# Computer Assisted Language Learning System for Hyperlexia Children of Tamilnadu

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*Abstract*— Children are born with neurological and developmental disorder in Tamilnadu. Hyperlexia children are good at reading and writing at the age of three. But they are lagging in social and emotional communication. They are required training from speech therapy pathologist to improve their social communication skill and comprehension reading. In our present research work, we are planning to design a computer assisted system to overcome language impairment of children who live in Tamilnadu.

Keywords— Hyperlexia, Autism Spectrum disorder (ASD), Speech Language Pathology (SLP), Natural Language Processing (NLP), Computational Linguistics, Computer-Assisted Language Learning (CALL)

#### I. INTRODUCTION

Nowadays children are born with different neurological and developmental disorder. It affects children brain's learning ability. We can notice that some children are lagging in producing speech and understanding others emotions at their early age.

Speech and Language Pathologists (SLP) are analyzing the children's behaviors and responses during conversation. Based on some specific symptoms, SLPs are diagnosing that the children are affected by Autism Spectrum Disorder.

Few symptoms of Autism are:

- Poor eye coordination
- Echolalia
- Speechless
- Less receptive Communication
- Less expressive communication
- Poor in verbal communication
- Comprehensive communication deficit

Autism is the condition in children and the neurons in their brain are wired differently. So Autism is called as neurodevelopment disorder. Autism is present in children with other disorder also. Some of the additional disorders are Language Disorder, Hyperlexia, Attention Deficit and Hyperactivity Disorder (ADHD) etc., Lydia Denworth [6] explains the challenges of social communication of Autism children. Social rules must be framed for every environment which is faced by Autism children. This is the great assessment for the children and it should be practiced regularly by them.

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Autism children do not like to look at a speaker's eyes. The children feel that eye contact is straining them. Forcing eye contact may affect their thinking. Eye contact is stressful or painful for Autism children [1]. Occupational therapists are identified that the Autism children feel comfortable to communicate without eye coordination as well. Echolalia means that the Autism children repeat the same words of opponent speaker as response. The Autism children's language level is low at the age of 1.5 years without producing even single word in mother language. Tamil and English are the two languages are necessary for both social communication and education in Tamilnadu. The Autism children face difficulties with society without knowing any specific language.

Hyperlexia is the condition and is part of Autism. The specific kind of children read and writes more through sight words initially at the age of three years. Hyperlexia is noticed in children from the age of three to four. Reading is a powerful tool for learning language and social skills. This is the strength of Hyperlexia children. With the help the reading ability, SLPs train the children to learn specific language.

Audra Jensen explains about Hyperlexia by giving a picture [5]. The condition of Hyperlexia comes with other disorder like Autism, Language Disorder, and Social Impairment is shown in figure 1. But Hyperlexia children can improve their language level by following precocious reading and rote learning. The learning process should be continued throughout their life. The language learning system should be updated regularly to show the improvement in academics up to college level.

Audra Jensen [5] explains teaching methodology and therapy for Hyperlexia children in paper and pen method. His whole work should be converted to a visual mode by using computer systems. The learning methods concentrated on teaching language and social communication. The Hyperlexia children are showing interest to learn everything in visual mode. They feel comfortable to learn everything by examples than explanations. We are facing difficulties when we teach the learning process through explanations.

SLPs concentrate on the children's cognitive skills which develops communication skill by introducing language's features like:

- Preposition
- Pronouns
- Money concept
- Time concept

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- Days of the week
- Tenses
- Story and picture description etc.,



Fig. 1. Diagram of Hyperlexia

Pathologists follow formal and informal language assessments [2]. The assessment includes:

- Vocabulary knowledge
- Rote learning
- Receptive and expressive language skills
- Ability to answer the questions

Hyperlexia children are good at reading from visual models. The department of special education and SLPs write more learning methods for these children. In our research work we have considered the language learning level of Autism children with Hyperlexia condition. The language level of Hyperlexia children has improved by giving Computer Assisted Language Learning system.

## II. LITERATURE REVIEW

Selvia Kuriakose et al. [12] designed virtual reality based anxiety-sensitive system aimed at improving social communication. They did not use more realistic and active communication mode. They concentrated only on verbal communication through speech recognizer and they did not include eye-tracking system. They used less active model of menu-driven conversation.

Zhi Zheng et al. [13] developed virtual reality based system to focus on the scenario of 'Response to Name'. They designed an autonomous social orienting training system to bring the children attention towards the target.

Camila et al. [14] developed a mobile application in the name of **ValpoDijo** in Chilean language for Chile's Autism children. They trained the children to practices Chilean idioms. They experimented that multi touch devices support the comprehension of linguistic expressions.

David et al. [15] used Tablet devices to overcome the communication deficits in children with Autism. They designed the **Chain-of-words** application for tablet devices. It provides the facilities of touch, drag & drop, voice recognition and multimedia support activities.

Raafat et el. [16] designed a learning mobile application for autistic children by using Applied Behavioural Analysis (ABA) learning method. They believed that touch screen activities on smart devices make the child to feel comfortable to learn.

Mirko et al. [17] designed a wearable virtual reality storytelling tool for children with intellectual Developmental Disability (IDD). IDD is a broad term which includes any form of disability. They used the device Google Cardboard with smart phones to give virtual reality environment.

Sen-Ching [18] developed multimedia based system by using Multimedia Based Instruction (MBI). They proved that play skills of children be improved by multimedia tool. They concentrated on proper eye gaze, hand movement and vocalization of children. MEBook is a social narrative tool which includes games for social greeting. They used Crazy Talk Animator which makes pictures to animation.

Andres et al. [19] developed videogame to improve communication in children with autism.

Richa et. al. [20] used multimedia tool and measure the different parameters related Autism condition of children to show the improvement of using it. They used the teaching method which is efficient and prominent one i.e. Rapid Prompting method (RPM) by Soma.

Tayde et al. [21] completed the project in the name of AUTHIC which is a part of assistive technologies and helps the Autism children to understand and interpret facial expressions of different emotions through interactive games.

Afshara et al. [22] designed a learning system PLaN for numeric calculation. They used Picture Exchange Communication System (PECS) and Treatment and Education of Autistic and related Communication disabled Children (TEACCH) teaching system. This system targets the mild category Autism children.

Vedad et al. [23] proposed to set a curriculum for undergraduate computer science and engineering students to develop video games for children with Autism. They believed video games make interest to learn.

## III. METHODOLOGY

Darold Treffert et al. [9] Provided complete manual about Hyperlexia with Autism Spectrum Disorder. They have explained the creation of separate learning environment for Hyperlexia children and they have instructed to start early intervention. They explained that how to start special education for hyperlexia children to teach language. Hyperlexia children are comfortable in visual learning. The computer technologies are used to design CALL system and it encourages the children to improve their social and academic activities.

Many technologies help Hyperlexia children in language learning process. They are:

• Mobile application

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- Video games
- Virtual reality systems
- Robotics

Number of researchers developed different helping tools for the ASD children to make their life independently.

When we analyze these technologies they are concentrating only specific language development or eye contact. The Autism children require a complete language learning system from diagnosed period of Autism i.e. the age of 1.5 years to adult age to lead their life independently. Johnny L. Matson [7] gave ideas to start the treatments in the form of assessment like video modelling to improve social skills. We are considering the Hyperlexia children from the age of three to five years old. Pathologist can identify the condition of Hyperlexia with ASD in children at their age of three.

Speech and Language Pathologist starts to build the children's vocabulary knowledge with the help of flash cards which contains a picture with simple text. Then they are teaching them to identify the vocabulary from the group of words. The same procedure is followed to teach parts of the human body, numbers, colours, shapes, birds, animals and other things related to environmental studies. After teaching required list of vocabulary with pictures, SLPs begins to teach social communication.

All the above teaching methods should be repeated regularly to give practice to children's brain for managing routine life. SLPs are introducing patterned language and question and answering to initiate receptive and expressive communication. Hyperlexia children really face the difficulties in creative thinking and logical reasoning [3].

Our proposed CALL system includes text, image and audio. There are four skills of language learning. Those skills are listening, speaking, reading and writing. Hyperlexia children face difficulties in both listening and speaking. The complete Tamil-language learning system must contain all areas of language skills [3] which help Hyperlexia children. They are:

- 1. Gaining Attention
- 2. Labelling
- 3. Vocabulary
- 4. Communicating basic wants and needs
- 5. Requesting
- 6. Protesting
- 7. Making choices
- 8. Following directions
- 9. Giving directions
- 10. Language concepts
- 11. Associations (including categorization, opposites, analogies)
- 12. Answering questions
- 13. Asking questions
- 14. Sequencing

- 15. Attributes and descriptors
- 16. Explaining and describing
- 17. Narratives and dialogues
- 18. Grammar skills
- 19. Using social rule
- 20. Time concepts

Nikki L. Murdick [11] explained the need of special care in education at classroom environment. They analyzed four case studies of Hyperlexia children to improve their education and social skills. They identified that some Hyperlexia children learn from music. We will prove that our CALL system improves Hyperlexia children's listening and speaking skills with the help of their strength in reading.

Natural Language Processing is an area of Computer Science and Artificial Intelligence which helps to design a language learning system with interactions between computers and human languages. It is very helpful for Hyperlexia children to promote their language level and used to promote their learning level [4].

Diane Litman [10] explained about how Natural Language processing based system is used in education. They explained that how we can use NLP for learning through teaching in an interactive way by using text and speech through dialogue based learning. Fig. 2. Shows that typical NLP for education research lifecycle. The NLP based leaning system is designed and used by the teachers and students and updated regularly according to the growth of student's knowledge to make interest to learn.



Fig. 2. Typical NLP for education research lifecycle

Language learning system requires the following data.

- 1. Experienced data with Hyperlexia children
- 2. Corpora for Tamil and English languages
- 3. Linguistics data

A corpus provides computational data of specific language to speak and write. Language learning will be completed when one can listen, read, write and speak the specific language in a perfect way.

Many language learning systems have designed already in English language and especially it is designed to run in iPad. Toby Playpad is a platform for English language learning and it delivers therapy for autism children. Susan Rovet Polirstok et al. lists out all the resources related to Autism, therapies, education assessments and training.

Our language learning system is focused both languages Tamil and English which means that the system should be designed in a colloquial language used in Tamilnadu.

#### IV. CONCLUSION

We are designing CALL system for Tamilnadu's Hyperlexia children. We are using Natural Language Tool Kit (NLTK) with Python to design our system. In Tamilnadu we could not find any complete CALL system for Hyperlexia children. The non-technical parents in Tamilnadu are facing difficulties to teach social activities and academic activities to their children. Our specific CALL system surely acts as a tutoring system for pathologists, special educators, parents and children of Tamilnadu.

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