DEPARTMENT OF EDUCATION, COMMUNICATION & LEARNING

ASSISTIVE TECHNOLOGY FOR PRIMARY STUDENTS IN ENGLISH LEARNING AT HOME

With Pen Scanner as example exploring the possibilities and challenges in English learning

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Abstract

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Purpose:
The aim of this study is to explore the possibilities and challenges of the assistive technology for primary school students in English learning and examine what becomes significant at home English literacy practices mediated by digital tools. The study also looks into the possibilities and challenges of technologies for EFL learning by investigating the problem of EFL learning for primary children in China.

Theory:
Theoretical framework chosen is grounded theory.

Method:
The approach undertaken in this thesis includes, qualitative research method, document review, and thematic analysis.

Results:
The results of this study indicate that assistive technology such as the pen scanner in this paper serves as a tool for primary children in their pathway to achieve independent learning at home. The functionalities of the technology, translation, vocabulary tracking, text recognition function, are significant in improving English proficiency for primary school children at home environment by the improved exposure of English input.

Foreword

This thesis would not have been possible without support from many people. First and foremost, thank you to my supervisors, Sylvi Vigmo, for your guidance and feedback. Also, thank you to my internship company, giving me the opportunity to have a glance in the educational technology industry. Thank you, the product manager, Ben Huang, for providing me access to the data used in the study. The last but not the least, thank you for my family, and friends for your support. Finally, I hope this thesis fulfills its scientific purposes and contributes to future research in this domain.

Table of content

1. Introduction

1.1 Background

With schools shut across the world during pandemic, face-to-face socializing was prohibited in China, teaching continued at distance by the China's Ministry of Education (CME). Data from the CME (2020) shows that there were more than 270 million students confined to home, including 17.67 million primary school students. The limitations of classroom-based language learning under the pandemic period, particularly in the English as a foreign language (EFL) context due to the limitation of EFL teaching in China, have led learners towards out-of-class opportunities for English learning (Richards, 2015). China can be defined as overwhelmingly monolingual as "Chinese" is almost exclusively spoken and used among people, and "Mandarin" is the official language of the nation, spoken by ethnic-Han Chinese, who are more than 90% of the population (*The Economist* ,2018). The challenges for EFL teaching in China are, a) English proficiency levels; b) knowledge about language in general; c) language teaching philosophies and methodology (Yian, 2001). When it comes to the English learning situation for primary students in China, EFL students need technologies that can address language and access issues, and they need support in the area of access and literacy in the outside-classroom settings (Carvin, 2000).

This thesis introduces the implementation of information and computer technologies (ICT) in teaching and learning for primary education, the advantages and limitation have been recognized. Further investigating the ICTs' use in the field of language learning and its relation with assisted technologies (AT). Computer-assisted language learning (CALL) is emphasized with connection of the monolingual learning environment and the English teaching limitation in China.

The educational technology in this paper, pen scanner, is one of the technologies that prevailed under the pandemic and it was developed for fulfilling the needs of English learning at home. The features of the technologies for language learning are analysed, in exploring the usability of the technology upon English learning in China at home.

1.1.1 Pen scanner

Research shows that English language learners regardless of their level of proficiency in their native language, have greater difficulty with language-based tasks in English due to that they have to acquire a new sound system, a new vocabulary, new grammar and spelling rules, which might share similar learning difficulties as those with learning disabilities (Banks, 2008). The investigated technology, Pen scanner, was originally designed to serve the purpose of solving dyslexia problem. "*Dyslexia is a*

specific learning disability that is neurobiological in origin, which is characterized by difficulties with accurate and fluent word recognition and by poor spelling and decoding abilities", referring to the International Dyslexia Association (2002). The pandemic background has accelerated its adaptation for meeting the EFL home tutoring needs for children. The pen scanner uses text recognition technology by scanning the textbook and transferring the text to speech, meanwhile, playing out with the equipped speaker. The audio function serves as a recorder that enables audio recording. Furthermore, with its install pocket dictionary, it can translate the language into destinate language under off-line situation.

1.2 Aims and Objectives of the Study

The aim of this study is to explore the possibilities and challenges of the assistive technology for primary school students in English learning. The study also looks into the problem of EFL learning for primary children in China. Using the educational technology, pen scanner, as an example. In order to explore the value of assistive technologies in the role of supporting EFL learning, the using experiences of the pen scanner is investigated to find out what concerns the users arise in use of the product. And from the using experiences further studying the functionalities of the pen scanner to discover the pen scanner's usability in English learning.

Research questions are as follows:

1. What are the experiences of technology intervention for primary students English learning at home?
    i. What concerns are communicated while using the pen scanner?
2. What functions of a technology are significant in supporting primary students English learning?
    i. How the functionalities of the pen scanner are evaluated for English learning?

1.3 Significance of the Study

By identifying the features of learning technologies for language learning. The learning needs were recognized. This thesis may contribute to studying the usability of learning technologies for a successful individual English learning under the home learning environment and further explore the possibility of the technology in school.

1.4 Structure of the Thesis

This thesis is established by 6 sections. Section 1 summarizes the study background, domain, purpose, and gaps of the study contributes to fill in. Section 2, key concepts and relevant researches are introduced. Concepts include the monolingual learning environment, information and communication technologies (ICT), assistive technology (AT), computer-assisted language learning (CALL), self-directed learning (SDL), and related empirical researches are synthesized and compared. Section 3

elaborates the research methodology along with the study design, data collection and analysis, and describes in detail the operationalization procedure. Section 4 presents and interprets the results. Section 5 discusses the results from the literature review, limitation, and recommendations for further studies, finally the thesis is finalized with conclusion.

2. Literature review

This section consists of literature reviews on key concepts, related to existing studies and empirical research. These are summarized, analyzed and compared in order to provide a factual and comprehensive insights for the study.

2.1 Key Concepts

2.1.1 Monolingual Learning Environment

In order to have a better understanding of the study background, having knowledge of what learning environment and learning context our participants/target users are in is of great importance for this paper. The monolingual learning environment, the English as foreign language (EFL) condition, second language acquisition (SLA) and the influence of home engagement will be brought up with the combination of English literacy development for primary education.

Even though people being multilingual is more common now, the fact that most of the world's population is multilingual does not prevent the construction of monolingualism as the norm (Corbetta, 2003). The definition of "*monolingual*" in dictionary states as "*said of a person or a community with only one language', also unilingual*" (Crystal, 1987:425). When "*monolingual*" used as an adjective word, and as for nonce, "*monolingual*" refers to "1. *A person who knows and uses only one language. 2. A person who has an active knowledge of only one language, though perhaps a passive knowledge of others.*" in *Longman Dictionary of Language Teaching and Applied Linguistics* (Richards and Schmidt, 2002). Working from the above definition, an individual who is *monolingual* can mean that an individual who does not have access to more than one linguistic code as a method of social communication. Although using this as a working definition means, the proficiency of an individual's monolingual language needs to be identified, such as the skills of an individual who can say simple phrases in their second language (L2), and who has studied one or more languages yet falls short of being able to communicate in them. From this perspective, China can be defined as overwhelmingly monolingual as "*Chinese*" is almost exclusively spoken and used among people, and "*Mandarin*" is the official language of the nation, spoken by ethnic-Han Chinese, who are more than 90% of the population (*The Economist*, 2018).

English learning in China mostly happens in the EFL classroom with Chinese EFL teacher, both language input and output, therefore the most important part of teaching are making input comprehensible and absorbed, and creating opportunities to promote output. J. Xu, Fan and Q. Xu

(2019) study in investigating EFL learners' feedback in EFL classroom found that in EFL learning environment learners favoured digging into the grammatical mistakes and explicit correction in responding to their peers' linguistic error. This reflects that Chinese EFL classroom might exist with difficulty in the accessibility to English comprehension for the learners.

Parental engagement has been studied among monolingual families in association with students' learning outcomes. Findings show that parental engagement is viewed as social capital regarding their English literacy (Cahit Erdem & Metin Kaya, 2020). Following UNESCO (2006), literacy is delineated as including four elements: literacy as an autonomous set of skills, they are reading, writing, and oral skills. However, English is not the language of the society in China and most families are not able to offer extra English tutoring by themselves or by third party, and the accessibility to learn English is very limited outside classroom based on the above-mentioned situation. Therefore, parents' English literacy level is associated with levels of children's literacy achievement, results also been proven in the programme *Parental engagement in learning activities at home* (2018), thus it is difficult for underprivileged family in fostering a rich English literacy environment at home for their children's English language development when they are not literate in English themselves. Many parents are hesitant to help their children study English, for fear of teaching them incorrect grammar or pronunciation (Cervantes & Olson, 2011).

Under this context, teaching seems crucial to adapt multiple means in enhancing Chinese children English (L2) acquisition both in school and outside school, significantly for those families that are lacking English literacy, and places which are economically disadvantaged meaning that the schools fail to offer support. The introduction of Information and Communication Technologies (ICT) has played an important role in primary education discussed in the book, *ICT in Primary Education: Analytical Survey* (Kalas, 2012)*, as it states that countries with challenging economic situations are seeking innovative and creative means to reform and integrate new technologies into education for easing the shortage of competent teachers.

2.1.2 Computer-Assisted Language Learning (CALL)

Studies of EFL learners use of ICT demonstrate that EFL learners need AT to address language and access issues, similarly, as learners with disabilities who need AT to address physical and cognitive learning issue (Chapelle, 2001). In the field of AT for learners with special needs, developments in ICT have led to new understanding of the ICT application for language learners, which has come to be known as computer assisted language learning (CALL) (Hanson-Smith, 1997).

The computer-assisted Language Learning (CALL), which is widely regarded as the central acronym among others acronyms, whose studies refer to individual second language learning with computer

technology including adaptive computer systems, promoted as intelligent CALL (ICALL), and web-enhanced language learning (WELL), is used by educators who propose Internet-based activities. The main purpose of CALL was to "improve the learning capacity of those who are being taught a language through computerized means" (Gruba, 2004). The limitations of classroom-based language learning at home setting, in the English as a foreign language (EFL) context based on the limitation of EFL teaching, have led learners towards out-of-class opportunities for language learning (Richards, 2015).

Additionally, the understanding of contextual and cultural phenomenon in China contributes to construct a broader and deeper view upon CALL. As mentioned above that the learning environment for EFL learners in China can be identified as monolingual, adoption of technological resources for out-of-class language learning could be a salient manifestation of this situation based on the EFL literacy teaching context. The challenges for EFL teaching in China are, a) English proficiency levels; b) knowledge about language in general; c) language teaching philosophies and methodology (Yian, 2001). Findings on CALL in China suggested that Chinese EFL teachers hold positive attitudes toward the value of ICT for teaching and learning. However, they use technology mainly for teacher-centred purposes, such as teaching preparation and instructional delivery, they seldom utilize or combed technology for student-centred activities. Factors constraining the use of technologies in EFL instruction include the teaching philosophies, for instance, the teacher-centred pedagogical practices and lack of effective professional development on instructional design and technology integration (Li & Ni, 2011).

Richards (2015) viewed that instructional material matters and they make a difference concerning teaching, therefore special attention should be paid to the design of teaching materials, which are based on, recent research, appropriate to language proficiency, motivation and state-of-the-art technology. Results of studies show that an integrated curriculum increases intellectual curiosity, improves attitude towards schooling, enhances problem-solving skills and higher achievement (Gajek, 2017). The use of CALL has facilitated a shift from a teacher-centred to a student-centred approach to learning as Belanger and Jordan (1999) pointed out in *Evaluation and Implementation of Distance Learning: Technologies, Tools, and Techniques,* that converting a course into a computer-based model is converting an existing traditional course to a completely online format, the technology insertion to an existing traditional class should take the following learning variables into account: learner centeredness, course mediation, objectives, interaction, and synchronicity.

Developing novel and effective learning environments that promote students' reading effectiveness and increase their interest is an important issue for L2 development (Baddeley, Gathercole & Papagno,1998). The integration of technology can improve learner's attitude and increase learning

objective and with a focus on the learner centeredness have been addressed. Recommendations are given by Li and Ni (2011) on emphasize alignment among technology, curriculum, and pedagogy in EFL teaching and entails the use of various media, especially video and audio, making learning appealing and motivating to learners.

2.1.3 Self-directed Learning (SDL)

Self-directed learning (SDL), originates from the adult learning field (Tough, 1971), is one of the required skills in the 21st century skills and highlighted by scholars in its fostering in K-12 education, proven by the findings in the K-12 educational reports e.g., *Partnership for 21st century skills* (2006). Knowles (1975) described SDL as a process in which learners take the initiative, with or without assistance. Previous research has proved that it is essential for students to acquire knowledge proactively where SDL activities involved (Knowles, Holton, & Swanson, 2012). Generally speaking, SDL is usually used for describing learning activities outside school environment and it focuses on an individual's internal learning including growth process as well as the external characteristics of an instruction (Brockett & Hiemstra, 1991). Internal characteristics may include self-discipline, love of reading, and curiosity (Guglielmino, 2013; Tredoux, 2012).

According to Gibbons (2002), a learner who practises SDL can initiate tough activities and develop personal knowledge to solve these challenges successfully. However, there are few concerns with the adoption and design of SDL in elementary education since most of the existing studies mainly discussed the exploration for SDL about adults (Teo et al., 2010). This could be because of the differences in motivation for children, unlike adults, who have clear goal and highly self-regulated, children on the other hand may be hard to concentrate on certain tasks (Duckworth, Gendler, & Gross, 2014). In this paper, SDL is approached to be influenced by external frames with the implementation of ICTs and in the relevant section it will be further discussed in the following section.

Hiemstra and Brockett (1991) postulated that learning environments that foster SDL are believed to promote cognitive and metacognitive ability where learners seek meaning in the subject matter rather than basic rehearsal or memorization of the construct knowledge, in other words, it means that SDL learner's contribution to the process of learning depends on the possibilities that the environment can offer. Research done by Vonderwell and Turner (2005) has shown that the ICTs learning environment provides more control of the instruction to the learners and thereby could enhance aspects of SDL.

2.2 Previous Research

This section will introduce previous research, related empirical studies that have been carried out in the field of the implementation of ICT in teaching and learning for primary education, specifically,

focus will lie on the functionality of technology regarding language learning, more specifically English learning in China. The section consists of reviews of research on how ICT have been applied in primary education in the subject of CALL as well as the teacher and parent influence on the use of technologies. For investigating several perspectives on the issues and the limitations of the field, an overview of relevant literature is presented. Besides, the gaps in the earlier researches that this study contributes to filling in are also highlighted.

2.2.1 The Role of Information and Communications Technology Inputs

The previous section has introduced the implementation of ICT in teaching and learning for primary education, the advantages have been recognized. This section draws upon existing research and evaluation on how ICT has been used in schools, and identifies associated concerns on these ICT-integrated teaching and learning practices.

Effectiveness, cost, equity, and willingness are four broad intertwined issues addressed when considering the overall impact of the use of ICTs in primary education as the following research indicates. It is easy to neglect that the use of ICT requires support by education and school policy and by effective professional development for teachers first of all (Lim, 2007), strategies need to be applied by the policy makers for addressing the various barriers in order to make the successful integration of ICT in the classroom. Therefore, there are certainly cases where a lack of ICT infrastructure, hardware and software in schools can deny students the opportunities to properly take advantage of ICT in their learning for meeting the 21st century competence requirement. Moreover, the expenditure of most of the ICT in school are not affordable for many developing countries and economically disadvantaged areas. For better use of multimedia for learning objectives in primary education, a balance between traditional teaching and learning with ICT is desirable (Tinio, 2021), yet the current application of ICTs is studied mostly under the in-class activities with access to internet, which depends heavily on the school budget, school policies, teacher's acceptancy, and sufficient instruction on the usage of ICTs.

2.2.2 Digital Technologies in Out-of-classroom Learning

Based on the development of ICT and accessible internet in 1990, distance learning spread. Distance learning, also called distance education, e-learning, and online learning, is a form of education where the main elements include physical separation of teachers and students during instruction and the use of various technologies to facilitate student-teacher and student-student communication (Hendrix, 2019).

With schools shut across the world during pandemic, face-to-face socializing was prohibited in China, teaching continue procceed in distance by the China's Ministry of Education. Data shows that there

were more than 270 million students confined to home, including 17.67 million elementary school students (*China's Ministry of Education*, 2020). Education has changed the way of learning and teaching dramatically in China under the pandemic period. Beside the distinctive rise of distance learning which component into three factors, there are pedagogical models, instructional strategies, and learning technologies (Aparicio & Bacao, 2013).

According to the examined study regarding the pedagogical models in digital tools intervention learning (Manuela, 2016), that the way contents are delivered and the underlying learning strategies play important roles in e-learning studies with the integration of ICT. Study have done by Manuela (2016) on the pedagogical models applied to e-learning in higher education as well as international education, they are supported by the following attributes: learning is a social process, learning in group is fundamental to achieve knowledge; distance is unimportant; teaching and learning can be segregated in time and space. However, there are very limited corpus of K12 studies regarding the distance learning available, which requires a different instructional strategies as the group tend to acquire a discipline-based subject, thus leaving practitioners with little guidance on how to effectively design, deliver, and support online learning (Barbour, 2016).

Today in China, societal challenges require emergency home schooling plan implemented throughout the country, family needs of home-tutoring have also increased rigorously. Previous studies on problems related to online learning have focused primarily on college students, few studies have focused on primary school students' experiences and take parents influence into account. Plowman and McPake (2013) looked into how parents influence children's technology habits and behaviours, concerning technology access (e.g. whether or not to buy an iPad, amount of screen time), function (e.g. for education), attitudes (e.g. health concerns), and support (e.g. emotional or technical help), et. Findings on the satisfaction of distance learning technologies from *Parents' Perceived Pressure from and Satisfaction with Online Learning* suggest that content quality, interactivity, and platform availability may be the key factors for children in distance learning (Cui, 2021). The parents were generally the most stressed about their children's online lessons, teachers' afterschool demands, including monitoring children's studies, guiding homework, and regularly providing feedback on students' learning, greatly increased their workload, stress, and annoyance, among all most of the parents expressed their concern over those technology access such as iPad, and computer for children learning at home as they worry about their kids health under long time exposure to screen as well as to computer games.

2.2.3 The Monolingual Problem of CALL

As mentioned in the previous section, monolingual environment does not necessarily limit to monolingual individuals in the monolingual settings, but also take the influence of other languages rather than the target language into concern, refer to the use of monolingual in Gogolin (1994) *monolingual habitu*s. However, linguistic theory is concerned with an ideal situation when in a completely homogeneous speech community, who knows the language perfectly without effected by grammatically irrelevant conditions such as memory limitations, distractions, shifts of attention, interest, and random or characteristic errors in applying the knowledge of this language in an actual performance according to Chomsky (1965). The monolingual bias refers to the viewpoint that people who speak only one language, that is, monolinguals, which often occurs when speaking of the monolingual problem when the linguistic and cultural aspects of diversity and complexity are often ignored. This leads to the result that most of the technologies focus only on the basic grammatical knowledge of the target language, instead of how to make use of the learner linguistic resources and taking curriculum, parents into concern, in creating a literacy rich learning environment. Sun's (2016) study investigating the factors influence English proficiency of children in China revealed that the total amount of school input and home English media environment were significant predictors for English proficiency.

A study on the acquisition of English with Mandarin speaking monolingual children conducted by Xi (2014) indicates that having access to two languages allows children to compare and contrast structural features of language at a more abstract level and develop a metalinguistic awareness, which is defined as an individual's ability to focus, reflect and evaluate upon the objective language. Types of metalinguistic abilities includes phonological awareness, and strong overall language skills, coupled with explicit and systematic instruction in decoding, and comprehension (Bialystock, 1988). Phonological loop is a central mechanism in language learning, which appears to mediate the acquisition of new vocabulary objects in both native and foreign languages (Baddeley, Gathercole & Papagno, 1998). Hence, the issue on CALL discussed above derived from the monolingual bias, which has significant implication on the study of the functionality of pen scanner in this study.

2.2.4 The CALL Technologies for English Learning

Previous section has discussed the challenges of ICT integration in primary school on its effectiveness, cost, teachers, and parents' acceptancy. The following section will investigate the functionality of some English learning technologies, bringing up what the pen scanner in this paper can offer in filling in the gaps in English learning for primary school students in the distance learning settings.

According to the book *Evaluation and Implementation of Distance Learning: Technologies, Tools and Techniques* (Belanger & Jordan, 1999), technology can be defined in relation to six factors, they are interface characteristics, multimedia capabilities, document organization, content, topic specificity, and interactivity. When it comes to the EFL situation for primary students in China during the pandemic, EFL students need technology that can address language and access issues as mentioned above. EFL students might benefit from AT as well because AT are designed to help with reading, comprehension, and visual attention since EFL students resemble students with learning difficulties during the acquisition period, many learning disabilities are manifested by significant difficulties in the acquisition of listening, speaking, reading and writing (Wilson-Portuondo & Hardy, 2001).

Generally, most of the technologies both software and hardware such as iPad, computer, mobile apps, web-based, computer-based learning have used multimedia including film, digital video for conducting online courses, which is believed to be a positive trigger for easier comprehension, but many investigations have found that visual content draws learner's attention away from the audio (Ockey, 2007; Rahmatian & Armiun, 2011). Many web-based digital reading materials have integrated audio and interactive functions which can help to create instructional activities that promote reading fluency for students. Oral reading fluency is the ability to read aloud a text accurately and quickly with the appropriate pacing and intonation (*Report of the National Reading Panel*, 2000). Oral reading fluency provides the crucial bridge between word recognition and text comprehension (Pikulski & Chard, 2005). For enhancing word recognition ability, read-aloud software is feasible and text-to-speech is a technology that designed to assist individuals who have difficulty reading with audible input of text, which is built on the philosophy of *Universal Design for Learning* (Wood et al., 2018). Studies showed that text-to-speech is beneficial for children vocabulary learning so that assists word recognition and text comprehension (Kim et al., 2012).

Vocabulary development is an essential element in EFL learning, pocket translators might help for vocabulary acquisition (Naima, 2013), research upon the development of EFL learners' vocabulary, vocabulary can be divided into four types, see *Figure 1: Types of vocabulary*, knowledge of vocabulary supports EFL learners in speaking and writing, receptive vocabulary is most of is obtained through listening and reading activities, but the problem is EFL learners often fail to remember and establish with unfamiliar vocabulary during their language acquisition. Repeated reading strategy is an

educational strategy for building vocabulary in which a student rereads until being familiar with the vocabulary (Willis, 2008).

Oral Vocabulary

Listening   Speaking

Receptive Vocabulary   **Productive Vocabulary**

Reading   Writing

Written Vocabulary
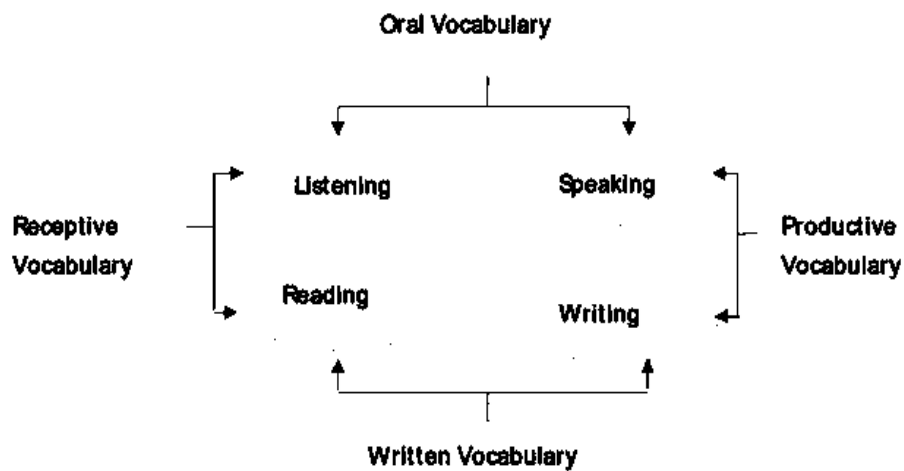
Fingure 1: Types of vocabulary, Naima (2013)

However, learning vocabulary by memorizing is discouraged, Decarrico (2001) states that words should not be learnt separately or by memorization without understanding. This is because the vocabulary learned in this way often results in the neglecting of lexical aspect. Clarification is needed for knowing how to use it in real life communication and develop extend reading experiences. Translating the acquired language into learner's first language adds value in understanding and clarification with support of context and synonyms might be of help.

On the current learning technologies which is mostly digital-based and web-based, the function of interactivity is emphasized. AT is increasingly designed to support access to the curriculum through learning as motor and sensory support (Chen et al., 2016). Many specialized English-language learning platforms and commercial products, such as the Read, Write & Type! Learning System (http://www.talkingfingers.com/) and Read Naturally (http://www.readnaturally.com/), that helps with oral fluency and reading comprehension with an integration of school curriculum (2016). Those platforms all require the access of internet, which has caused difficulties for the off-line situation. There are few technologies designed for situations with limited or no access to the internet. With the pre-install digital dictionaries that offer key content, vocabulary definitions, or even word pronunciation, pen scanner serves as a pocket translator that can scan and translate the text to target language without access to the internet.

3. Method

3.1 Theoretical Framework

3.1.1 Grounded Theory

The theoretical framework chosen to lead this research is grounded theory. It provides systematic procedures for shaping and handling rich qualitative data aimed to develop theory. Grounded theory starts with individual cases, incidents or experiences and develop progressively more abstract conceptual categories to synthesize, to explain and to understand a set of data and to identify patterned relationships within it (Charmaz, 1996). In this study, the qualitative data is rich and the aim is to explore the pen scanner technology for English learning at home by studying the learning experiences. This framework contributes to identify patterned relationships in the data. This study is explorative, it does not intervene in the activity of instruction but collect data from an open data source, they are reviews from the pen scanner website. The below diagram I created shows the theoretical framework used in this study.
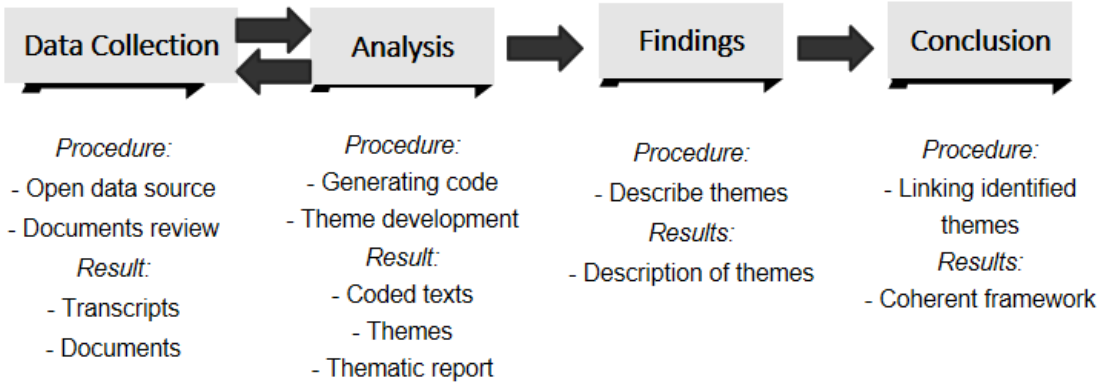
The method to collect data is document review, which is used for conducting systematic evaluation (Bowen, 2009). The method is applicable to qualitative case studies, intensive studies producing rich descriptions of a phenomenon (Bowen, 2009). Since that this is not a linear study, the data were generated during the pandemic. Therefore, observation, and interview methods is not applied for the study. The type of data in this research are reviews and comments from the product website, they contain text and images that have been recorded without intervention. This method can provide data on the context of primary students English learning situation with the pen scanner in China. It helps to understand specific issues, and can indicate the conditions upon the phenomena currently under investigation.

In order to investigate the user's experiences upon the technology, this method is suitable for large data and provide flexibility in interpreting. The analytical tool in the study is thematic analysis. It is a qualitative analytical approach for identifying, analysing and interpreting themes within rich qualitative data, according to the procedure described by Clarke and Braun (2015), a six-phase process was used: 1, familiarizing the data, 2, generating initial codes, 3, generating themes, 4, reviewing themes, 5, defining and naming themes, 6, producing the report. Accordingly, this study has followed these six steps.

Firstly, the data was collected and transcribed in a meaningful way for understanding and being familiar with the data. Next, the data was extracted and coded according to their content with shorthand labels. And those codes were analysed and combined into different themes, at the same time, the themes were further reviewed and modified into overbridging themes intended to answer the research questions of this thesis. The final list of themes eventually was defined by a succinct and concise name. Finally, the thematic analysis report was conducted by the qualitative software NVivo.

The interpretation of the results is the final phase of the methodology. In this phase, the results obtained in data analysis are interpreted specifically according to the goal and scope defined in the data collection phase. The findings are summarized, compared, and synthesized. Finally, to emerge possible theoretical model by linking the identified themes, finding out the patterned relationship between the themes.

3.2 Methods for Literature Review

The research articles and literatures are found via database such as, Scopus, Elsevier, Eric, Google Scholar database, Scopus, Education Research Complete. The policies and official documents from government websites such as the China's Ministry of Education, Educational Support and Guidance, Agency for Special Needs and Inclusive Education, in the search of related articles.

The following search keywords were applied: "information and communication technologies in education", "assistive technology", "computer-assisted language learning", "distance learning", "self-directed learning", "self-regulated learning", "EFL learning", "learning disabilities in reading", "technology for home environment" combined with the "AND/OR" and "E-learning technology", "CALL technologies", "digital reading aid", "reading technology". The Norwegian Register for Scientific Journals was used in order to examine the chosen articles' scientific value and to examine their citation frequency. Finally, the related literatures and articles were selected, and results were summarized, analysed, and synthesized.

The following inclusion criteria were established: papers on the use of ICT in Education; EFL learning; AT for English learning; CALL; distance learning; parents' perception on technologies; SRL and SDL, written in English. The following exclusion criteria were established: effectiveness reports; papers on the use of ICT and English learning for native English speaker. The keywords were searched in the publication title, abstract, or content. Articles were analysed with respect to their content, and those with content that were not fully within the scope of this paper were eliminated. After examination of included articles and according to the research questions, ICT effectiveness and English learning for native speaker was not considered suitable for this paper since the study subject is EFL learner in China.

3.3 Data Collection

This chapter presents the collection of the data, the procedure, choice of method, the criteria of data selection, the limitation of the data, in order to conducting a systematic analysis of data collection. Data contributes to the study aims, in exploring the possibilities and challenges in the assistive technology, pen scanner, for primary school children English learning under the distance learning settings, were collected.

3.3.1 Data Selection

The first step of data collection was to define goal and scope for answering the research questions. Several specific criteria on the dataset were identified. The data is complex, firstly they are dialogue containing subjective viewpoints, secondly the amount of data is huge regardless of time frame. Thus, the following inclusion criteria were established according to the research questions: content concerns about the experiences, and functionality of the pen scanner, learning effect, and the time period should be in the frame of April in 2022. Content that concerns about giveaway and package that do not contribute to the research aims were excluded.

3.3.2 Pen Scanner

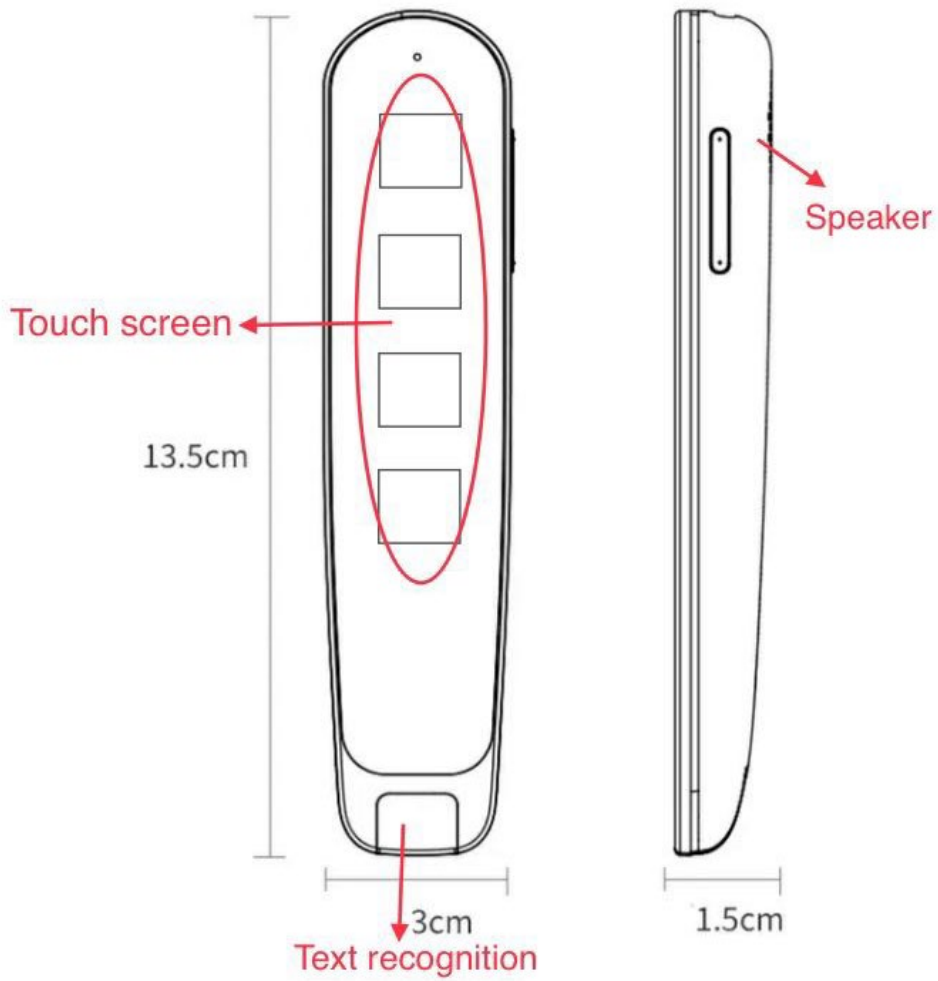The pandemic background has accelerated its adaptation for meeting the EFL distance learning needs for children. *Figure 1: Pen scanner specification* shows the design of the pen scanner. Features in details see *Figure 2: Features.* The pen scanner uses text recognition technology by scanning the textbook and transferring the text to speech, meanwhile, playing out with the equipped speaker. The audio function serves as a recorder that enables audio recording. Furthermore, with its install pocket dictionary, which can translate the language into destinate language under off-line situation.

Touch screen ← ● Speaker

13.5cm

3cm
Text recognition

1.5cm

Figure 1: Pen scanner specification

Translator | Study Mode | Record Tracking

Light Weight | Touch Screen | Dictionaries

Audio | Off-line Mode | Multi Languages
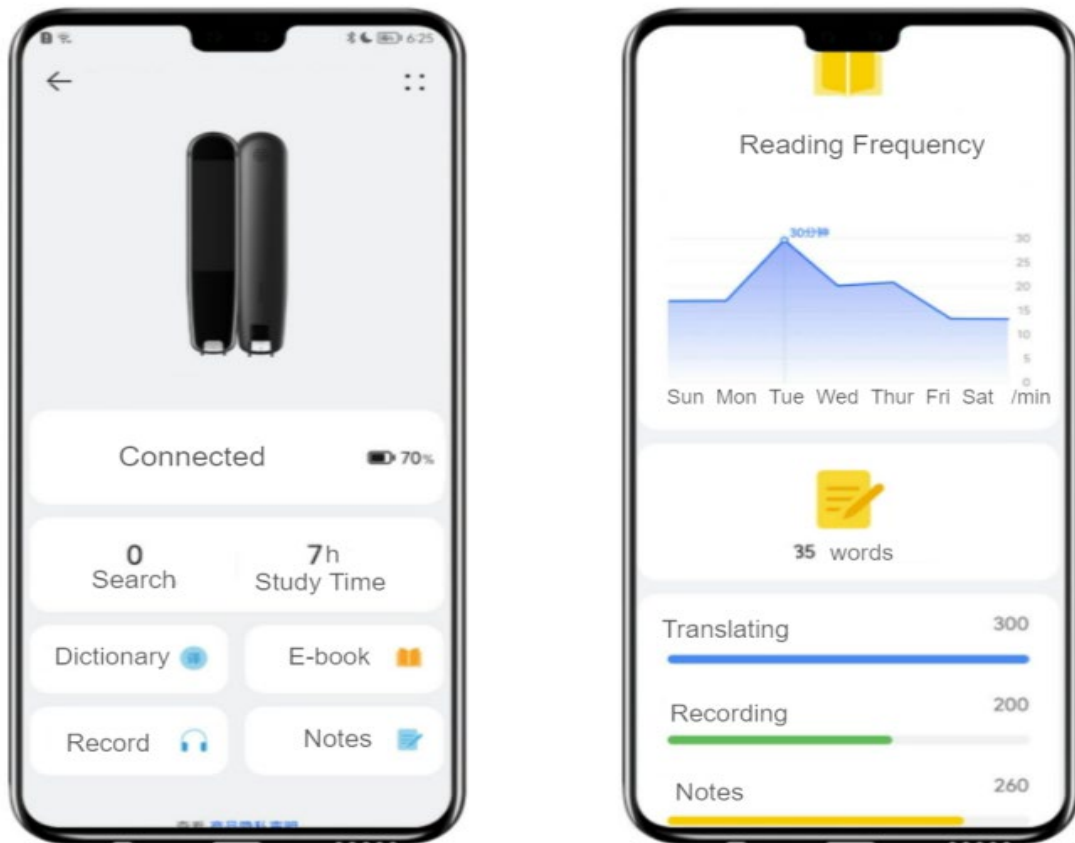
Figure 2: Features

Figure 3: App interface

3.3.3 Sampling Group

In this study, pandemic and social distancing have hindered the primary data collection plan so the data will be catered by different means. For this purpose, online data sources will be preferred to save time and access reliable data. Open data is used by many researchers, because it has significant implications for the quality of the analysis and interpretation (Chauvette et al., 2019). The whole population is not investigated in this study, some samples are being taken from the population on their contextual relevancy. Data are directly collected from the selling's platform; they include evaluation and feedback from those whom have purchased the pen scanner. The study involved buyers' reviews of the pen scanner. Identity and background of the reviewers are anonymous.

3.3.4 Study Design

This section presents the study design for data collection, including the specification of the source of the data, the Pen scanner webpage, and the interaction between the webpage and the customers. They are as follows, product webpage, see *Figure 4: Pen scanner webpage in the selling platform* with ① description; product evaluation page that contains ② purchase comments by time scale and featured

tags, see *Figure 5: Product evaluation in general*; the reviews content can be filtered by time and its classification, such as a total 158 reviews mentioned ③ low price, 48 reviews on ④ sensitivity, and ⑤ follow-up reviews, see *Figure 6: Review's classification*.

Being familiar with the interface of product website have helped to define the goal and scope of the data collection. From the number of total reviews and comments, there was a huge amount of data mixed with different information. The goal was to narrow down information, and search for meaningful data within the scope of pen scanner user's experiences. Thus, data selection was set based on time scale for filtering out useful data. Secondly, the classification auto-generated by the website has helped generating codes in my data analysis.

I began from selecting the available reviews by time scale, since the research aim in studying the phenomenon accrued during pandemic period. In *Figure 5: Product evaluation in general,* ② was set from April to June, excluding the tag "giveaway", which was considered not relevant to the research aims. Screenshots of the qualified reviews page were taken, saved, and transcribed into text in the database with the software Nvivo,

Figure 4: Pen scanner web page in the selling platform

product details	② cumulative evaluation			mobile phone

matches the description	everyone wrote	low price (158)	very sensitive (48)	is genuine (33)	With giveaway(22)	purchase
0 ★★★★★		good battery(6)	The sound is too low (23)			

● all ○ Follow up (462) ○ Pictures(2519)   ☑ has content   by time ∨

By default

Very satisfied, I compared a lot of brands, and finally chose the little genius. I don't think this kind of thing is cheap. It supports nine studies. You can learn from textbooks and extracurricular books. If you don't know it, you can search for questions. The customer service attitude is very good.

Color classification:

red

National *** Da...

Package Type:
Standard

today

The pen is pretty good. It has many functions. It can scan and shoot. There are 9 lectures, and it can also solve problems. The texture of the pen is also very good. The child likes it very much. I can use it too. Ancient poetry, poetry appreciation, voice playback can also tell a story and listen to a song. The content is quite rich, technology changes life!

Color classification:

red

t *** 8 (anonym...

Package Type:
Standard

today

The scanning response is very fast, the function is powerful, you can explain word by word, learn word by word, you can learn it by yourself, you don't need me to accompany you all the time, and you don't need me to check the phone, very good, cow

Color classification:

red

z *** 8 (anony...

Package Type:
Standard

today

Recommended by a friend, small and portable, functional and practical, no fancy entertainment functions, easy for children to read and study, I bought it before to play, this is really for children to learn

Color classification:

red

Do *** mi (anon...

Package Type:
Standard

today

It is true that any book can be scanned and translated. It is very convenient to scan questions and voice input, and the English vocabulary is very large, which can be used in junior high school and high school. The scanning and recognition speed is very fast, very accurate, and the voice is loud, and the language can be adjusted. Fast and slow, suitable for children!

Color classification:

red

Ze *** Egg (An...

Package Type:
Standard

today

My daughter is in the fifth grade. The memory of the three books of Chinese, mathematics and English is full of 16G without downloading it. It is a fly in the ointment. I hope the developers can improve it.

Color classification:

Figure 5: Product's evaluation in general
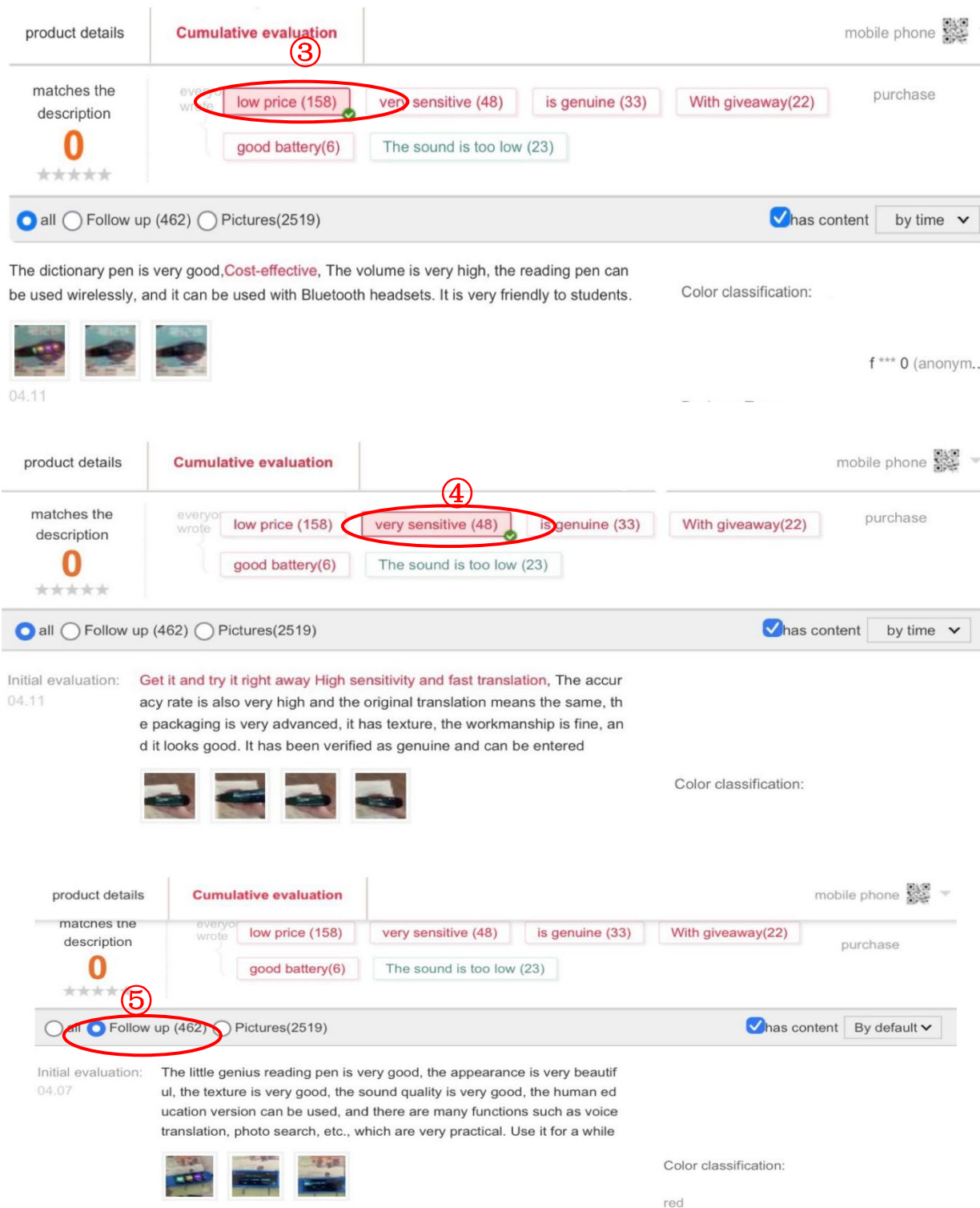
Figure 6: Review's classification

3.3.5 Ethical Considerations

Certain ethical considerations are taken into account for the study design, and data collection. Firstly, all the data involved in this paper is consent and approved by the data owner, ████████████████████

The company was contacted and informed about the purpose of study and the use of data, which includes company's profile, related documents, investigated technologies' software, hardware, as well as user's data. There are certain documents and data considered sensitive by the company, which is kept confidential in this paper, and involved subjects are: company's manuscript of the technology design, both software and hardware in details, products' factory price, sell data, the information of buyers and sellers, the customers' data. Users of the investigated technology, pen scanner, are children age between 6 and 13, who are the main intended user of the product. The collected data are comments and reviews shared on the product website, whose data is owned by the selling platform. Secondly, from the perspective of the reviewers, their identity was anonymous, as the source of information provision, they are consent about their own experience serve as an information source on the internet (Savolainen, 2011). All the data were presented in English in this paper, original data was in Chinese, which was direct machine-translated from Chinese to English, minor errors may occur in translation. Therefore, some sentences may be rephrased for better understanding.

3.4 Data Analysis

This chapter described the procedure of data analysis, including the code generation, and development of theme. In accordance with the results of the data analysis, see *Figure 9: Thematic report with the amount of coding references,* presents the results of the qualitative data systematically. A total 25 codes were generated, generally divided into three categories according to the reviews content, technical reviews, socio-technical reviews, educational reviews. and further classified into 6 themes, they are technical evaluations, operation, speed and accuracy, functionalities, health considerations, and learning effect.

3.4.1 Data Analysis Procedure

A total 221 of reviews were collected and transcribed using NVivo, each content was classified and labeled, eventually presented by a comprehensive report of thematic analysis.

Generating initial codes

Firstly, content was processed by NVivo for locating the top 500 frequent words in the data, they were presented by word cloud, see *Figure 7: WordCloud of Pen scanner data,* displays the most frequent words found in the selected content. The word cloud suggested that the topic discussed most is that the pen scanner has been considered useful for English learning, according to the most frequent words which includes "good", "use", "English", "learning", and "reading". They were extracted and have helped to locate the reviews with highly relevant content. There are other means of initiating codes from the data, using the frequent words cloud is not a necessary method in thematic analysis.

Figure 7 : WordCloud of Pen scanner data

After I have filtered out the relevant information, the key contents were extracted and read through again. *Figure 8: Content coding,* shows an example page of initial coding and the process of classifying the transcribed data, the content were analysed and labelled into codes, which marked with different colours. In this extract, various phrases in different colours corresponding to different codes were highlighted. The codes were generated by the software according to the reviews content, such as the code "help in English learning", "learning interest", which were extracted directly from the text.

Figure 8: Content coding

Searching for themes

I searched for a coherent and meaningful pattern that related to the research questions in the data with the help of words cloud to filtering out unecessary information, and from the codes I generated; ideas that could radically change the perception of some questions were also marked as a possible theme, such as the code "translation" "operation" and "functionality are good" were marked into the theme of functionalities, because the codes related to the product functionalities. The theme "health" were identified by the code of "friendly to children", and "eyes protection. The coded data relevant to each theme was collected.

Reviewing themes

The themes were reviewed according to coded content and the full data. The theme "Operation" were separated from the theme "Functionalities" after reviewing the coded content, because the code "easy to use" that concerns about the product's operation and it takes the biggest part of the data. I attempted to find the relationship between the themes, for presenting the data in a convincing way to answer my research questions, some themes were combined together and a few were discarded. Such as the theme "Issues" which contains by the reviews concerning its technical functions was discarded, replaced with "Technical evaluation" for answering the research questions.

Defining and naming themes

The final list of the themes was defined with a concise, punchy and informative name, each theme represented the essence of the data and showed a relationship with the research questions.

3.4.2 Data Limitations

Firstly, thematic analysis is often quite subjective and relies on the researcher's judgement (Javadi and Koroush, 2016). The data were not captured fully and solely in transcripts, the content was not precisely described, contents such as dialogues and comments are very subjective. This involves the risk of missing nuances in the data. Secondly, direct machine translation of the contents might not deliver the content accurately, which might result in misunderstanding of the contents. Thirdly, there is possibility of overlapping of the content when dealing with huge sample size, which causes the themes incoherent and inconsistent. Collected data isn't first source from the user, the children, as the platform only available for any adults to purchase and leave comments.

4. Findings

Finally, the data are presented in a systematic and transparent way as *Figure 9: Thematic report,* including category, theme, code, examples content, and number of references by Nvivo. This section will explain the relationship between the categories, theme, and code explicitly with examples content of the data, how and why the codes were grouped into different themes.

Category	Theme	Code	Examples	References
Technical reviews	Technical evaluation	Bad quality	*"If the characters are too large to be scanned, the small characters do not match the actual font after scanning, it is very difficult to use, it is too bad quality, not worth the price at all."*	1
		volume	*"...the price is high; the volume is high..."*	1
		inaccurate	*"The translation from Chinese to English is not so accurate, and sometimes the text is scanned in wrong places"*	1
		Cost is high	*"...I think the price is very high."; "...it is not worth the price at all."*	2
Socio-technical reviews	Health considerations	Friendly to children	*"The reading pen can be used wirelessly, and it can be used with Bluetooth headsets. It is very friendly to children health."*	1
		Eyes protective	*"This reading pen is really good! The screen does not hurt the eyes, the sound quality is clear, and the battery life is long! The child can study without screen."*	1
	Operation	Easy to use	*"It is very easy to use, the pronunciation is very standard, and the response is very fast. Children in elementary school can operate on their own without any problem. You can learn both Chines and English.";* *"It has been used for a period of time, and the child can correctly grasp the operation method."*	52
		Fit description	*"It is consistent with the description. I will use it when I get it back"*	1

Category	Theme	Code	Examples	References
		Practical	*"The reading pen is really practical, and those who can't can take it out to study at any time. easy to use and practical."*	4
	Speed and accuracy	Fast and accurate	*"...and the recognition speed is also very fast.";* *"It is very easy to use, the pronunciation is very standard, and the response is very fast.";"* *Different speed: the recognition speed is very fast, the response speed is very fast, the recognition correct rate is high."*	25
		dictionary	*"Chinese and English meaning is relatively accurate, both in terms of interpretation and example sentences in dictionary."*	3
		pronunciation	*"...the pronunciation is very standard, and the recognition speed is also very fast."; "..., It can improve English pronunciation and vocabulary."*	26
		translation	*"The translation is accurate, the scanning is fast, and the reading speed can be adjusted. It is very suitable for children to use."* *"It is very good to read English with translations. There are sentences, new words in the dictionaries can be saved, including phonetics, and word groups."*	23
	Functionalities	Good quality	*"This reading pen, the quality and appearance are very good. The functions are comprehensive, very good.";" ...the quality of the items is really good."*	4
		Functions are good	*"When I bought it, I compared it back and forth. This is really the most comprehensive function on the market."; "The functions are complete, mainly for children to learn English, as well as the explanations, etc., in short, enough."*	11
		Off-line available	*"...You can connect to WIFI to download synchronous dictionaries. ";" The reading pen*	17

Category	Theme	Code	Examples	References
			can be used wirelessly, and it can be used with Bluetooth headsets"	
		good audio and content	"... screen is also very clear; the *sound quality is very good.*" *"This reading pen is really good! The screen does not hurt the eyes, the sound quality is clear..."; "voice playback can play out a story and song. The content is quite rich."*	3
		text recognition	*"Any book can be scanned, and can be translated. It has many functions and is really very convenient.";" strong recognition ability…"* *" The recognition is very accurate, and the texts can be recognized, and translated into Chinese."*	19
		translator	*"It is very good to use English words and have translations. Easy for understanding the meaning and memorize the words"*	9
		vocabulary	*"Solve the difficult problem of learning English words. They can spell and read the new vocabulary in time."*	7
Educational reviews	Learning effect	Help in English learning	*"The pen is really easy to use, with fine workmanship, strong recognition ability, accurate translation, accurate pronunciation. It is a good teacher for children to learn English and a good helper for children to read English books."*	16
		independent learning	*"This pen helped children in all aspects of multi-disciplinary, ...";* *"As long as the child does not understand, he will learn it by himself now, and can develop a good habit of independent."*	16
		learning interest	*"The children have a good experience and solve the difficult problem of English words, mainly in the pronunciation part. They can spell and read in time, and they are willing to learn."; "It took me a while to evaluate it. Children are very willing to use it. It can improve English pronunciation and vocabulary."*	12

Category	Theme	Code	Examples	References
		solve the problem of home tutoring	*"It's good to use, the pronunciation is very standard, and it solves the trouble that we can't teach.";* *"... study at home now, so the parents have a lot of peace in mind!"*	16
		spoken fluency	*"After using it for a period of time, the child's interest in learning has improved, and the spoken language has become better..."*	1

Figure 9: Thematic report with the amount of coding references

4.1 Description of the Themes

This section presents description of the themes explicitly with the number of references. The data were further categorized into three types aimed at answering the research questions, they are technical reviews, socio-technical reviews, and educational reviews.

4.1.1 Technical Reviews

The Theme "Technical evaluation"

There are 5 reviews in total that indicated the parents' concerns. Two reviews expressed that the price was above its value, *"...I think the price is very high.";* *"...it is not worth the price at all.",* while others considered the technical problem such as the scanning malfunction, inappropriate volume, which may be due to lack of instruction as one described the pen scanner was difficult to use. *"If the characters are too large to be scanned, the small characters do not match the actual font after scanning, it is very difficult to use, it is too bad quality, not worth the price at all.".*

4.1.2 Soci-technical Reviews

The Theme "Health consideration"

The parents also mentioned health consideration for their children while using technology, eyes protection is emphasized. Under the theme of health consideration, a reference expressed, *"This reading pen is really good! The screen does not hurt the eyes, the sound quality is clear, and the battery life is long! The child can study without screen."*

The Theme "Operation"

The theme of operation, the code *"easy to use"* were labeled by 52 references, which covers the largest part of the data. *"It has been used for a period of time, and the child can correctly grasp the operation method.";* *"Children in elementary school can operate on their own without any problem.".*

There are 4 references stated that the pen scanner is practical as it is portable, light weight, and easily operated by children.

The Theme "Speed and accuracy"

The pen scanner's dictionary, pronunciation, translation and accuracy are coded under the theme of speed and accuracy with a total 77 references. Pronunciation is highly valued, supported by 26 references, *"...the pronunciation is very standard, and the recognition speed is also very fast."; "..., It can improve English pronunciation and vocabulary.".* Followed by accuracy with 25 references, *"The recognition speed is very fast, the response speed is very fast, the recognition correct rate is high."* Thirdly, translation accuracy supported by 23 references *"It is very good to read English with translations. There are sentences, new words in the dictionaries can be saved, including phonetics, and word groups.".*

The Theme "Functionalities"

On the evaluation of the Pen scanner functionalities, 7 codes were grouped into the theme of functionalities with 69 references in total. 19 references mentioned the text recognition technology, 17 references viewed the off-line function was of important so that it can be used without internet with predownloaded dictionaries, which has created convenience for children. 9 references recommended the function of translation, they stated that the function has helped in understanding and memorizing vocabulary in the text. *"It is very good to use English words and have translations. Easy for understanding the meaning and memorize the words".* For vocabulary learning, 7 references indicated that the dictionary has solved the difficulty of spelling and vocabulary building. *"Solve the difficult problem of learning English words. They can spell and read the new vocabulary in time.".* 11 references evaluated generally that the function of pen scanner is very comprehensive and good for children in English learning. *"When I bought it, I compared it back and forth. This is really the most comprehensive function on the market."; "The functions are complete, mainly for children to learn English, as well as the explanations, etc., in short, enough."*

4.1.3 Educational Reviews

The Theme "Learning effects"

For the theme of learning effects, there are 5 codes under it: *"Help in English learning"; "independent learning"; "learning interest"; "solve the problem of home tutoring"; "spoken fluency".* Among 61 references, 16 of them stated that it helps in English learning for book reading, *"It is a good teacher for children to learn English and a good helper for children to read English books.",* the same number of references suggested that the pen scanner had helped the children developed discipline and self-learning ability, *"This pen helped children in all aspects of multi-*

disciplinary, …"; "As long as the child does not understand, he will learn it by himself now, and can develop a good habit of independent.". And this solved the problem of difficulty in home tutoring from the parent's perspective, *"It's good to use, the pronunciation is very standard, and it solves the trouble that we can't teach."; "… study at home now, so the parents have a lot of peace in mind!".* 12 references for the code learning interest stated that the technology has increased children's learning interest, and they are able to take initiative in learning, "*They can spell and read in time, and they are willing to learn."; "It took me a while to evaluate it. Children are very willing to use it.".*

5. Discussion and Conclusion

5.1 Interpretation of the results

The purpose of this study was to explore the value of assistive technologies in the role of supporting English learning at home. The results of the English learning technology, pen scanner, have given some insights in answering the research questions.

5.1.1 Concerns while using pen scanner

There were three major concerns in using the pen scanner according to the results, from technical, socio-technical, and educational perspective. Among all, socio-technical perspective was emphasized by 4 themes; "Health considerations", "Operation", "Speed and accuracy", and "Functionalities".

Technical perspective and socio-technical perspective

The technical perspective included only 5 codes with 5 references, while the socio-technical perspective have most of the references, and part of the codes were also connected with the socio-technical perspective since both discussed the technical functions. Therefore in this discussion these two perspectives will be analyzed together with the focus laid on the socio-technical perspective. The theme of "Technical evaluation" indicated that parents were concerned about the pen scanner technical value, such as its quality in application. The operation of the pen scanner was the biggest concerns. Both categories have addressed the IT accessibility for children on its accessible design. In *the AT Act* stated that the technology should be designed and created for all. The operation was reviewed positively in the code "easy to use" and "practical". Readers may not desire to replace completely the traditional paper-based reading mode with the digital reading mode (Wood et al., 2018). The interaction of pen scanner was considered as an essential factor for children to exploit digital functions supported by the code "easy to use" with the largest references.

Evidence provided in Cui (2021) study on *Parents' Perceived Pressure from and Satisfaction with Online Learning,* that parents concern over kids' health under long time exposure to screen and to unappropriated content. The pen scanner design has eased the stress from those concerns for the parents according to the data. In general, technologies intervention was precepted as a learning's tool that has improved parents' confidence in supporting their children English learning in distance by offering proficiency and accessibility.

Educational perspective

the educational reviews showed the feedback in helping children learning English at home, while the parents might be incompetent on the subject, they considered that the pen scanner helped them to solve the problem of home tutoring, and independent learning". According to Sun (2016), making use of the learner linguistic resources and taking parents into concern is meaningful in creating a literacy

rich learning environment, and total amount of home English media environment were significant predictors for English proficiency.

Hiemstra and Brockett (1991) postulated that SDL learner's contribution to the process of learning depends on the possibilities that the environment can offer. The pen scanner has influenced children's SDL ability from the results. For the learning effects the pen scanner was beneficial for supporting independent learning. Reading exposure has increased with the pen scanner intervention, reading comprehension invovled children spoken fluency, and independent learning. As one type of AT catering for English learning, the pen scanner has been reviewed positively generally for children in English learning due to its simple operation, and health consideration.

5.1.2 Evaluation of the functionalities

Evaluation of the pen scanner's functionalities concentrated in the theme of "speedy and accuracy" and "functionalities". They were also connected with the theme "learning effect", because some of the functionalities were mentioned regarding their educational influence.

Text recognition

Firstly, the quality of the pen scanner in regard of its design and functions was featured in its good audio and content for the text recognition function. This indicated that the design of the pen scanner influenced children focus. The pen scanner is designed with a focus on the audio output instead of the visual components with its equipped software that converts text into spoken voice output. This has emphasized in chapter *2.2.4 The CALL Technologies in English Learning* that visual content distracts learner from the audio content. For enhancing word recognition ability, read-aloud software is feasible and text-to-speech is a technology that designed to assist individuals who have difficulty reading with audible input of text, which is built on the philosophy of *Universal Design for Learning* (Wood et al., 2018). The pen scanner showed that text-to-speech is beneficial for children vocabulary learning so that assists word recognition and text comprehension.

Translation

Secondly, the function was evaluated highly upond the translation speed and accuracy. The translation was mostly reviewed as fast and accurate. By translating the English text into learner's native language, these have provided comprehensive understanding for the learners in their reading, thus improved their learning interest. The learning interest increased, children were willing to use the pen scanner, because it attracted attention and facilitated self-learning. The children had access to both Chinese and English with help of the translation, they were encouraged to initiating self-learning tasks. Based on the research for the acquisition of English with Mandarin speaking monolingual children, that having access to two languages allows children to compare and contrast structural

features of language at a more abstract level and develop an independent learning ability by reflecting, evaluating upon the objective language (Bialystock,1988).

Off-line dictionary

The pen scanner attempted to solve the English proficiency issue for Chinese EFL teaching by offering offline authentic audio/dictionary package so that the learners have accurate input of the language under off-line situation. Spoken fluency was one of the learning effect benefited from the off-line dictionary. Listening and reading were considered beneficial for children spoken fluency, through bridging word recognition and text comprehension together. Vocabulary building is considered important for being able to read, the search vocabulary can be saved in the pen scanner respective app for mobile, which allows for quick retrieval of vocabulary, spelling, or pronunciation. The frequents problem for EFL learners is that they fail to establish familiarity and remember the vocabulary from the above literature reviews. It showed that the dictionary has enabled learners take in information more precisely by presenting grammatical explanation, and extended sentences as example. Furthermore, except the translation, extended clarification of the text is also praised in the results for assisting in decoding.

5.2 Possibilities and Future Research

In this paper, the application of pen scanner has been studied in regards of outside classroom learning situation. In reviewing the experiences with the use of the pen scanner, we can find evidence showing improved performances of reading and literacy skills, including word recognition, word recall, and reading comprehension according to the results. It also appeared to be engaging and motivating to the learners. The pen scanner has influences on learners learning interest, learning objectives, and learning effect according to the above results. As a tool designed to encourage autonomous studying in English reading for primary students in China, it showed the potential for independent learning for children with the functionalities such as text recognition, translation, and off-line dictionary.

There is implication for English learning in primary school in using such technology. One of the limitations for technology used in learning is that they are mainly used for teaching purposes in China, and seldom utilized for student-centred activities as mentioned in the literature reviews above, which is due to the teacher-centred teaching philosophies and methodology. For children, the pen scanner has strengthened their learning interest and learning objective through providing access to various media with a focus on the learner centeredness, such as the access to audio dictionary, easy operation. The current used technology in China is mainly for teacher-centred purposes, such as teaching preparation and instructional delivery, they seldom utilize technology for student-centred activities. The pen scanner has potential in helping students accelerate their reading regardless support from

teacher and this can be an effective instructional mode for those teachers who plan to integrate digital pen technologies and printed textbooks into English courses in the class.

For education, in chapter *2.2.1 The Role of Information and Communication Technology Inputs* has mentioned that, effectiveness, cost, equity, and willingness are four broad intertwined issues addressed when considering the overall impact of the use of ICTs in primary education, in accordance with the results of the pen scanner, that the cost is relatively affordable comparing with laptop, or iPad, and the design of the pen scanner is practical that can use without connection of internet, and portable. Additionally, the operation of pen scanner is considered simple while there is lack of sufficient ICT instruction training for the user in school that may cause low efficiency for the integration.

In general, the combination of pen scanner for in-class activities of English subject in school teaching is worth studied as the results indicated that the pen scanner has encouraged students independent learning, thus the tool might make complement to the ICT in use for school teaching by emphasizing the role of learner, in improving learning efficiency and effectiveness of English learning

5.3 Limitations

The study did not consider the learning outcome since the focus is on the experience of the pen scanner intervention and also the functionality of the product for English learning. English learning in traditional class in school involves learner centeredness, course mediation, objectives, interaction, and synchronicity (Belanger & Jordan, 1999), the pen scanner was not investigated in such. The pen scanner must have other characteristics of importance in a regular evaluation of the product. Into consideration was only taken the descriptions of experiences on the featured usability for English learning at home. At home settings or study in distance, the variators for learning are, discipline, parent engagement, pedagogical models, instructional strategies, and learning technologies, the alignment among technology, curriculum, and pedagogy model are emphasized (Aparicio & Bacao, 2013).

However, the curriculum was not investigated in this study, the level of difficulty in the language was not standardized, thus the evaluation of the pen scanner could be bias. It is difficult to have control over what content the learners acquire from, and to know their proficiency in English learning. Curriculum alignment requires purposeful interactions over the learning content, learning objectives and pedagogy instruction, such interactions between participants establish either cooperation or collaboration patterns (Gajek, 2017). School package of the lesson materials may be beneficial for this issue and can improve the implementation for school education as well.

5.4 Conclusion

The aim of this study was to explore the value of assistive technologies in the role of supporting English learning for primary school students. In line with previous research, English input quantity and quality, English proficiency are factors significant for English learning in China. Assistive technologies such as the pen scanner, can increase language input quantity by encouraging children independent learning. Besides, the technology has increased the accuracy of language input by providing accurate pronunciation. This is significant in supporting English learning in a monolingual environment. For children, operation of the technology and English proficiency are factors that effects children's achievement in English learning at home. Therefore, the assistive technology has improved home English literacy environment through offering access to the language, and encouraging independent learning.

There is possibility in fitting the technology in the pedagogical structure in school. Improving children's English learning with assistive technology requires further research in China on the following aspects refer to the results of this paper: the quality and quantity of English input for listening and reading; establishing a combination between in-class and after-class independent learning.

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