Interactive Learning and Intervention for Communication Discrepancies in Children with Asperger Syndrome

Mr.V.Balaji¹ Nivetha Thiruppathi² Shalini Bhaskar³ Lydia Blessie.J⁴

¹,²,³,⁴Department of Information Technology
¹,²,³,⁴Easwari Engineering College, Chennai, India

Abstract—The ability to communicate and interact with others seems to be difficult for children with Asperger syndrome. The proposed application system uses an interactive learning technique where the needs of the autistic children are analyzed and child responds based on his/her interest. With the help of the software an autistic kid can get to know about the subjects which teach basic operations. The subjects available in the software are Maths, Science, General Knowledge, Rhymes and English. The software has a login page for both the child and the teacher who can update the curriculum. The student login can be logged in for learning based on child’s interest and take up tests. The admin login has a provision to upload the course contents and update them regularly. Finally, after the kid has taken up tests an evaluation phase occurs where the scorecard is generated and based on improvement of the child, the software moves to the next level of teaching for that specific subject. On the next login of the child the interest and behaviour is analysed using behaviour analysis, thereby the corresponding subject appears upon login. The evaluation is done and the results are compared using a graph.

Key words: Asperger syndrome, interactive learning, curriculum, improvement, evaluation

I. INTRODUCTION

Autism spectrum disorder or autism, refers to a range of conditions characterized by challenges with social skills, repetitive behaviours, speech and nonverbal communication, as well as by unique strengths and differences. The term “spectrum” reflects the wide variation in challenges and strengths possessed by each person with autism. We now know that there is not one autism but many types, caused by different combinations of genetic and environmental influences. Autism is one of the five pervasive developmental disorders (PDD), which are characterized by the abnormalities in social interactions and communication, and severely restricted interests and highly repetitive behaviour. Autism’s most-obvious signs tend to appear between 2 and 3 years of age. In some cases, it can be diagnosed as early as 18 months. Autism Speaks urges parents with concerns to seek evaluation without delay, as early intervention can improve outcomes.

Autism is a neurodevelopmental disorder that can be characterized by impaired social interaction, verbal and nonverbal communication, and restricted and repetitive behaviour. It affects information processing in the brain by altering nerve cells and how their synapses connect. How this occurs is not well understood. In the DSM V, autism is included within the autism spectrum, as is Asperger syndrome and pervasive developmental disorder (commonly abbreviated as PDD-NOS), that were diagnosed when the full set of criteria for autism or Asperger syndrome were not met.
communication, social and vocational skills that are not naturally acquired during their development, with intervention tailored to the needs and requirements of the individual based on multidisciplinary assessment. Although progress has been made, data supporting the efficacy of certain interventions are limited.

II. RELATED WORKS

In Erik Marchi1, Fabien Ringeval’s, “Towards Cross-lingual Automatic Diagnosis of Autism Spectrum Condition in Children’s Voices”, a method was proposed for automatic diagnosis of voice with cross-lingual evaluation on languages such as English, French, Swedish and Hebrew focusing on six emotions like happy, sad, angry, surprised, afraid and neutral.

In Matthew K. Belmonte’s “Can computer assisted training of prerequisite motor skills help enable communication in people with autism?” targets people with autism who lack communicative speech such as deficit in motor skills. Autistic clients practise pointing and dragging at objects which makes it easy for them to learn. Point Outwords software contains five separate themes depicting a different scene associated with living activities.

III. PROPOSED MODEL

A. Applied behaviour analysis:

Applied behaviour analysis (ABA) is a scientific discipline concerned with analysing the principles of learning theory and systematically applying this technology to change behaviour of social significance. It is the applied form of behaviour analysis. ABA tries to change behaviour by first assessing the functional relationship between the environment and a targeted behaviour. This approach seeks to develop replacement behaviours which serve the same function as the aberrant behaviours. ABA is devoted to developing procedures which will produce observable changes in behaviour. It is to be distinguished from the experimental analysis of behaviour, which focuses on basic experimental research, but it uses principles developed by such research, in particular operant conditioning, classical conditioning and social learning theory.

Behaviour analysis adopts the viewpoint of radical behaviourism, treating thoughts, emotions, and other covert cognitive activity as behaviour that is subject to the same rules as observable responses. This represents a shift away from methodological behaviourism, which restricts behaviour-change procedures to behaviours that are observable, and was the conceptual underpinning of modification. Methods in applied behaviour analysis range from early intensive behavioural interventions for children with autism spectrum disorder (ASD) to research on the principles influencing criminal behaviour. However, ABA has also been brought to bear on a wide range of areas and behavioural problems exemplified by the following: HIV prevention, education, gerontology, conservation of natural resources, health and exercise, industrial safety, language acquisition, littering, medical procedures, parenting, psychotherapy, seatbelt use, sports, severe mental disorders, substance abuse, phobias, paediatric feeding disorders, zoo management and care of animals. Behaviour analysts also emphasize that the science of behaviour must be a natural science as opposed to a social science. As such, behaviour analysts focus on the noticeable relationship of behaviour to the environment, including past history and consequences, without resort to “hypothetical constructs”.

In applied behaviour analysis, all experiments include the following:

- At least one participant.
- At least one behaviour (dependent variable).
- At least one setting.
- A system for measuring the behaviour and on-going visual analysis of data.
- At least one treatment or intervention condition.
- An intervention that will benefit the participant in some way.
- Manipulations of the independent variable so that its effects on the dependent variable may be qualitatively or quantitatively analysed.

ABA-based techniques are often used to change behaviours associated with autism, so much so that ABA itself is often considered to be synonymous with therapy for autism mistakenly. ABA for autism may be limited by IQ and diagnostic severity. The most influential and widely cited review of the literature regarding efficacy of treatments for Autism concluded that ABA was the best and most effective treatment for the main characteristics of Autism. Medications are not the primary treatment and have not been proven to correct the core deficits of ASD. ABA is the primary treatment according to the American Academy of Paediatrics.

ABA must be able to prove that its methods are effective. This requires frequently measuring the success of interventions, and, if necessary, making changes that improve their effectiveness. To be useful generally, interventions should be available to a variety of people, who might be teachers, parents, therapists, or even those who wish to modify their own behaviour. With appropriate planning and training, many interventions can be done almost anyone willing to invest the effort. ABA provides tools that give the practitioner feedback on the results of interventions. These allow anyone to assess their skill level and build confidence in their effectiveness.

B. Proposed Model:

The proposed application system uses an interactive learning technique where the needs of the autistic children is analysed and child responds based on his/her interest. With the help of the software an autistic kid can get to know about the subjects which teach basic operations. The software has a login page for both the child and the teacher who can update the curriculum. The student login can be logged in for learning based on child’s interest and take up tests.

1) Evaluation and Learning – Administrative
2) Learning and evaluation – User
3) Evaluation Graph.

I) Evaluation and Learning – Administrative:

The administrative module contains provision for adding questions for the selected subjects, each question will have image to be displayed, the learning text to be displayed and convert to speech. This module provides the administrator to add training materials. The materials needed for evaluating the student can be added in this module. This administrative module allows the user to feed the images, question, options and correct answer for a particular question for that particular subject.
2) **Learning and evaluation – User:**
The student can login to the software with the username and password provided for them. Once they login, they will be presented with an option to choose between training and evaluation.

**Training** – When the user chooses training, the subject list will be displayed; upon selecting a subject, the student will be presented with the training material, which is uploaded by the administrator in the previous module. Training material will be displayed as one question per screen. It will convert the text content of the training material to an automated speech conversion engine and outputs as audible speech content.

**Evaluation** – Once the logged in user chooses the evaluation module, the software directs to the list of subjects. By selecting a particular subject, the question for that subject will be displayed. The user/student should select the appropriate answer by clicking that options presented below the question. The user can proceed to the next question by clicking the “Next” button. The software verifies the answer with the database and maintains the score card for that student for that test.

3) **Evaluation Graph:**
The progress of the student can be viewed graphically. A line chart is generated with marks as Y axis and test as X axis. Every time the user takes a test his final marks will be stored in the database. The final marks will be plotted in the graph. When the user takes multiple tests on different subjects, a graph with multi-line will be generated as one line for one subject per student.

**C. Progression graph:**
A graph is viewed at the end for all children in their unique logins. A kid’s mark updates for each test is stored. From the number of tests taken, tests taken in different subjects, frequently assessed subjects and the score details can be obtained in a single glimpse of this graph. This is the ultimate goal of the graph.
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D. Interests Wall:  
After the login of an individual child with their unique identity, depending upon the Applied Behaviour Analysis (ABA) Algorithm, the page is redirected to the child's interested subject wall. To be detailed, if a child has taken 2 or more tests in the same Subject then, if the same child logs in again gets redirected to the interested subject wall i.e., to the learning module of the specific subject. If there's equal threshold of tests in all subjects then the algorithm redirects to the main subject categories page. This allows the kid to get updated of new syllabus which if updated on their interested subject and helps in learning and practicing it.

IV. CONCLUSION  
This project serves as an instrument in helping the children with Autism Spectrum Disorder by providing a platform for interactive learning and implementing Applied Behaviour Analysis in the intervention process. The proposed system uses ABA and projects the learning as per the child’s interest. Ultimately, the analysis of the child’s improvement in the evaluation is represented in a graph for better understanding. The recorded results can be useful in updating the curriculum accordingly. Thus, the system illustrates effectiveness in enhancing overall functioning improving their intellectual performance.

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