

A Project entitled

Mobile assisted language learning: Conversion from Mandarin to Cantonese

Submitted by

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DECLARATION

I, *Lam Yick Sun* , declare that this research report represents my own work under the supervision of *Dr. Lai Yiu Chi, Associate Professor, Department of Mathematics and Information Technology, The Education University of Hong Kong* and that it has not been submitted previously for examination to any tertiary institution.

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ABSTRACT

Cantonese as a spoken variety of Chinese Language is widely adopted in not only the Cantonese speaking region in China, but also other Chinese communities in the world, with an estimated population of 72 million of native speakers in different countries. 90% of the population in Hong Kong adopt it as first language. Cantonese is inevitable for daily life purpose in Hong Kong. A mobile assisted language learning tool applying the concept of conversion from Mandarin to Cantonese apply the corresponding is developed by a famous native mobile application development framework, React Native is developed in this project. On one hand it can assist Mandarin speaks to learn Cantonese, on the other hand it can help promoting the Cantonese language and culture to the whole Chinese community with Mandarin's statue of lingua franca. Experiments is carried out to evaluate the learning effectiveness of the mobile application comparing to the traditional method and the result shows that the mobile application achieve a similar effect as the traditional method. The result of the follow up interview evaluating learner's attitude towards the experience of using the tool to learn Cantonese shows that generally the learners satisfy the overall experience, however, their attitude and confidence towards mobile assisted language learning is just average.

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS	4
LIST OF TABLES	7
LIST OF FIGURES	8
CHAPTERS	
1 Introduction	9
2 Literature Review	9
2.1 Computer assisted language learning	9
2.2 Mobile Assisted Language Learning	10
2.3 Second language acquisition	12
2.4 Conversion from Mandarin to Cantonese	12
2.5 Romanization of Chinese	14
3 Research Aims and Questions	15
4 Design of Application	15
4.1 Basic Principles	15
4.1.1 Authentic materials	15
4.1.2 Collaborative learning materials	16
4.2 Main function	16
4.2.1 Reading	16
4.2.2 Training	18
4.3 Development procedures and technology involved	20
5 Methodology	22
5.1 The experiment	22
5.2 Data collection	25
5.3 Method of data analysis	27

6 Result Analysis	27
6.1 Background information	27
6.2 Quantitative analysis of result score	28
6.2.1 Score improvement	28
6.2.2 Proficiency vs Improvement	30
6.2.3 Frequency of error and rate of correction	32
6.3 Qualitative analysis of interview responses	35
6.3.1 Motivation in learning Cantonese	35
6.3.2 Effective way to learn Cantonese	37
6.3.3 Difficulties in learning Cantonese	37
6.3.4 Attitudes towards MALL learning experience	38
6.3.5 Positive and negative feedback towards the mobile application	39
7 Limitations	41
8 Further Investigations	43
9 Conclusion	44
REFERENCES	45
APPENDICES	48

LIST OF TABLES

1 Mean of Score Improvement Rate of the Six Score in Testing Group and Control Group	29
2 Correlation Coefficient of Improvement	31
3 Frequency of Error and Rate of Correction	32
4 Ten Most Corrected Error by Syllabic Component	34

LIST OF FIGURES

1 Screen Capture of “Reading Passage”	17
2 Screen capture of syllable analysis	18
3 Screen capture of training session.....	19
4 Screen capture of the experimental setting	25
5 Screen Capture of mark sheet of testing result	26
6 Motivation of learning Cantonese	35
7 Prestigiousness of Cantonese	36
8 Average time spent to learn Cantonese in a week	36
9 Positive feedback of the mobile application	39

1 Introduction

Cantonese as a spoken variety of Chinese Language is widely adopted in not only the Cantonese speaking region in China, but also other Chinese communities in the world, with an estimated population of 72 million of native speakers in different countries in the world (List of languages by total number of speakers, n.d.). Cantonese as the official language of Hong Kong, nearly 90% of the population (Census and Statistics Department, 2011) adopt it as first language. As a low variety language, Cantonese is inevitable especially for daily life purpose in Hong Kong. For the sake of assisting Cantonese learners, especially the group of Mandarin speakers to learn Cantonese, as well as promoting Cantonese to all the Mandarin speakers, a MALL mobile application of conversion approach from Mandarin to Cantonese is developed, following by an experiment testing the effectiveness of learning Cantonese with the application and the users' attitude towards the application and learning Cantonese.

2 Literature Review

2.1 Computer assisted language learning

Generally speaking, computer assisted language learning (CALL) is defined as the process of using a computer to improve the learner's language ability, it can either be assisted by using any forms of technology, or using a particular application (Levy, 1997; Beatty, 2003). Computer can mainly assist teaching and learning in the following areas: materials design, technologies, pedagogical theories and modes of instruction (Beatty, 2003). As suggested by Davies & Higgins (1982), CALL emphasizes on student-centered approach

rather than teacher-centered approach, which means it emphasizes on the self-access to the materials by students.

Meskill (2002) points out that computer can mainly perform four main roles in CALL, 1) justify predefined answer for question type with model answer, for example MC and fill-in-the-blanks, 2) Provide immediate comment or feedback in a fixed manner, 3) Provide multimedia authentic materials and 4) record learner's learning progress. Bax (2003) suggests some task that can be performed by CALL, including closed drills, quizzes, simulations, games, computer-mediated communication and web-based programs.

2.2 Mobile assisted language learning

Mobile assisted language learning (CALL) is derived from the concept of mobile learning and computer assisted language learning. It is firstly defined as the process of the enhancement in language learning assisted by handheld mobile devices (Chinnery, 2006) for example laptop computer, tablet computer and smartphone. Miangah & Nezarat (2012) suggests that collaborative learning is highly encouraged by mobile learning as learners are allowed to exchange their knowledge and skills through the interaction made by mobile devices, which is helpful in supporting, motivating and evaluating each other among learners. They also state that mobile device enables learner accessing to multimedia element. It is especially important for teaching and learning of pronunciation, speech and voices should be included for learners to learn correct and unfamiliar pronunciation. Learners can also record their own voice for evaluation by teachers or peers.

Klopfer, Squire & Jenkins (2002) points out five features of mobile device which facilitate learning. 1) Portability, the small size and the weight of mobile devices allow the users to access to the learning materials without geographical limitations, in any time and any places; 2) Social interactivity, it allows the users to exchange information and collaborate with other learners; 3)Context sensitivity, mobile devices can collect and respond to real data regarding time, location and environment; 4)Connectivity, devices can be connected to the network for data collection; and 5)Individuality, individual learners can scaffold to learn from for customized activities in different difficulty.

From the studies of Burston (2013), it is noted that over the past two decades (from 1994-2012), over 300 projects implementing MALL have been published, the most popular target language is English, following by Chinese, Japanese and other European languages, however, none of the publication targets Cantonese as target language.

2.3 Second language acquisition

From the input hypothesis raised by Krashen (1977), comprehensible input is important for learning second language, which means the input of the language should only be slightly more advanced than the learner's current level. She also claims that language can only be subconsciously acquired but not consciously learnt. Consciously learning of the language cannot be used as the source of spontaneous language production. The noticing hypothesis by Schmidt(1990) also states that the learner can only learn the grammatical features of a language by consciously noticing the error made.

The connectionist approach of language acquisition tries to explain the cognitive learning process of human brain with the architecture of a neuron network in a computer that it works based on the frequency of the language input and the patterns in the input. With the increased number of co-occurrence of a particular, human brains tend to adopt this form as an acceptable and grammatical form. The belief may vary based on memory as well as the frequency of the input language (Christiansen, & Chater, 2001).

2.4 Conversion from Mandarin to Cantonese

Mandarin and Cantonese being different variety of Chinese, from the linguist point of view, should be considered two different language because of their mutually unintelligibility. Bao (1999), Duanmu (2002), Li & Thompson (1981) and Yan (2006) share the belief that Cantonese and Mandarin are mutually unintelligibility, which means they cannot communicate with each other. Tang (2009) even points out that although Mandarin and

Cantonese share the same writing system, Mandarin is only 19% similar to Cantonese by lexical similarity.

However, Mandarin and Cantonese is rather similar in terms of syllabic structure and syllabic components. Cantonese and Mandarin are both tonal and syllable-timed language that each syllable is represented by a character. Each syllable in Cantonese and Mandarin consists of three components, an initial, a final and a tone.

There are altogether 20 initials in Cantonese, in which 14 of them are found in Mandarin while 3 of them are considered similar, therefore mandarin speakers already familiarize with 85% of initials in Cantonese with only 3 of the rest are distinctive in Cantonese. Comparing the finals in Cantonese and Mandarin, among the 8 monophthongs in Cantonese, 3 of them are found in Mandarin, 3 of them are similar and only 2 of them are distinctive in Cantonese (Chan & Li, 2000; Duanmu, 2000).

Kataoka (2016) and Ho (n.d.) concluded some rules of conversion from Mandarin to Cantonese by corpus-based studies, they suggested that there are certain numbers of possibility for one sound converted from Mandarin to Cantonese, for example for the words with initials /b/ in Mandarin, 91.8 % of them will have the same initial /b/ in Cantonese, 6.3% to have /p/, /m/ and /f/ would be some minor exceptions. By understanding the corresponding rules of conversion for every sound in both the languages, it constructs a systematic way for Cantonese speaker to learn Cantonese.

2.5 Romanization of Chinese

Chinese adopts logographic characters in its writing system, Chinese characters only represent meaning and concept but not phonemes. Unlike other languages which use phonograms in their writing system, for example English, Korean, Hiragana in Japanese, it is impossible to determine the pronunciation of a Chinese character by only reading it. (Coulmas, 2003) Learning Chinese is difficult for many nonnative Cantonese speaker as it involves the recognition of Chinese characters.

Romanization refers to the conversion of a writing system into another writing system in Latin script. For Romanization of Chinese characters, Latin alphabet is used to write Chinese, or as annotations for Chinese characters as an assistive tool for pronunciation. Jyutping (粵拼), one of the most popular Romanization system developed by LSHK in 1993, is mainly used to transcribe Cantonese. LSHK Jyutping system has the feature of “typing-friendly”, in which all the symbols it adopts can be typed by a common keyboard. Jyutping enhances the learning progress for learning Cantonese, especially for people who are familiar with Latin alphabets (Kataoka & Lee, 2008).

3 Research Aims and Questions

The conversion approach from Mandarin to Cantonese is expected to be beneficial to groups of learners who understand Mandarin. Mandarin as the lingua franca of Chinese community in the world, this tool can promote the Cantonese language as well as Cantonese culture to the entire Chinese community in the world.

A mobile application applying the corresponding rule from Mandarin to Cantonese is developed in this project, following by a research aiming at investigating the learning effectiveness of the mobile application, learners' attitude towards using MALL tools to learn Cantonese and their motivation towards Cantonese learning.

4 Design of Application

4.1 Basic principles

4.1.1 Authentic materials

Authentic materials in language learning can be defined as the real language produced by a real speaker or writer that is addressing a real message to a group of real audience (Morrow, 1977), comparing to the artificial content in some language textbooks that made up for specific grammar training, authentic text is suggested as the reading material for language teaching by Hwang (2005). This application adopts text extracted from authentic Cantonese materials as learning materials for example real life dialogue, movie, TV drama, radio program and speech etc.

4.1.2 Collaborative learning materials

The learning materials in this application is expected to be contributed by different internets who are supposed to be Cantonese Native speakers or language teachers. Each set of material is tagged by different criteria for example the background of the target students, levels, topics, learning objectives etc. so that learners can search for their desirable set of materials with respect to their needs of study.

4.2 Main function

4.2.1 Reading

The reading session is divided into two parts, the Reading Passage and Syllable Analysis. In the reading passage, the text is displayed with Cantonese Jyutping annotation. The text is also segmented into words with respect to the meaning of the word. For example, the sentence “我自細就好鐘意電影” (I liked movie since I was young) is segmented into “我/自細/就/好/鐘意/電影” (I/ since young/ thereupon/ very/ like/ movie). The whole passage comes with an audio recording which can be played by clicking the button on top of the interface. The audio file is also trimmed into parts of each words, the sound of that word will be played by clicking the words in the passage.



Figure 1. Screen Capture of “Reading Passage”

After the annotation of Jyutping and Pinyin by the syllabic components, each syllable is categorized by the syllabic components according to its Jyutping and its corresponding Mandarin Pinyin, this is how the corresponding rules applied.



Figure 2. Screen capture of syllable analysis

As seen in figure 4.2, a specific syllable component (initials, finals and tones) can be selected from the interface on the left, for example the Mandarin initials [q] is selected as shown on the right of the figure, all the syllables with initials [q] in Mandarin is shortlisted: 愛情片, 老前輩, 平步青雲 and so on. The syllables are then categorized according to their corresponding Cantonese syllabic components, as shown in the figure, the possible initials in Cantonese corresponding to the initials [q] in Mandarin are [c] and [h] deduced by the syllable given from the reading passage. Learners can listen to the pronunciation of that word by clicking the button.

4.2.2 Training

The training session is also divided into three parts the same as the syllabic components of a syllable: initials, finals and tones. Learners are required to go through the whole passage word by word with the targeted word displayed on screen, they are required to

choose the correct syllabic component of the syllable with the choices given, all the choices are the possible syllabic components derived from the syllable analysis session according to the corresponding rules.



Figure 3. Screen capture of training session

As seen in figure 4.3, learners can choose a category of syllabic component to train in the interface on the left, the example shown on the right is the training of “finals”. The word “一定” (must) contains two syllables, take the first syllable “一” (one) as example, its “finals” in mandarin is [i], according to the corresponding rules, there could be six possible choices in Cantonese for the finals [i] as seen in the figure: [at], [ek], [ei], [ai], [ik] and [i], learners are required to choose the correct one [at] and the button turns green to indicate that the correct answer is chosen. The sound of that word will be played if the answers of all the syllables is chosen correctly and the user is prompted to the next question.

4.3 Development procedures and technology involved

The developmental procedure involves the steps to manipulate the learning materials, the design of the user interface and the algorithm to perform the functions.

To begin with, a text is chosen as the learning materials. A text chosen from a Cantonese textbook is used as a sample to test the algorithm. The first step is to prepare the audio recording file of the text, prepared depending on the source of the text. The next step is to segment the text into words. Unlike English or other languages with clear word boundary indicated by a space, segmentation is the very first step in the natural language processing in Chinese linguistics. Automatic segmentation of Chinese language can be done in two approaches, supervised segmentation by a lexicon and unsupervised segmentation based on the training of a big corpus regarding the frequency of combination of characters (Magistry, 2012). However, both approaches do not work for the case of Cantonese because of the limited resource in Cantonese linguistics. Segmentation is done manually instead.

The next step is the transcription of Pinyin and Jyutping, both processes are done by programming, the former one is done by a Python library and the former one is done by a online conversion tool as no available Python library is found. Both the transcriptions are done by matching characters with its dictionary pronunciation that the transcription may vary as there may be more than one possible pronunciation for the same character. Manually proofreading of the transcription is done after the transcription to ensure that the transcription is corresponding to the recording. After that a Python script is written to break down the Jyutping and Pinyin into three components respectively and the result is saved in a json file.

An excerpt of the json file is shown as follow:

```

{
  "character": "我",
  "pinyin": [
    "w/o/3"
  ],
  "jyutping": [
    "ng/o/5"
  ]
},
{
  "character": "自細",
  "pinyin": [
    "z/i/4",
    "x/i/4"
  ],
  "jyutping": [
    "z/i/6",
    "s/ai/3"
  ]
},

```

After the transcription, the next step is to prepare the sound files of each word. A time marker file is prepared by marking the beginning and the end time of each word in the recording of the whole text manually, a python script is written to trim the whole text sound file into individual sound files of each word with the time markers.

The interface of the application and the algorithm of the functions of the algorithm is developed using React Native ES6 JavaScript. React Native is a JS framework for mobile application development that support both the native development of Android and iOS application. The login information, learning materials and the learning process are handled by Firebase, which is a service of real time, cloud base, NoSQL database management system provided by Google.

5 Methodology

5.1 The experiment

To test the learning effectiveness of the mobile application and the attitude towards mobile assisted language learning, experiments and interviews were conducted to collect the required data. A total number of 26 participants were recruited to participate experiments in March and the whole process was finished in eight days. All the participants are aged 18 or above native Mandarin speakers but nonnative Cantonese speakers recruited through the intranet of the Education University of Hong Kong. All the participants are current undergraduate or postgraduate students and no specific proficiency of Cantonese is required for the participants.

The research is conducted individually with an experiment of pre-test post-test design to measure the subject's learning effectiveness by the improvement made by the subject. An in-depth interview regarding the subject's attitude towards Cantonese learning and mobile assisted language learning is given after the experiment. The whole process lasts for about one hour and the content of the pre-test and post-test is audio recorded. Fifty-dollar

supermarket cash coupon is given to subject who can successfully finish all the process as reimbursement. The subjects will be randomly divided into two groups, testing group and control group while the subjects in the testing group used the mobile application for training, traditional paper form notes were used for the testing group.

The research begins with an introduction of the background of the research project. The subject is consented to participate the research by signing the consent form and the subject also agrees to be audio recorded during the process. The subject is then being divided into either the testing group and the control group and a subject number is assigned to the subject. (Odd number: testing group, Even number: control group)

Before the experiment, a questionnaire to collect the subject's background information is given. The data collected include the gender, age, the city of origin, the language proficiency, the duration of learning Cantonese and staying in HK of the subject. This information is used to test the correlation with the experiment result.

A pre-test is given to the subject after the background survey. There is only one set of question, all the subjects are tested with the same set of question. The subject is required to read aloud a text of 263 characters in Cantonese. The process is audio recorded for the ease of score marking. The audio of the subject is recorded using zoom h4n handheld recorder with a specific SD card as the medium of storage.

After the pre-test, a 30-minute training session is given to both groups of subjects. The subjects in the testing group use the mobile application as the training materials while the control group uses the paper form notes as the training materials. The content is the same text

used in the pre-test. A brief introduction of the mobile application is given to the subjects in testing group demonstrating the functions of the application. The materials for control group include a printout explaining the conversion rule from Mandarin to Cantonese, the reading passage with Cantonese Jyutping annotated and the audio recording of the passage played on a computer. There are no regulations to the subjects in terms of the usage of the training materials, they can choose any functions or materials for self-learning.

After the training session, a post test the same as the pre-test will be given to both groups of subjects so as to compare the result to deduce the improvement. An interview is conducted after the post-test to collect the data regarding the subject's motivation of learning Cantonese, the reasons of learning Cantonese, the ways of learning Cantonese, the difficulties in learning Cantonese, the opinion regarding the mobile application (testing group only) and the attitude towards mobile assisted language learning.

Experimental settings of the mobile application are adopted instead of a version with full functions for the sake of having better control of factors in the experiment. All the subjects use the same mobile device in the training session, which is an iPhone X provided by the researcher. The subjects use the account registered by the research before the experiment instead of using their own credentials to register their own account so as to keep the subject identity anonymous. Their identity is represented by the subject number only. In the experimental settings of the mobile application, there is only one set of learning materials which is used in the pre-test, post-test and the training session for both the testing group and control group. The set of materials is adopted from a Cantonese Textbook of university level targeting native Mandarin speaker (Ng & Lee, 2012). The chosen excerpt of article is under the context of a speech by an awardee in a film prize-giving ceremony, which is the transcript

of authentic language. The audio recording the text is the speech delivered by a native Cantonese speaker.

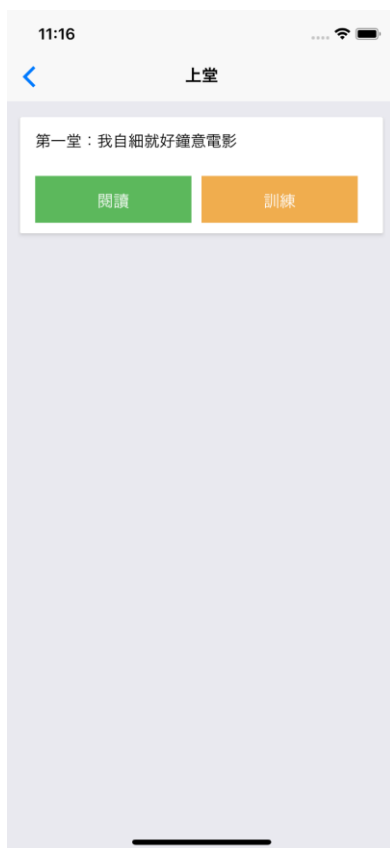


Figure 4. Screen capture of the experimental setting

5.2 Data collection

With the audio recording files, a marking scheme is designed to measure the score of the subject's performance in pre-test and post-test. Score is given for every syllable in sound file. There are 6 scoring criteria for each syllable: initials, vowel, coda, final, tone and overview in which the "final" is constituent of the vowel and coda and the "overview" is constituent of all the previous scores. Each error made by the speaker is marked in the score sheet using IPA symbols instead of Jyutping and pinyin. The benefit of using IPA is that there is set of symbols to represent both the languages so that the error across the languages

can be represented. All the recordings files are marked by the same marker, who is a native speaker of Cantonese who has undergone phonetics and phonology training. There are all together 24 valid subjects and 263 syllables in each test, as a result, 6312 entries in total. There are 12 columns in each entry representing the 6 criteria in both the pre-test and post-test. The non-empty entries indicate the existence of an error.

A	B	C	K	L	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
#	s		ki	ch	onset	vo	cc	fil	to	rer	o	on	vov	co	fin	toi	ret	o
1	1	t	0	我				0			0				0			0
2	1	t	1	自				0			0				0			0
3	1	t	2	細		e		1		1					0			0
4	1	t	3	就				0		0		o	u		1			1
5	1	t	4	好				0		0					0			0
6	1	t	5	鐘	ts			0		1					0			0
7	1	t	6	意				0		0					0			0
8	1	t	7	電				0		0					0			0
9	1	t	8	影				0		0					0			0
10	1	t	9	愛				0		0					0			0
11	1	t	10	情				0		0					0			0
12	1	t	11	片				0	1		1				0			0
13	1	t	12	科				0		0					0			0
14	1	t	13	幻		u		1		1		u			1			1
15	1	t	14	片				0	1		1				0			0
16	1	t	15	甚			n	1		1			n		1			1

Figure 5. Screen Capture of mark sheet of testing result

There are four possible types of error in each syllabic component: substitution, insertion, deletion and invalid. Substitution means that a phoneme is replaced by a wrong phoneme, for example for the syllable 我 ŋɔ5 -> wɔ5, the initials [ŋ] is substituted by [w] in this case, this type of error is indicated by the wrong phoneme, i.e. [w]. The second type of error is insertion, which means the addition of an unexist phoneme in to a syllable, for example 左 tsɔ2 -> tsɔk2, an unexist coda [k] is added to the syllable. This kind of error is indicated by the added phoneme, i.e. [k]. The third type of error is the deletion of phoneme, which means that a phoneme is missing in the syllable, for example tək1 -> tɛ1, the coda [k] is missing in the uttered syllable. This kind of error is indicated by the symbol “-”. The last type of error is called “invalid”, which refers to a missing syllable, a wrong or unrecognized

syllable or the syllable uttered by its Mandarin pronunciation, the error is not specifically marked in this case, instead, a “X” symbol is marked to represent this type of error.

5.3 Method of data analysis

Both the quantitative and qualitative data analysis method is adopted to analysis the data. Quantitative method is used to analysis the score of the pre-test and post-test. The score of each subject is deduced by counting the number of occurrence of error in each test. The findings are manipulated using R programming in R studio. The mean of score improvement of both groups of subjects is calculated and the significance of the difference is deduced by both a non-parametric statistical method. The correlation between the proficiency and the rate of improvement is calculated. The rate of correction and the most frequent error in each categories of syllabic component are also deduced.

Qualitative analysis is used to analysis the responses from the interview and the result is divided into several parts: Motivation of learning Cantonese, Reasons for learning Cantonese, Effective ways of learning Cantonese, Difficulties in learning Cantonese, Opinion about the mobile application (testing group) and Attitude towards mobile assisted language learning.

6 Result Analysis

6.1 Background information

There are altogether 26 participants in this research, 24 of them finished the experiment successfully, 12 of them are in the training of testing group and 12 of them are in the control group. The 2 subjects who cannot finish the experiment also participated in the

follow up interview. Among the 24 subjects who can finish the experiment, 22 of them are female and 2 of them are male. All are from the age group of 18-25, all of them are current undergraduate or postgraduate students from the Education University of Hong Kong. The mean score of proficiency of Cantonese claimed by the subjects in testing group is 1.83 out of 5 in a range from 1 to 4, that of the control group is also 1.83 out of 5 in a range from 1 to 4. The average number of month of learning Cantonese of the subject from the testing group and control group is 21.5 and 14 respectively and the average number of month for staying in Hong Kong of the subject from the testing group and control group 26.67 and 14.58 respectively.

6.2 Quantitative analysis of result score

6.2.1 Score improvement

Among the 24 samples collected, 12 of them from the testing group and 12 of them from the control group. 1 outlier excluded in the testing group. By comparing the mean of score improvement rate of the six scores in the testing group and control group, the result of the testing group is a bit higher than that of the control group, with a difference of 1.53%, 0.37%, 0.31%, 0.63%, 0.47% and 2.76% for the score of initials, vowel, coda, finals, tone and overview respectively.

Table 1

Mean of Score Improvement Rate of the Six Score in Testing Group and Control Group

		Mean (%)	Standard Deviation
Testing Group	onset	6.152783	4.989017
n=11	vowel	9.056343	6.097461
	coda	6.08365	5.438725
	final	10.26616	5.678017
	tone	4.597304	5.671532
	overview	13.37712	6.076084
Control Group	onset	4.626109	4.386004
n=12	vowel	8.681876	4.678881
	coda	5.766793	3.88379
	final	9.632446	4.618092
	tone	4.119138	2.931069
	overview	10.6147	4.929542

With the small number of sample size, normal distribution cannot be assumed in the populations, parametric hypothesis test is not suitable for determining the statistical significance of the difference by the two groups. A nonparametric test of null hypothesis is used to test the mean of score improvement. Mann–Whitney U test is used as it is suitable for comparing 2 groups of independent variables.

One-tailed Mann-Whitney U test is used under the assumption that H0: mean score of improvement of two groups have no relationship and H1: mean score of improvement of testing group is greater than that of the control group. The p value of the six groups of scores under a level of significant (α) of 0.05 are 0.34, 0.95, 0.84, 0.603, 0.91 and 0.15 the score of initials, vowel, coda, finals, tone and overview respectively, all of the p values is greater than 0.05. The null hypothesis cannot be rejected, indicating that the difference between the mean score of the testing group and the control group is not significant. It can be deduced that using the tested mobile application to learn Cantonese under the experimental settings is as effective as the traditional method of using paper form notes.

6.2.2 Proficiency vs Improvement

Among the factors surveyed in the background questionnaire, three factors is related to the subject's proficiency of Cantonese: self-claimed proficiency of Cantonese, period of learning Cantonese and period of staying in Hong Kong. The self-claimed proficiency is not investigated in data analysis as this is the subjects' personal judgment made by the subject that is not a fair judgment. However, the subject's performance is the pre-test is the most direct indicator of the proficiency level. Therefore, 3 factors: period of learning Cantonese, period of staying in Hong Kong and score in pre-test of the subjects in testing group (N=12) are adopted to calculate the Pearson correlation coefficient with the improvement of the score of the six marking criteria.

Table 2

Correlation Coefficient of Improvement (R0: period of learning Cantonese, R1: period of staying in Hong Kong, R3: pre-test score)

	R0	Correlation	R1	Correlation	R2	Correlation
onset	-0.5378	moderate	-0.5047	moderate	0.9605377	strong
vowel	-0.5732	moderate	-0.5826	moderate	0.919981	strong
coda	-0.5318	moderate	-0.5365	moderate	0.9705625	strong
final	-0.6056	moderate	-0.6629	moderate	0.8946394	strong
tone	-0.4849	weak	-0.4851	weak	0.9656296	strong
overview	-0.6376	moderate	-0.9041	strong	0.6954791	moderate

As seen in table 2, the correlation coefficients of period of learning Cantonese in 5 out of the 6 criteria have an absolute value more than 0.5 except in the category of tone, it indicates that there is a moderate negative relation between the period of learning Cantonese and the rate of improvement in a sense that the longer the period of learning, the lower the improvement can be made. Similar result is also drawn for the period of staying in Hong Kong, an even stronger negative correlation is found in the criteria of overview. This result indicates that there is a certain relation between the period of staying in Hong Kong and the rate of improvement in a sense that the longer the period staying in Hong Kong, the lower the improvement can be made. Strong relation is shown by comparing the pre-test score and the score improvement. The R value in 4 out of 5 criteria have an absolute value greater than 0.8 except the one in overview, the value is 0.70 which still indicates a moderate relation. This result shows that the lower the pre-test result, the higher the rate of improvement will be.

From the above three sets of figures, it can be deduced that the tested mobile application is more effective for beginning learners than intermediate or advanced learners.

Other factors for example gender, age and the city of origin is not tested due to the small number of sample size in each group that no representative findings can be drawn from the sets of data.

6.2.3 Frequency of error and rate of correction

By counting the frequency of error made by the subjects in the testing group in both the pre-test and post-test, it is found that there are altogether 189 types of error in the four marking criteria: onset, vowel, coda and tone, the frequency of error of these four marking criteria in pre-test is 250, 537, 256 and 158 respectively. This figure shows that vowel in the most problematic area for the subject in the test group. By comparing the frequency of error in the pre-test and post-test, the rate of correction is deduced in the four marking areas, which is 75.6%, 52.70%, 86.72% and 71.52% respectively. The overall rate of correction is 67.19%. This figure shows that the mobile application improves the error of coda most effectively, following by onset, tone and vowel.

Table 3

Frequency of Error and Rate of Correction

	onset	vowel	coda	tone	Total
Types	61	69	34	25	189
Frequency in pre-test	250	537	256	158	1201
Frequency in post-test	61	254	34	45	394
Rate of correction (%)	75.6	52.70	86.72	71.52	67.19

By comparing the frequency of each type or error by each syllabic component in the pre-test and post-test of the subject in the testing group, the 10 most corrected types of error are shortlisted by syllabic component as shown in the table below. This information can be the implications for language teachers to design teaching materials. As seen in Table 4, each type of error is represented in from of a “from and to” contrast, the phoneme in “from” is the correct one and the symbol in “to” is the error made by the lernsers.

Table 4

Ten Most Corrected Error by Syllabic Component

Onset					Vowel				
	From	To	Frequency	Correction Rate	From	To	Frequency	Correction Rate	
1	w	h	6	100	a	e	7	100	
2	p ^h	p ^h _j	4	100	ɐ	y	4	100	
3	h	s	3	100	o	ɔ	4	100	
4	f	k ^h	3	100	ɔ	o	3	100	
5	k	ts	16	81.25	y	e	3	100	
6	h	k ^h	4	75	y	u	3	100	
7	p	p ^h	11	72.72	i	e	20	85	
8	j	-	6	66.67	i	a	6	83.33	
9	j	ɥ	6	66.67	u	a	6	83.33	
10	j	h	3	66.67	ɐ	ɿ	6	83.33	
Coda					Tone				
	From	To	Frequency	Correction Rate	From	To	Frequency	Correction Rate	
1	i	-	18	88.89	2	3	8	100	
2	y	i	7	85.71	1	3	4	100	
3		i	28	75	2	6	3	100	
4	n	m	4	75	3	6	3	100	
5		u	4	75	2	1	28	89.29	
6	k	i	7	71.43	2	4	5	80	
7	k	-	36	66.67	6	1	12	75	
8	m	n	30	66.67	4	2	24	70.83	
9	n	ŋ	9	66.67	1	5	6	66.67	
10	u	u	8	62.5	5	4	3	66.67	

6.3 Qualitative analysis of interview responses

6.3.1 Motivation in learning Cantonese

Generally speaking, the subjects possess a high motivation in learning Cantonese in general with a mean score of 3.88 out of 5, 13 of the subjects out of 26 mark a score of 4 for the motivation of learning Cantonese. The subjects regard Cantonese as a moderate prestige language with a mean score of prestigious of 3.27 out of 5 with 9 out of 26 of the subjects mark a score of 4. With a general high motivation towards learning Cantonese, 73.1% of the subject would like to take a further Cantonese course, however, more than 50% of them claim that they would never spend extra time to learn Cantonese in daily life, and 26.9% of them would spend about 1-2 hours per week to learn Cantonese.

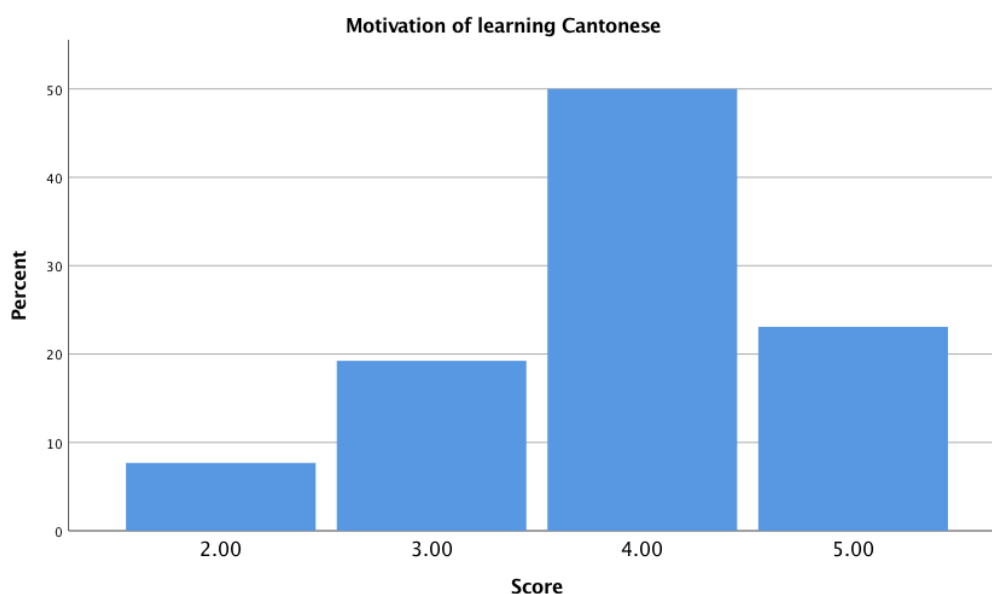


Figure 6. Motivation of learning Cantonese (N=26)

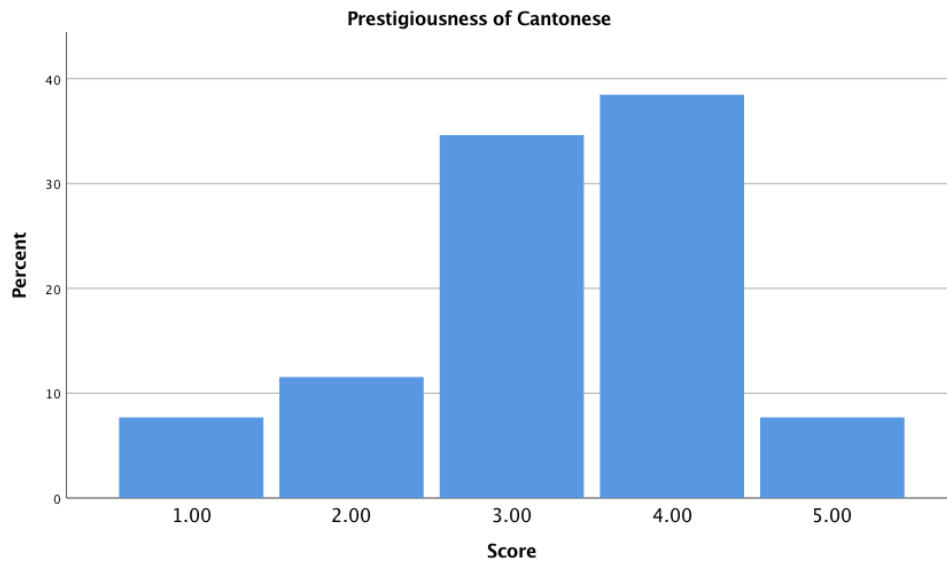


Figure 7. Prestigiousness of Cantonese (N=26)

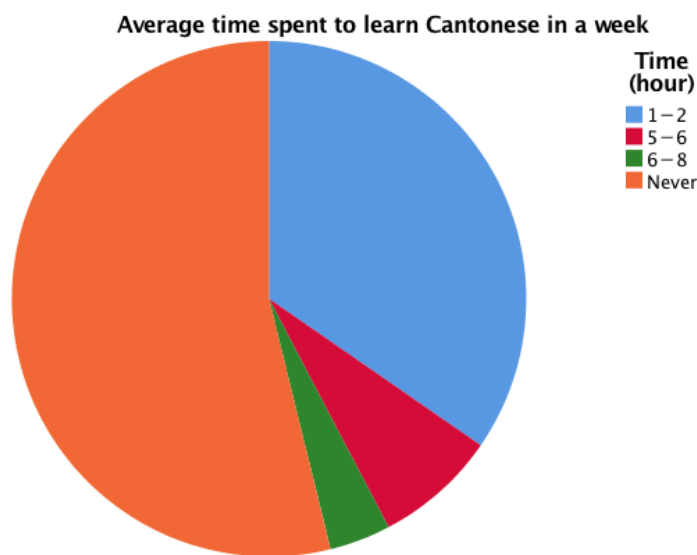


Figure 8. Average time spent to learn Cantonese in a week

For the reasons for learning Cantonese, the subjects regard the practical reason as the most significant reason, with a mean score of 4.77 out of 5. They think that as they need to live and work in Hong Kong, it is important to understand Cantonese. The second most important reason is interaction with local people as cultural exchange, with a mean score of 4.15 out of 5. Other reasons with a score of about 3 include passion in Cantonese pop culture,

passion in language learning and attracted by the unique feature of Cantonese.

6.3.2 Effective way to learn Cantonese

The subjects regard interaction with native Cantonese speaker as the most effective way of learning Cantonese with a mean score of 4.15 out of 5, however, interaction is not always feasible especially for learners who is not living in the community of the target language. Attending Cantonese tutorial scores 3.58 out of 5, which is the second most effective way among the choices. For the three other options related to self-learning, self-learning through textbook scores 2.80 out of 5; self-learning through authentic materials such as TV and movies scores 3.54 out of 5 and self-learning through computer assisted language learning tool scores 3.20 out of 5. Using CALL tools is considered as averagely effective as and the score is higher than that of using traditional paper form text book.

6.3.3 Difficulties in learning Cantonese

The subjects regard the most difficult part in learning Cantonese is the colloquial expressions in Cantonese, which score 4.15 out of 5. Difficulty in pronunciation problems in Cantonese and materials with low authenticity score 3.65 out of 5 and 2.92 out of 5 respectively. With respect to these findings, it is suggested that materials with more colloquial expressions should be included in the mobile materials. The design principles of the mobile application also address the problem of difficulty in pronunciation and authenticity of learning materials by the design of adopting conversion rules from Mandarin to Cantonese and adopting authentic materials.

6.3.4 Attitudes towards MALL learning experience

The 14 subjects who had the experience of using the tested mobile application suggest that the overall learning experience of learning using mobile application to learn Cantonese is satisfactory, with a mean score of 3.78 out of 5. For the 12 subjects in the control group who did not try the mobile application, they have a mean score of 3.08 out of 5 of tendency to try the mobile application.

Among the subjects in both the testing and control group, more the 60% of the subject consider the corresponding rule from Cantonese useful. The reason supporting the corresponding rules include 1) it provides a systematic approach to learn Cantonese as the words are categorized in to different categories by the syllabic components and 2) it is helpful to predict the pronunciation of an unseen by its pronunciation of Mandarin. The reasons that against using the corresponding rules to learn Cantonese include 1) Learning Cantonese directly is more preferable. 2) Not every sound in Cantonese in corresponding to Cantonese. 3) Audio-lingual approach of learning is more preferable. 4) Mandarin and Cantonese are treated as two separate system that no conversion is needed. 5) The corresponding rules is only effective for beginning learners and 6) There is a prerequisite of understanding Jyutping to apply the corresponding rules. These findings implicate that although majority of the respondents regard the conversion approach useful, different learning style of learners affect the effectiveness of a specific approach of learning that the conversion approach may not be equally effective to all learners.

6.3.5 Positive and negative feedback towards the mobile application

The responses about the design of the mobile application that is considered useful is concluded into 8 points. 25.9% of the respondents suggest that the function of voice of individual words is useful while the same percentage of respondents also suggest the function of voice of whole passage is useful, as a result, more than 50% of the respondents consider the audio function of the mobile application useful. 22.2% of the respondents claim that the function of corresponding rules is useful. The other positive feedback mentioned by the respondents include high accessibility, high interactivity, consecutive training and monitoring learning progress.

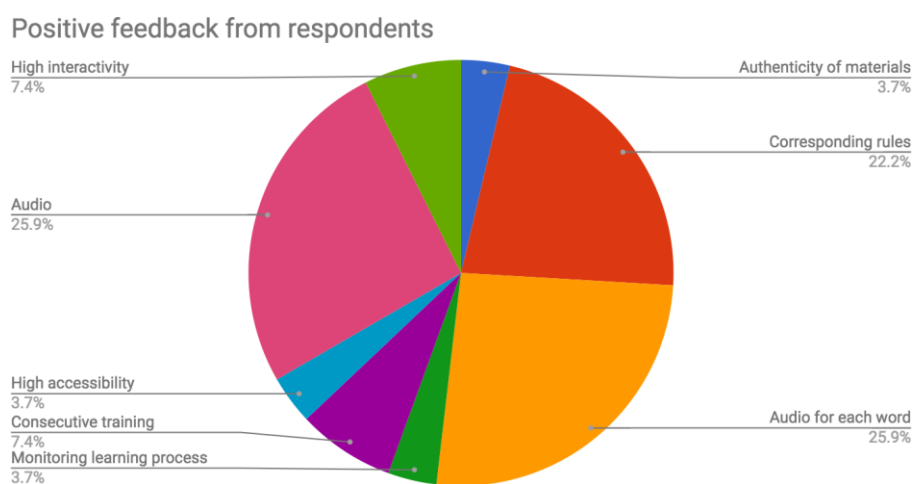


Figure 9. Positive feedback of the mobile application

The respondents also raise quite a number of construction recommendations with respect to the drawbacks of the design of the application. Some respondents point out that the training session is too long, and the consecutive drilling exercise is too boring. Some of them suggest removing some items in the training, for example skipping words with same pronunciation with Mandarin, skipping the repeating words or even adjusting the frequency

of occurrence of words in the training session. However, these suggestions are considered invalid according to the design principle of authentic materials. The whole process of training is also considered as the authentic input of reading material. A respondent suggests breaking down the whole passage into several parts in training session, which is a more feasible suggestion. Some respondents suggest adding messages to reinforce the learner upon finishing a certain part of training to motivate the learner to continue. This suggestion is also considered feasible.

The respondents suggest adding more multimedia component for example videos and pictures as well as a fancier interface, as long as the videos and pictures are related to the training materials, this is also a feasible suggestion. Some respondents suggest adding more varieties of learning materials instead of one single piece of materials, this problem is addressed in the original design of collaborate materials which is not included in the experiment settings.

One respondent points out that the some of the sound files of individual word are incomplete as the sound files are trimmed from the recording of the whole passage. It is suggested to record the sound of individual words individually. This suggestion is considered not feasible as it increases the workload of the person who prepares the materials. It also violates the principle of authentic materials that natural language input should be used in learning materials.

A respondent points out that no element of interactive communication is included in the application. However, it is not corresponding to the purpose of facilitating self-learning of this application. Some respondents suggest adding a session of teaching Jyutping, which is a feasible suggestion. One respondent points out that the application is a bit unresponsive, in response to this comment, the technology of development is suggested to be improved.

The respondents also suggest some constructive and feasible functions to be added to the mobile application: 1) Recording function for self-evaluation of pronunciation. 2) Add choices to distract the learners in the training session. 3) Option to show the Jyutping in the reading passage. 4) Displaying the Jyutping of the word upon finishing each question in a training. 5) Function to bookmark the vocabulary and 6) Translation function to translation Mandarin to Cantonese.

7 Limitations

Regarding the design of experiment to evaluate the effectiveness of the mobile application, due to the limited resources and time of investigation, only 12 samples are collected in each group (the testing and control group), the sample size is too small to represent the population of a normal distribution that the actual situation is not reflected with the small sample size. It also cannot cover the subjects with different backgrounds, for example different age, gender and city of origin. There are only one to 2 samples in some of the groups so that the factors cannot be used in measuring the correlation with the rate of improvement. With the limited time for application development and conducting the experiment, only the experimental settings is adopted in the test that some of the functions in the original design are not included in the application such as the collaborative materials. This is limited by the 30-minute training time for each subject in a 60-minute experiment session. Some of the participants focus only on their performance in the post test and somehow neglect the experience of using mobile application to learning Cantonese, some of them even rely on the single reading aloud function which is considered as the most direct and effect means to enhance their performance in a short period of time. If allowed, a long-term monitoring of the usage of the mobile application is recommended to achieve a more representative experiment result. All in all, the actual performance of the mobile application

design may not be thoroughly represented in this experimental setting.

Individual difference of learners is not taken into account in the design of experiment. As shown in the result in the most effective way to learn Cantonese, majority of the respondents consider the interactionist approach as the most effect way of learning a language. Different learners possess different style of learning, in a sense that the approach adopted in the application may not be equally effective to individual learners, which is a factor which hinders the accuracy of the experiment results. The fundamental problem of learners' motivation towards learning a language is also not taken into account. Although it is shown in the result that generally the subjects have high motivation in learning Cantonese, there should be individual difference of the degree of satisfaction which varies person by person. With the degree of satisfaction, the acceptance of error is also different for different subject, as a result affects the motivation to achieve a high proficiency. Added to the point of motivation, one respondent states that she will never open a language learning application even if it is already installed in her mobile phone. This is also a fundamental problem of motivation that is not taken into account.

Cantonese as a poor-resource language hinders the automation process in application development. Because of the immaturity of the development of unsupervised segmentation in Cantonese, segmentation of the text into sentences or even words still rely on manual process, which requires a huge demand of human resources and time consuming. It is also not possible to automatically break down the audio file of a whole passage into words without an automatic segmentation solution. The lack of a complete Cantonese lexicon also prohibits the automatic process of determining the pronunciation of a word with more than one possible pronunciation.

8 Further Investigations

A second phase experiment can be conducted to obtain a more precise experiment result. The function of the mobile application is expected to be fully implemented including the function of collaborative materials that learners can look for their desirable and suitable materials to learn, the function and the interface of the mobile application should be further improved with respect to the suggestions from the result. Some natural language processing function can be added to the application such as text-to-speech and voice recognition. It is expected to go through several times of development cycle to ensure the completeness of the design of the application. The experiment of testing the effectiveness of the mobile application should be lasted for a longer period, for example 2 cycles of two weeks of training to monitor the improvement in different stages. The number of participants can be increased, and it is expected to cover the learners from different backgrounds for example different age group, different purpose of learning, different learning style, different proficiency level etc.

Another area that worth further investigation is the types of error the learner's made and in what way the application can help to correct the error. The result of this project points out the most frequent type of error and the most corrected error in different syllabic component, however, the result does not include the distribution of the types of error. By comparing the phonological structure of Mandarin and Cantonese with the types of error, the cause of the error can be deduced so as to deduce the influence of Mandarin to Cantonese in terms of the error made in different syllabic components.

The effect of the corresponding rules as a pedagogy to learn Cantonese is also an area for further investigation. In the design of experiment, the conversion approach is included as a function in the mobile application, in a sense that the learners can opt to adopt it or not. The pure effect caused by the corresponding rule is not investigated in this project.

9 Conclusion

In response to the research question, although the experiment result does not show that the effectiveness of using the designed mobile application to learn Cantonese is higher than that of the traditional method, the performance of the application is still comparable to the traditional as shown in the result, which can be treated as an alternative to the traditional method with its unique benefit of probability, high accessibility and multimedia and interaction components. The result also shows that there is a high degree of satisfaction regarding the experience of using the designed mobile application as a learning tools to learn Cantonese, however, the overall attitude towards using MALL tools is just average, which may be attributed to the traditional learning style in Chinese community and learners' personal preference. The use of mobile assist learning tools still need more promotion either in the field of formal school education or as a self-learning platform.

Regarding the scale of the research project with the limited resources and time, the result is satisfactory although there are several limitations and rooms for improvement.

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APPENDICES

- I. Information sheet
- II. Consent form
- III. Background survey
- IV. Follow up survey
- V. Testing material
- VI. Control group training materials
 - For the recordings file, please go to <https://youtu.be/L7caLiwdfQY>
- VII. Raw data table
- VIII. Score result table
- IX. Background survey result table
- X. Follow up interview result table
- XI. Follow up interview analysis table
- XII. Demonstration video of experiment
- XIII. Recordings of experiment

To access the appendix files, please go to <https://goo.gl/b9dju6>