A Study on Persuasive System Features to Help Kids with Speech Delay Problem

BY

HANG WEI HEN

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF INFORMATION SYSTEMS (HONOURS) INFORMATION SYSTEMS ENGINEERING

Faculty of Information and Communication Technology

(Kampar Campus)

JANUARY 2024

UNIVERSITI TUNKU ABDUL RAHMAN

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Dr Zurida Ishak
Supervisor's name

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ACKNOWLEDGEMENTS

I would like to express my sincere thanks and appreciation to my supervisors, Dr Zurida Binti Ishak has given me this bright opportunity to engage in doing research Son persuasive system features to help kids with speech delay problem. Besides, he is even willing to take his precious time to give me some suggestions for improving for this project. I want to say million thanks to you.

In addition, I would like to thank my friends who were willing to hear my problem and provide suggestions for me. Thanks for your patience and love. Finally, I must say thanks to my parents and my family for their love, support, and continuous encouragement throughout the course.

ABSTRACT

Speech delay in children is a prevalent concern, often necessitating early intervention for optimal outcomes. Traditional therapy methods conducted solely by speech-language pathologists can be costly and inaccessible, prompting the need for alternative solutions. This research investigates the effectiveness of persuasive systems, particularly mobile applications, in addressing speech delay issues in children. A quantitative research approach was employed, utilizing a structured questionnaire distributed to parents of children with speech delay. Purposive sampling targeted this specific demographic to gain insights into the efficacy of mobile app features for speech delay therapy. Data collection involved four phases: literature review, questionnaire design, distribution, and analysis. Statistical methods, including regression analysis and t-tests, were employed to evaluate the effectiveness of persuasive system elements. Analysis of the data revealed significant positive correlations between various aspects of language development, including pronunciation, comprehension, expressive vocabulary, and articulation skills. Descriptive statistics indicated overall agreement among respondents regarding the effectiveness of different therapeutic methods incorporated into mobile applications. The findings suggest that mobile applications can serve as valuable tools in speech delay therapy, offering cost-effective, accessible, and engaging interventions for children. The study contributes insights into the design and implementation of persuasive systems tailored to address speech delay issues, benefiting both parents and society by promoting early intervention and enhancing developmental outcomes. This research underscores the potential of persuasive systems, particularly mobile applications, in augmenting traditional speech delay therapy methods. By leveraging technology to deliver tailored interventions, such systems can facilitate early detection, intervention, and ongoing support for children with speech delay, ultimately improving their communication abilities and quality of life.

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LIST OF ABBREVIATIONS

MASSDEC	Mobile Application to Support Speech Delay Children
GU	Game Usability
MO	Mobility
GP	Gameplay

Chapter 1

Introduction

In this chapter, we present the background and motivation of our research, our contributions to the field, and the outline of the thesis.

1.1 Problem Statement and Motivation

1.1 Problem Statement

Although now many persuasive systems and applications available is having features that support speech delay in children. But there is always a catch to everything. Here are some reasons why speech delay therapy with only a speech-language pathologist is ineffective, and why a persuasive system or application is required.

1.1.1 Cost is higher compared to using the application

Most parents cannot afford expensive fees for their children's therapy so many parents choose to ignore this serious problem for their children. The cost is high because the therapy can be influenced by the setting in which it is delivered. Therapy delivered in a private practice or clinic is typically more expensive than therapy delivered through a mobile application or system. This is due to the high overhead costs of private practices and clinics. Teletherapy, or therapy delivered via video conferencing, can also have an impact on treatment costs. It is usually less expensive than in-person therapy but more expensive than self-guided therapy.

1.1.2 Unable to conduct therapy practice anytime anywhere

The significant benefit of the persuasive system is offering an easily accessible way for children to practice at home. Given that the frequency of practice and the quality of guidance are critical to progress, persuasive systems have the potential to significantly increase and accelerate children's development. Furthermore, practicing in the comfort of their own home with only their family or caregivers present can help children relax. A comfortable environment and being surrounded by people they know will help them perform better.

1.1.3 Capability of an application or system to provide multiple features

The mobile application or system can provide many features, such as a screening tool for detecting children's speech delays, as well as conduct speech therapy by answering some questions and generating analysis. Furthermore, the application offers assistance and feedback to parents. When it comes to speech delay therapy, a speech-language pathologist only uses traditional methods to provide treatment and does not have many other options.

1.2 Objectives

1.2.1 To investigate the factors in designing the apps of speed delay for kids.

The project's main goal is to assist children with speech delays in early detection and intervention. Early detection is essential. Early detection of any delay in a child's developmental milestone is essential so that parents can prepare for early intervention to enhance their child's development using the persuasive system.

1.2.2 To aid developer develop apps of speed delay for kids.

The process of seeking therapy and diagnosis is costly and inconvenient, and there is a dearth of knowledge concerning speech delay and early detection. Therefore, the persuasive system about speech delay will benefit both parents and society.

1.3 Project Scope and Direction

The scope of this study is to find out the factors in designing the app of speech delay for kids. Then, with the focus mostly on early identification and treatment. With the aim of helping children with speech difficulties, the study seeks to determine and understand the critical components that make these apps useful. Furthermore, via examining the opportunities and difficulties associated with establishing apps especially designed to treat children's speed delay, the research aims to guide app developers on how to create intentional and effective interventions.

The primary goal is to bridge the gap between the pragmatic and easily accessible features of well-designed apps and the early identification and intervention required for speech delays, so making a valuable contribution to the field of early childhood development. The research helps society by addressing the issues brought up by the expense and hassle of using conventional therapy and diagnostic techniques. It also helps parents by helping them plan for and promote early intervention.

1.4 Contributions

This project will undoubtedly benefit children and parents by assisting in the treatment and screening of speech delay problems. The system feedback will be included in the upcoming speech delay persuasive system and will be able to provide overall feedback once the children have completed answering all of the questions in the module. The children understand why the answer he/she chose is incorrect and what the correct answer is and how to pronounce the word. Aside from that, the system will provide overall feedback based on communication and behavioral tests that parents and children must complete. It is to provide analysis based on their responses and to guide parents step by step on how to cope.

Aside from that, the upcoming persuasive system will enable users to review the history of their activities. This is due to data being saved in the database. After logging into the system, users can see and refer back to what the children have previously done. It is also a useful tool for speech therapists to use because they can see the average rate obtained in the activity history and determine the situation of the children.

Last but not least, Google Maps will be used to locate all Speech Therapist Centres near the user in the upcoming speech delay persuasive system. The user can view information about nearby Speech Therapist Centres such as name, address, phone number, and reviews. As a result, based on the system's analysis, it will recommend that the user visit which center.

1.5 Report Organization

This report is organized into 6 chapters: Chapter 1 Introduction, Chapter 2 Literature Review, Chapter 3 Research Methodology, Chapter 4 Research Finding, Chapter 5 Summary and Conclusion. The first chapter is the introduction of this project which includes problem statement, project background and motivation, project scope, project objectives, project contribution, and report organization. The second chapter is the literature review carried out on several existing Speech Delay Therapy applications in the market to evaluate the strengths and weaknesses of each application. The third chapter is discussing the research methodology of this project includes introduction, research method, and research framework. The fourth chapter is regarding the research finding that done by using SPSS software. Chapter 4 includes introduction, descriptive, correlations, T-test,and conclusions. Furthermore, the fifth chapter reports the summary and conclusions of the research.

Chapter 2
Literature Review

2.1 Existing Speech Delay Therapy Application

MASSDEC

2.1.1 Brief

MASSDEC (Mobile Application to Support Speech Delay Children) [2] was created to help children with speech delays learn basic Malay vocabulary. The application had five modules and was built with the [2] ADDIE model. Numbers, Fruits, Colors, Transport, and Animals are among the modules. To assist students, quizzes are provided at the end of each module. The application included multimedia components. The environmental impact on student learning and behavior should be emphasized when teaching students with speech delays. The learning environment is influenced by the physical, sensory, and surrounding environment.

Figure 2.1 MASSDEC Modules Page

2.1.2 Strength

MASSDEC [2] has conducted evaluations by experts in multimedia design to use and thoroughly test the application. Both specialists agreed that the title screen met the requirements for attracting the user's attention. It can attract children's attention and arouse their interest in learning due to the main interface design's use of gorgeous landscapes and captivating images. Furthermore, User can explore how to pronounce vocabularies related to numbers in Malay. Audio sound to support explanation was also provided. Children who can read, write, and pronounce the explanation.

Figure 2.2 Main Interface of MASSDEC

2.1.3 Limitation

The Malay language is the only one supported by MASSDEC [2]. Children of other races may not understand what the content is attempting to convey. Aside from that, the application does not provide feedback for incorrect answers to let the user know why the other answer is correct. Furthermore, the application lacks the screening tool used to determine the severity of speech delay. It is necessary to know which modules are most appropriate for them to learn more effectively.

2.1.4 Recommendation

It is recommended that MASSDEC [2] add more languages such as Chinese and English. Because it is simple for children to understand, more people will likely use the application. It is also suggested that a summary of the total question that was answered correctly and incorrectly be included, as well as feedback based on the answer that the user chose, is incorrect and what the correct answer should answer. Furthermore, the screening tool used to determine the severity of speech delay should be included in the application. This function can assess the severity of a child's speech delay problem and

recommend the next steps.

2.2 SPEECHY

2.2.1 Brief

SPEECHY [1] is a mobile app that allows users to conduct assessments, receive results, and identify which problems their children are having. This mobile application also includes Google Maps features to locate all Speech Therapist Centres in Kuala Lumpur so that the user can immediately refer to the expert for further evaluation after completing the test.

2.2.2 Strength

Users must register their child profile when logging into SPEECHY [1] for the system to save the child's details into the database. When logging in again, the system will display a history of previous activity to allow the user to refer back. Additionally, the system includes a communication and behavior test to detect levels and as an indicator of a speech delay problem. The test question is special in that it requires the child to reflect before they can respond. Only then can they respond fully, having understood the scenario, having knowledge of the facts, etc. This could be more effective diagnostic prescriptive teaching for children with speech delays. Aside from that, SPEECHY [1] uses Google Maps to locate all Speech Therapist Centres in Kuala Lumpur, allowing the user to immediately refer to an expert after completing the test for further evaluation.

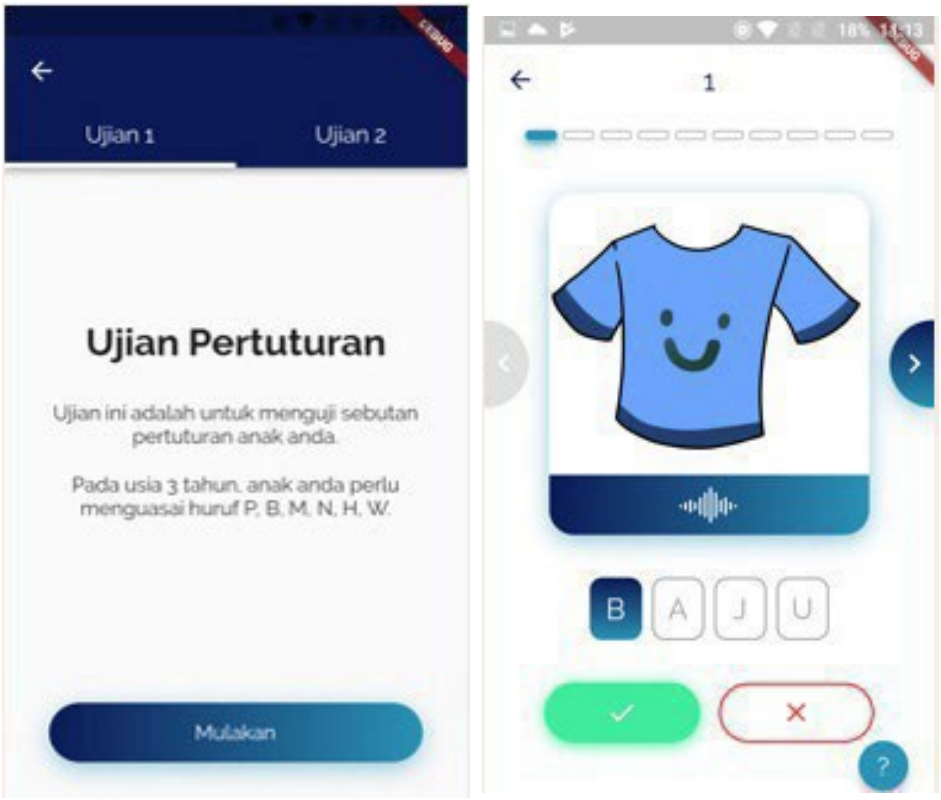

Figure 2.3 Interface of Communication Test

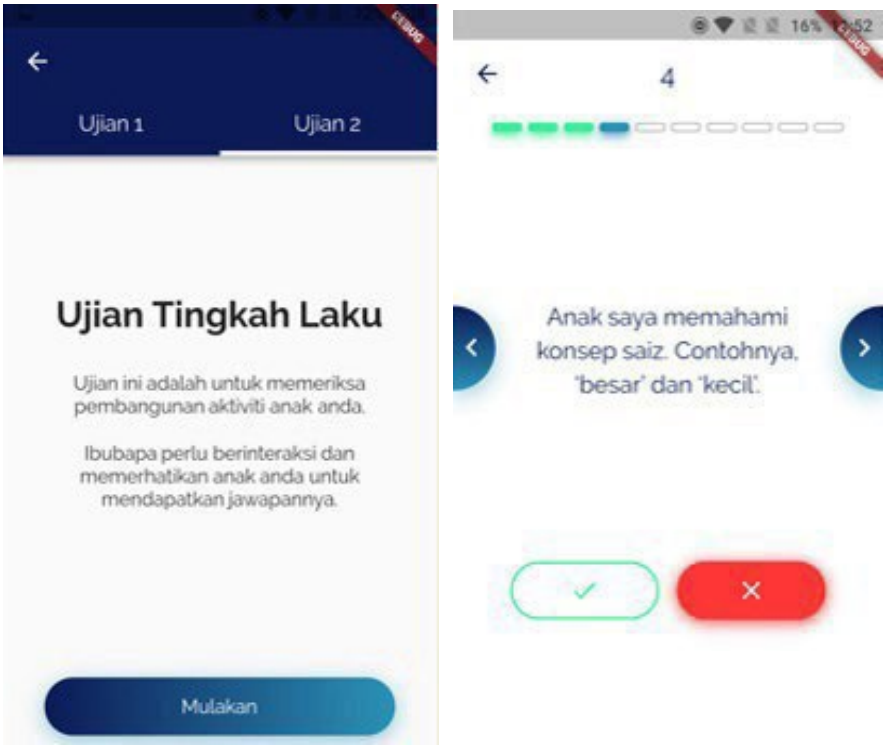

Figure 2.4 Interface of Behaviour Test

2.2.3 Limitation

The interface of SPEECHY[1] is looking not so attractive to children as its background is not colorful, the background color is mostly white with a little blue color. Children might not so interested to use it. Furthermore, the design of the interface is complex, and it is not so user-friendly for first-time users. The new user that first time logs in to use, will take a long time to browse the function.

2.2.4 Recommendation

It is recommended to redesign the interface to make it more appealing and interesting by including some photos and colors in the interface background. Furthermore, the interface should be simple and easy to use. It is possible to say that the application is simple to use because the first-time user does not need to spend time locating where the function is located, and after logging in, the user can immediately see the function.

2.3 Speech Therapy Mobile Application Games

2.3.1 Brief

An adaptation of the game usability (GU) [3] component of the heuristic assessment approach will be used to assess a local prototype mobile speech treatment application. To evaluate the effectiveness of an application or software product, heuristic evaluation[3] was developed. As a result, they proposed and created a collection of heuristics evaluations specifically made for mobile games, as shown in Figure 2.5. The three parts of the heuristics model are game usability (GU), mobility (MO), and gameplay (GP). The interface and controls that players utilise to interact with the game are considered by the game usability heuristic. Usability makes sure that the player enjoys playing a good game. The mobility heuristic concentrates on the game's mobility and discusses problems that limit it. The third heuristic, gameplay concerns, is shown when players engage with the rules and mechanics of the game. Because the interface created for children is the main concern, particularly for kids with speech difficulties, we exclusively employed the Game Usability (GU) heuristic for the trial [3].

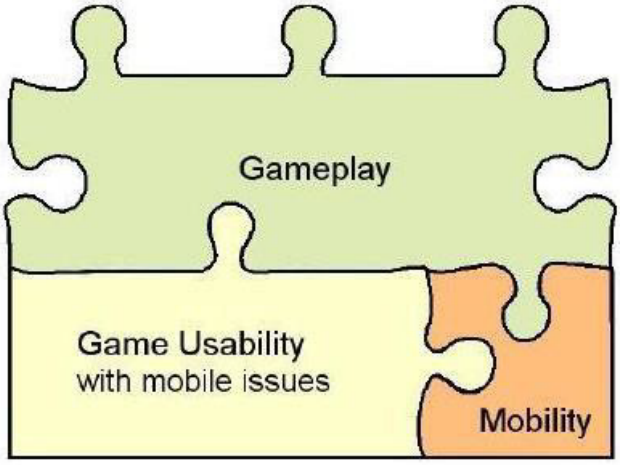

Figure 2.5 Three components of the heuristics model

2.3.2 Strength

The interactive features of the GU7 [3] and GU8 [3] interfaces include animation, attractive and colorful graphics, and sound effects. Children able learn the sound of phonic for each letter of A to Z and sound of each word based on the phonic sound for each letter of A to Z . Furthermore, the prototype includes feedback features. After receiving positive feedback from the mobile application, the children are more confident. In the menu of the game consist of quiz that let children identify the phonic sound and match the same phonic sound in memory sound. This able to help the way the way in which child pronounce words or produce sounds.

Figure 2.6 Main Menu of Speech Therapy Mobile Application

2.3.3 Limitation

The interface lacks visually appealing graphics. Most children enjoy colorful things and will only play if they are drawn to a graphic or sound. Furthermore, this mobile application lacks more useful features. The mobile application's feature is limited to basic test questions.

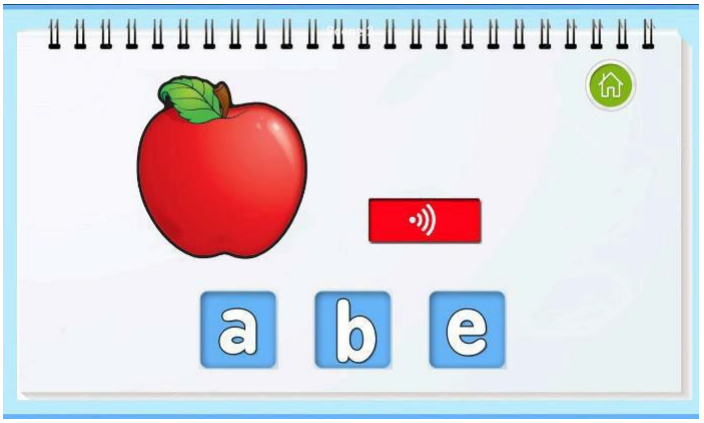

Figure 2.7 Phonic Sound Page

2.3.4 Recommendation

It is advised that to match user demand, the interface of the mobile application be built with more colorful images and amusing audio or sounds to draw children's attention. Additionally, incorporate useful features into the mobile application. One of the featured [3] Google Maps capabilities, for instance, is the capability to identify all Speech Therapist Centres near one's residence.

2.4 I Can Talk

2.4.1 Brief

For children with speech delays, I Can Talk [4] was created using the Cordova environment to help them communicate and express themselves. The programme has been designed with tablets and mobile phones in mind. It was developed to meet the needs of kids with a range of ages and skill sets. Both severe and mild deficits can be a part of autism spectrum disorder. This programme was created using techniques that have been shown to work with kids who have high, moderate, and mild levels of autism spectrum disorder [4]. youngsters may recognise things with their original meanings and associations thanks to the application's [4] visual and audio aids, which also make youngsters feel more at ease. The programme stands out since it was created in Arabic [4] for Saudi autistic children, unlike the majority of other autistic programmes, which are created for English language learners.

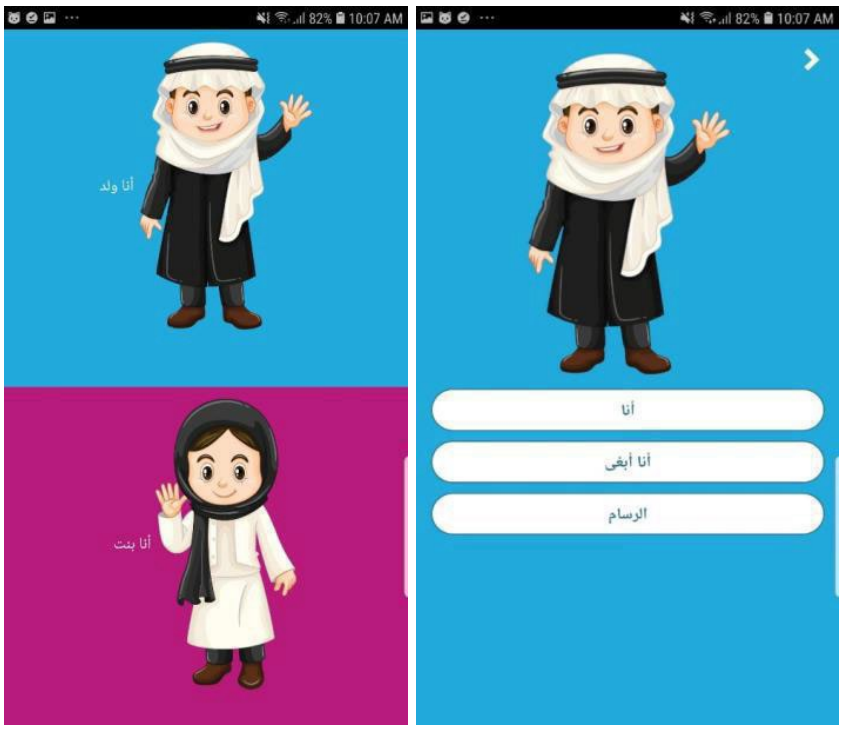

Figure 2.8 Main Interface of I Can Talk

2.4.2 Strength

The mobile software offers intriguing features including the ability for children to [4] express their emotions, which can aid kids in gradually building self-confidence. For instance, if the child chooses I want to drink, the programme shows a menu of drinks from which the child can select one, such as milk, orange juice, or water. (words with expression) The interface design is also highly attractive, featuring vibrant colours and a choice of boy or girl voice to start using the application.

Figure 2.9 I Am Happy

Figure 3.0 I Want to Drink

2.4.3 Limitation

The application only supports one language, and that is Arabic. Because the developer is tailored specifically to Arabic learners [4]. Furthermore, the application has too few features to support children's speech delays. The user is unable to view the activity history.

2.4.4 Recommendation

It is recommended that more languages, particularly the international language English, be added to serve more users. Furthermore, the application can be enhanced with additional features to assist children with speech delays. For instance, one of the features that can be added to the application is a screening

tool for detecting the level of speech delay.

2.5 Questionnaire Design Based on Previous Research

The questionnaire is designed to assess the efficacy of techniques and strategies derived from previous research aimed at addressing specific challenges faced by children with speech delays. It covers four key areas: pronunciation improvement, comprehension enhancement, expressive vocabulary development, and articulation. For each area, respondents are presented with a list of techniques and asked to indicate their agreement or disagreement regarding their effectiveness. Techniques include minimal pairs, visual aids, interactive media, and various exercises tailored to each aspect of speech and language development. This questionnaire aims to provide valuable insights into the practical applicability and effectiveness of these methods in supporting children with speech and language difficulties.

Table 1.0 List of Questionnaire

What can be built in the Application	References (Author of Article/Journal)	Questionnaire
Pronunciation Children with speech delays have trouble pronouncing words or entire sentences that are appropriate for their age. It can be frustrating for both the child and the parents to try to understand children who have speech delays.	[5] Speakometer	**Minimal pairs "bat" and "pat" are helpful to improve pronunciation [1]** **[ ] Agree [ ] Disagree**
	[6] M. S. Leanne Sherred,	**Showing a picture of a snake and playing the sound "Sssss" helpful to improve pronunciation [2]** **[ ] Agree [ ] Disagree**
	[7]Bracu	**Teaching by using sound like"bat" leading to "cat," "rat," and "hat"), are helpful to improve pronunciation [3]** **[ ] Agree [ ] Disagree**
	[8] M. G. T. Espinoza, Y. I. C. Cárdenas, C. V. P. Martinez, and F. I. B. Saavedra	**Presenting a set of pictures and identify the target sound helpful to improve pronunciation [4]** **[ ] Agree [ ] Disagree**
	[9] "Lund University"	**Singing familiar songs can improve pronunciation. [5] [ ] Agree [ ] Disagree**

	[10] How to improve pronunciation? an in-depth	**Emphasizing the "s" in "sun" or the "f" in "fish" improve pronunciation. [6]** **[ ] Agree [ ] Disagree**
	[11] M. Gagen	**Mouth Positioning demonstrating producing specific sounds helpful in improve pronunciation [7]** **[ ] Agree [ ] Disagree**
	[12]CLST-when_children_learn_sounds.PDF	**Picture of a "cat" for the /k/ sound, a "dog" for the /d/ sound help to improve pronunciation . [8] [ ] Agree [ ] Disagree**
	[13] E. Path	**Short videos of characters celebrating when pronounces words correctly helpful in pronunciation. [9]** **[ ] Agree [ ] Disagree**
	[14] D. M. Brinton,	**Highlight the differences using visual cues like colored overlays or waveforms help in improve pronunciation.[10]** **[ ] Agree [ ] Disagree**
	[15] “Progress bars”	**Visual progress trackers such as stars, badges, or virtual rewards help to improve pronunciation.[11]**

		[ ] Agree [ ] Disagree
	[16] By: Edwin S. Ellis	**Practice 's' and 'n,' by repeating words like 'sun,' 'sand,' 'snake improve pronunciation [12]** **[ ] Agree [ ] Disagree**
	[17] R. Laghari	**Stressing the "p" in "jump" or the "t" in "cat."** **Help to improve pronunciation[13] [ ] Agree [ ] Disagree**
	[18] "50 tongue twisters to improve pronunciation in English"	**Tongue twisters like "Eleven eloquent elephants elegantly eating eggplants." helping improve pronunciation [14]** **[ ] Agree [ ] Disagree**
	[19] D. for Education	**Match rhyming words by dragging the train to the picture of a plane while saying both words aloud help to improve pronunciation[15]** **[ ] Agree [ ] Disagree**

Comprehension A limited vocabulary due to speech difficulties can have a substantial impact on a reader's ability to comprehend what they are reading. Without assistance, these kids may probably struggle to communicate effectively once they enter school and may find it difficult to explain what they understand about particular subjects or readings[12].	[20] D. Howe et al., "Visual imagery"	**Exercises that pair words with images help to improve comprehension [16]** **[ ] Agree** **[ ] Disagree**
	[21] (PDF) what is listening comprehension and what does it take to ...	**Answer questions based on audio clips of conversations, stories, or instructions help to improve comprehension.[17]** **[ ] Agree [ ] Disagree**
	[22] "Use images and media to enhance understanding," Digital Accessibility	**A series of pictures to tell a story is effective to enhancing comprehension[18]** **[ ] Agree [ ] Disagree**
	[23] By: C.R. Adler, "Seven strategies to teach students text comprehension"	**Following instructions or completing task based on given information help to improve comprehension.[19]** **[ ] Agree [ ] Disagree**
	[24] "Comprehension," Read Naturally, Inc.	**Listen to the story and follow along with the pictures help to improve comprehension.[20]** **[ ] Agree [ ] Disagree**
	[25] "Comprehension: Activities for your kindergartener," Reading Rockets	**Incorporate daily life scenarios that the child can relate to can help to improve comprehension.[21]** **[ ] Agree [ ] Disagree**

Expressive Vocabulary Children with expressive language delays frequently struggle to string words together correctly to form sentences or phrases [13].	[26] K. S. W. Admin	**A set of letters drag and combine to form new words helpful in expressive vocabulary** **[ ] Agree [ ] Disagree**
	[27] O. U. P. ELT	**Record own voice saying a word then play it back able improve expressive vocabulary** **[ ] Agree [ ] Disagree**
	[28] C. O'Donnell	**Show a picture of a dog and ask to say the first word are helpful in expressive vocabulary** **[ ] Agree [ ] Disagree**
	[29] "Emojis"	**Display various emoticons and ask to identify and explain helpful in expressive vocabulary** **[ ] Agree [ ] Disagree**
	[30]"Expressive language disorder"	**Show the word "hot" and ask to identify the antonym, which is "cold " helpful in expressive vocabulary** **[ ] Agree [ ] Disagree**

Articulation Speaking properly is difficult for a child with an articulation impairment.Moving the lips, tongue, teeth, palate (roof of the mouth), and respiratory system (lungs) in unison is necessary for sound generation [14].	[31] Author links open overlay panelLan Wang a et al.	**Displays visual animations of the tongue and lips help improve articulation.** **[ ] Agree [ ] Disagree**
	[32] Author links open overlay panelLan Wang a et al.	**Discriminate "ship" and "sheep," by selecting the correct picture or word is helpful in articulation** **[ ] Agree [ ] Disagree**
	[33] (PDF) recognizing self in puppet controlled virtual avatars	**Virtual puppet shows or talking avatars that respond to the child's speech input helpful in articulation.** **[ ] Agree [ ] Disagree**
	[34] Public Speaking, "What are some exercises to improve your articulation?"	**Mimic various mouth movements like stretching, puckering, and rolling their lips, promoting flexibility and control improve articulation** **[ ] Agree [ ] Disagree**

Chapter 3
Research Methodology

3.1 Introduction

In this study project titled "A Study on Persuasive System Features to Help Kids with Speech Delay Problem," a quantitative research method is used to assess the effects of persuasive system characteristics on kids with speech delay issues. The study focuses on how well certain mobile app features work in helping children with speech delay receive therapy.

The research methodology entails creating a structured questionnaire with questions about the usefulness of mobile apps in speech delay therapy. Only parents of children with speech delay issues are given the questionnaire. The questions seek to elicit comments and insights regarding the usefulness of various app features, such as the enhancement of pronunciation through the usage of simple pairings like "bat" and "pat."

Purposive sampling, with a specific focus on parents of children with speech delays, was chosen as the sampling technique for this study. This decision was made with the intention of focusing on a particular participant group that has firsthand knowledge of the difficulties posed by speech delay and the use of mobile apps for therapy. By focusing on this group, the study can acquire pertinent information from actual participants that is pertinent to the study's subject.

Purposive sampling is acceptable in this situation since the research aims to comprehend the perspectives and experiences of a particular population: parents of children with speech delays. The research can gain important knowledge on the

effectiveness of persuasive system elements in the context of speech delay therapy by obtaining insights from this group. Additionally, using this approach makes it possible to explore the subject in depth and gain a thorough grasp of how these characteristics help kids with their pronunciation and communication abilities.

The quantitative technique is suited for this study since it allows for the collecting of numerical data that can be statistically analysed. The research can make objective judgements regarding the app features' perceived usefulness by examining the parents' responses. This approach offers an organised and methodical manner to evaluate the effect of persuasive system elements on speech delay therapy and add evidence-based insights to the profession.

3.2 Research Method

This research will be executed in four distinct phases: the literature review, questionnaire design, data collection, and data analysis. Each phase is crucial for obtaining comprehensive insights into speech delay and the efficacy of a speech delay therapy app.

In Phase 1, the literature review serves as the foundation for the study. This phase involves an in-depth analysis of existing literature on speech delay, encompassing factors contributing to speech delay, therapy approaches, and technological interventions such as speech delay therapy apps. The objective is to gather a comprehensive understanding of the current state of knowledge in this domain. Additionally, the literature review may explore studies on the effectiveness of technology-based interventions for speech delay.

Phase 2 focuses on the design of a questionnaire tailored to investigate speech delay and the potential therapy app. Survey questions will be crafted to cover aspects related to speech delay, therapy app features, and user preferences. The validation of the questionnaire is imperative to ensure the reliability and validity of the collected data. The questionnaire will then be distributed to a targeted sample,

possibly including parents, caregivers, or professionals involved with speech-delayed individuals. This phase aims to gather firsthand insights into the challenges faced and preferences regarding speech delay interventions.

Moving on to Phase 3, data collection involves the sampling process and distribution of the survey. The sampling strategy needs to be carefully considered to ensure representation from relevant demographics, such as age groups, severity of speech delay, and technological proficiency. The respondent will be the parents of the speech delay kid that had use any app related to speech delay. The survey will be distributed through various channels, including online platforms, support groups, and healthcare facilities. This phase will provide a diverse set of responses, enriching the dataset for subsequent analysis.

In Phase 4, data analysis takes center stage. Statistical tools, specifically SPSS, will be employed to analyze the collected data. Regression analysis will help identify relationships between variables, t-tests can be utilized to compare means, ANOVA to assess group differences, and chi-square tests for categorical data. The results will be interpreted to draw conclusions regarding the effectiveness of speech delay therapy apps, factors influencing speech delay, and potential correlations among variables.

3.3 Research Framework

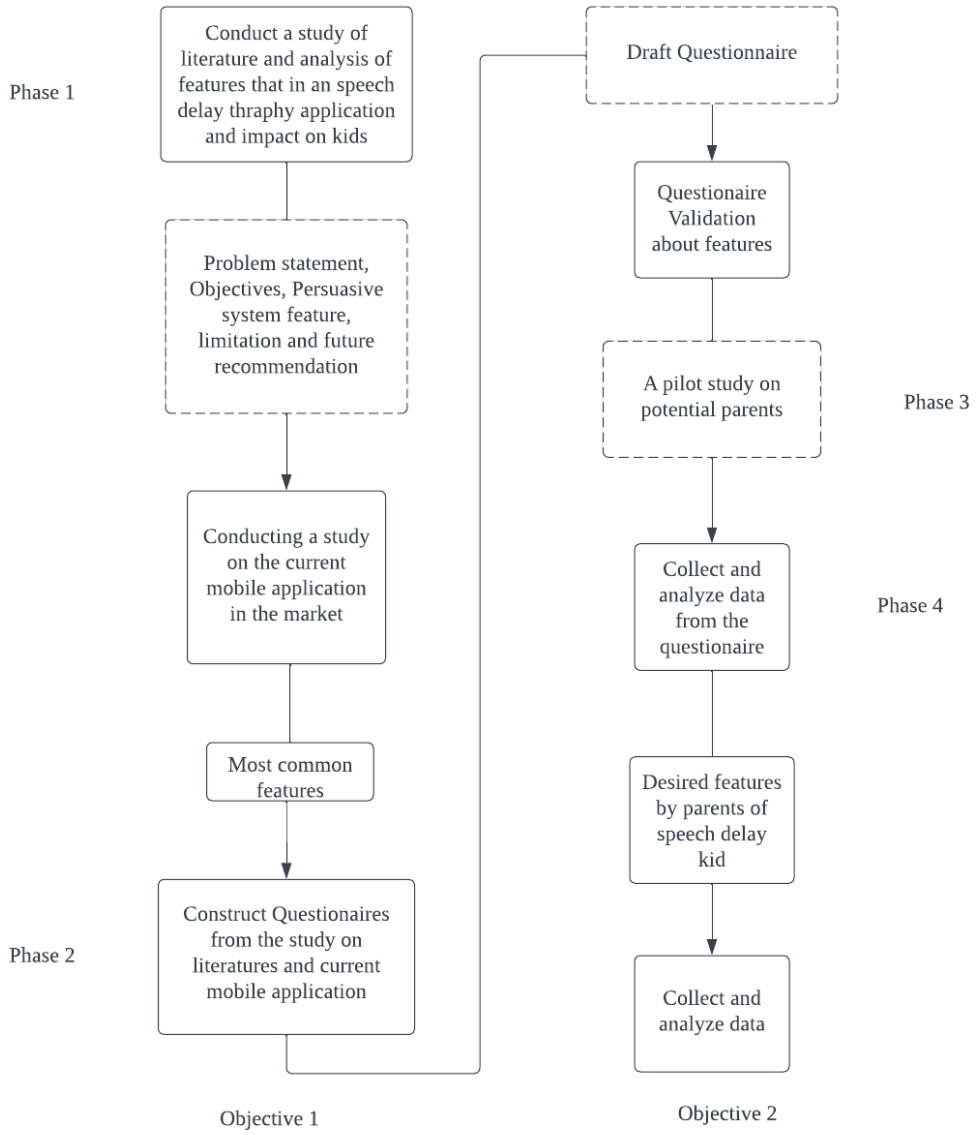

Figure 3.0 Research Framework

Chapter 4
Research Finding

4.1 Introduction

The present chapter focuses on the research findings obtained through the utilisation of a mixed methods strategy. The data was collected using questionnaires and descriptive analysis and inferential analysis were conducted to produce the results. This chapter provides a more comprehensive description of the study's findings, building upon the evaluation offered in the preceding chapter.

4.2 Descriptive

Table 1.1 Descriptive of Pronounciation

Questions	Agree	Disagree	Mean	SD
1. Minimal pairs "bat" and "pat" are helpful to improve pronunciation	91	20	1.1802	±0.38
2. Showing a picture of a snake and playing the sound "Sssss" helpful to improve pronunciation	89	22	1.1982	±0.40
4. Teaching by using sound like "bat" leading to "cat," "rat," and "hat" are helpful to improve pronunciation	98	13	1.1171	±0.32
5. Presenting a set of pictures and identifying the target sound are helpful to improve pronunciation	80	31	1.2793	±0.45
6. Singing familiar songs can improve pronunciation	81	30	1.2703	±0.44
7. Emphasizing the "s" in "sun" or the "f" in "fish" improves pronunciation	88	23	1.2072	±0.40
8. Mouth Positioning demonstrating producing specific sounds helpful in improving pronunciation	97	14	1.1261	±0.33
9. Using a picture of a "cat" for the /k/ sound, a "dog" for the /d/ sound helps to improve pronunciation	82	29	1.2613	±0.44
10. Short videos of characters celebrating when pronouncing words correctly are helpful in pronunciation	71	40	1.3604	±0.48
11. Highlighting the differences using visual cues like colored overlays or waveforms helps in improving pronunciation	90	21	1.1892	±0.39
12. Visual progress trackers such as stars, badges, or virtual rewards help to improve pronunciation	83	28	1.2523	±0.43
13. Practicing 's' and 'n' by repeating words like 'sun,' 'sand,' 'snake' improves pronunciation	94	17	1.1532	±0.36

14. Stressing the "p" in "jump" or the "t" in "cat" improves pronunciation	90	21	1.1892	±0.39
15. Tongue twisters like "Eleven eloquent elephants elegantly eating eggplants" help improve pronunciation	82	29	1.2613	±0.44
16. Matching rhyming words by dragging the train to the picture of a plane while saying both words aloud helps to improve pronunciation	99	12	1.1081	±0.31

The table above presents responses regarding various methods aimed at improving pronunciation skills, including agreement levels, means, and standard deviations. Especially, respondents generally agreed that these methods are effective for enhancing pronunciation. For instance, a significant majority agreed that minimal pairs like "bat" and "pat" (91 agree, 20 disagree) or teaching through sound associations (98 agree, 13 disagree) contribute positively to pronunciation improvement. Similarly, incorporating visual aids, such as presenting pictures to identify target sounds (80 agree, 31 disagree), or emphasizing specific sounds like "s" and "f" (88 agree, 23 disagree), received substantial agreement.

Next, methods involving multimedia elements were also well-received. Short videos of characters celebrating correct pronunciation (71 agree, 40 disagree) and matching rhyming words with images (99 agree, 12 disagree) garnered strong support. Additionally, incorporating progress trackers (83 agree, 28 disagree) and utilizing tongue twisters (82 agree, 29 disagree) were perceived positively.

Interestingly, methods emphasizing repetition, such as practicing with specific words like "sun," "sand," and "snake" (94 agree, 17 disagree), or stressing particular sounds like "p" and "t" (90 agree, 21 disagree), received slightly lower agreement levels compared to other methods. However, despite variations in agreement levels, all methods demonstrated means above 1 on a scale of 1 to 2, indicating overall agreement with their effectiveness in pronunciation improvement. Inferential measures of response dispersion around the mean, standard deviations indicate that respondents' agreement with the various methods was relatively consistent. Hence, although there may be variations in individual preferences, the prevailing agreement among participants affirms the effectiveness of a range of approaches in improving pronunciation abilities.

Table 1.2 Descriptive of Comprehension

Questions	Agree	Disagree	Mean	SD
1. Exercises that pair words with images help to improve comprehension	80	31	1.2793	±0.45
2. Answer questions based on audio clips of conversations, stories, or instructions help to improve comprehension	81	30	1.2703	±0.44
3. A series of pictures to tell a story is effective to enhancing comprehension	85	26	1.2342	±0.42
4. Following instructions or completing task based on given information help to improve comprehension	89	22	1.1982	±0.40
5. Listen to the story and follow along with the pictures help to improve comprehension.	82	29	1.2613	±0.44
6. Incorporate daily life scenarios that the child can relate to can help to improve comprehension	90	21	1.1892	±0.39

The table of comprehension presents responses regarding various methods aimed at improving comprehension skills, including agreement levels, means, and standard deviations. Overall, respondents demonstrated a strong consensus on the effectiveness of these methods in enhancing comprehension. Methods that incorporate visual elements were particularly well-received, with exercises pairing words with images (80 agree, 31 disagree), a series of pictures to tell a story (85 agree, 26 disagree), and listening to stories while following along with pictures (82 agree, 29 disagree) all receiving substantial agreement.

Moreover, respondents also agreed that interactive methods, such as answering questions based on audio clips (81 agree, 30 disagree) and following instructions or completing tasks based on given information (89 agree, 22 disagree), are effective for improving comprehension. Moreover, incorporating daily life scenarios that children can relate to was perceived as beneficial (90 agree, 21 disagree).

Other than that, the means across all methods ranged between 1.1892 and 1.2793 on a scale of 1 to 2, indicating a generally high level of agreement with the effectiveness of these comprehension-enhancing techniques.Standard deviations, which quantify the extent to which responses deviate from the mean, indicate a high degree of agreement among respondents regarding the effectiveness of the various methods, implying a relatively stable consensus. Hence, the data suggests that respondents recognise a range of approaches, such as those incorporating real-life scenarios, interactivity, and visual aids, as efficacious methods for enhancing comprehension abilities.

Table 1.3 Descriptive of Expressive Vocabulary

Questions	Agree	Disagree	Mean	SD
1. A set of letters drag and combine to form new words helpful in expressive vocabulary	88	23	1.2072	±0.40
2. Record own voice saying a word then play it back able improve expressive vocabulary	79	32	1.2883	±0.45
3. Show a picture of a dog and ask to say the first word are helpful in expressive vocabulary	92	19	1.1712	±0.37
4. Display various emoticons and ask to identify and explain helpful in expressive vocabulary	82	29	1.2613	±0.44

Table 1.3 descriptive of expressive vocabulary illustrate the responses regarding methods aimed at improving expressive vocabulary, including agreement levels, means, and standard deviations. Overall, respondents demonstrated varying levels of agreement on the effectiveness of these methods in enhancing expressive vocabulary. Methods such as showing a picture of a dog and asking to say the first word (92 agree, 19 disagree) and using a set of letters to drag and combine to form new words (88 agree, 23 disagree) received relatively high levels of agreement. These methods likely leverage visual and interactive elements to engage learners, making the process of vocabulary acquisition more stimulating and effective.

On the other hand, methods like displaying various emoticons and asking to identify and explain (82 agree, 29 disagree) received somewhat lower levels of agreement. While still considered helpful by a majority of respondents, these methods may not be as universally effective as those involving more direct interaction or visual aids.

The means across all methods ranged between 1.1712 and 1.2883 on a scale of 1 to 2, indicating a moderate to high level of agreement with the effectiveness of these expressive vocabulary-enhancing techniques. Standard deviations, which measure the dispersion of responses around the mean, indicates relatively consistent agreement among respondents across the different methods, indicating a general consensus on their efficacy, albeit with some variability. Therefore, while some methods may be more widely accepted than others, the data suggests that a variety of approaches can be effective in improving expressive vocabulary skills.

Table 1.4 Descriptive of Expressive Vocabulary

Questions	Agree	Disagree	Mean	SD
1. Show the word "hot" and ask to identify the antonym, which is "cold" helpful in expressive vocabulary	99	12	1.1081	±0.31
2. Virtual puppet shows or talking avatars that respond to the child's speech input helpful in articulation	96	15	1.1351	±0.34
3. Mimic various mouth movements like stretching, puckering, and rolling their lips, promoting flexibility and control improve articulation	95	16	1.1441	±0.35

The table 1.4 descriptive of articulation shows responses regarding the perceived effectiveness of different methods in improving expressive vocabulary and articulation skills. For the first question, showing the word "hot" and asking to identify the antonym, which is "cold," respondents largely agreed with its effectiveness (99 agree, 12 disagree). This method likely facilitates vocabulary expansion by contextualizing words within their semantic opposites, aiding in understanding and retention.

Regarding the second question, virtual puppet shows or talking avatars that respond to the child's speech input were considered helpful in articulation by a majority of respondents (96 agree, 15 disagree). This interactive approach likely engages learners and provides real-time feedback, encouraging correct pronunciation and articulation.

For the third question, mimicking various mouth movements such as stretching, puckering, and rolling their lips to promote flexibility and control in articulation received significant agreement (95 agree, 16 disagree). This approach is expected to improve articulatory awareness and coordination through the promotion of physical exercises that specifically target the muscles involved in speech production.

In short, the evidence indicates that these strategies are widely regarded as efficacious in enhancing expressive vocabulary and articulation abilities, since consensus was reached among respondents about their usefulness. The apparent effectiveness of these strategies in aiding language development and voice clarity is likely attributed to their interactive and engaging aspect.

4.3 Correlations

Table 1.5 Correlation Range

Correlation Range (±)	Strength
0.00 – 0.39	Weak Positive
0.40 – 0.79	Moderate Positive
0.80 – 0.99	Very Strong Positive
1	Perfect Positive

Sources: (Alaloul et al., 2021)

Table 1.6 Pearson Correlations (r)

Variables	Pearson Correlation Value (r)	Sig. value	Strength
Pronunciation	1	p < .001	Perfect Positive
Comprehension	.749**	p < .001	Moderate Positive
Expressive Vocabulary	.618**	p < .001	Moderate Positive
Articulation	.393**	p < .001	Weak Positive

** Correlation is significant at the 0.01 level (2-tailed).

The table 1.6 presents Pearson correlation coefficients (r) between different variables: Pronunciation, Comprehension, Expressive Vocabulary, and Articulation. Each correlation coefficient is accompanied by its significance level (Sig. value) and an indication of the strength of the correlation.

The correlation between Pronunciation and Comprehension is notably strong at r = 0.749**, with a p-value less than 0.001. This indicates a significant and moderate positive relationship between the two variables, suggesting that individuals with better pronunciation skills tend to have higher levels of comprehension, and vice versa.

Similarly, there is a moderate positive correlation between Comprehension and Expressive Vocabulary, with a correlation coefficient of r = 0.618** and a p-value less than

0.001. This indicates that individuals who comprehend language well also tend to have a richer and more extensive expressive vocabulary.

Furthermore, there is a weaker positive correlation between Comprehension and Articulation, with a correlation coefficient of r = 0.393** and a p-value less than 0.001. While statistically significant, this correlation suggests a less pronounced relationship compared to the previous ones. It implies that while there is some association between comprehension abilities and articulation skills, it is not as strong as the correlations observed between comprehension and pronunciation or expressive vocabulary.

In summary, the data shows that there are positive relationships between pronunciation, comprehension, expressive vocabulary, and articulation skills. Individuals with better pronunciation skills tend to have higher comprehension levels and a richer expressive vocabulary. However, the association between comprehension and articulation, while still significant, is comparatively weaker.

4.4 T-test

Table 1.7 One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Pronunciation	111	1.2102	.19052	.01808
Comprehension	111	1.2387	.25388	.02410
Expressive Vocabulary	111	1.2320	.22541	.02139
Articulation	111	1.1291	.21164	.02009

The table 1.7 displays one-sample statistics for four key variables: Pronunciation, Comprehension, Expressive Vocabulary, and Articulation. Each variable's statistics include the number of observations (N), the mean score, the standard deviation (Std. Deviation), and the standard error of the mean (Std. Error Mean). In terms of Pronunciation, the mean score is 1.2102, with a standard deviation of 0.19052 and a standard error of the mean of 0.01808. Comprehension exhibits a slightly higher mean score of 1.2387, along with a larger standard deviation of 0.25388 and a standard error of the mean of 0.02410. Expressive Vocabulary follows closely with a mean score of 1.2320, a standard deviation of 0.22541, and a standard

error of the mean of 0.02139. Conversely, Articulation displays the lowest mean score at 1.1291, with a standard deviation of 0.21164 and a standard error of the mean of 0.02009. These statistics unveil the central tendency and variability of scores within each variable, showcasing that participants generally scored slightly above the midpoint for pronunciation, comprehension, and expressive vocabulary, while articulation scores were slightly below the midpoint. The standard deviations highlight the spread of scores around the mean, with comprehension showing the widest spread and articulation the narrowest. Furthermore, the standard errors of the mean indicate the precision of the sample mean estimates, with lower values suggesting more precise estimates. Overall, these statistics offer valuable insights into the participants' performance on each variable, laying the groundwork for further analysis and interpretation.

Table 1.8 One-Sample Test

	Test Value = 0						
			Significance			95% Confidence Interval of the Difference	
	t	df	One-Sided p	Two-Sided p	Mean Difference	Lower	Upper
Pronunciation	66.923	110	<.001	<.001	1.21021	1.1744	1.2460
Comprehension	51.406	110	<.001	<.001	1.23874	1.1910	1.2865
Expressive Vocabulary	57.583	110	<.001	<.001	1.23198	1.1896	1.2744
Articulation	56.210	110	<.001	<.001	1.12913	1.0893	1.1689

The table 1.8 presents the results of one-sample t-tests conducted on four variables, pronunciation, comprehension, expressive vocabulary, and articulation, with a test value set at 0. Each row of the table includes the t-value, degrees of freedom (df), significance level (p-value), mean difference, and the 95% confidence interval of the difference for the respective variable.

For Pronunciation, the t-value is 66.923 with 110 degrees of freedom, indicating a highly significant difference from the test value ($p < .001$). The mean difference is 1.21021,

suggesting that participants scored significantly above the test value on Pronunciation, with a 95% confidence interval for the difference between 1.1744 and 1.2460.

Similarly, for Comprehension, the t-value is 51.406 with 110 degrees of freedom, showing a highly significant difference from the test value ($p < .001$). The mean difference is 1.23874, indicating that participants scored significantly above the test value on Comprehension, with a 95% confidence interval for the difference between 1.1910 and 1.2865.

Expressive Vocabulary also displays a highly significant difference from the test value, with a t-value of 57.583 and 110 degrees of freedom ($p < .001$). The mean difference is 1.23198, suggesting that participants scored significantly above the test value on Expressive Vocabulary, with a 95% confidence interval for the difference between 1.1896 and 1.2744.

Finally, for Articulation, the t-value is 56.210 with 110 degrees of freedom, indicating a highly significant difference from the test value ($p < .001$). The mean difference is 1.12913, suggesting that participants scored significantly above the test value on Articulation, with a 95% confidence interval for the difference between 1.0893 and 1.1689. Overall, these results demonstrate that participants scored significantly higher than the test value across all four variables, indicating proficiency in Pronunciation, Comprehension, Expressive Vocabulary, and Articulation. The findings of this study indicate that the participants exhibited proficiency in the language-related skills identified.

4.5 Conclusions

In summary, this chapter has presented a comprehensive analysis of the data that was gathered. Based on the comprehensive dataset obtained through the data collection technique, it important to note that the research findings were derived by analysing the data. As previously stated, the data methods used in this research, such as the Frequencies analysis, Descriptive analysis, Correlation analysis, and t-test analysis have been extensively explored.

Chapter 5
SUMMARY AND CONCLUSION

5.1 Introduction

Features of the persuasive system that is designed to help children with speech delay issues are explored and a thorough summary and conclusion are given. In order to emphasise the value of using mobile applications and persuasive systems in speech delay therapy, this chapter summarises the major conclusions and ideas from the previous chapters.

This chapter's opening portions highlight the fundamental issues that the research attempts to solve, most notably the drawbacks associated with traditional speech treatment methods, namely their high prices and restricted applicability. The discussion highlights the need to use cutting-edge strategies, such as persuasive systems, in order to get over these challenges and improve the effectiveness of speech delay treatments.

In addition, the research objectives listed in Chapter 1 are reviewed, demonstrating how each goal was addressed and accomplished during the investigation. In particular, the exploration of variables impacting speech delay app design and the support of app development are highlighted as major achievements, illustrating the usefulness of the study findings.

The project's direction and scope are carefully considered, with a focus on the importance of early detection and intervention in the management of speech delay concerns. Through the identification of crucial elements necessary for creating successful speech delay applications, the research helps close the gap between early childhood development requirements and accessible technology.

Moreover, the project's contributions are highlighted, highlighting the possible advantages for kids, parents, and society as a whole. The addition of resource recommendations, activity history tracking, and system feedback is an example of how concrete results might influence speech delay therapy procedures.

The research technique and phases are briefly summarised in the final remarks, demonstrating the methodical strategy used to collect data and analyse outcomes. The application of quantitative research methodologies made it easier to objectively assess the efficacy of the app's features, which has improved our understanding of the persuasive system components used in speech delay therapy.

5.2 Summary and Conclusion

The research aimed to investigate factors influencing the design of speech delay apps and aid developers in creating effective interventions. Through a mixed-methods approach, including questionnaire surveys and statistical analysis in SPSS, the study addressed these objectives comprehensively.

Firstly, the descriptive analysis revealed significant agreement among respondents regarding the effectiveness of various methods aimed at improving pronunciation, comprehension, expressive vocabulary, and articulation skills in children with speech delay. Methods incorporating visual aids, multimedia elements, and interactive components received notable support, indicating their potential to enhance speech therapy outcomes.

Furthermore, correlations between different variables demonstrated positive relationships between pronunciation, comprehension, expressive vocabulary, and articulation skills. Particularly, strong correlations were observed between pronunciation and comprehension, as well as between comprehension and expressive vocabulary, highlighting the interconnectedness of these language-related abilities.

Additionally, one-sample t-tests confirmed that participants scored significantly above the test value across all variables, indicating proficiency in pronunciation, comprehension, expressive vocabulary, and articulation. These findings suggest that participants exhibited substantial progress in language-related skills following the interventions provided through speech delay apps.

In conclusion, the research findings underscore the importance of leveraging innovative approaches, such as persuasive systems and mobile applications, to address speech delay in children effectively. By identifying effective intervention methods and elucidating their impact on language development, the study contributes valuable insights to the field of speech therapy. Moreover, the findings provide actionable guidance for developers in designing app-based interventions tailored to the needs of children with speech delay, thereby facilitating early detection and intervention to support their developmental milestones. Overall, the study's outcomes hold promise for improving outcomes in speech delay therapy and promoting early childhood development.

5.3 Recommendation for Future Work

While this study has provided valuable insights into the effectiveness of speech delay interventions through mobile applications, there are several avenues for future research to explore and enhance our understanding of this important area.

Firstly, future studies could expand the participant pool to include a broader range of stakeholders beyond just parents and children. Involving speech-language pathologists, educators, and healthcare professionals in the research process would offer diverse perspectives and expertise, enriching the data and findings. Additionally, incorporating feedback from speech therapy clinics and educational institutions could provide valuable insights into the practical implementation of speech delay interventions in real-world settings.

Secondly, the analysis in this study focused on a limited number of speech delay intervention methods and their impact on language-related skills. Future research could explore a wider range of intervention strategies, including emerging technologies such as virtual reality and artificial intelligence, to assess their efficacy in improving speech and language outcomes in children with speech delay. Moreover, longitudinal studies tracking the long-term effects of speech delay interventions over time would provide valuable insights into their sustainability and effectiveness in supporting children's ongoing language development.

Lastly, while the study employed statistical analysis to examine correlations and differences in intervention effectiveness, future research could delve deeper into qualitative methodologies

to explore the lived experiences and perspectives of children, parents, and clinicians involved in speech delay interventions. Qualitative approaches such as interviews, focus groups, and observational studies could offer nuanced insights into the challenges, successes, and preferences of stakeholders, informing the design and implementation of more tailored and effective speech delay interventions.

In conclusion, by addressing these recommendations for future work, researchers can continue to advance our understanding of speech delay interventions and contribute to the development of innovative and evidence-based approaches to support children's speech and language development.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3Y3	**Study week no.:4**
Student Name & ID: Hang Wei Hen 2002118	
Supervisor: Dr. Zurida Binti Ishak	
Project Title: A Study on Persuasive System Features to Help Kids with Speech Delay Problem	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

- Observe current market mobile application
- Write Literature review

2. WORK TO BE DONE

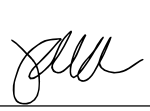
- Do Google Form Questionnaire
- Distribute Questionnaire

3. PROBLEMS ENCOUNTERED

- Not sure what need to be included in the questionnaire

4. SELF EVALUATION OF THE PROGRESS

Project progress is good but need time to evaluate the attribute and question



Supervisor's signature

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3Y3	**Study week no.:5**
Student Name & ID: Hang Wei Hen 2002118	
Supervisor: Dr. Zurida Binti Ishak	
Project Title: A Study on Persuasive System Features to Help Kids with Speech Delay Problem	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

- Questionnaire is distributing out to the targeted people
- Write Chalpter 3 Research Methodology

3. WORK TO BE DONE

- Do analysis using SPSS

3. PROBLEMS ENCOUNTERED

Need some time to learn how to do analysis using SPSS

4. SELF EVALUATION OF THE PROGRESS

Project progress is overall good

Supervisor's signature

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3Y3	**Study week no.:7**
Student Name & ID: Hang Wei Hen 2002118	
Supervisor: Dr. Zurida Binti Ishak	
Project Title: A Study on Persuasive System Features to Help Kids with Speech Delay Problem	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Done collect all responses from survey respondent

2. WORK TO BE DONE

Doing analysis using data generated by questionnaire

3. PROBLEMS ENCOUNTERED

So far no

4. SELF EVALUATION OF THE PROGRESS

Project progress is overall good

Supervisor's signature

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3Y3	**Study week no.:10**
Student Name & ID: Hang Wei Hen 2002118	
Supervisor: Dr. Zurida Binti Ishak	
Project Title: A Study on Persuasive System Features to Help Kids with Speech Delay Problem	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

SPSS analysis done

2. WORK TO BE DONE

Chapter 5 will be going to start to do

3. PROBLEMS ENCOUNTERED

No at all

4. SELF EVALUATION OF THE PROGRESS

The progress is consider good

Supervisor's signature

Student's signature

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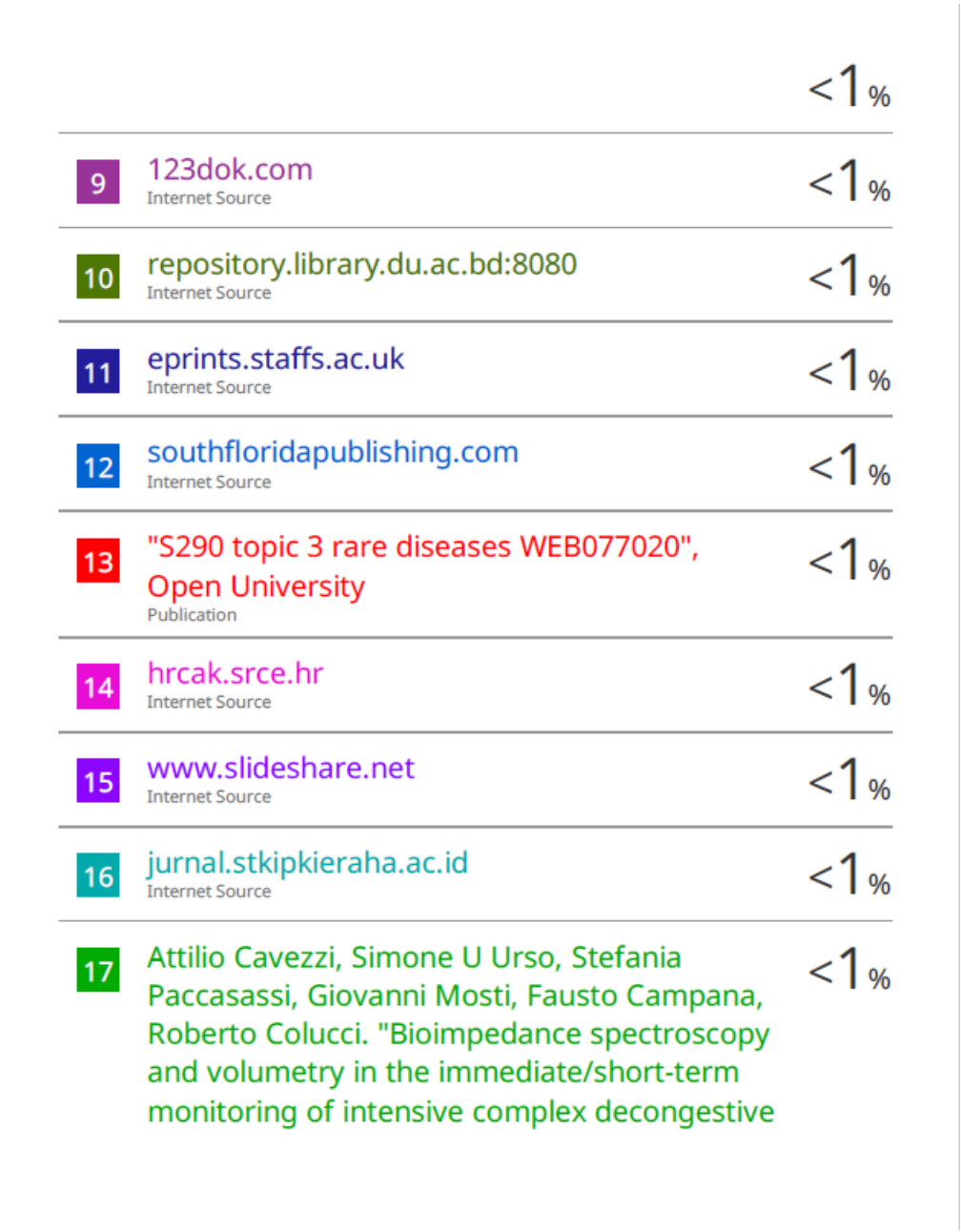

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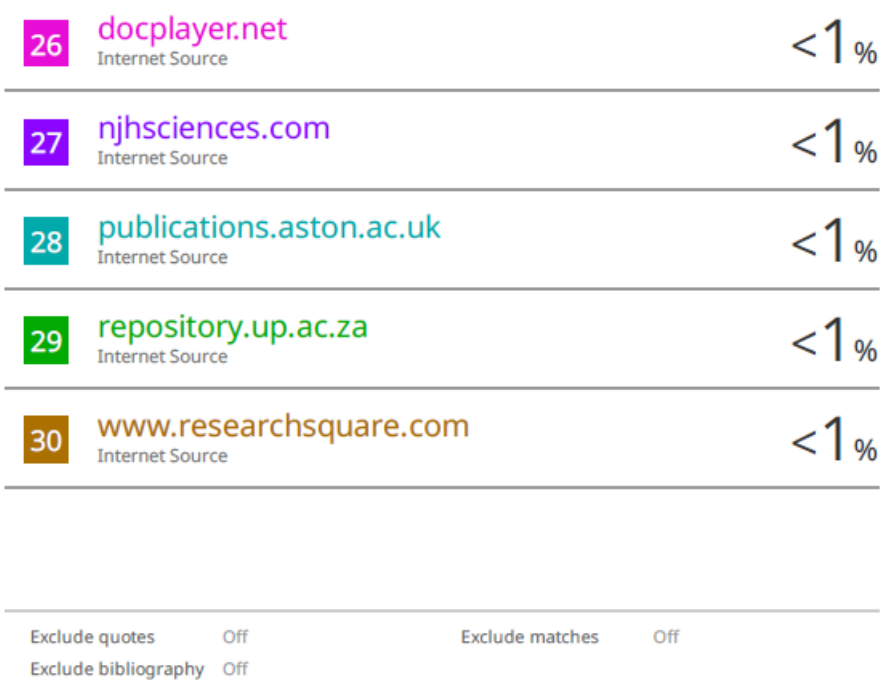
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Full Name(s) of Candidate(s)	HANG WEI HEN
ID Number(s)	20ACB02118
Programme / Course	IA
Title of Final Year Project	A Study on Persuasive System Features to Help Kids with Speech Delay Problem

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Signature of Supervisor

Name: Dr Zurida Ishak

Date: 25 April 2024

Signature of Co-Supervisor

Name: _____

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Student Name	HANG WEI HEN
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