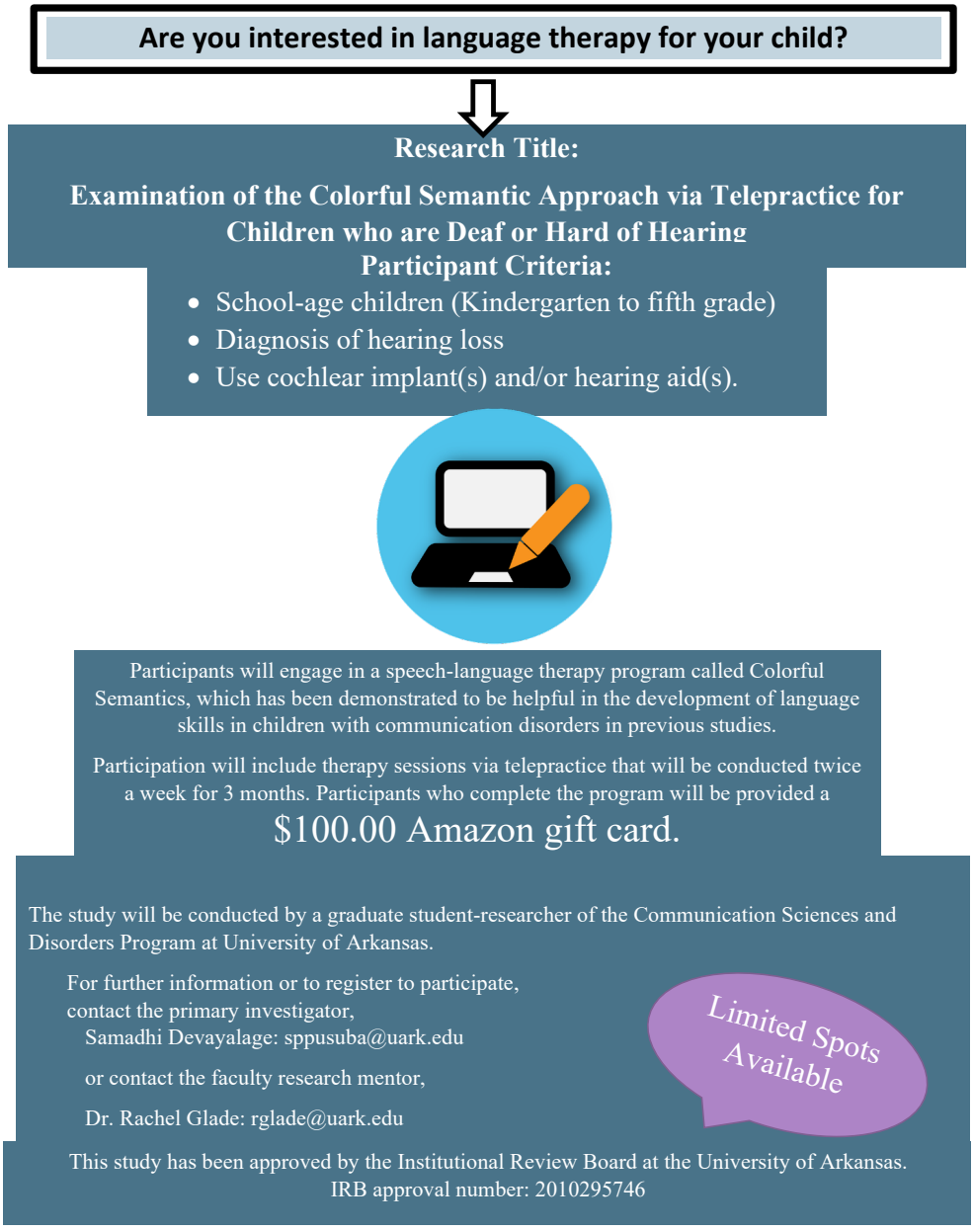
Do you agree to participate in the research study?

(Please Move the red circle to your choice and type your first and last name below)

YES NO

Name: _____

C The Flyer


Are you interested in language therapy for your child?
Research Title:
Examination of the Colorful Semantic Approach via Telepractice for Children who are Deaf or Hard of Hearing
Participant Criteria:
• School-age children (Kindergarten to fifth grade)
• Diagnosis of hearing loss
• Use cochlear implant(s) and/or hearing aid(s).
Participants will engage in a speech-language therapy program called Colorful Semantics, which has been demonstrated to be helpful in the development of language skills in children with communication disorders in previous studies.
Participation will include therapy sessions via telepractice that will be conducted twice a week for 3 months. Participants who complete the program will be provided a
$100.00 Amazon gift card.
The study will be conducted by a graduate student-researcher of the Communication Sciences and Disorders Program at University of Arkansas.
For further information or to register to participate, contact the primary investigator,
Samadhi Devayalage: sppusuba@uark.edu
or contact the faculty research mentor,
Dr. Rachel Glade: rglade@uark.edu
Limited Spots Available
This study has been approved by the Institutional Review Board at the University of Arkansas.
IRB approval number: 2010295746

D Test Materials - Complex Picture

Figure D.1: The Main Stimulus Complex Picture [Michelle Bernadette Xavier]

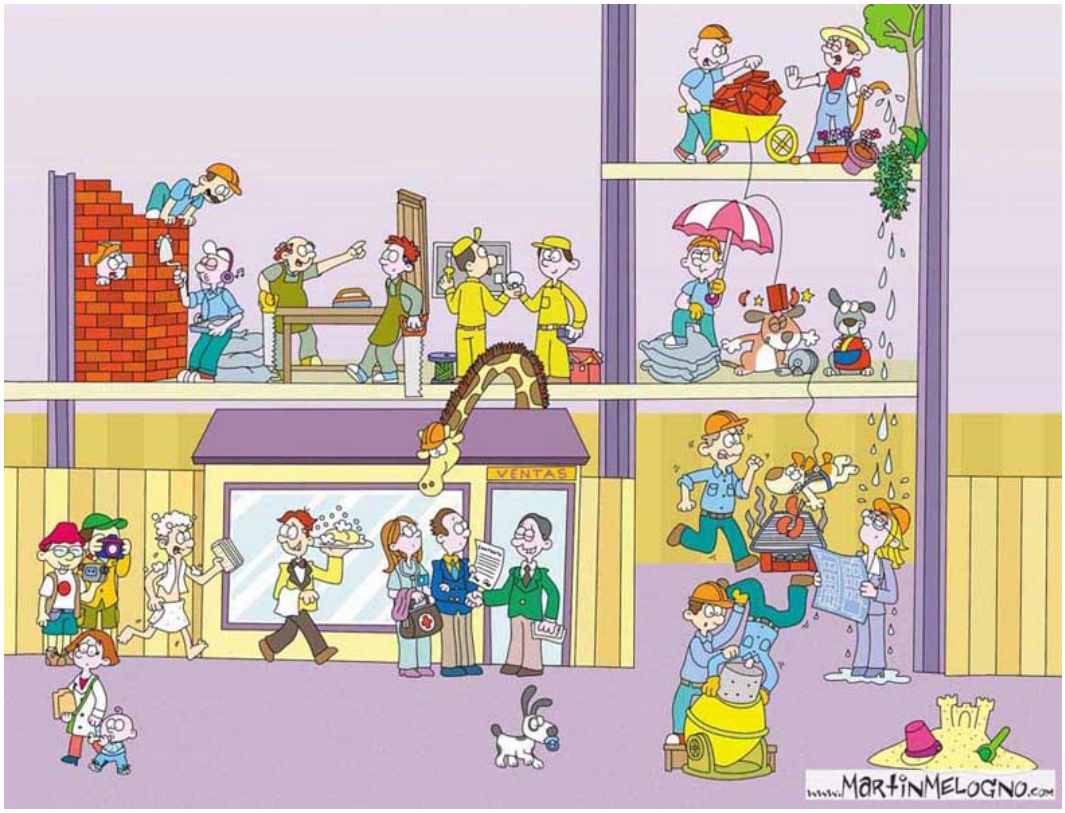


Figure D.2: Complex Picture [https://www.pinterest.com/]

E IRB Approval Letter

UNIVERSITY OF ARKANSAS

To:	Samadhi Priyanwada Kumari Gunathilaka Pusuba Devayalage
From:	Douglas J Adams, Chair IRB Expedited Review
Date:	02/08/2021
Action:	**Expedited Approval**
Action Date:	02/08/2021
Protocol #:	2010295746
Study Title:	Examination of the Colorful Semantic Approach via Telepractice for Children who are Deaf or Hard of Hearing
Expiration Date:	01/14/2022
Last Approval Date:	

The above-referenced protocol has been approved following expedited review by the IRB Committee that oversees research with human subjects.

If the research involves collaboration with another institution then the research cannot commence until the Committee receives written notification of approval from the collaborating institution's IRB.

It is the Principal Investigator's responsibility to obtain review and continued approval before the expiration date.

Protocols are approved for a maximum period of one year. You may not continue any research activity beyond the expiration date without Committee approval. Please submit continuation requests early enough to allow sufficient time for review. Failure to receive approval for continuation before the expiration date will result in the automatic suspension of the approval of this protocol. Information collected following suspension is unapproved research and cannot be reported or published as research data. If you do not wish continued approval, please notify the Committee of the study closure.

Adverse Events: Any serious or unexpected adverse event must be reported to the IRB Committee within 48 hours. All other adverse events should be reported within 10 working days.

Amendments: If you wish to change any aspect of this study, such as the procedures, the consent forms, study personnel, or number of participants, please submit an amendment to the IRB. All changes must be approved by the IRB Committee before they can be initiated.

You must maintain a research file for at least 3 years after completion of the study. This file should include all correspondence with the IRB Committee, original signed consent forms, and study data.

cc: Rachel Glade, Investigator