DESIGN, DEVELOPMENT, AND DEPLOYMENT OF A VOICE-OUTPUT MOBILE APPLICATION FOR STUDENTS WITH NON-VERBAL AUTISM

A Thesis
Presented to the
School of Advanced Studies
The National Teachers College

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts in Education

By

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DEDICATION

I wholeheartedly dedicate this study to God who has always been answering my prayers. Thank you, Lord God, for not giving up on me.

To my family and friends who are my inspiration to do my best in achieving my dreams.

To Xavier who has been giving me all the love that I need. Your support and encouragement have kept me strong during hard times.

To the children with special needs, this is for you.

ACKNOWLEDGEMENT

The researcher wishes to express her sincerest gratitude and deepest appreciation to the following persons who had helped her in accomplishing this study.

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Principal, teachers, and parents of the Isaac Lopez Integrated School, Division of City Schools Mandaluyong City, for undoubtedly lending their hands in participating in this study.

ABSTRACT

Title : **Design, Development, and Deployment of a Voice-Output Mobile Application for Students with Non-Verbal Autism**
Researcher : **Maria Felisa Maiso Aranas**
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School : **The National Teachers College**
Degree : **Master of Arts in Education**
Subject Area : **Special Education**
Year : **2021**

The students with nonverbal autism are challenged in communicating their needs which is fundamental in the everyday life of a person. Augmentative and Alternative Communication (AAC) aids children with a speech impediment in expressing necessities. However, the Philippines might be one of the most numerous smartphone users in the world but it still seems to lag in terms of using Technological aids. Thus, the researcher thought of taking advantage of this and created "ClickOr."

ClickOr Speech Generator offers free access to a communication app that is available in both English and Filipino languages to cater the Filipino children with speech impediments. The project shows the design, development, and deployment of a voice-output mobile application for students with nonverbal autism and its outcomes.

The study used thematic analysis for the utilization of the quantitative and qualitative research design in which words were coded

from unstructured interviews done with 5 respondents during and after 4 parts of training.

The results of the study showed that "Expressing wants", "Social Interaction" and "Expressing emotions" were exhibited by the children during and after the training. On the other hand, "Introducing self" is unpopular, and "Asking a question" wasn't mentioned for the child's recorded progress.

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CHAPTER I
PROJECT IDEATION

ALTERNATIVES AND SOLUTIONS

Special Education is not an easy way of teaching students with special needs. From the word itself "Special," passion is the key to successfully providing the educational needs of these children. The inspiration behind the project happened to be an idealization after watching a video of a boy with non-verbal autism who happened to use a speech app in ordering food in a fast-food chain. The conceptualization on how this kind of Technological Aid could be used as a support in the communication of the students with speech impediments particularly in the Philippines where there are more than 74 million smartphone users and it has persistently grown since 2015 (Sanchez, 2020). However, the country still seems to lag in terms of assistive technology for individuals with disabilities. The researcher wanted to take advantage of the utilization of cellular devices for assisting kids with speech problems. Communication is significant to any relationship. One's ability to express thoughts and feelings is vital in daily human interactions. This is more amplified in the case of those who have serious speech impediments. Filipino students with speech difficulty, specifically the children with non-verbal Autism may have

trouble in opportunities classroom setup because of their inability to express their needs as well as to socialize with peers. As classified, "autism" means a developmental disability significantly affecting verbal and nonverbal communication and social interaction, generally evident before age three, that adversely affects a child's educational performance. Other characteristics often associated with autism are engagement in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences. (Individuals with Disabilities Education Act [IDEA] of 2006, 2017). As cited by McEwin & Santow (2018) the United Nations Universal Declaration of Human Rights (UNUDHR) Article 19 states that communication is a basic human right which includes persons who use sign language, braille, and Augmentative and Alternative Communication (AAC) as an instrument in self-expression.

The use of AAC is proven beneficial not only in communication and self-expression; it also promotes academic opportunity, speech development, and social relationships.

Academic Opportunity

According to De Leon (2020) a Speech Pathologist, using AAC specifically Speech-generating devices aids for teaching Children with non-verbal Autism for language and literacy skills also the general education teachers of students with communication problems perceive that the use of the speech-generating device helps them in the classroom (Westrum, 2019). AAC promotes academic and social opportunities for Culturally and Linguistically Diverse students in which it highly recommends being used in the classroom setup. However, the families of students with speech problems who are using AAC find it challenging to use AAC because most of them are only available in English and they suggest that speech-generating devices should be available in their native language (Kulkarni&Parmar, 2017).

Speech Development

Waller (2018) examined the result of using AAC for over 25 years and these studies proved that using speech-generating devices channel effective conversation, decrease operational/cognitive load, develop aptitudes in communication and provide an opportunity for language play to users with speech problems. However, according to the study, the AAC should establish support from the multidisciplinary team which includes assistive technologists, educators, and care staff for its success on the familiarization of the users.

A study found out that a speech-generating device called Proloquo2Go® has shown an effect on the reduction of echolalia of users with Autism Spectrum Disorder (Alrusayni, 2017). A speech-generating device promotes vocalization during the intervention of children with autism who are non-verbal (Gevarter&Horan, 2018).

Social Relationship

Speech apps have a positive result in developing friendships between children with and without communication problems (Biggs & Snodgrass, 2020). The participants were 16 students ages 6-12 with peers who have communication difficulties aided with AAC were interviewed, the results showed that students without CCN have reciprocal training with those students with communication problems. Biggs et al., (2016) confirmed that children with speech difficulties may improve in requesting ability and social sharing over a period using a speech-generating device. A study by Kranich (2018) where the respondents were mothers of children with speech and language impairment determined that communication ability and social interaction of children with speech problems have increased because of Voice Output Communication Aid. Additionally, parents have a huge role in the use of (VOCA) and the professionals must also be aware that they should also train parents in using communication devices.

DESIGN OPPORTUNITY

Communication apps interface is designed distinctively in which studies have been proven that it is effective for children with speech difficulties. Three considerations were taken to maximize the impact of this project; Design, Conversational Voice, and Language.

Figure 1
"ClickOr" Project Design

The figure below shows the categories that were considered in the design of "ClickOr."

Design

According to the study of Barton-Hulsey et al., (2017), the interface design grid display with the arrangement of symbols will make it easier to familiarize the user, most especially that the users are visual learners. The study also suggests using a white background that draws attention to help the user to focus on the icons on the screen.

Conversational Voice

Gevarter & Horan (2018) found that digitized speech to be generated by the device claims to be naturalized for real conversation. However, the researcher did not use the traditional Picture Exchange Communication Exchange System (PECS) images to deliver more color and graphic designs to the users who are Children with Speech Difficulties.

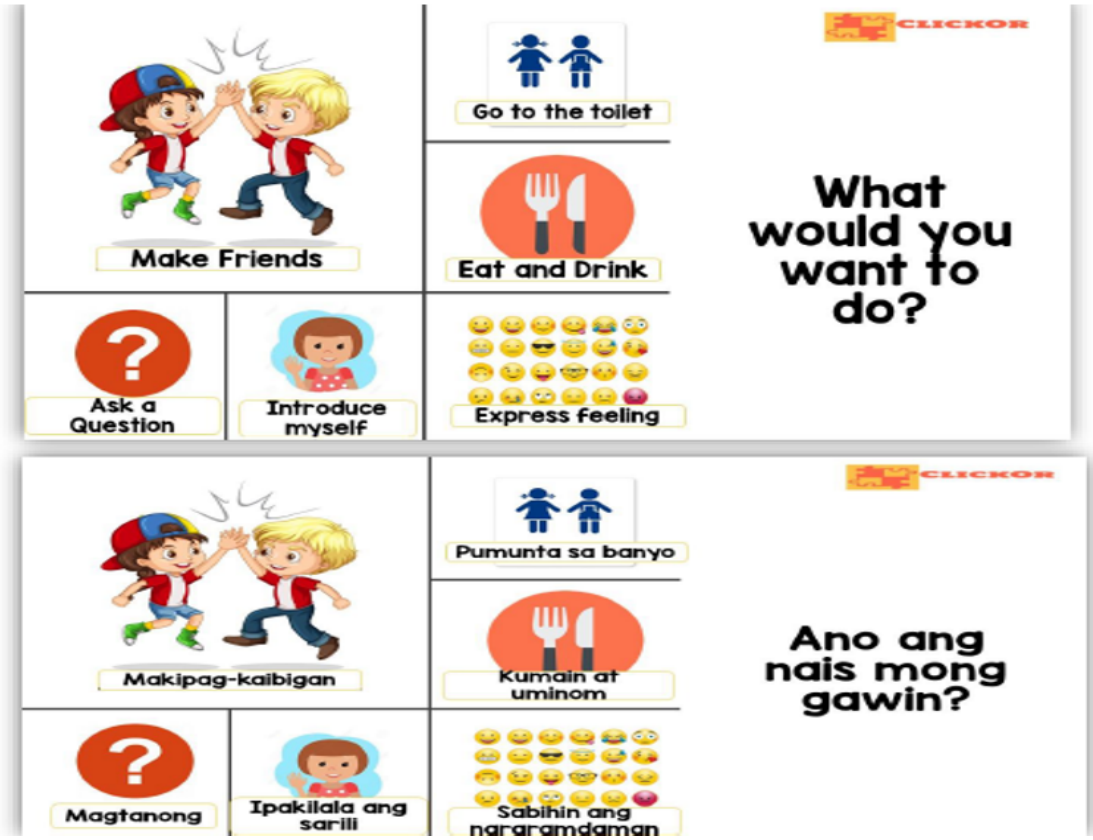
Language

The research of (Kulkarni&Parmar, 2017) and (Tönsing et al., 2019) said that nonnative English speakers with speech impediments are having difficulty in using Speech-apps that are only available in English.

The Transition Designs of "ClickOr"

The research studies above provide concreteness to the prototype design that was presented to the panelists for approval for the initial phase of the app development.

Figure 2
Prototype Design of "ClickOr"
The images below display the idealized design of "ClickOr."



The picture above shows the research-based design of "ClickOr" that was conceptualized by the studies of Barton-Hulsey et al., (2017), Gevarter & Horan (2018), (Kulkarni&Parmar, 2017) and (Tönsing et al., 2019).

Figure 3

Digitized Prototype Design

The screenshots below show the digitized prototype design of "ClickOr."

The screenshots above are the actual digitized design of the conceived plan of "ClickOr." With the help of the IT expert, the first stage of "ClickOr" was developed and created in a month. The researcher and the IT expert had continuous appraisals on the milestones done each week to be able to show the progress made as well as to check whether the goals on the app design are being met.

The IT expert also provided suggestions for the application's improvement based on the experience that he had with the communication website that he had created in the past for his client.

Figure 4
Outline of the creation of the Prototype Design of "ClickOr."

The picture below shows the report provided by the IT Expert on the stages of the creation of the app.

ClickOr Mobile Application

Overview

ClickOr is a mobile application that will be developed using React-Native as the front end and firebase as backend.

Milestones

Milestone 1 (July 2, 2020 - July 10, 2020)
- A. Backend
  - I. Setup firebase
  - II. Setup ser database
- B. Mobile App
  - I. Setup environment
  - II. Setup firebase integration
  - III. Landing page
  - IV. Sign in / Information input page
  - V. Login page

Milestone 2 (July 11, 2020 - July 17, 2020)
- A. Mobile App
  - I. Language selection page
  - II. Category selection page
  - III. Activity page

Milestone 3 (July 18, 2020 - July 24, 2020)
- A. Backend
- B. Mobile App
  - I. Activity page

Milestone 4 (July 25, 2020 - July 31, 2020)
- A. UAT
- B. Deployment to Play Store

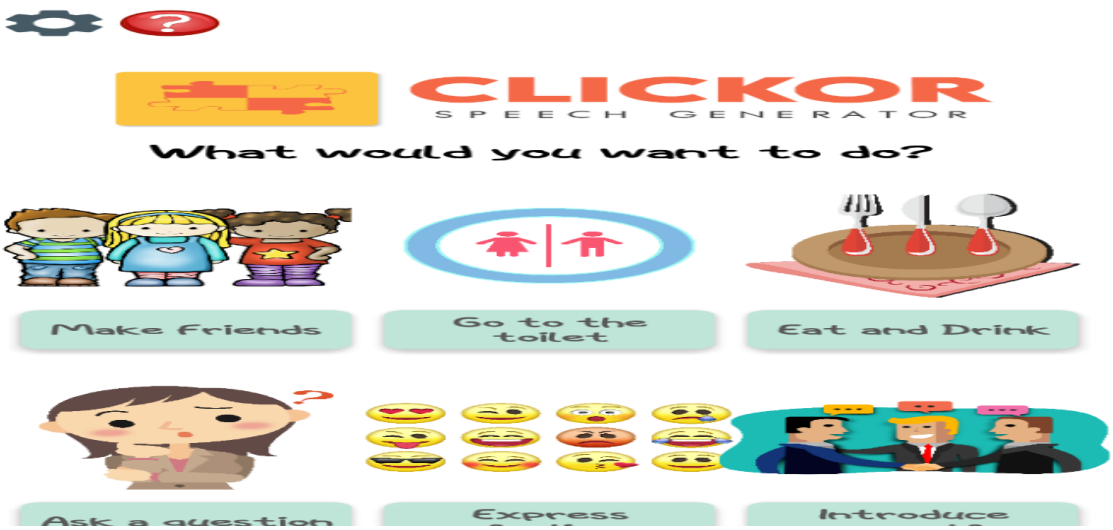
The picture above shows the milestone report provided by the IT expert for the researcher on the development of "ClickOr" which started on July 02, 2020, and ended on July 31, 2020. It was divided into four milestones for easy progress monitoring and delivering the researcher the needed information.

The IT expert provided the researcher pictures and videos to show the progress on each milestone for the researcher to be able to

guide him about "ClickOr's" expected outcome. On milestone 4 "ClickOr" was supposed to be available on the Play store however the IT Expert has suggested creating a downloadable link to make the application accessible without the use of the internet.

While on the testing stage the researcher was able to gather data for the final app design according to the suggestions given by the respondents using an in-depth interview for a thorough collection of data in a detailed manner which is more efficient for a small number of respondents (Rutledge, 2020).

Figure 5
Final App Design of "ClickOr"
The screenshots below display the Finalized Design of "ClickOr."



Six weeks of testing and training were done to be able to re-evaluate the mobile application with the help of the respondents who know better about the needs of their child. From the rough draft conceptualized by the researcher to the Final App design done with the suggestions of the respondents as well as the validators. Usability assessment in comparison to novice and expert's points of view needs to be done for a mobile application to evaluate the effectiveness, efficiency, and usefulness of a mobile application (Mugisha et al., 2019). The final app design became possible and more reliant through the validators' assessment using Google Forms. Stoyanov et al., (2015) state that there is no perfect assessment tool for mobile applications, self-developed tools are to be created. The "ClickOr" assessment form is based on the Assistive and Accessible Technology Checklist in choosing an app for the children with special needs "SNOW Inclusive Learning and Education" (n.d) and with the researchers added input.

In the process, one of the respondents (a child's mother) has claimed that she is a "Social Media Advertisements Consultant" in which she has shared her knowledge and expertise for the redesigning, recreating, and redefining of "ClickOr." Common suggestions of her were "Sana may consistency with the figures na pang bata"," Sana mas malaki yung mga figures," "Lagyan ng differentiation ang pictures," "Based on the color, what if change the color to green kasi kaya sya nilalagay sa classroom is it is conducive to studying kahit siguro mint green." Other respondents also suggested their ideas to the researcher "Mas maganda po siguro teacher kung lagyan ng background music kasi mahilig si Angel makinig ng music sa YouTube baka mas magustuhan nya suggestion lang po," "Teacher naghahanap si Kaylo ng Sanitize your hand saka wear facemask saka teacher yung ibang food hinahanap nya french fries and burger""Mejo mahina po ang sounds ma'am." All the responses gathered from them were noted and recorded for "ClickOr's" final design.

The researcher also sought the help of the graphic artist to redesign the images in the app. The IT expert collaborated with the Graphic artist on the fixes done on the images of "ClickOr."

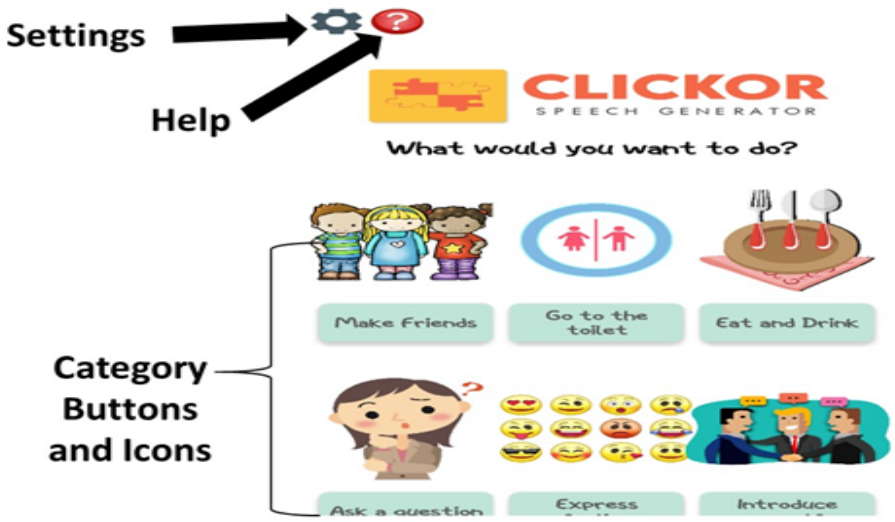
Final App Design Parts and Functions of "ClickOr."

The screens of "ClickOr" are composed of parts that have variations of functions.

Figure 6
Different Parts and Functions of "ClickOr."

The figures below display the design of "ClickOr," it also exhibits the functions of each button.

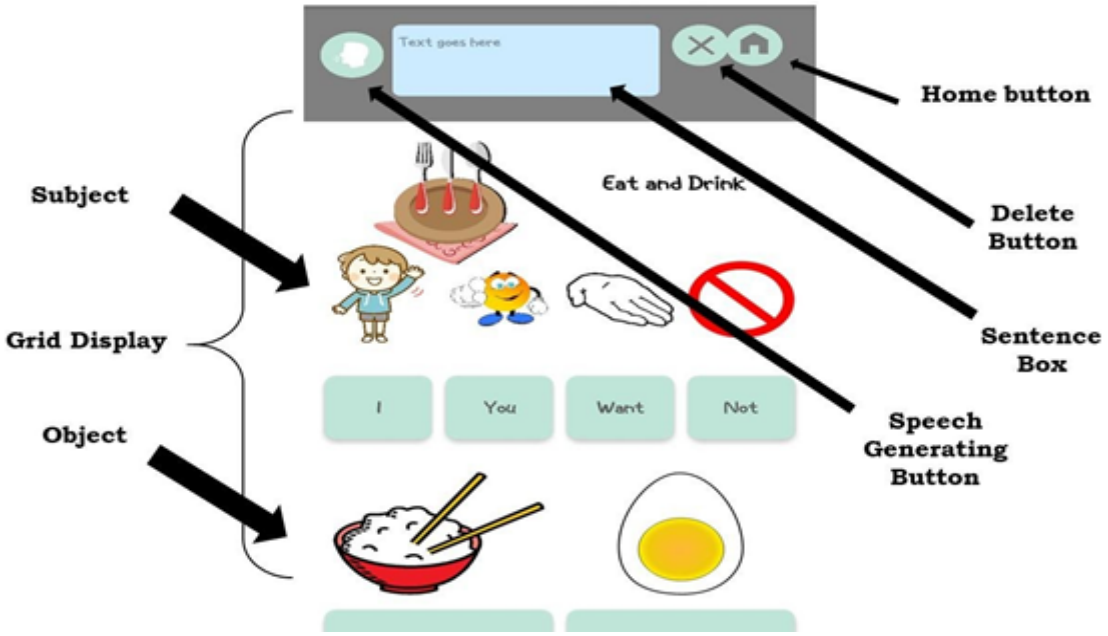
Figure 6.1
Parts and Functions of the Home screen
Functions of "ClickOr" Buttons:



- "Settings Button'' – the settings button turns into a pop-up button containing change language and change personal information (see the picture in appendices). The user may be able to edit the language and the personal information that has been set after the installation.
- "Help Button" – the help button turns to a pop-up screen which leads to the user guide (refer to the appendices) and the email of the help center. The help center directly goes to the email of "ClickOr" managed by the researcher.

- "Category Buttons and Icons" – the category buttons lead to the subcategories screen while the Icons visually represent the category.

Figure 6.2
Parts and Functions of Subcategories Screen



The interface design is comparable with the common communication apps, the buttons created for speech app functions to be accessible for simple sentence construction. On the first row of the Grid Display, subject buttons are displayed to be able for the user to point out the person being talked about. However, in some category greetings were displayed first before the subject. On the remaining rows, the buttons for the objects were displayed for options. Most categories also display polite words in the last row mainly to build appreciation. These words are "Thank you," "You're welcome," and "Goodbye."

Functions of "ClickOr" Buttons:

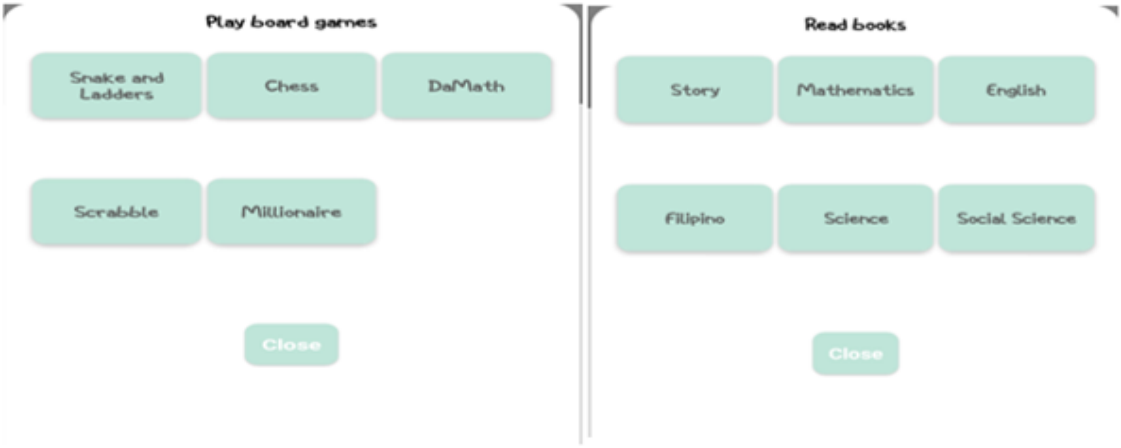
- "Home Button" - this will take you back to the "Category Screen."
- "Delete Button" - the button deletes the text in the sentence box by word/words.
- "Sentence Box" - all text from clicked text buttons will appear here.
- "Speech-generate button" - This microphone button will convert texts orally.
- "Text Button" and "Icon" - Icons are symbols of the written text found in the "Text Button". Text buttons contain words that can be generated.

Figure 6.3
Additional screen
Images of Pop-up category screens

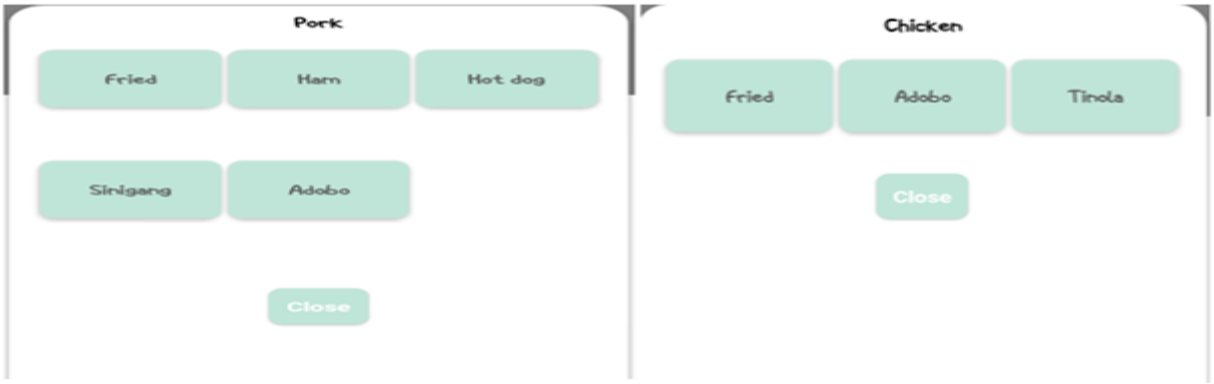
Pop-up Screens are used to organize the main screen, this provides a proper view for the user.

The first pop-up screen is when you click the settings and help buttons. The second type of pop-up screen is found in the Make Friends screen in which multiple types of games are found. The last type of pop-up screen is the text to speech in which the user may encode the name of the teacher or a friend in the greeting category to be speech-generated by the app.

Pop-up Screen "Make Friends"



Pop-up Screen "Eat and Drink"



Pop-up Screen Text to Speech on the "Greeting" category

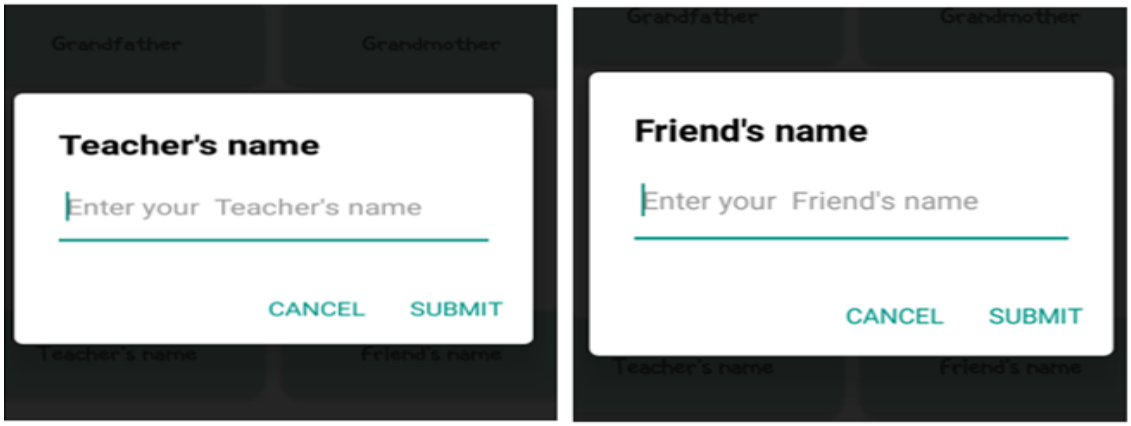


Figure 7
"ClickOr" Logo
The picture below shows the logo used for the "ClickOr" Mobile Application.

"ClickOr's" name is a combination of two words which are "Click" (to select especially in a computer interface by pressing a button on a control device [such as a mouse] and "Order" (to give an order; to Command) (Merriam-Webster, n.d. In Merriam-Webster.com dictionary).

The logo is a picture of four combined puzzle pieces in which edges are needed to be completed. The logo conveys connection through communication made possible by the mobile application "ClickOr."

STATEMENT OF THE PROBLEM

1. What is the profile of the learners that will use "ClickOr"
    - 1.1 Age;
    - 1.2 Gender;
    - 1.3 School;
    - 1.4 Grade level; and
    - 1.5 Exceptionality?
2. What is the profile of the adult guide that will train the learners in using "ClickOr"
    - 2.1 Age;
    - 2.2 Gender;
    - 2.3 Educational attainment; and
    - 2.4 Relation to the child?
3. How suitable is "ClickOr" in terms of:
    - 3.1 Appearance and Design;
        - 3.1.1 Logo
        - 3.1.2 Icons
        - 3.1.3 Buttons
        - 3.1.4 Color
    - 3.2 Language;
        - 3.2.1 Volume
        - 3.2.2 Used voice

3.3 Optimization;

3.3.1 Meets the proper optimization for easy screen view.

3.3.2 Uses proper speed in opening and closing the application

3.3.3 Uses proper speed in scrolling up and down

3.3.4 Uses proper speed in transferring from home screen to activity screen

3.4 Accessibility; and

3.4.1 The mobile application can be accessed easily from the device.

3.5 Functions?

3.5.1 Its functions are unique from other Speech Apps

3.5 Functions?

3.5.1 Its functions are unique from other Speech Apps

3.5.2 It provides useful functions for a Speech Generating app

4. What is the performance rate of “ClickOr” in terms of:

4.1 Introducing self;

4.2 Expressing wants;

4.4.1 Food

4.4.2 Drink

4.4.3 Toiletries

4.3 Asking a question;

4.4 Expressing emotion; and

4.5 Social interaction?

OBJECTIVES OF THE PROJECT

"ClickOr" aims to provide the students with speech problems to afford the use of a voice output mobile application, express their feelings and emotions, communicate their needs, introduce themselves to others and communicate in their main language English and/or Filipino.

"ClickOr" is intended for a broader participant that will enable it to support more students with speech impediments in their communication and as well as provide the app its improvement from a wider perspective.

The researcher aims for the wider project which will train the parents/guardians of students with speech problems with the help of

the Schools Division City of Mandaluyong. The researcher will coordinate and plan with the Supervisor of the Special Education Department of the Division for the referral of the students who will qualify in the program.

SCOPE AND LIMITATION

The main purpose of this impact project is to create a voice output mobile application that helps students with Non-Verbal Autism. The intervention to be done for the testing is to find not more than ten students with communication difficulties of Isaac Lopez Integrated School referred to the researcher by the Special Education Teachers. A small sample size of qualitative research provides notable intention in an interview compared to a large sample size which needs to have a profound investigation (Weller et al., 2018).

The main concern of this study is for the familiarization of the students with nonverbal autism on the mobile application and being able to use it in their day-to-day communication with the guidance of their family members. The researcher focuses on the children’s individualization to meet their individual needs. The children with special needs are accommodated individually in measuring achievement and functional performance (Individuals with Disabilities

Education Act [IDEA] of 2006, 2017). Maximum assistance to independence in the use of the application will be checked for four hours a week; this would be a four-week individual training with the adult guide. Moreover, the researcher gathers feedback, comments, and suggestions from the adult guide on "ClickOr's" design, content, and features for the final app conceptualization.

The researcher provided a three-part group training to the adult guide and weekly individual monitoring for each child in a total of seven weeks. Its reliability and validity are done through an interview and questionnaire, to be accomplished by the adult guide on their observations during and after the familiarization stage.

CHAPTER II

PROJECT DESIGN AND METHODOLOGY

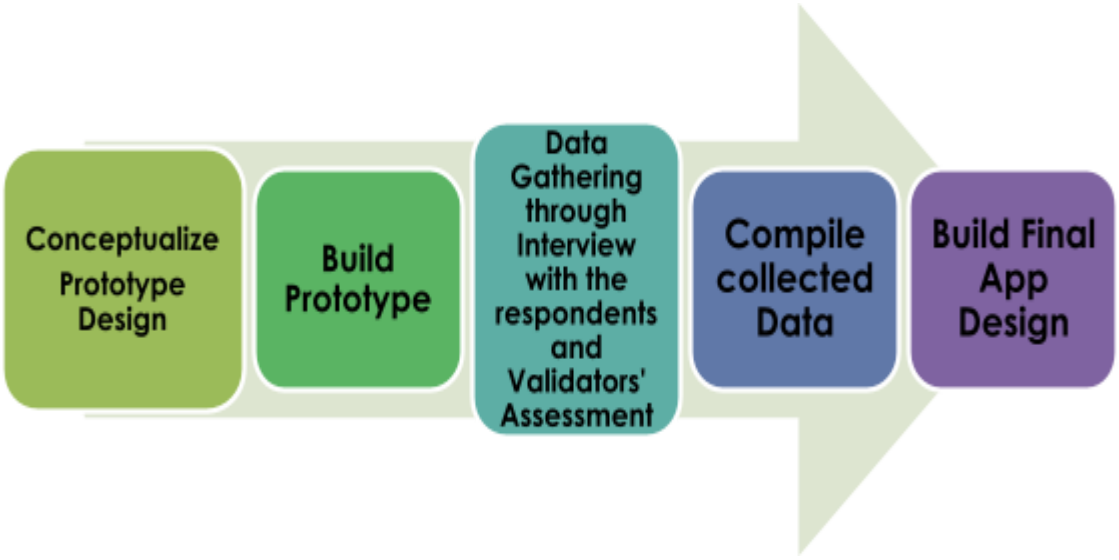
DESIGN PRINCIPLES

The researcher thought of making a communication app that is free of use-inspired by the “TinigAAC Project” established by the groups of Filipino Speech and Language Pathologists in August 2014, formally introducing the use of AAC which were tablets with communication applications to children with communication problems in the country. It aims to provide training for the SLP and provide an outreach program to give tablets with communication applications for children with communication problems (Manalansan, 2015). Terese Manansalan one of the founders of the “TinigAAC Project” maintains the program’s continuity and encourages researchers to create budget-friendly AAC that would benefit children with communication problems. The “TinigAAC'' Project is recognized by the International Society for Augmentative and Alternative Communication (ISAAC), an international organization that supports AAC around the world. The Autism Society of the Philippines (ASP) (2016) also encourages the integration of the AAC in-class lessons and discussions and in interacting with students with autism who are non-verbal.

In the generation of technological advances, the wide availability of gadgets is seen by the researcher as a key to aid persons with speech difficulties. In some countries, smartphones and tablets are used as Assistive Technology for individuals with speech difficulties to be able to communicate. The United Nations Convention on the Rights of Persons with Disabilities in 2006 as cited by Dufour et al., (2020) promotes the development of Assistive Technologies (AT) which aims to support and lessen the struggles of persons with disabilities in terms of mobility, education, and communication as using AT is considered by the UN as a right of persons with disability. Communication software and mobile applications can be used as assistive technology for persons with speech difficulties to be able to communicate. AAC such as speech generating devices that are considered as a tool for persons with a speech impairment provides benefits which on the other hand requires skill to be able to be manipulated (Howery, 2018).

INCUBATION FRAMEWORK

Figure 8
The Development Stages of "ClickOr"



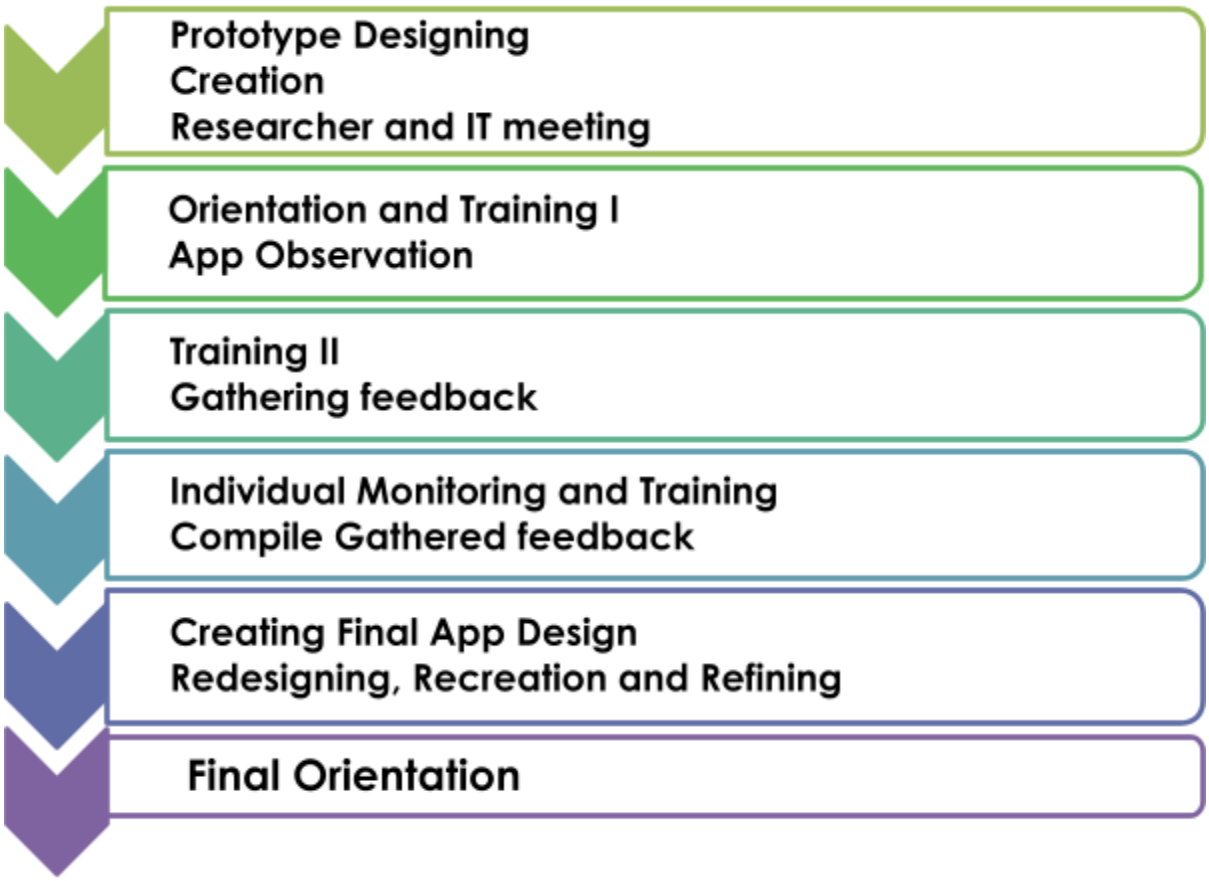
The diagram exhibits the flow of the development of the project from a rough draft of its prototype design into digitized multimedia made possible by the Information Technology expert and the Graphic Designer. In one month through weekly consultation on the milestones of the app set by the IT Expert, the collaboration of ideas was successful. Even if the app was developed during the government-imposed quarantines, iterations to the project were conducted and interviews/consultations and app development were done through online sessions.

On orientation and training, the researcher presented "ClickOr" to the respondents for observation on their child's take in using it.

While on the open forum stage the researcher also collected feedback on the respondents' perspective about the app in terms of design, color, text size, and style, and content. The researcher created a compilation of feedback for revision and presented it to the IT expert for the recreation stage. The feedback from the validators was also reconsidered for the minor changes in the app design on its final part. Seppänen et al., (2017) studied the validation of product ideas that are inadequately recognized in the literature. These researchers found out that idea validation is a business requirement and a design requirement.

ITERATION FRAMEWORK

Figure 9
The Diagram of the Iteration of "ClickOr"



The diagram shows the entire stages of "ClickOr" from the Prototype Designing to the Final Orientation of the app. The creation of the speech app based on the researcher's prototype design was done by the IT expert in its first stage. The researcher and the multimedia experts have simultaneous consultations on the progress of the creation. After the creation, the application was reviewed by the researcher and has undergone minor changes. The IT expert has

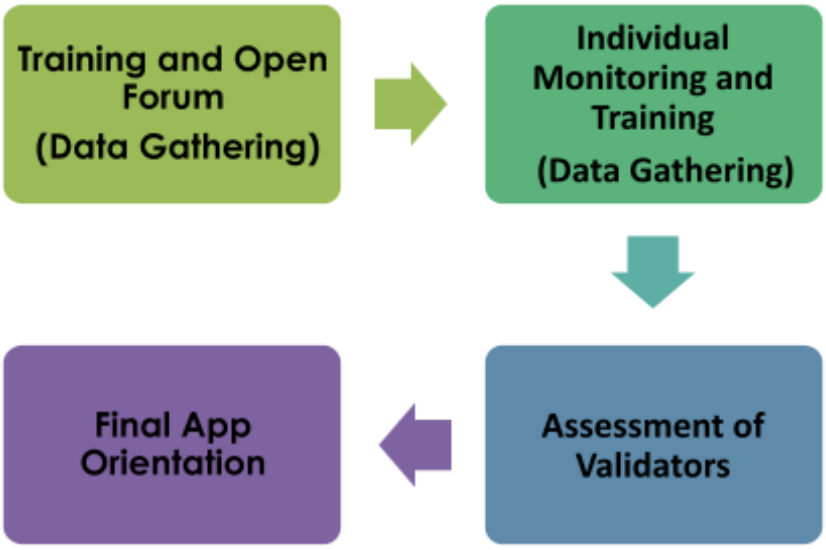
provided orientation for the researcher on ways to download and use the app in preparation for the orientation and training for respondents.

Archibald et al., (2019) suggested using Zoom as an online platform for researchers who use Qualitative data. Zoom has been reported to provide minor technical problems however they also suggested the data collectors provide a written interview question before the interview. The online meeting was implemented where the respondents were guided to download the link of "ClickOr" as well as for the basic functions of the app. The following seven days were the observation stages at how the child reacts to the app for the open forum on the meeting in the second week. After the open forum the following week, a thorough training was done in which goals and objectives for the four-week individual training were presented to the respondents for the expected outcomes in each training week for the individual training and monitoring. The suggestions from the Social Media Advertising consultant who happened to be one of the respondents as well as the feedback from the other respondents was collected during the 3-part training. The help from the Graphic Designer to fix the images of "ClickOr" as recommended by the IT Expert and the Social Media Advertising consultant.

The collected data from the interview and online questionnaire have been recorded and compiled. The researcher also prepared an assessment form for the validators who are technology and education experts to gather their feedback about "ClickOr."

IMPLEMENTATION FRAMEWORK

Figure 10
The Diagram of the Implementation of "ClickOr"



The figure exhibits the training process. From the group training to the individual training as seen in the diagram above, the researcher was able to train the adult guide and monitor the progress of the children while collecting data to improve the app. To provide validity the experts assessed ClickOr on the Final app design and reconsider their suggestions. According to Mugisha et al., (2019) usability

assessment in comparison to novice and expert's points of view needs to be done for a mobile application to evaluate the effectiveness, efficiency, and usefulness of a mobile app.

The respondents were given the orientation in downloading and using the mobile application. On the first training, they were given a week to observe the app. An open forum was provided on the second training about their observations in the design and features, they were also given training on how to introduce the app to their child. Target outcomes were provided each week and a weekly consultation was provided through a one-on-one video call. The Fifth week is an extension to those children who were not provided enough time to engage with “ClickOr.” In the target weeks of training, the respondents have provided feedback through the online interview on what changes and additions are needed for the app, and this feedback was compiled for the final app design. The compilations of interviews undertook a thematic analysis for qualitative research design. The researcher used graphical representations to present data, according to Bavdekar (2015) that tables, graphs, and charts establish a more understandable presentation of data. It makes the readers appreciate a representation of a text more easily.

The Incubation, iteration, and implementation framework were inspired by a success model of Subiyakto et al., (2015) for an

Information System Project in the form of a case study that is found to be valid and proven through the research methods interview, consultation, discussion, and seminars.

CHAPTER III

PROJECT OUTCOMES

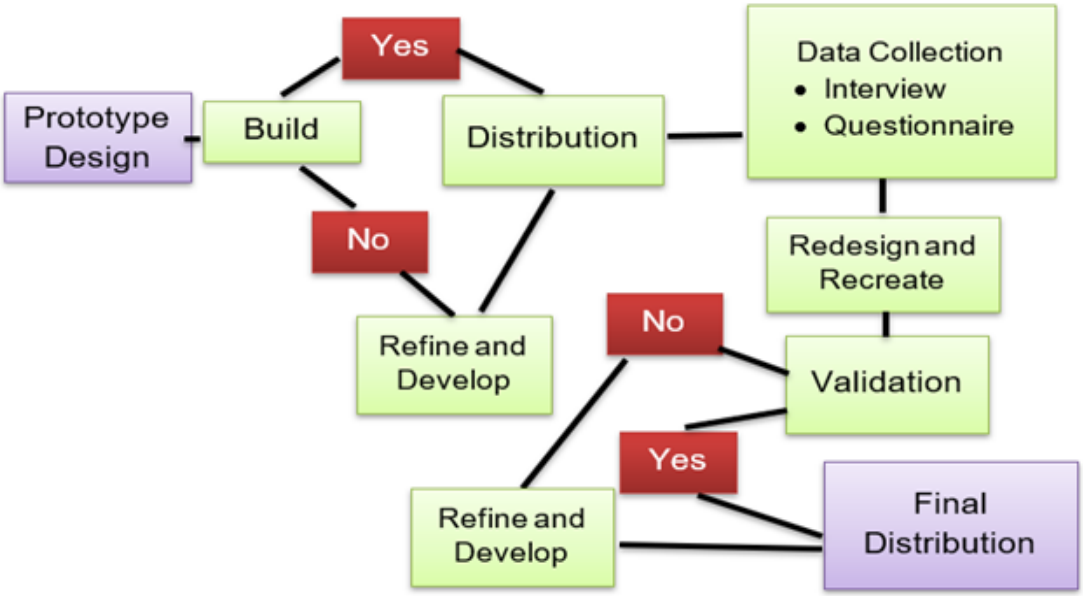
PRESENTATION OF FINDINGS

This chapter presents the analysis of incubation, analysis of iteration, and analysis of implementation.

a. Analysis of Incubation

Figure 11
The Workflow of "ClickOr"

The figure below displays the workflow done in collaboration with the Multimedia Experts, Validators, and Respondents.

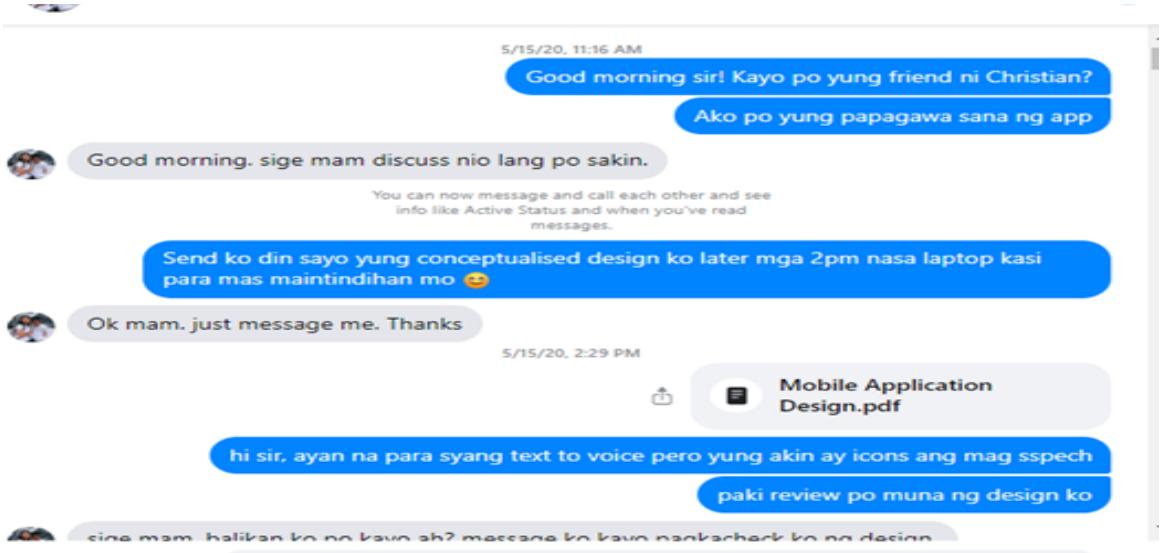


The diagram shows that the design was built and was reviewed twice by the researcher. Although the IT expert consults the milestones

each week to the researcher, the outcome needs further review to check if the design is being met. The researcher had minor changes with the images and text size on the prototype design that happened in each consultation of the created versions of "ClickOr". The researcher sought help from the Graphic Designer to improve the icons of the app. This is when the researcher had collaborations with the Multimedia experts.

Figure 12
Images of Communication with the IT Expert and the Graphic Designer
Figure 12. 1
Images of Communication with the I.T Expert

The images show the exchange of Messenger chats in collaboration with the I.T Expert for the creation of "ClickOr".



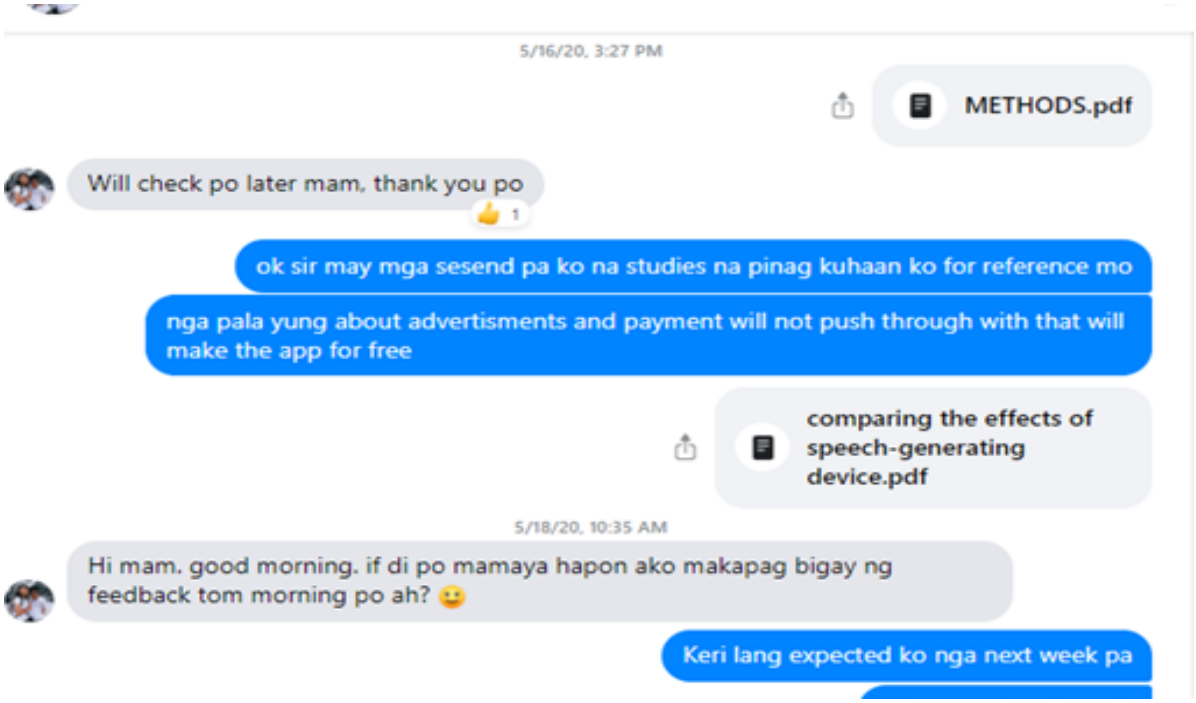


Figure 12. 2
Images of Communication with the Graphic Designer

The images show the exchange of Messenger chats in collaboration with the Graphic Designer for the creation of "ClickOr".

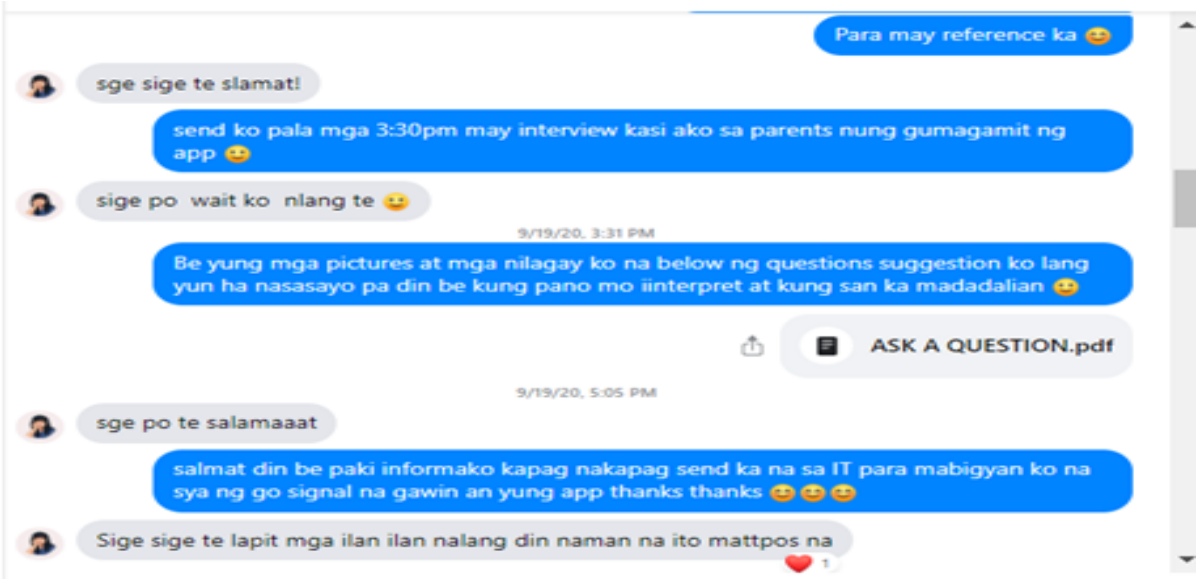
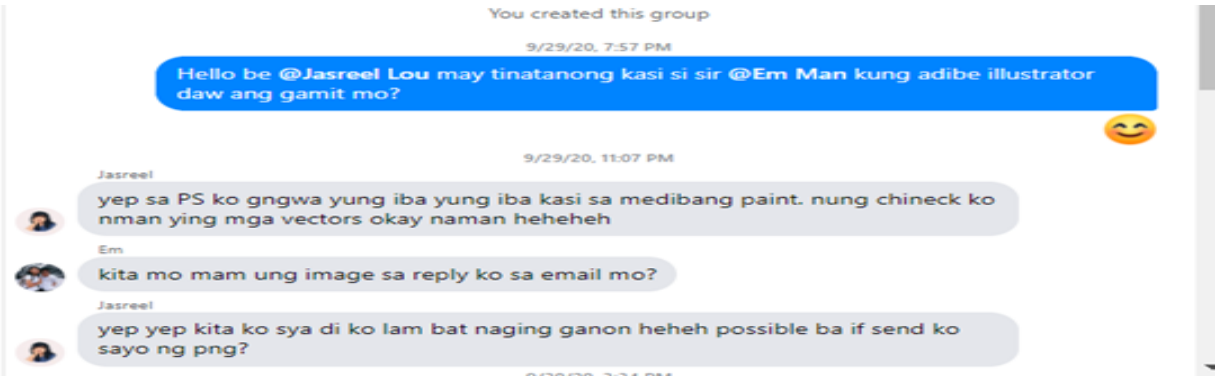


Figure 12. 3
Images of Communication with the IT Expert and the Graphic Designer

The images show the exchange of Messenger chats in collaboration with the I.T Expert and the Graphic Designer for the creation of "ClickOr".



After the distribution of the updated versions to the respondents, the feedback and suggestions were collected for the final app redesigning and recreating. The validators' outlook on the app was also reconsidered. The final application was distributed after two weeks of work done by the Multimedia Experts and was able to be distributed to the respondents.

Table 1
Summary of Profile of the Multimedia Experts and the Validators.

Each profile shows the background of the persons involved in the work process of "ClickOr."

Table 1.1
Profile of the Multimedia Experts

The table below shows the IT expert and the graphic artist's profile in which the researcher had been collaborating during the Redesigning, Redefining, and Recreating stage of the project.

IT Expert	Graduate of B.S Computer Science 5 years working as a Freelance Software developer and IT Consultant
Graphic Artist	Graduate of Bachelor of Fine Arts major in Visual Communication 4 years working as Graphic Artist Designer at Spiritgame.net

Table 1.2
Profile of the Experts on Validation for the Content Analysis

The table below shows the Validators' profile who suggested ideas for "ClickOr" and validated its content.

Expert	Position	Years of Experience	Highest Educational Attainment
1	Teacher III	More than 10 years	Units in Ph.D. Technological Education
2	ICT Coordinator ICT track SHS Teacher	More than 10 years	Graduate of B.S Computer Science Teaching units

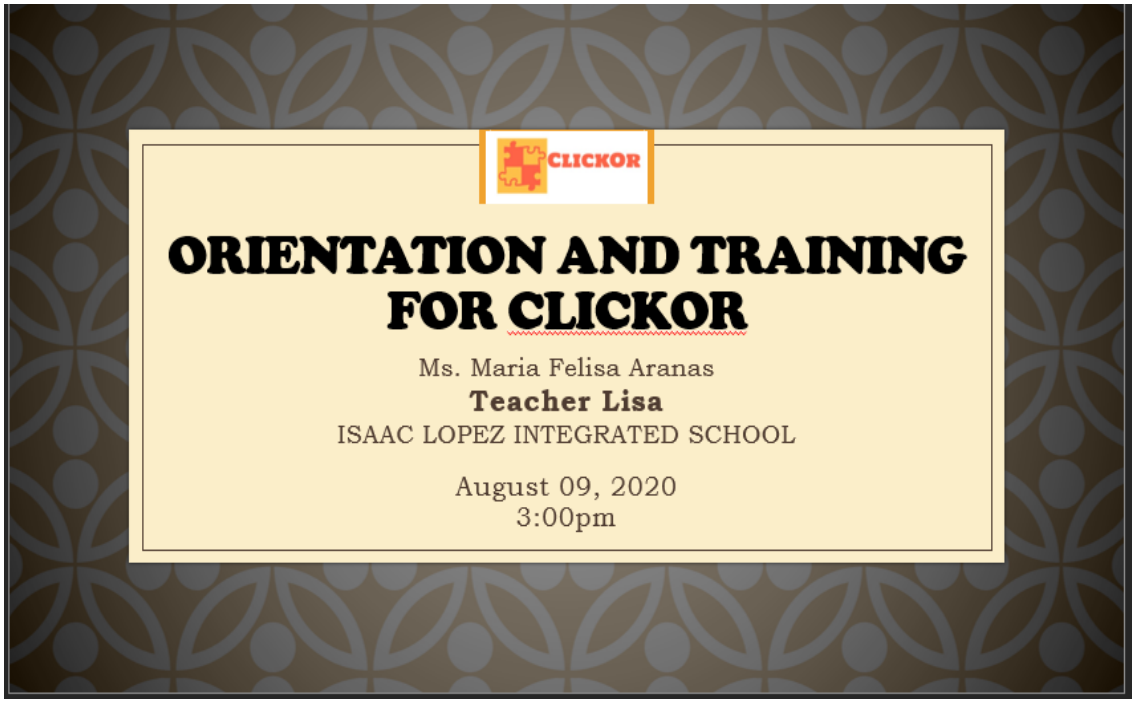
b. Analysis of Iteration

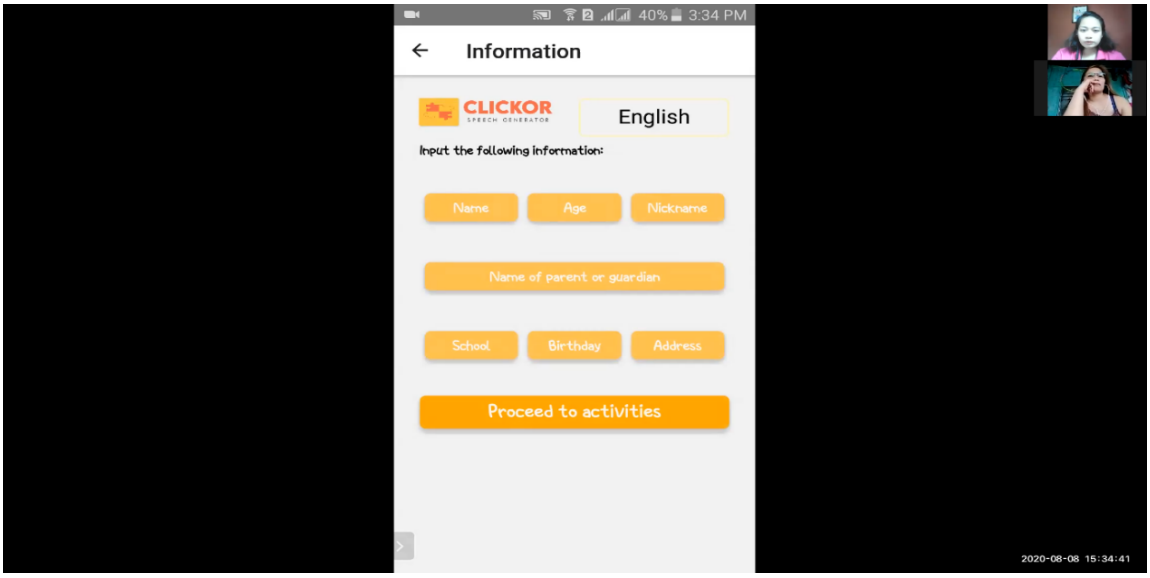
"ClickOr" had three parts of training, these training were done through Zoom Cloud meetings for six consecutive weeks both as a group and individual. For the first week, the researcher has undergone the orientation and the first part of the training. The purpose of the application was explained, as well as the ways on how to download and use it. The respondents were provided one week to introduce and observe the grasp of the children with speech difficulties in "ClickOr."

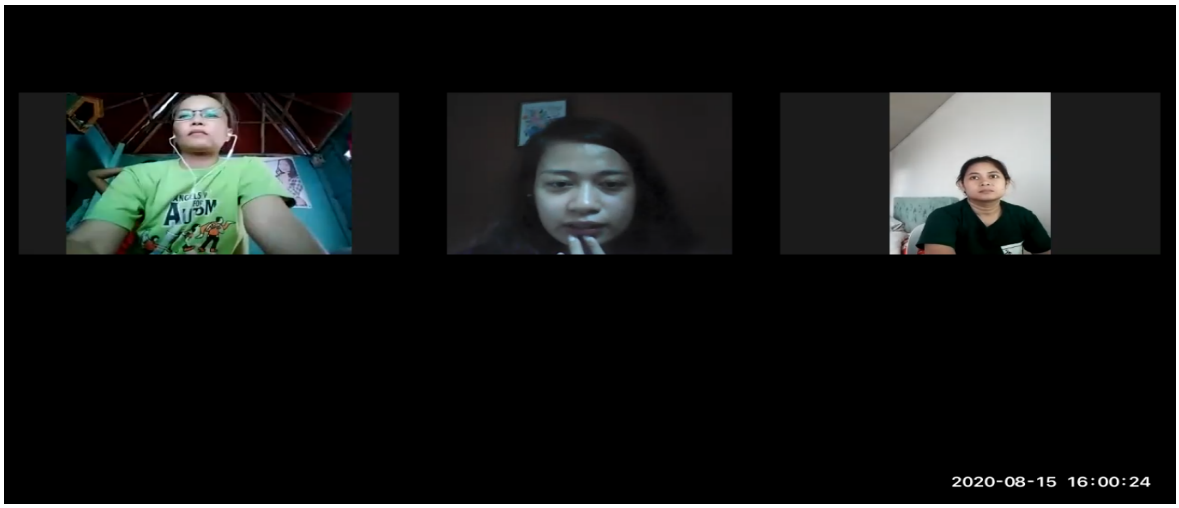
Figure 13
Images of Group and Individual Online Training I to IV

The images below display the online training done from the first week to the seventh week.

Figure 13.1
Orientation and Training I



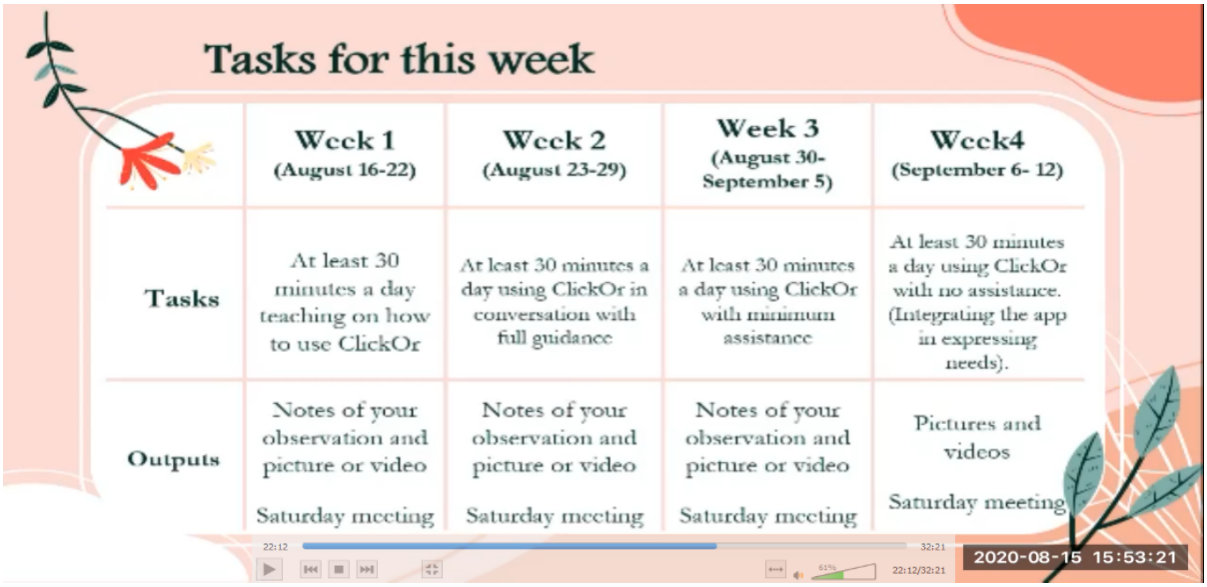




The first orientation and training were done on August 9, 2020, it comprises the introduction on how to use “ClickOr” and ways to download it. The researcher provided a group download session for the respondents to inquire about concerns at the meeting. Right before the installation, they were also guided on the basic functions of the app and ways on how it works. The researcher asked the adult guides for seven days of observation as the kids tried to work on the app.

Figure 13.2
Feedbacking and Training II

After the one-week observation, the respondents were able to provide feedback for "ClickOr" on their observation when they introduced it to their children. One respondent said "Mejo mahina po ang voice," another one said, "Sa akin po struggle ko po is nagnull po yung details ng kapatid ko…" another respondent said, "Yung concern ko po maliit yung text content po nya." A sibling of the user said that "Teacher, nakuha po agad ni Kaylo nagagamit na po nya mag isa,." The researcher took note of these responses for the Recreating, Redesigning, and Refining stage.



The researcher introduced strategies and studies of the benefits of communication app, she also gave ways to teach the child in the four-week plan for individual monitoring and training. The goal presented served as a guide on the expected outcomes for each week.

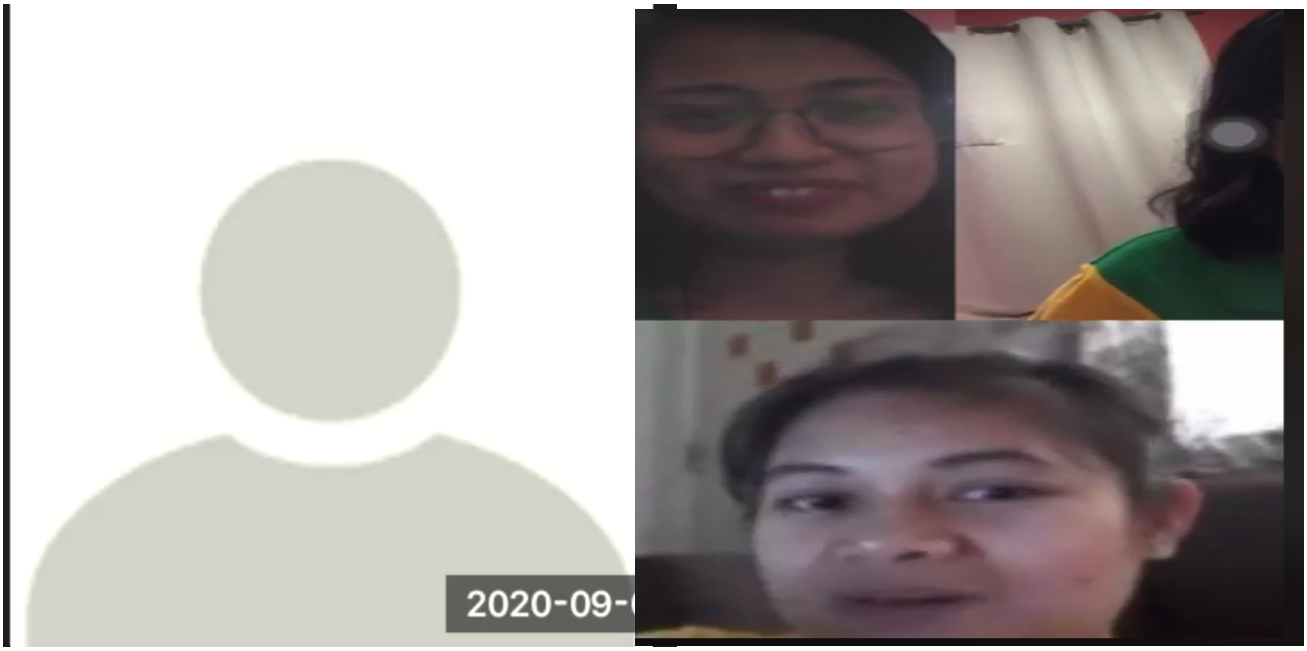
From the third week until the sixth week the respondents were interviewed exclusively to be able to monitor the individual needs of the child. Each week the researcher sets up an online meeting to ask the respondents about the outcome of the 4-hour training in a week. Some requested to shorten the day but were directed to prolong the time.

Figure 13.3
Images and Reports on the Weekly Individual Monitoring.

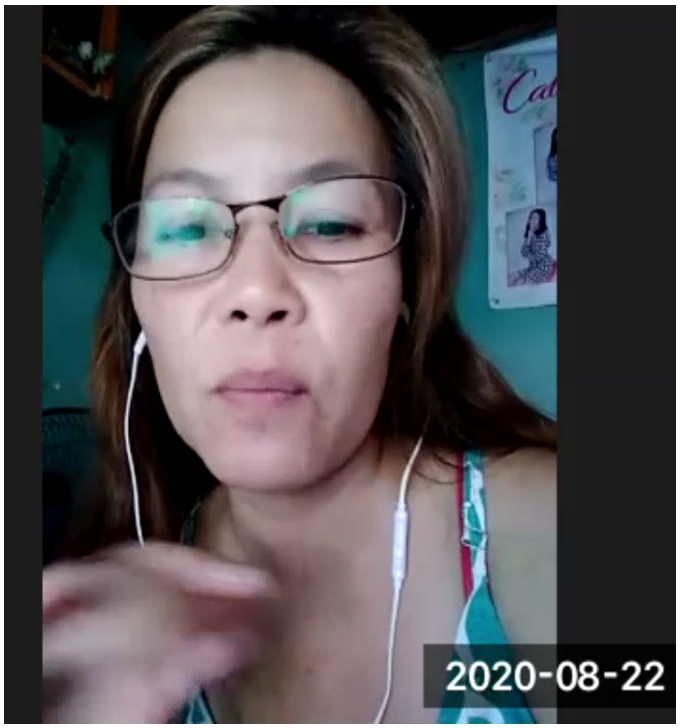
The images below show the individual training and monitoring of the adult guide of children in the "ClickOr" training program.

Respondent 1. Angel's Mother

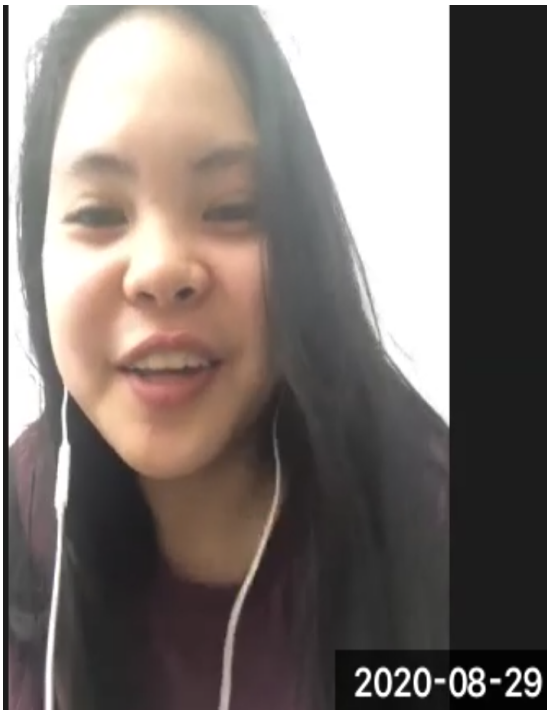
Respondent 2. Job's Mother

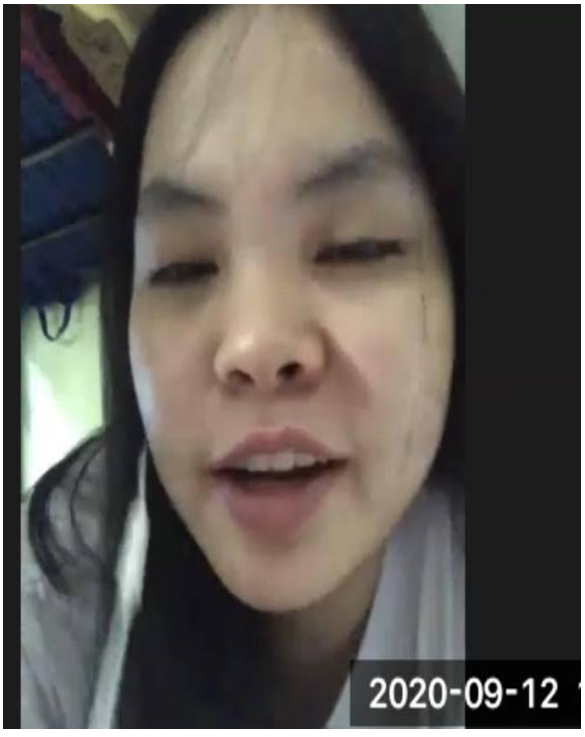


Respondent 3 Jonah's Mother



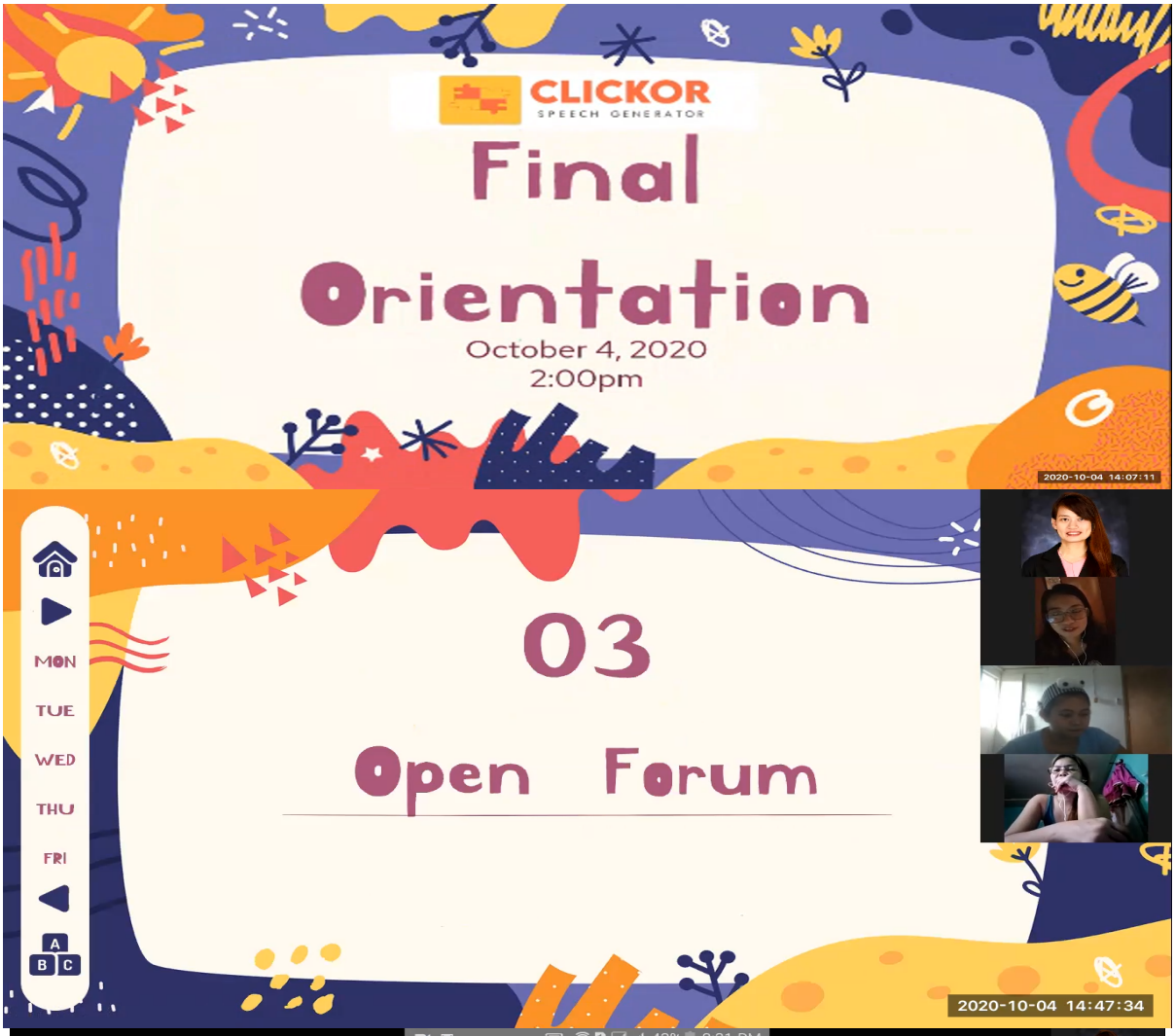
Respondent 4. Kailies' Aunt

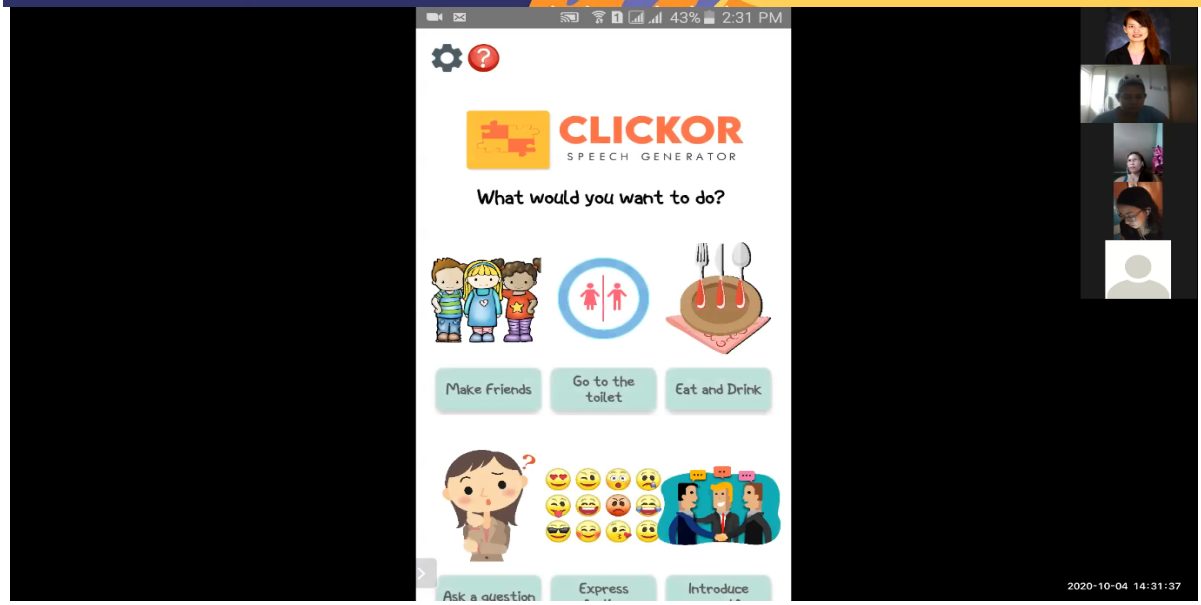




Respondent 5. Kaylo’s Sister

Figure 13.4
Final Orientation





The final Orientation for the Final App Design on October 4, 2020, became the last part of the program. Not unless the respondent was asked to still go on training because of the unfollowed schedule. The researcher provided a short message and video for the participants. They were also provided a few reorientations because of the new features added to the app. They were asked on the open forum about their journey in the program but there was no response from them. The downloading process was retaught to them as well, their responses were “Maganda ma’am,” “Nakalagay na po lahat ng hinahanap ni Kaylo,” “Yung pagtuturo naman teacher madali na lang kasi may training naman online,””Nakapag initiate na syang makipag usap,” “Masarap sa mata yung kulay,” “Malaking tulong po sa bata how to express yung nararamdaman po nya.” Another participant said “Feeling ko mas ok siya at may music siya” and “A good start because it’s virtual but still needs improvement.”

c. Analysis of Implementation

The researcher uses a case study and thematic analysis for the interpretation of the results. Each interpretation was based on the recorded interview with the adult guide and the online demographic form and questionnaire that they have filled out.

Reports of the Individual Training a Case Study

The researcher used a unique case study to represent the events of each child without comparing them to the norm (Sammut-Bonnici & McGree, 2015). The case studies of the Children with Speech Difficulties are based on the reports gathered by the researcher on the report provided by their adult guide on their observation during the training program. The case study below is a brief description of each child on their responses before, during, and after using "ClickOr."

The permission to use the pictures for the project was done on the profiling but some respondents did not agree to send pictures of their child. Still, they agreed to actively participate during online interview schedules. On the other hand, pictures of the children were covered to respect the child's privacy and as well as to abide by the Data Privacy Act of 2012 (Republic Act. No 10173, Ch. 1 Sec.2).

Table 2
Demographic Profile of the Respondents and the Children.

Table 2.1
Profile of the Respondents

The table indicates the profile of the adult guide of the children who have undergone the program. The researcher used a demographic questionnaire to provide identity in which might be a factor that affects one behavior and/or to describe their samples for comparison and contrast (Hughes et al., 2016).

Respondent	Age	Gender	Educational Attainment	Relation to the child
1	25	F	College Graduate	Sister
2	52	F	College Graduate	Mother
3	44	F	College Undergraduate	Mother
4	44	F	College Undergraduate	Aunt
5	21	F	College Graduate	Sister

Table 2.2
Profile of the Children

Through profiling, at the beginning of the program, the researcher gathered the children's profiles through an online pre-survey questionnaire.

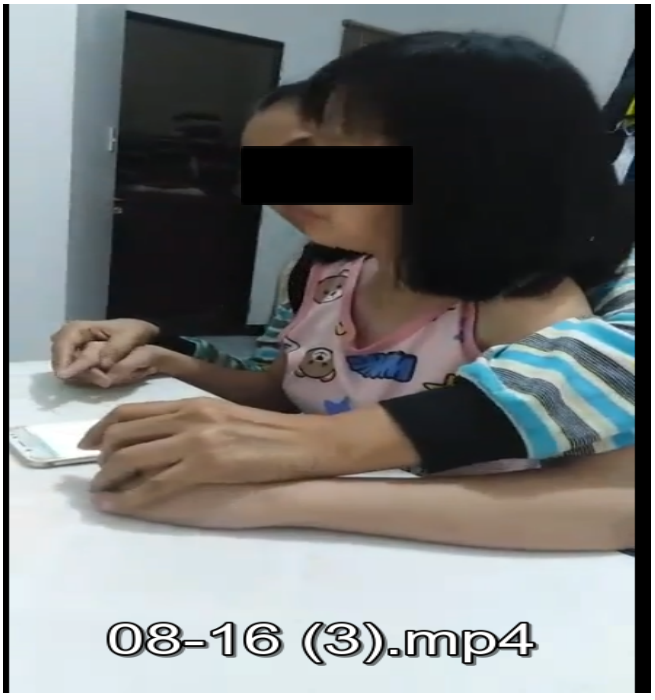
Name of the child	Age	Gender	School Level
Angel	16	F	SpEd

Job	18	M	SpEd
Jonah	7	M	Primary
Kailie	9	F	Primary
Kaylo	11	M	SpEd

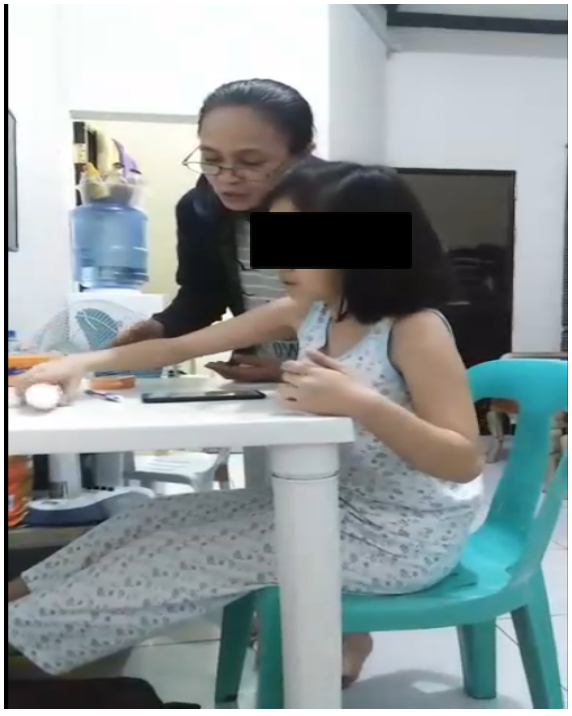
Figure 14
Images of the Children with Nonverbal Autism during the 4-week training.

The images below show the children with speech difficulties while undergoing individual training.

Child number 1. Angel



Angel is a girl with Autism Spectrum Disorder who is non-verbal. Her mother reported that her child had a hard time focusing while on training and reported to be clicking the app repeatedly during the first two weeks of training. However, she was able to cope up with the continuous training with her mother. The adult guide followed the tip of the researcher in providing the child maximum assistance while



teaching her in doing the activity for the first two weeks and then gradually removed assistance on the next days. It can be seen in Table 2 that Respondent 1’s profile is based on Angel’s sister. Angel’s sister leads her mother in online communication with the researcher. Nevertheless, the mother is seen as the adult guide of Angel.

Angel had undergone training for 30 minutes a day for four weeks. In the successive week, Angel was reported to imitate speech like Good Morning, Hi, Hello, and Bye while using the app. Angel’s mother said that she can click the buttons of the app by just providing verbal cues in the fourth week of the training. She was also able to associate the icons on the app to the real objects while her mother would make her click the object and generate the voice and ask her to get the object to confirm if she acknowledged it.

Child number 2. Job

Job is a boy with CHARGE Syndrome, a recognizable genetic syndrome with a known pattern of features. An extremely complex syndrome, involving extensive medical and physical difficulties that differ from child to child (The CHARGE Syndrome Foundation, 2020, About Section, para. 1). Job was not able to be guided constantly in using the "ClickOr", but he was provided follow-ups right after the four-week training. His mother had reported that Job's case hinders him from learning to read and write because it affects his fine-motor and gross-motor skills. Job's mother could not attend the Saturday individual training throughout the provided time though videos of the meeting were sent to her at her request.

Job was observed by his mother who is not engaged in using "ClickOr." "Si Job kasi ay visual learner ma'am, di sya makarelate with the app." On the follow-up after the final app design, the child was said to be exhibiting attention with "ClickOr" when it was introduced to him

and when Job's mother was trying to train him. "Sana matutunan din gamitin ni Job ma'am," the child is being monitored by the researcher for his improvement.

Child number 3. Jonah

Jonah a boy with Autism who is non-verbal was seen to have an interest by looking at "ClickOr" while she was using it, as reported by his mother during the open forum, "Ma'am ang anak ko nakatingin sya sa app nakaupo sa tabi ko," "Madali syang pag aralan pero mahirap sya sa anak ko." His mother patiently trains her child whenever she has time although his mother said "Kinukuha kasi sya ng lola nya sa kabilang bahay ma'am kaya di ko na natututukan."

The child was reported to be engaged in the new app's graphic designs and features when monitored by the respondent after the final orientation. His mother reported that Jonah shows interest in the improved app that became an opportunity for her to train her child. Jonah was later seen to be imitating the words like "Hi" and "Bye" on

the Final App Design of "ClickOr." Jonah is still being monitored by the researcher as well.

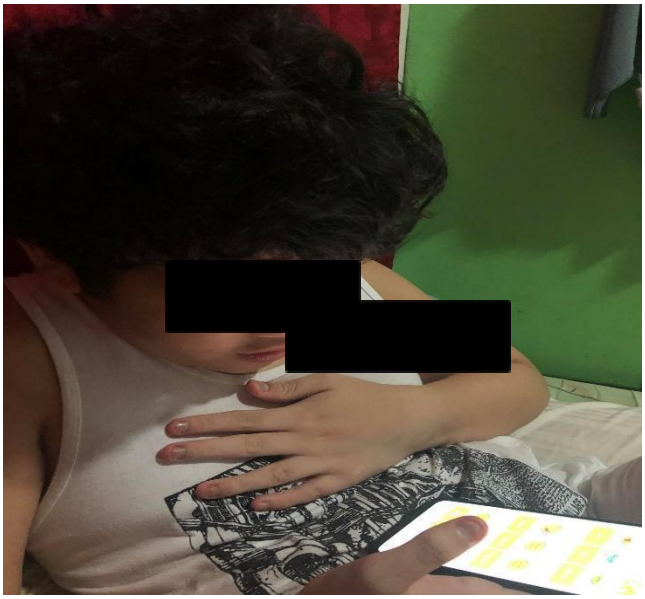
Child number 4. Kailie

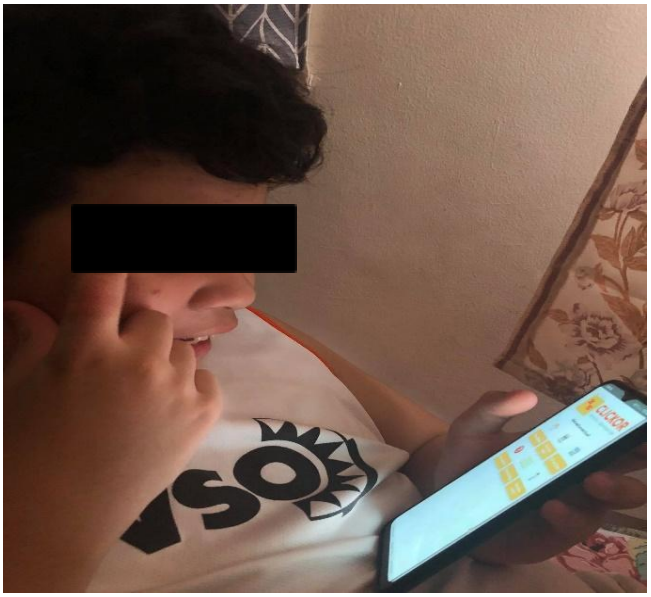
Kailie is a girl with Autism who is non-verbal, she had trouble focusing while using the app, her aunt reported that she cannot get the child's attention. "Ma'am kapag ginagamit nya yung app nagsasabi sya ng ayaw pero tinuturuan ko naman."

The researcher expanded her training week and provided the adult guide tips for more effective teaching for Kailie. In the fifth week, the child was reported to be engaged in the app when it was associated with her favorite food "Orange." Her aunt said that she has imitated words like "Good night" and "Orange."

She has also to be more engaged in the Final App Design where she has shown clicking the buttons of the app with verbal commands from the adult guide

Child number 5. Kaylo





Kaylo a boy with Autism who has speech difficulties was able to use the app with minimum to no assistance, he was also imitating the speech being generated by the app as reported by her sister. “Madali lang para sa kanya teacher kaya po minsan nilalaro na lang nya.” His older sister reported that Kaylo initiates conversations with them using the app. “Nagulat kami teacher kasi nag greet sya sa amin ng good morning pagka gising nya gamit yung ‘ClickOr’ natawa na lang kami.” Furthermore, Kaylo finds the app easy to use and becomes dependent on it. His adult guide told the researcher that the child is talking to the

app by responding when clicking the questions on the "Ask a question" category since Kaylo's sister claimed that he doesn't have a playmate at home and spends a lot of time on gadgets. On the other hand, "Masaya po kami na nakakapag initiate na po sya ng conversation kasi dati po hindi po." Kaylo's sister said.

Table 3
Thematic Analysis Table

Below is a table of the theme based on the functions of the mobile application, the recorded interviews from the individual training and monitoring, and the final orientation were coded and analyzed according to its appropriate theme using Microsoft Excel. The numbers of comments were analyzed to a total number and calculated into a percentage. Using Microsoft Excel in thematic coding, organizing, and classifying data is cost-effective. Correspondingly, it increases validity and reliability (Bree & Gallagher, 2016).

Themes	Total Number of Coded Responses	Percentage of Coded Responses
Expressing wants	7	39%
Social interaction	7	39%
Expressing Emotions	3	17%
Introducing self	1	6%
Asking a question	0	0%
TOTAL COMMENTS AROUND THEMES	**18**	**100%**

The themes are sorted from greatest to least, the top three themes are “Expressing wants”, “Social Interaction” and “Expressing emotions” in which comments from respondents were about their child exhibiting these. On the other hand, “Introducing self” is unpopular, and “Asking a question” wasn’t mentioned for the child’s recorded progress. In the research study of Parrocha (2017) children with non-verbal Autism who used a designed speech application were observed to improve in communication skills most especially in expressing wants and needs. “ClickOr” in equivalent has also proved that “Expressing wants and needs” is exhibited in the program.

RECOMMENDATIONS

Based on the findings, these are the recommendations of the researcher:

- Train more parents and/or guardians and share the Speech Application with more students with speech difficulties.
- Create mobile applications with the Filipino language to meet the needs of Filipino children who have speech and language impairment. Moreover, researchers could also use dialects for more localized conversation.
- Special needs professionals should consider the use of a communication application as assistive technology. They should include their learning in the therapy or the curriculum.
- Other mobile applications might add more features to the update on annual trends.

TERMINAL SECTION

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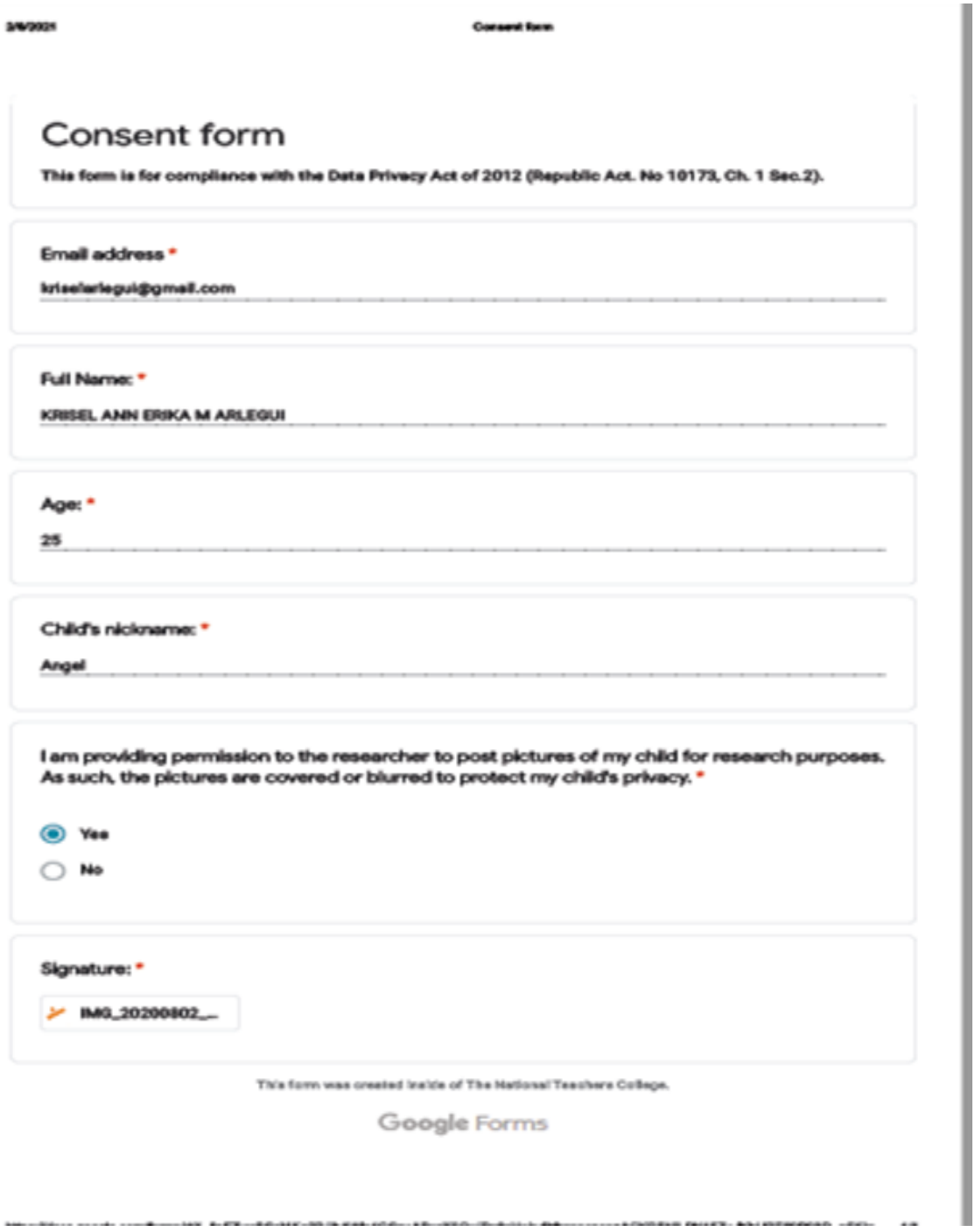
Westrum, E. (2019). *General Education Teachers Perception Toward Augmentative and Alternative Communication.* [Master's Thesis, Minot State University]. ProQuest Dissertations & Theses Global. https://search.proquest.com/openview/0ad5004b140f689d14b6fc44419f93ad/1?pq-origsite=gscholar&cbl=18750&diss=y

APPENDICES

APPENDIX A: Consent Forms



3/6/2021 Consent form

Consent form

This form is for compliance with the Data Privacy Act of 2012 (Republic Act. No 10173, Ch. 1 Sec.2).

Email address *

krisellarleguI@gmail.com

Full Name: *

KRISEL ANN ERIKA M ARLEGUI

Age: *

25

Child's nickname: *

Angel

I am providing permission to the researcher to post pictures of my child for research purposes. As such, the pictures are covered or blurred to protect my child's privacy. *

- (•) Yes
- ( ) No

Signature: *

IMG_20200802_...

This form was created inside of The National Teachers College.

Google Forms

Consent form

This form is for compliance with the Data Privacy Act of 2012 (Republic Act. No 10173, Ch. 1 Sec.2).

Email address *

ritztejano93@gmail.com

Full Name: *

Emerita Tejano

Age: *

44

Child's nickname: *

Kaille Jaurigue

I am providing permission to the researcher to post pictures of my child for research purposes. As such, the pictures are covered or blurred to protect my child's privacy. *

- (●) Yes
- ( ) No

Signature: *

IMG20200801 16...

This form was created inside of The National Teachers College.

Google Forms

Consent form

This form is for compliance with the Data Privacy Act of 2012 (Republic Act. No 10173, Ch. 1 Sec.2).

Email address *

myvyginanuran@gmail.com

Full Name: *

Myvy Inanuran

Age: *

21

Child's nickname: *

Kaylo

I am providing permission to the researcher to post pictures of my child for research purposes. As such, the pictures are covered or blurred to protect my child's privacy. *

- (●) Yes
- ( ) No

Signature: *

0EE7CEBB-94AE-...

This form was created inside of The National Teachers College.

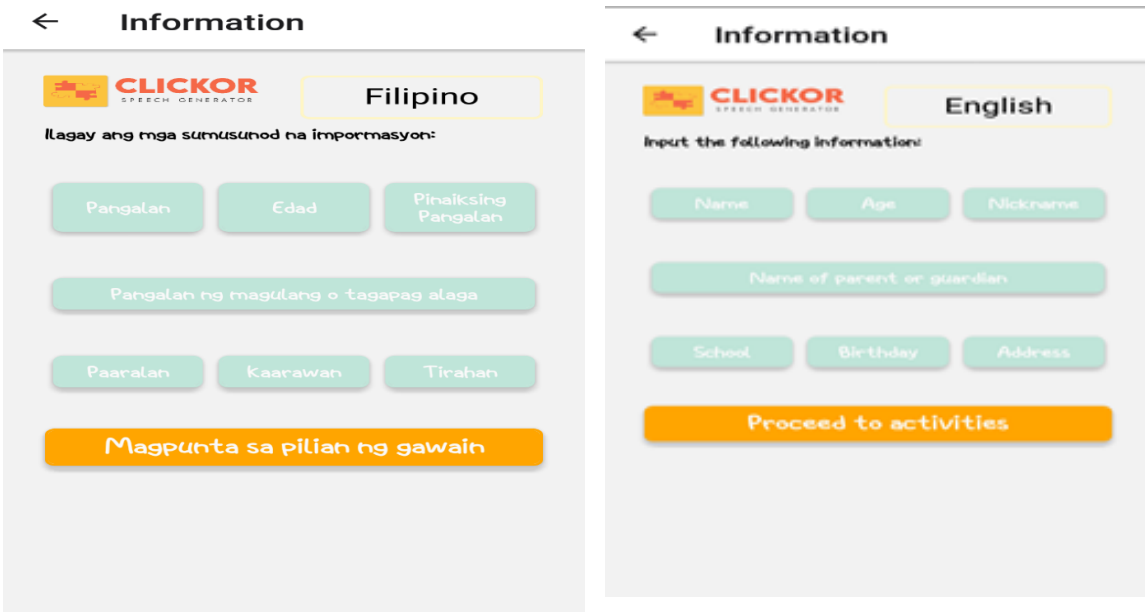
Google Forms

APPENDIX B: Final Voice-Output Mobile Application Design

The actual design in the success of its testing stage was refined and recreated. Screenshots below show the improved design of "ClickOr."

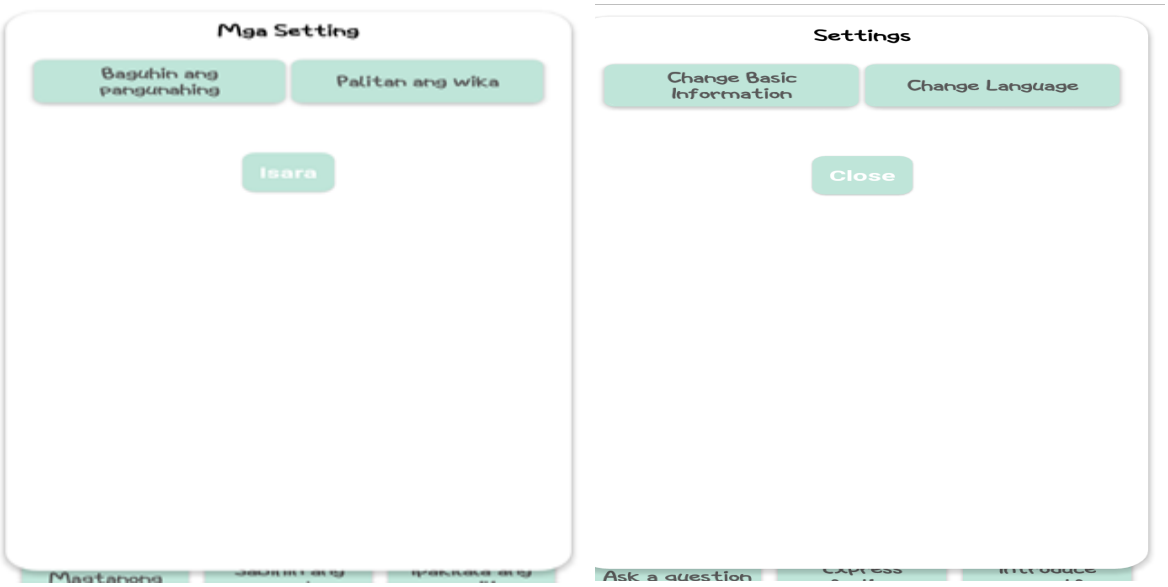
Screen 1.1 Welcome Screen. The image above contains the logo and the Mobile Application name, this will be the screen as the user opens the App. The screen contains a greeting "Welcome Back" with the user's name that will be registered once the user inputs the information needed. This will be the screen that will appear if the user is signed in.

Screen 2. Language Screen. The second screen contains the setting of the mobile for personal preferred language use. The user may also change the language on the settings which are found in the Categories Screen.



Screen 3. Information Screen. The information input which includes name, nickname, age, birthday, address, school, and name of parent and guardian would be needed to accomplish to proceed to the home screen. This will be needed for the self-introduction of the user. The information may also be edited in the settings button found on the home screen.

Screen 4. Home Screen. Shows the home page which will lead to different activities. Each icon is the main category that will lead to its subcategories. The home screen also contains the setting and help button.



Screen 4.1 Settings pop-up screen. The settings button shows the Language and Basic information buttons for changing once the user has signed in.

Screen 4.2. Help pop-up screen. The help button leads to this screen in which the user may read the user guide or may email the IT for questions

Screen 5. Grid display with symbols and words. Each screen contains icons for the speech-generating button, delete button, home button, sentence box, and rows and columns for sentence completion (subject, word, and object).
Screen 5.1. Introduce Self (Makipagkilala)

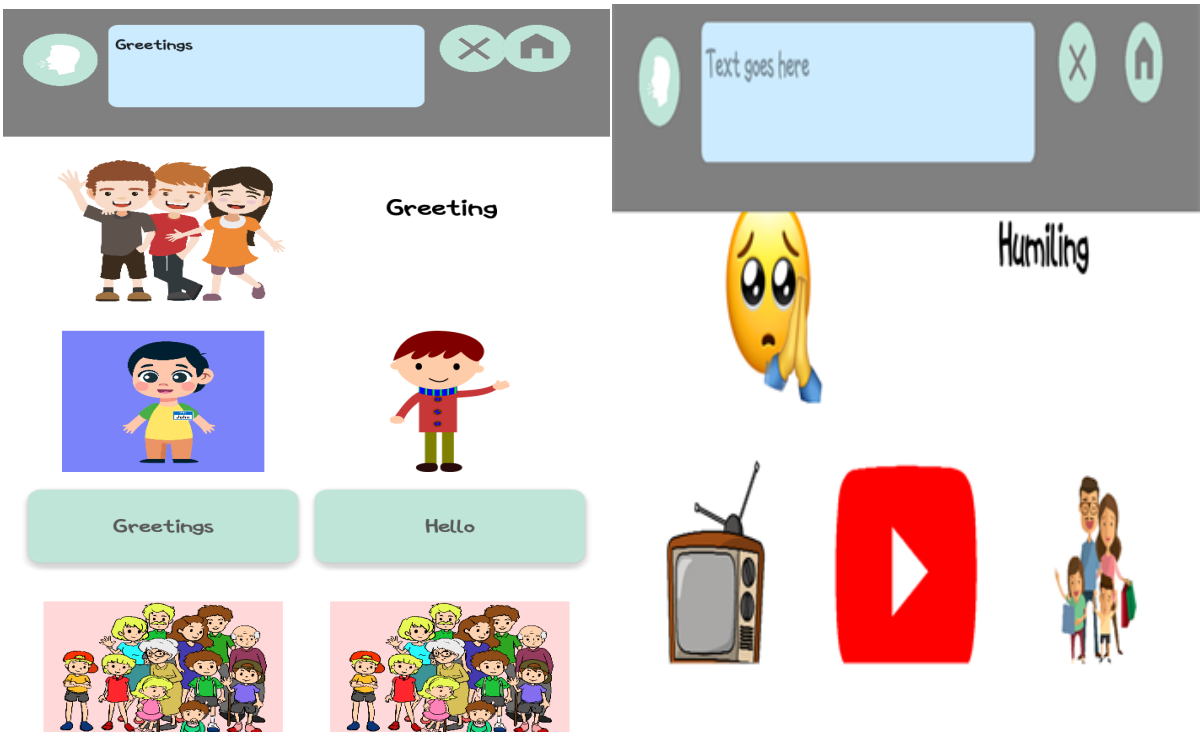
Screen 5.2 Make Friends (Makipagkaibigan)

Screen 5.3 Express feeling (Sabihin ang nararamdaman)

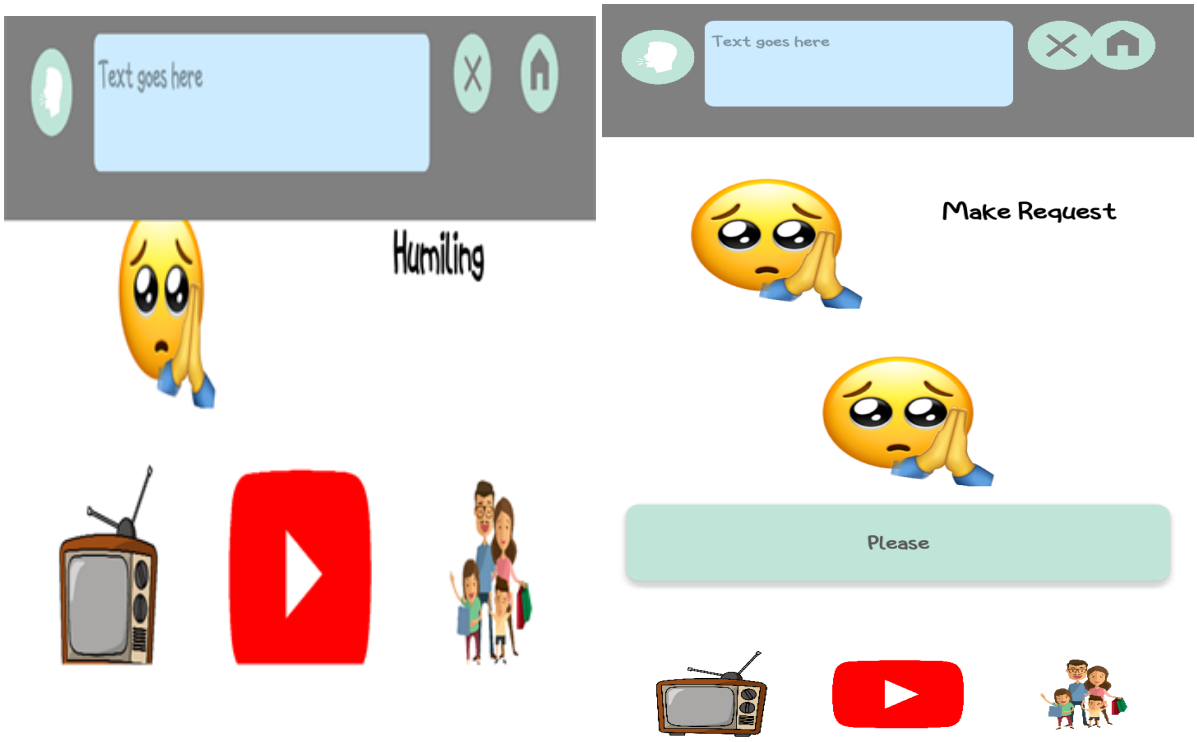
Screen 5.4 Go to the toilet (Pumunta sa banyo)

Screen 5.5 Eat and Drink (Kumain at uminom)

Screen 5.6. Ask a question (Magtanong)



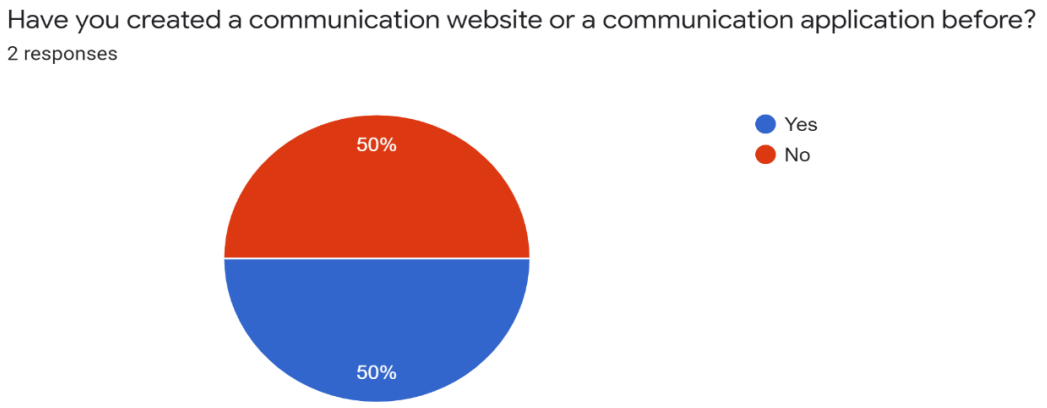
Screen 5.7. Greeting (Pagbati)



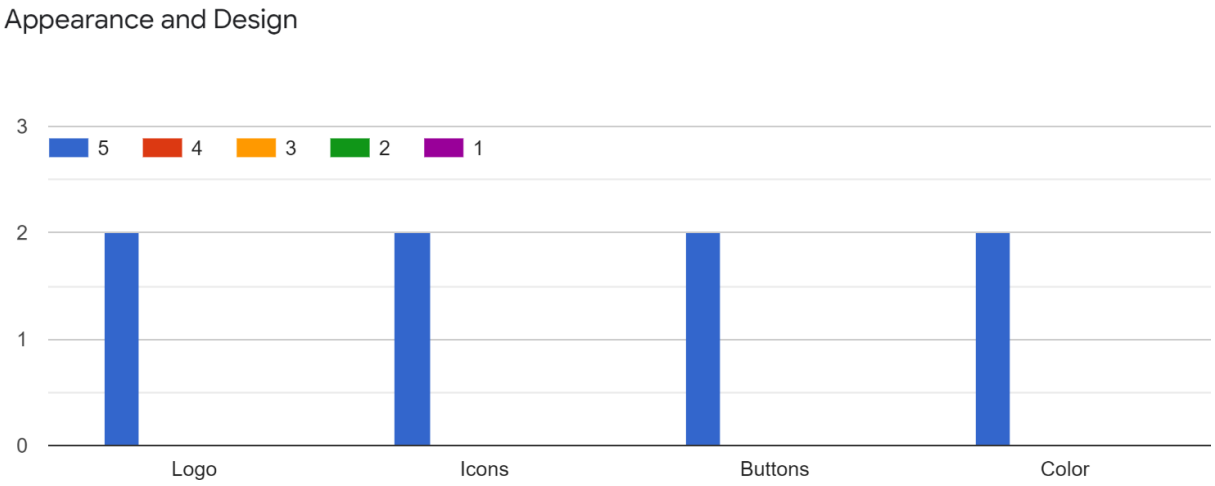
Screen 5.8. Make a Request (Humiling)

APPENDIX C: Charts of the Assessment done by the Validators.

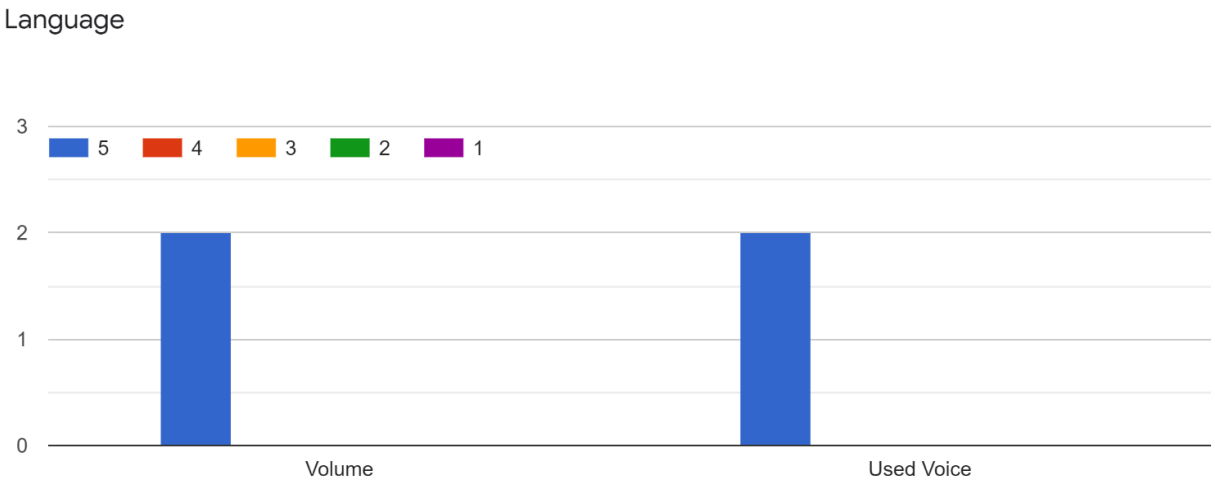
The responses of the validators to the Final Design of "ClickOr" are shown below. The availability of Google Forms on the internet provides an advantage to the data collectors as well as the respondents. The online forms are also considered reliable and easy to use. (Vasantha Raju & Harinarayana, 2016). The charts of the Google Form summary were used for a more comprehensive graphical representation.



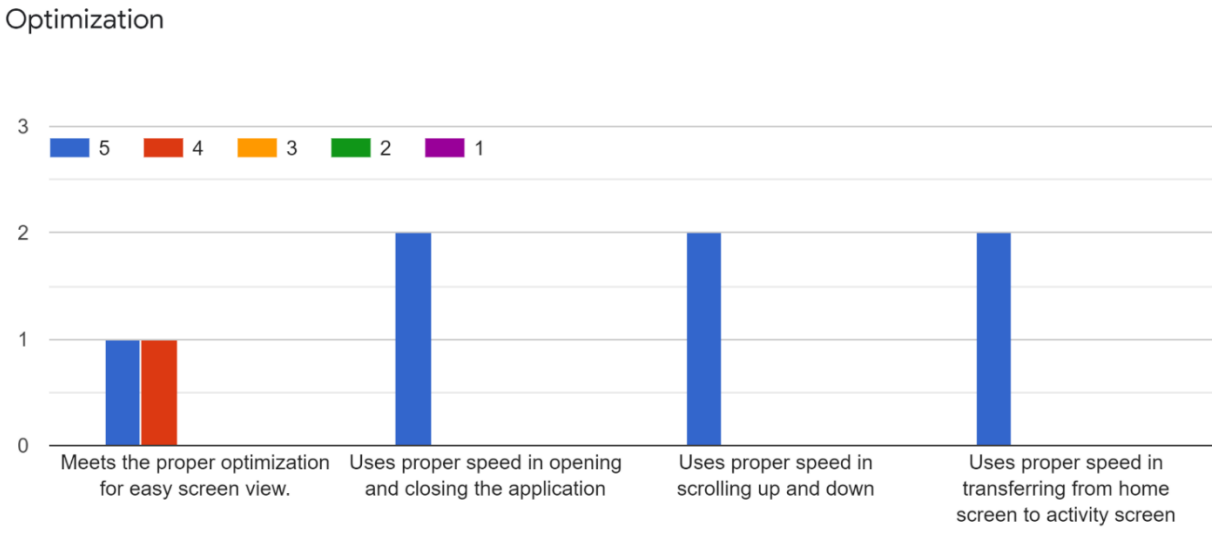
It can be garnered that 50% or 1 of the 2 validators have created a communication website or application before.



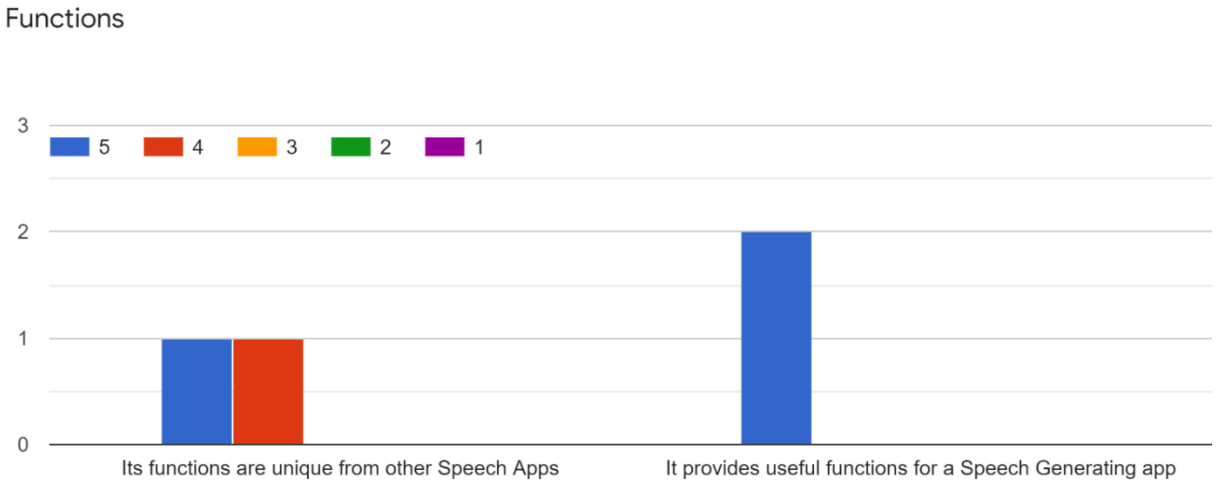
The appearance and design of "ClickOr" specifically the logo, icons, buttons, and color got the rank 5.



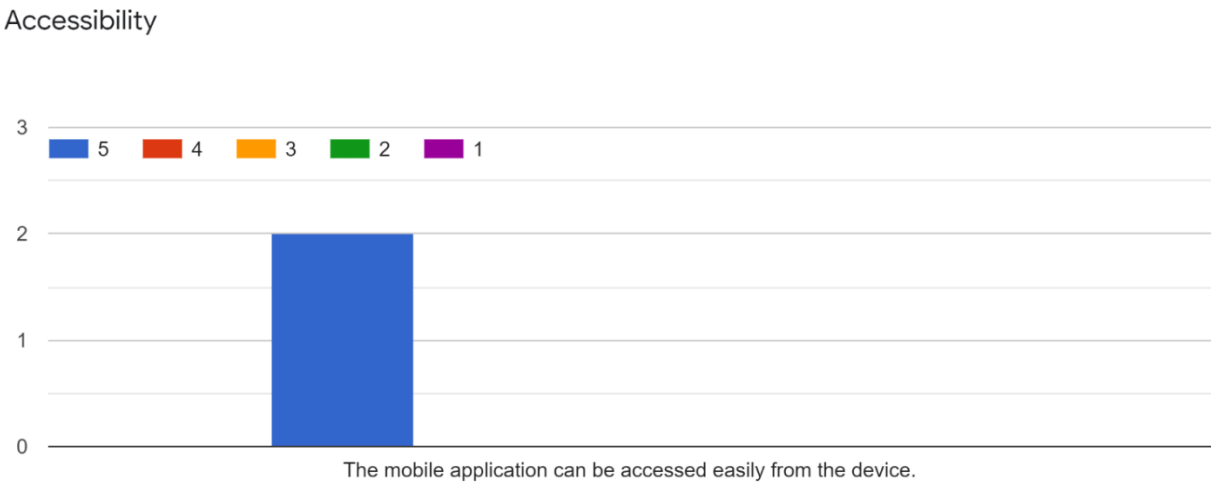
In the language category, the volume and used voice both got the highest rank of 5.



The Optimization for easy screen view got the rank of 4 and 5 whilst the uses the proper speed in opening and closing the application, use proper speed in scrolling up and down and uses proper speed in transferring from home screen to activity screen got the rank of 5.

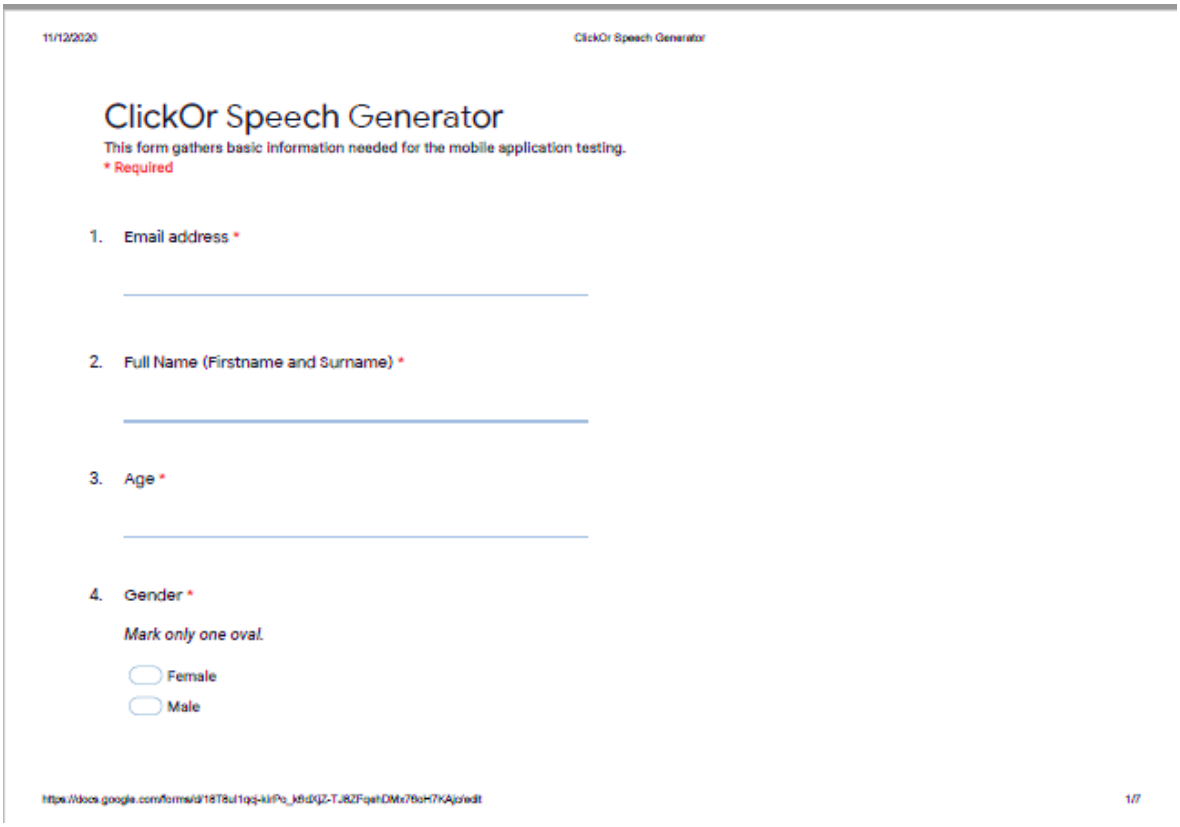


It can be gleaned that the function's uniqueness got 4 and 5 rank while providing useful functions for a Speech Generating App got 5.



The mobile application can be accessed easily from the device and has a rank of 5.

APPENDIX D: Profiling Form



11/12/2020 ClickOr Speech Generator

ClickOr Speech Generator

This form gathers basic information needed for the mobile application testing.
* Required

1. Email address *

2. Full Name (Firstname and Surname) *

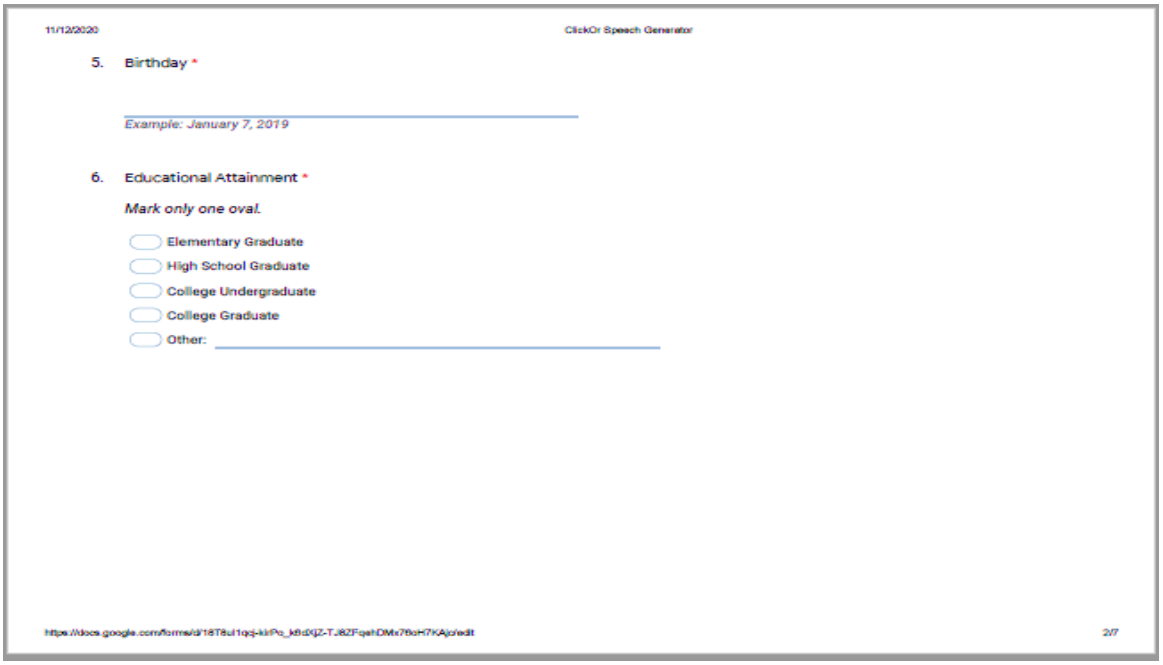
3. Age *

4. Gender *

Mark only one oval.

- ◯ Female
- ◯ Male

https://docs.google.com/forms/d/18T8ul1qqj-kirPo_k8dXjZ-TJ8ZFqehDMx76oH7KAjo/edit 1/7



11/12/2020 ClickOr Speech Generator

5. Birthday *

Example: January 7, 2019

6. Educational Attainment *

Mark only one oval.

- ◯ Elementary Graduate
- ◯ High School Graduate
- ◯ College Undergraduate
- ◯ College Graduate
- ◯ Other: _____

https://docs.google.com/forms/d/18T8ul1qqj-kirPo_k8dXjZ-TJ8ZFqehDMx76oH7KAjo/edit 2/7

7. Relation to the Student *

Mark only one oval.

- Parent
- Sibling
- Aunt/Uncle
- Cousin
- Grand Parent
- Nanny/Caregiver
- Other: ____________________

8. Name of the student (optional)

____

9. Student's Age *

____

10. Student's School Level *

Mark only one oval.

- Vocational
- Pre-vocational
- Primary
- SPED
- Other: ____________________

11. Student's Gender *

Mark only one oval.

- Female
- Male

12. Contact Number

____

13. What online meeting platform can you use? (select all that applies) *

Check all that apply.

- [ ] Messenger Video Call
- [ ] Google Meet
- [ ] Zoom

14. Does your child use mobile applications (studying, messaging, entertainment etc.)? *

Mark only one oval.

- ◯ Yes
- ◯ No

15. How often does your child use a mobile application?

Mark only one oval.

- ◯ Always
- ◯ Sometimes
- ◯ Rarely
- ◯ Never

16. Do you think that your child will be able to use a speech application as a support for his/her daily conversation? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Maybe

17. Are you willing to try to use ClickOr Speech Generator for your child? *

Mark only one oval.

- ◯ Yes
- ◯ No

18. Are you willing to attend orientation and training for the use of the application? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Maybe

19. Signature (you may sign on a piece of paper and take a picture for this) *

Files submitted:

APPENDIX E: Accomplished Online Assessment by the Validators

Validator 1

ClickOr Voice Output Mobile Application

This form assesses the designed mobile application.

Email address *

mechelle.tumanda@deped.gov.ph

Full Name *

Mechelle Dugmoc Tumanda

Age *

35

Birthday *

MM DD YYYY

01 / 07 / 1985

Highest Educational Attainment *

- ◯ College Graduate
- ◯ Master's degree units
- ◯ Master's degree graduate
- ◯ PhDTE Degree Units (Doctor of Philosophy Major in Technology Education
- ◉ Other: PhDTE Degree Units (Doctor of Philosophy Major in Technology Education

Occupation *

Teacher

Years in service *

more than 10 years

Have you created a communication website or a communication application before? *

- ◉ Yes
- ◯ No

Appearance and Design *

5 is the highest and 1 is the lowest

	5	4	3	2	1
Logo	◉	○	○	○	○
Icons	◉	○	○	○	○
Buttons	◉	○	○	○	○
Color	◉	○	○	○	○

Optimization *

5 is the highest and 1 is the lowest

	5	4	3	2	1
Meets the proper optimization for easy screen view.	○	◉	○	○	○
Uses proper speed in opening and closing the application	◉	○	○	○	○
Uses proper speed in scrolling up and down	◉	○	○	○	○
Uses proper speed in transferring from home screen to activity screen	◉	○	○	○	○

Language *
5 is the highest and 1 is the lowest

	5	4	3	2	1
Volume	◉	○	○	○	○
Used Voice	◉	○	○	○	○

Accessibility *
5 is the highest and 1 is the lowest

	5	4	3	2	1
The mobile application can be accessed easily from the device.	◉	○	○	○	○

Functions *
5 is the highest and 1 is the lowest

	5	4	3	2	1
Its functions are unique from other Speech Apps	○	◉	○	○	○
It provides useful functions for a Speech Generating app	◉	○	○	○	○

Other comments and suggestions

App's Appearance and Design, Optimization, Language, Accessibility and its Functions are great. This would be very useful for children in need. But may I suggest, that the developer will use black as its font color especially in the Home page since the background is light or neon color to meet the proper optimization for easy screen view.

Signature *

Your signature will serve as a proof that you acknowledge the information that you have provided.

my signature - M...

Validator 2

ClickOr Voice Output Mobile Application

This form assesses the designed mobile application.

Email address *

julieann.esparagoza002@deped.gov.ph

Full Name *

Julie Ann S. Esparagoza

Age *

38

Birthday *

MM DD YYYY

03 / 04 / 1982

Highest Educational Attainment *

- (•) College Graduate
- ( ) Master's degree units
- ( ) Master's degree graduate
- ( ) PhDTE Degree Units (Doctor of Philosophy Major in Technology Education
- ( ) Other: ____________

Occupation *

teacher

Years in service *

more than 10 years

Have you created a communication website or a communication application before? *

- ( ) Yes
- (•) No

Appearance and Design *

5 is the highest and 1 is the lowest

	5	4	3	2	1
Logo	◉	○	○	○	○
Icons	◉	○	○	○	○
Buttons	◉	○	○	○	○
Color	◉	○	○	○	○

Optimization *

5 is the highest and 1 is the lowest

	5	4	3	2	1
Meets the proper optimization for easy screen view.	◉	○	○	○	○
Uses proper speed in opening and closing the application	◉	○	○	○	○
Uses proper speed in scrolling up and down	◉	○	○	○	○
Uses proper speed in transferring from home screen to activity screen	◉	○	○	○	○

Language *

5 is the highest and 1 is the lowest

	5	4	3	2	1
Volume	◉	○	○	○	○
Used Voice	◉	○	○	○	○

Accessibility *

5 is the highest and 1 is the lowest

	5	4	3	2	1
The mobile application can be accessed easily from the device.	◉	○	○	○	○

Functions *

5 is the highest and 1 is the lowest

	5	4	3	2	1
Its functions are unique from other Speech Apps	◉	○	○	○	○
It provides useful functions for a Speech Generating app	◉	○	○	○	○

Other comments and suggestions

You can have a voice that is not that slang, o better have a local voice recording to make it more understandable mainly by our Filipino audiences.

Signature *

Your signature will serve as a proof that you acknowledge the information that you have provided.

jased111 - Julie ...