Effective Support System for Language Assessment and Training for Special Children

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Abstract: - Special children in this study focus on Down syndrome children. Very often, Down syndrome children are associated with some impairment language ability, cognitive ability, fine motor, gross motor, self help and social emotional. Early childhood intervention includes screening for common problems, and vocational training can improve the development of children with Down syndrome. However, Early Intervention Program (EIP) is not widely and effectively implemented in Malaysia due to several obstacles. In this study, the language assessment and training will be prioritized, in which the support system will provide the most effective assessment and training method to the children. This software utilizes speech recognition technology, together with modified internationally recognized curriculum, implemented in C sharp programming language. The result of this study is expected to be beneficial and able to assist parents and trainers on effective language training for special children. In conclusion, an effective language assessment and training support system has been developed for the improvement of the children’s language ability and their quality of lives in the long run.

Key-Words: - Support system, language training, language assessment, special children, speech recognition, Early Intervention Program

1 Introduction
The Down Syndrome (DS) is an anomaly caused by chromosomal abnormalities and is associated with mental retardation, being the most common genetic cause of disability in development [1]. Approximately one out of every 800-1,100 births results in an extra chromosome of the twenty-first group called Trisomy 21, or DS [2]. Although some of the limitations of DS cannot be overcome, early intervention program is proven to be able to improve quality of their lives. Early intervention program includes six main fields which are cognitive ability, language ability, gross motor ability, fine motor ability, social emotional, and self help ability.

2 Problem Formulation
The current EIP in Malaysia is done manually, in which it depends heavily on the experience of trainers and parents and the ability to interpret EIP as in books or website. Hence, the implementation of the EIP is still not effective. Problems for the ineffectiveness and implementation of EIP in Malaysia are
1. Lack of experienced trainers
2. Lack of assessment and training tool
3. Lack of information and awareness in the public

In this study, the language ability will be emphasized as the speech and language skill of DS children are significantly delayed – more delayed than non-verbal abilities Besides that, the speech and language skill underpin social and cognitive development, therefore affecting all aspects of development. In other words, improving the language ability of individuals with DS will improve all aspects of their development and quality of life. [3]. Learning to talk is a complicated process, it involves few emerging skills, influenced by learning
opportunities and it might take many years. The requirements in talking are as in Table 1. To express themselves through language, children need to know the words and grammar to express their thoughts in spoken language, they have to be able to make the sounds and words clearly so that their speech can be understood and then engaging someone effectively in conversation.

**TABLE 1**

<table>
<thead>
<tr>
<th>Interaction</th>
<th>Spoken language knowledge</th>
<th>Speaking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-verbal</td>
<td>Vocabulary</td>
<td>Grammar</td>
</tr>
<tr>
<td></td>
<td>building a dictionary of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>single words and their</td>
<td></td>
</tr>
<tr>
<td></td>
<td>meanings (lexicon and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>semantics)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>learning the word ending</td>
<td></td>
</tr>
<tr>
<td></td>
<td>rules for plurals, tenses,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>word order rules for</td>
<td></td>
</tr>
<tr>
<td></td>
<td>questions, negatives,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(morphology and syntax)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>learning to make speech</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sounds, produce clear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>words with correct stress</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and intonation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(articulation, phonology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and prosody)</td>
<td></td>
</tr>
</tbody>
</table>

To express themselves through language, children need to know the words and grammar to express their thoughts in spoken language, they have to be able to make the sounds and words clearly so that their speech can be understood and then engaging someone effectively in conversation.

**TABLE 2**

<table>
<thead>
<tr>
<th>Birth</th>
<th>1 year</th>
<th>2 years</th>
<th>3 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech</td>
<td>Smiling, cooing</td>
<td>Babbling, words</td>
<td>Keyword phrases</td>
</tr>
<tr>
<td>Reading</td>
<td>Experience of books and stories</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td>Attending</td>
<td>Copying</td>
<td>Choosing</td>
</tr>
</tbody>
</table>

**3 Problem Solution**

In this section, the procedure, and the methods used for language assessment and training support system will be described. C Sharp is being used in all the programming in this support system.

Generally, the flow of the language support system is as below:

From birth to 3 years, children change from totally helpless infants to a person who is able to socialize with others, co-operate and communicate in spoken language. The development progress is as in Table 2. Apart from that, they begin to write, to count and to read. However, most children need supervision and supports for almost all those activities. Generally, DS children develop slower in speech, reading and memory skills compared to normal children. Thus more care required by parents on training on those skills. In order to assist parents and trainers or DS children, an effective support system for language ability is discussed here.

In this paper, we present an effective support system for language assessment and training for special children. Several aspects for example the age and ability of the children are considered while the assessment and training for language is being done. This support system does not only serves language as assessment and training system, but also important in managing the children data effectively and providing scientific information about DS to parents and trainers.
1. Children data acquisition and management

The children data is obtained from the input of users. Then, all the inputted data is saved in the database in MS Access.

With the use of MS Access database, security measures can be implemented to protect the data and design. Besides that, the data can be retrieved easily in the later stage in result analyzing and language training generation stage.

![Fig. 2: Children data management for language assessment and training support system.](image)

2. Language Assessment for children

The most effective assessment method in language ability requires the biological age of child, a simple formula in C sharp programming is able for user to obtain biological age of children from his/her birth date.

\[
\text{years} = \text{now.Year} - \text{childBirth.Year}; \\
\text{Months} = \text{now.Month} - \text{childBirth.Month}; \\
\text{childAge} = (\text{years} \times 12) + \text{Months};
\]

(1)

The calculated results will be the biological age of children in months. The effective age of language assessment includes assessment activities on biological age of children, 5 months before and after the biological age of the children. The assessment list is according to the world wide recognized curriculum – Hawaii Early Learning Profile (HELP) with some modifications to suit Malaysian children. The language activities are being divided into 4 groups, namely the vocalize ability, verbalize ability, expression of thoughts and feelings, communication, and understanding of communication.

Database of the assessment list is available in Extensible Markup Language (XML) format. The main advantage of XML is that the data is portable and it allows users to have nested entries. XML allows users to preserve document structure, supports document transactions and execute queries in an XML query language.

Native XML databases are designed especially to store XML documents. It enables users to retrieve data much faster than a relational database. One more reason to store data in a native XML database is to exploit XML specification capabilities, such as executing XML queries. C Sharp language allows users to save and retrieve data from the database in XML effectively and easily by creating a tree view and called in the part of the program programmers want to execute or utilize the database.

During the effective assessment process, users can insert the level of achievement of the children in particular activity in the language assessment list, level 0 is inserted if the children cannot do it at all and level 3 is given if the children can do it well. In order to create a more accurate assessment results, speech recognition is used in language assessment. There are some assessments which require the usage of microphone to test the language ability of children pronouncing certain words or producing certain sounds. The input from children through microphone is compared to the database in the speech library used in C sharp programming. The saved assessment levels are kept inside MS Access in the training result table.

3. Generation of Assessment Report

After the assessment, result from effective language assessment is used to construct a graph for each group in language ability to the level of achievement of children in all the language activities assessed overtime. For effective language assessment, users need to repeat the assessment from time to time to ensure the trainings given to the children are generating positive impacts on the children language ability improvement. This support system can show the improvements of children in language ability from time to time so that the users can observe the effectiveness of training and thus give the most effective trainings to their children.
Also, the suggestions of children language training in the group that the children score the lowest will be given. By using that, the parents or trainers can use the guide to train their special children. The training generated for each child is different, depending on their achievement and ability in language. Unique and specific training suggestions are given to different children to ensure the best and most suitable trainings are given to a particular child.

4. Language Training for children

The tool used for training is microphone, the children needs to speak a word or phrases repeatedly until they can achieve good level in the particular activities with proper teaching and encouragements from the parents. Some other training activities which cannot be trained using microphone will be given training guidance and instructions so that the users can train the children well.

After the training is done, the whole process of effective assessment and training is finished.

5. Information and Help Topic

In order to carry out effective assessment and training for language ability, there is a button in the support system to call a Portable Document Format (PDF) file which contains the DS information. With this, parents are expected to know more about their children and understand their children’s needs and characteristics.

Apart from that, this support system is also equipped with a user manual which provides step by step instructions on how to use this support system is provided.

Discussion

It is important to consider the ability of the children before begin the training for language ability. This is because every child has different ability although they might be in the same age. In this study, the diversity of the children’s ability is taken into account. Besides, the database for assessment list is crucial in the support system. Thus, it is extracted from worldwide recognized assessment list. The assessment list in the database is also tested in various DS centers and proven to be effective to special children in Malaysia.

4 Conclusion

In conclusion, an effective support system for language assessment and training for special children has been developed. The level of achievement of special children in the activities under language ability is used as the input for the support system to generate graphs and suitable training to the particular child specifically. Besides that, the support system acts as a DS information provider and child data manager for parents and trainers. Help topic on step to step instructions on how to use the support system is also provided in order to ensure that parents and trainers are able to utilize the support system effectively. Results and findings show that the support system is effective and consistent in producing relevant results to the children. This support system can be developed in the algorithm for speech recognition system in the future in order to obtain more accurate and reliable voice input from children.

References


