

**A CONVERSATION ASSISTANCE TOOL FOR
PRAGMATIC SPEECH DEVELOPMENT,
AN ANDROID APPLICATION
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Abstract

The research project developed a Conversation Assistance Tool for Pragmatic Speech Development. Its main objective is to provide means to help people with conversational skills particularly on the pragmatic language, take full advantage of educational opportunities, and expose them to a literacy-rich environment using the current technology. The developed software can assist in different schools or organizations that cater to special education for the pragmatic speech development. Its features include creating learner's profile, assessment tests and modules of learning.

The software provides language assessment test to assess interactional skills of the learner. It automatically record the learner's performance during modules that can serve as basis for monitoring and evaluating learners' progress. The software provides lessons in three modules, namely: Level 1 which is Start a Conversation; Level 2, which is Maintain a Conversation; and Level 3, which is End a Conversation. These lessons can be taken repeatedly to meet goals and objectives in a learner's Individualized Educational Plan (IEP).

The software produced was developed using software particularly Adobe Photoshop and Flash CS5, Java and Basic4Android. The developed software was subjected to a performance evaluation which showed results that performed according to its designed functions to achieve its set of objectives. As such, the system

demonstrated that it can be a useful supplemental tool to assist persons on pragmatic speech development.

Key Words: pragmatic speech development, Conversation Assistance Tool

Introduction

Every child has a unique developmental pace that is influenced by their biological make-up and by the environment in which they live. Developmental pace can refer to all aspects of a human being: cognitive, social/emotional, physical and communication development. If a child develops in a slower pace from the developmental milestones, they have a developmental delay that can be determined from birth. An area of delay in communication development can refer to the speech and language that humans use to communicate or share thoughts, ideas, and emotions. The first three years of life, when the brain of a child is developing and maturing will determine his/her communication development. These are the critical periods for speech and language development for young children, which if given early assessment will determine a communication disorder or developmental delay at an early age.

Communication disorders can refer to receptive and expressive language, apraxia, articulation and pragmatic difficulties. Children with communication disorders need the help of speech and language pathologists to help them improve. Speech pathologists perform specific assessment to identify areas of speech and language deficiency. Assessing speech and language development can also be done by school psychologists, and special education teachers who also provide interventions to treat deficiency. An early assessment is beneficial to the child's developmental pace. Once

assessment is done, plans for treatment and intervention will provide tools and support for the speech and language deficiency.

Children with speech deficiency may undergo therapy and intervention in special schools through a speech pathologist or special education teacher. This intervention has to be done as soon as diagnosis of a communication disorder.

The kind of therapy and individualized program and social interaction can be achieved by using assistive technology to perform repetitive task for speech and language skills enhancement and socialization of these children.

This study aimed to provide early assessment on speech and language of children. It developed a communication assistance tool for pragmatic speech development that can be administered to children at any time. The purpose of which is to improve conversation, speech and language development and evaluate progress at the same time.

Communication Disorder

Children with communication disorder can have difficulties such as the following: communication development such as follows (PDCE, 2010):

- Receptive language difficulties means a child has difficulty with understanding what is said to them. This is also identified as problems with language comprehension which includes central auditory processing disorder or comprehension deficit.

- Expressive language difficulties means a child has difficulty with verbal and written expression.
- Articulation delay/disorder is a typical production of speech sounds created by sound substitutions, omissions, additions or distortions.
- Apraxia, also known as verbal apraxia or dyspraxia, is a speech disorder in which a person has trouble saying what he or she wants to say correctly and consistently.
- Pragmatic language impairment is a difficulty in understanding the pragmatics or semantics of language, what words mean and how and why they are used. Pragmatic language difficulties are related to autism or autism spectrum disorder (ASD) and Asperger's disorders. Children with autism spectrum disorder have difficulty learning to speak, both verbal and nonverbal communication, difficulty in understanding social cues, and difficulty in relating to others socially. They resist establishing eye contact with others and may not enjoy being touched or hugged by others, including their primary caregivers. Children with Asperger's syndrome sometimes referred to as high-functioning autism. They do learn to speak and are able to develop typical language skills; however, they exhibit difficulties communicating with others and need help with the pragmatic side of language.
- Children with severe learning disabilities may communicate with only minimal cues and signals.

- Children with hearing impairment are those diagnosed as deaf and with additional handicaps with means and extent of communication may be very different, such as use of hearing aids and sign language.

While many children with a range of types of disability have speech, language, and communication problems that impact on pragmatics, some have communication problems that seem to be largely focused on pragmatic aspects of language development (Dewart and Summers, 1995).

Since the scope of this study is the conversational tool, it will focus on the use of language and communication for social interaction and express intentions. The type of communication disorder will focus on pragmatic difficulties for children with autism or with speech/language disorder, but it is not exclusive for these groups. Children who have pragmatic language impairments have speech difficulty with language comprehension, telling stories and participating in conversations. This conversational tool will be particularly relevant to work with children with autism and related difficulties where pragmatic problems are a major feature.

Pragmatic Speech Development

Pragmatic language is the social reason used in language, or the “practical aspect of language. It refers to the study of language in context, by real speakers and hearers in real situations (Bates, 1974). It is the language to communicate thoughts and ideas to the people around. It is the language to explain and wonder about things, and try to make sense of the world around. Commonly referred to as social skills, pragmatic language refers to the verbal and non-verbal cues that dictate the social

interactions. Pragmatic milestones includes: making eye contact with others (unless culturally appropriate); learning to take turns; using a tone of voice that mirrors that of adults; modulating intensity of voice as needed; using language to label things, to protest something, to express emotions and opinions; answering questions; telling others about experiences, briefly at first, then in detail; staying on topic in a conversation and moving to a different topic in a conversation.

Pragmatics involve three major aspects of communication skills:

1. **Communicative Functions.** The first aspect is the development of communicative functions which uses language to express a range of intentions such as:
 - greeting (e.g., hello, goodbye)
 - informing (e.g., I'm going to get a cookie)
 - demanding (e.g., Give me a cookie)
 - promising (e.g., I'm going to get you a cookie)
 - requesting (e.g., I would like a cookie, please)

2. **Response to Communication.** The second aspect is the child's response to communication which involves changing language according to the needs of a listener or situation, such as:
 - talking differently to a baby than to an adult
 - giving background information to an unfamiliar listener
 - speaking differently in a classroom than on a playground

3. **Interaction and Conversation.** The third aspect is the way the child participates in interaction and

conversation, looking at the child as a participant in social interactions involving initiation, turn taking and repair. It is following the rules for conversations and storytelling, such as:

- taking turns in conversation
- introducing topics of conversation
- staying on topic
- rephrasing when misunderstood
- using verbal and nonverbal signals
- standing close to someone when speaking

From these different aspects of communication skills, there are major developmental milestones that are described for six age ranges. These developmental milestones can be used as a reference to monitor a child's speech and language development, specifically on pragmatic language skills and thus, can be a cause of special concern for a communication disorder in the absence of this milestone.

Intervention

Speech and language interventions for young children include a variety of methods and approaches. No one type of intervention is best for all young children. Interventions should focus directly on the child and on teaching intervention skills to family members or caregivers who interact with the child. When communication is the primary concern, the focus of intervention is to enhance the child's overall language development and promote better long-term functional outcomes, such as expressing basic needs, establishing functional use of language, interacting socially and acquiring knowledge.

Many intervention techniques have been shown to be effective in improving speech and language skills in children with communication disorder. The specific

intervention techniques that will be most effective for an individual child will depend upon many factors including the type of communication need, the child's personality and whether or not the child has other areas of developmental delay. Kinavey (2011) provides the guidelines to all intervention approaches and techniques as follows:

- Identify goals such as better functional outcomes, functional use of language, social interaction and acquisition of knowledge, and definition of measurable results for the child;
- Focus on increasing the amount, variety and success of verbal and nonverbal communication that relates to the child's needs and articulation;
- Facilitate the child's progress by focusing on the communication skills that are appropriate to the child's particular age or developmental level and natural environment.
- Evaluate effectiveness of intervention on a regular basis. Assess behavior and communication skills at the beginning and document progress at the end of each intervention session. Ongoing assessment of the child's progress is used to modify intervention strategies as needed.
- With the use of assistive technology, evaluate if the device will help the child meet its identified goals and measurable results.

Assistive technology is a form of technology that is designed more specifically to help children with learning and developmental disability. There are many forms of assistive technology to help individuals with

many types of disabilities -- from cognitive problems to physical impairment. Scherer (2009) defined assistive technology as any device, piece of equipment or any system that helps bypass, work around or compensate for an individual's specific learning deficits. He explains further that a number of studies have demonstrated the efficacy of assistive technology for individuals with disabilities. This assistive technology does not cure or eliminate disabilities, but it can help an individual reach her potential because it allows her to capitalize on her strengths and bypass areas of difficulty.

Assistive technology is any item, piece of equipment or product that can be used to help someone with a disability to successfully function at home, in school, at work, or in the community. It can be anything from a simple, low-tech device such as a magnifying glass, to a complex, high-tech device such as a computerized communication system. It can be big — an automated van lift for a wheelchair — or small — a Velcro grip attached to a book for easier page turning.

Various assistive technologies that address communication and social disability of children with special needs are available over the internet, mobile devices, tablets and other devices. They can be classified as audio books and publications, freeform database software, speech-recognition programs, speech synthesizers or screen readers, talking spell checkers and electronic dictionaries, word prediction programs, assistive listening devices, augmentative and alternative communication devices and speech therapy software.

Method

The developed system “A conversation assistance tool for pragmatic speech development” was designed with the following features:

- a. Assessment test;
- b. Modules on conversation assistance such as pragmatic language;
- c. Progress Monitoring

It was developed using the software: Java Development Kit in a Basic4 Android Integrated Development Environment for developing the Android application; and Android Operating System in an Android tablet for implementing the Android application. The system runs in a 4.0 Ice Cream Sandwich Android Operating system in an Android tablet or smartphone where it provides a communication platform for conversational interface.

The conversational tool with monitoring provides interactive communication interface in an Android tablet for children with speech deficiency. It includes interactive learning modules on communication skills for purpose of learning the skills on pragmatic language and meeting goals and objectives in a learner’s IEP. It is designed to help children ages 2 -7 years to develop their communication skills that can eventually let them participate in the society. Its main objective is to develop a tool that allows SPED teachers and speech pathologists to extend themselves in providing speech therapy and rehabilitation activities even in the children’s own homes and in smartphones and tablet PCs

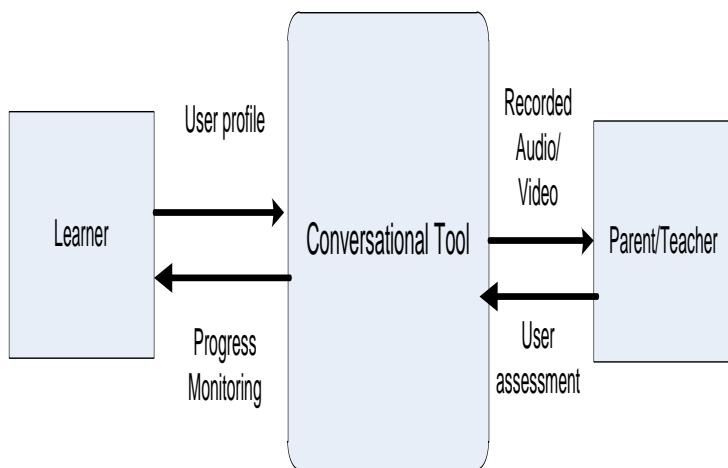


Figure 1.Context Diagram

Figure 1 of the context diagram of the conversational tool shows two main entities involved which are the learner/user and the parent/teacher. Learner/Users of the system were the children with speech deficiency, those with developmental delay, developmental disability, autism, autism spectrum disorder and/or with communication disorder. The parent/teacher acts as the one monitoring the progress on the conversational skills of the learner.

The learner's outcome is presented in a progress report in the parent interface and a summary of the accomplished modules.



Figure 2. Conversational Tool App Logo



Figure 3. Main Menu

Figure 3 shows the Main Menu of the software. This is the initial screen that appears every time the user press on the apps logo (Figure 2) in their tablet. The Main menu shows two types of users who can use the system: the learner and the parent. The parent can be the teacher and can access all modules that the software has, while the learner is limited to the assessment tests and conversation modules. The Main Menu also shows the User Manual (figure 9) for the system.

The software has four (4) major components: these are the Learner, Parent, Assessment Tests and Conversation Modules. Every screen display has a corresponding voice translation, which will guide the user all throughout the system.

The Learner Area is where learners create their profile before proceeding to the conversational tool. The Parent Area is where parents can create the learner's profile and view the learner's records to monitor the development throughout the intervention process. The focal point of the entire system is the Assessment Test

and Conversation Modules which consists of three different tests and three levels of activities starting from starting a conversation to ending a conversation. In addition, the system also has a Read Instructions feature that guides users in using the software.

The conversational tool is initiated by the learner touching on the screen the user interface. Initially, the learner is asked to give his/her name for the learner's record (figure 4). The system proceeds to the language assessment (figure 5). The result of the assessment is then recorded for progress monitoring. An assessment test is completed first before proceeding to the modules. The system then proceeds to the conversational skills module. The first module provides topics of initiating a conversation. The system displays the modules (figure 6) and say it aloud, and then the learner will tap on the screen monitor which module he/she prefers and proceed with the conversational interface. The system provides the output of the learner's outcome after each module to the parent or teacher. The levels of modules are (figure 6): 1) Starting a Conversation- What can I talk about?; 2) Reciprocal Conversation – Let's keep talking; and 3) Ending a conversation- Great conversation with you.

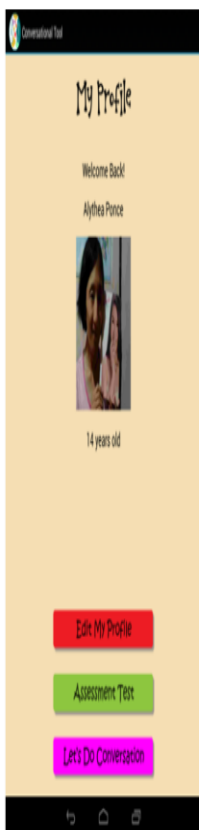


Figure 4. Learner's Profile Menu

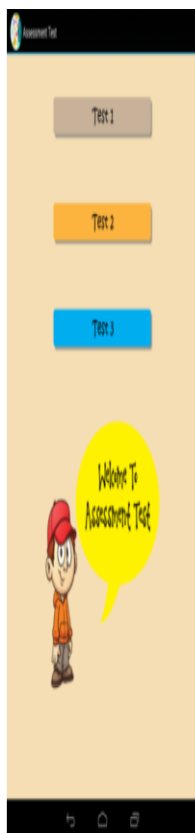


Figure 5. Assessment Tests Menu

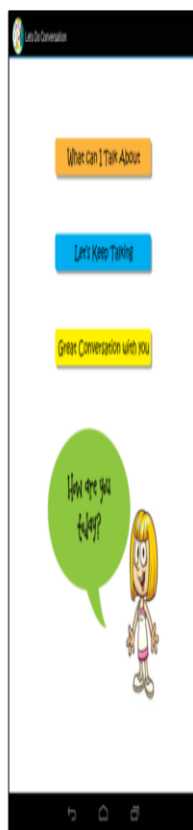


Figure 6. Conversation Modules Menu

Figure 7 shows the Parent area which displays the Progress Report on each profile. When the Profile is chosen, the name and age will appear on the top screen. The progress report shows two tabs namely: the Assessment Test Tab (Figure 8) and the Modules Tab (Figure 7). The Modules Progress Report shows three levels of modules status, frequency, percentage of accomplished module, remarks and recorded video. The frequency status will show how many times the learner has taken each level module. The percentage will show if the level's module was completed or was not completed.

The remarks will show if the level was 100% finished. The video retrieved the recorded video on the learner's file.

On the Assessment Test Tab (Figure 8), the test levels show three assessment tests and the remarks on each accomplished test. Recorded video and audio can be retrieved from the learner's file.

The following are the capabilities of the project:

1. The system has an instructions page that guides learner and the parent on how the system works;
2. The system has a record keeping module that allows the parent to keep track of the learner's development and progress;
3. Through the different levels of modules presented, the learner with speech deficiency can learn progressively;
4. The learners can bring the system in the comfort of their own homes allowing them to have unlimited access to speech training every time they want.
5. The software records audio performances on during assessment tests. This allows the patient to see any improvement on his/her performances. It also provides information on the development and progress of the patient on the part of the special education teacher handling the case;

6. Teachers and assistive services can benefit from this user friendly software. This can assist and support them to provide learners with more enhanced features of existing and upcoming software and technology.

The following are the limitations of the project:

1. The software can record video activities outside the assessment test and conversation modules and will only provide support to the progress report;
2. Text can only be inputted by the learner using the keyboard.
3. The software do not have all the activities for Level 1 – Communication Function Module, Level 2- Response to Communication and Level 3- Interaction and Conversation Module;
4. The software cannot change the pitch of the speech of the Android translating the system.

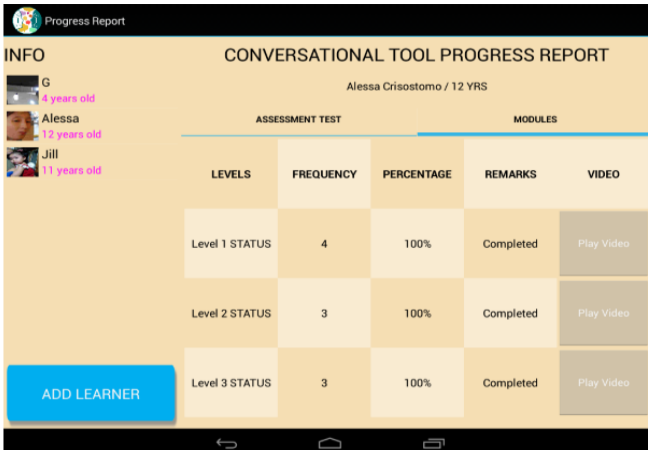


Figure 7. Parents Area - Progress Report: Modules Tab

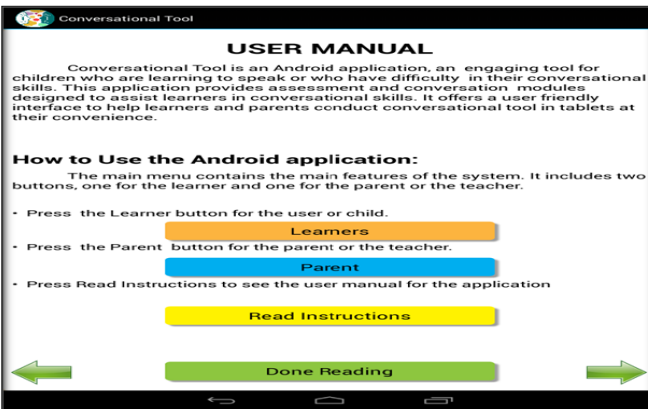


Figure 8 .Parent Area - Progress Report: Assessment Tab

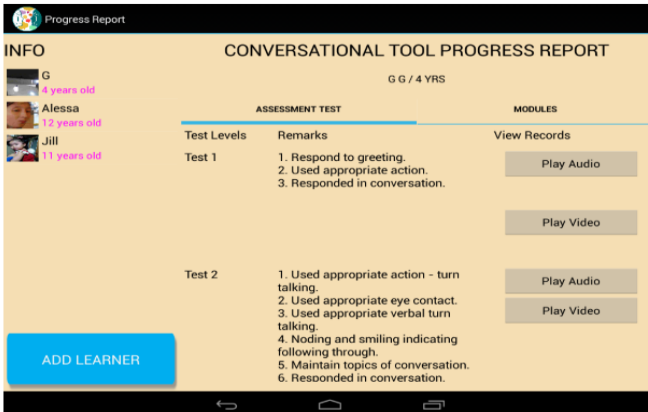


Figure 9. User Manual

Results

The Conversational Tool is designed to help children ages 2 -7 years to develop their communication skills that can eventually let them participate in society. Its main objective is to develop a tool that allows SPED teachers and speech pathologists to extend themselves in providing speech therapy and rehabilitation activities even in the children's own homes, smartphones, and tablet PCs.

The components of the software are the different assessment tests and levels of modules that serve as speech therapy and intervention activities for children who have speech deficiency particularly in pragmatic skills.

An additional key feature of the software is the parent's area that gives monitoring and allows proper record keeping of the learner's profile, assessment tests and, observations. These features of the software keep track of the learner's development during the entire intervention process. The software allows proper updating of progress report to supervise any improvement in the learner's condition.

Android API's allows permission on the use of devices such as microphone, camera, keyboard, and speaker that are required to run the system. The learner first creates a profile while the system creates a record for the progress report. The profile contains the learner's first name, last name, age and image. Further analysis and review of the assessment tests allows parents to conduct modules on four (4) opportunities to help meet IEP goals and objectives.

The software was tested with five (5) speech deficient learners from ages two (2) to seven (7) who

were assisted first by their SPED teacher together with their parents from The Birthright Educators Foundation undergo speech therapy in a special school. It was also conducted with children and their speech pathologist who administers to them.

The software runs on Android operating system with 4.0 Ice Cream Sandwich, 32 GB of memory, with audio and video. It was designed and coded using Android and Java SDK and Basic4Android IDE to develop the Graphical User Interface as well as SQLite which served as the database of learner's records.

The system provided assessment for children of ages 2-7 years old on the areas of pragmatics skills. These assessments provided results that will determine if the child achieved a level of speech deficiency. Furthermore, this kind of assessment was based on the developmental milestones of children from ages 2-7 years old but did not produce a standard test of measurement. The actual assessment and evaluation on the severity or degree of the deficiency on a person is not included in this project, such is done by the speech pathologist. The system also act as a tool for intervention and therapy that can be done by the special education teacher using an Android Tablet. Moreover, the clinical standards of measurement is not applied in this study. The system does not guarantee treatment among children, as it is based on the assessment and recommendation of the special education teacher using it.

The system was evaluated by five (5) respondents both parents and children with speech deficiency, particularly with communication disorder, specifically on the pragmatic difficulties such as children with developmental delay or developmental disability; or autism or autism spectrum disorder. The system was also evaluated by five (5) IT experts South Mansfield College

and Technological University of the Philippines and two (2) Special Education Teachers and Administrator. The ISO 9126 quality software criteria was used to evaluate the system's performance with respect to its functionality, usability, reliability, efficiency, maintainability, and portability.

On the basis of tests and evaluation conducted on the performance capability of the Conversation Assistance Tool, the following are the salient findings of the study:

The Conversation Assistance Tool provides a distinctive way of assisting pragmatic speech deficient individuals through the use of modern technology. The different components, namely: the assessment test and the modules of learning can help speech deficient individuals regain their capability to speak and be reintegrated back into the society. The system also offers a record keeping system that allows parents and teachers to keep important information about the individual. Moreover, learners' performances are recorded through audio and video which can be retrieved on the system. Such can be the basis for a parent or a teacher to monitor the learners' progress.

The test conducted for the different activities included in the software performed smoothly as the learner easily learned and progressively adapted with the software. The learners' progress report successfully kept necessary information that the parent or teacher can use to observe or monitor the learner's progress.

The respondents assessed the software as having very much attained objectives and was developed according to the planned design and specifications. The different modules or system components like creating profile, assessment tests and levels of module did not

encounter major issues and problems upon testing. The software successfully generated the learner's progress report. It served its purpose by allowing the special education teacher to further assess and observe the learner's performance and recommend another set of activities. The test conducted for the levels of learning presented ran smoothly as the learners easily learned and progressively adapted the software. Assessments were also undertaken, thus reports were accurately generated based on the responses inputted. The software is acceptable and functioned according to preferred specifications of providing a tool that special education teachers can use in rehabilitating individuals with speech deficiency.

Based on the data gathered during the project evaluation, the study got an overall mean rating of 4.34 with a rating of "Very Good." Particularly, the study obtained 4.0 for functionality, meaning that the system performed the task required. Usability got 4.6 which means that the application software is easy to use and operate, and has an attractive user interface as well. Reliability acquired a rating of 3.83 which proves that the system performs well in terms of fault tolerance and recoverability. The mean rating of 4.50 for efficiency showed that the system's time behaviour and utilization is very good.

Furthermore, the system got a rating of 4.27 for maintainability, which means that the system is maintainable in terms of stability, testability and changeability. Lastly, portability got the highest mean rating of 4.89 which means that it is portable in stipulations of adaptability, instability and conformance.

Based on the IEP Goals and Objectives, the specific learner's outcome was evaluated and the user was rated based on the following specific outcomes:

The learner has increased conversational skills as measured by the benchmarks listed below:

- a. The learner initiates communicative interactions with others at four (4) opportunities to do so.
- b. The learner initiates varied appropriate topics with others at four (4) opportunities to do so.
- c. The learner initiates communicative interactions with others by asking questions at four (4) opportunities to do so.
- d. The learner engages in conversational turn-taking with others across three to four (3-4) conversational turns, at four (4) opportunities to do so (topics initiated by self /others).
- e. The learner calls attention to communicative partner prior to communicating at four (4) opportunities to do so.
- f. The learner asks questions of others regarding topics initiated by self or others to sustain conversation for conversational turn-taking at four (4) opportunities to do so.
- g. The learner spontaneously seeks assistance, asks for help, seeks additional information given visual prompts at four (4) opportunities to do so.
- h. The learner spontaneously uses a verbal or non-verbal message to indicate to the speaker that he needs additional “wait” time to process information editorially at four (4) opportunities to do so.

After recording or updating the learner's record, the modules were repeated four (4) or five (5) times and produced a progress report for the parent/teacher. The progress report is based on the learner's outcome as evaluated in the IEP Goals and Objectives above.

The test result on software functionality, reliability and portability showed that the system obtained the expected software characteristics. Results showed that the main components of the software performed well in terms of functionality, reliability and portability.

1. On the results of the functionality testing, the instructions were able to briefly orient users, particularly learners, parents and teachers, on how the software works. The graphics, sound, and voice were clearly heard. The content was complete and properly presented that guided users throughout the system. With respect to learner's progress report, the parent/teacher was able to access the assessment test and the modules. Record creation and manipulation was also done to update, save and retrieve profile and progress report. This software feature allowed parent and teacher to effectively monitor the learner's progress. The learner's outcome is presented in a progress report with a summary of the accomplished modules.
2. The reliability of the software implies that the software can proceed with every component and recover after accessing devices used in each component. The test results showed that the learner can easily adapt with the software environment, as evidenced that he/she can go through with the lessons by just following the text

and voice instructions. The test results showed the speed and behavior of each component.

3. On the results conducted on the software portability, it signifies that the software worked well with versions of operating system in smartphone or tablet as it displayed the intended output. Test results includes easy installation of the software, mobility of the software from one environment to another, restoration capacity of the software and adaptability of the software in any environment or location to run without compromising the functions of the system.

In the assessment test and conversation modules, the learner was able to go through the different activities with ease. Additional information on each activity module effectively guided the learner and the parent/teacher in the conduct of the activity. Finally the progress report on the parent/teacher module let them view the result of the tests and accomplished modules.

Moreover, the parent and the teacher realized that technology can be an alternative method to regain the learner's capability to speak. This shows the functionality of the system where the parent/teacher performs the task required to assist the learner. The learner found it easy to use the system and can utilize it even in their homes, thus reducing transportation cost and do it repeatedly, whenever and whenever they are. Furthermore, the parent/teacher can attend to other matters while the system attends to the intervention needs of the learner. The system was user-friendly and with a good design. The software is well-designed and purposeful as it suits the supplemental tool for the learning process of persons with pragmatic speech deficiency. Learners began to associate the use of technology as a conversational tool.

Summary of system performance evaluation results is presented in Table 1. Portability got the highest mean, while Reliability got the lowest mean. Nevertheless, it is also excellent as construed. The overall mean for selected criteria contained in the ISO 9126 Evaluation Instrument for Software Materials yielded an average rating of 4.34 which indicates that the software is very good. This means that the software can be one of the tools that special education teacher can use to speed-up rehabilitation of individuals with pragmatic speech deficiency.

Qualitative Interpretation of Evaluator-Respondent's Rating for the Performance Evaluation of the Conversation Assistance Tool

Table 1. Software Performance Evaluation Results

<i>Criteria</i>	<i>Mean</i>	<i>Qualitative Interpretation</i>
Functionality	4.00	Very Good
Usability	4.60	Excellent
Reliability	3.83	Very Good
Efficiency	4.50	Very Good
Maintainability	4.27	Very Good
Portability	4.89	Excellent
Overall Mean	4.34	Very Good

Conclusion

In consideration of the objectives of the study and the outcomes of the testing and evaluation made, the following conclusions were derived:

1. The “Conversation Assistance Tool for Pragmatic Speech Development” was successfully designed such that:
 - a. The software can provide assessments that can be prepared by the teacher and can be carried out by the learner;
 - b. Exercises or activities with the focus on conversational skills in three modules (i.e., starting a conversation, maintaining a conversation and ending a conversation) were provided by the software; and
 - c. Progress reports of the learner and results of actual exercises of learners with an audio and video format were automatically generated by the system;
2. The software was successfully created using Java and Basic4 Android for the project design and coding. Adobe Photoshop CS5 was used to edit images and Adobe Flash CS5 for creating additional 2D animation.
3. Collectively, the software was successfully tested for functionality, usability, reliability and portability. Testing results showed that the software supports the assistance and educational needs of persons with speech deficiency by providing different activities. Special Education teachers can monitor learner’s progress through the software’s record keeping system;

4. The performance of the system was rated “very good” in terms of its functionality, usability, efficiency, reliability, maintainability and portability that attained an overall mean rating of 4.34. As such, the system proves that it can be a useful supplemental tool to educate persons with speech deficiency.

Recommendations

The following recommendations for the improvement of the software are hereby presented:

1. Provide additional activity modules that guides learners in exercising conversational skills;
2. Make the system run on iOS phone or iPad and other smartphones; and
3. Refinements and enhancements on the system’s design are also recommended.

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