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博士（工学）学位論文

**DEVELOPMENT OF NEW SOFTWARE
FOR COMMUNICATIVE SKILLS IN FOREIGN LANGUAGE LEARNING
BASED ON VOICE RECOGNITION TECHNOLOGY**

音声認識をベースとした新しい英会話速成ソフトの開発

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SUMMARY & CONCLUSION

The purpose of this research was to develop new foreign language learning software based on the presently existing hardware technology of voice recognition to solve the problem of delaying improvement in listening and speaking skills.

Original points of the present research are summarized in the following

1. Real issues on language production
2. Basic design concept
3. Ear-Lip Service approach
4. Pair-work methodology
5. Software implementation.
6. Application to business

1. Real issue on language production

According to some estimates, Japanese spent as much as thirty billion U.S. dollars each year on English language education. However, the exact reason that causes poor communicative language skills is seldom investigated. In this research, the author, for the first time, made an experimental study on learners' both language input and output ability and the real issue was found out that the lack of oral practice of the target language is responsible for the poor communicative language skills. Therefore, the author concluded that the training of lip flexibility becomes extremely important for oral proficiency improvement.

2. Basic design concept

Recent progress in voice recognition technology is remarkable in word processing, document dictating, translating and so on. The use of these technologies for language learning systems is also of interest. However, such progress of the hardware technology contributes only to native speaker's language. It can be much more practical if it can be used for non-native

speakers. Therefore, in this study, three techniques were proposed to meet the requirement for non-native speakers language education.

(1) System controlled systematic learning

(2) Time interval control

(3) Key-word spotting technique

3. Ear-Lip Service approach

This approach is to bridge the existing two approaches: comprehension-based approach and production-based approach. The former one emphasizes listening comprehension at the belief that language production emerges when enough input is acquired. The later one, on the contrary, begins with the teacher being silent while reinforcing verbal output from the learners. As a result, late production or no production emerges by the former approach; Similarly, learners are not able to produce without a solid training of how to make production in the later approach. Hence, this new approach, ELSA, was proposed to establish a new language learning model. As the name suggests, it focuses on ear and lip training through a series of learning activities.

4. Pair-work methodology

The author proposed an information based pair-work methodology, which was proved to be the best way in increasing learners opportunities to use the target language in the limited period of class time, especially the pairs with different personalities made the most production than others.

5. Software implementation

This software design was completed based on voice recognition technology and new design concepts (system control, time interval and key-word spotting). The Ear-Lip Service approach and the pair-work method are also used in the design of learning activities.

The development of the software is a mixture of the approximation methodology and algorithm programming for the discovery of artificial

intelligence: dialogue between learner and machine. Based on the design concepts, three creative techniques complete an appropriate system for language listening and speaking skills in a foreign setting.

Systematic learning

Like the study of language in a real classroom, this system acts as a teacher to guide learners to complete the learning tasks by an activated command button.

Natural dialogue patterns

This is for the case of the delaying of computer processing and the non-real time dialogue between man and machines by time interval control.

Open dialogue system

Multiple paths are prepared for the open dialogue system based on key-word spotting to avoid low accuracy of voice recognition for non-native speakers.

The systematic learning and the open response dialogue system were evaluated with the evaluations obtained from Computer-Assisted Language Learning.

6. Application to business

This software will be used in the English immersion school the author has been planning. This software can help students reach the ultimate goal of communication in much shorter time, so that much time and financial resources can be saved on hiring native language teachers.

It is concluded in this research that the systematic learning system, the natural dialogue patterns, the open response dialogue system, the newly proposed Ear-Lip Service approach and pair-work method present a distinct challenge for a much more flexible communicative interaction between computer and man, which starts a new orientation for foreign language learning and a new business model inside business.

Chapter One The first chapter offers literature reviews of current research on voice recognition assisted language learning and sets up goals for this study.

Chapter Two In Chapter Two, the present issues on foreign language learning were investigated, which directed the design of the software.

Chapter Three The basic concepts of the development of software are put forward.

Chapter Four This chapter briefly reviews some of the present language learning approaches, and a new approach: Ear-Lip Service approach, was proposed.

Chapter Five Pair-work methodology was proposed, based on which and the Ear-Lip Service approach, an experimental study in the language classroom was carried out.

Chapter Six This chapter is contributed to the development of the software based on voice recognition technology.

Chapter Seven How to apply this software in the business is discussed.

Chapter Eight and Chapter Nine These two chapters are devoted to the summary and the conclusion of this study. The limitation of this study is also mentioned.

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I. INTRODUCTION

Since the Second World War, the public became painfully aware of the failure of the language teaching profession to train students in communicative abilities [1]. They state the reasons: methods in which students never engage in real communication cannot be expected to produce students able to communicate using the language they study. Since speech technology came into being, more and more language teachers, researchers and system designers are increasingly interested in voice recognition technology assisted language learning programs. Recently, this technology has been incorporated into many products which are believed to develop spoken skills.

Among many products featuring voice recognition technology are TeLL Me More Pro [2], Talk to Me English [3], Echo-me [4] and Native World [5].

TeLL Me More Pro



Fig. 1-1 Intonation evaluation



Fig. 1-2 Close dialogue system

TeLL Me More Pro is voice recognition assisted English conversation learning system with many supplementary functions available: interactive dialogue, pronunciation practice, grammar explanation, video for listening, learner results analysis and tools for teachers teaching activities. With voice

recognition technology, learners first listen to a question of dialogue and then choose one of the acceptable responses given and talk into the microphone. If learners choose the wrong response, the learner has to listen to the example and try again. In the intonation practice, learners listen to a selected word or sentence and try to pronounce it, followed by a voice evaluation check. The exercise mode introduces a full view like the regular text book with the items such as fill-in-banks, crossword puzzle, and word association. Also some of the exercises can be done by voice input, like word order, selection of right word and multiple choices. The dictation item has to be done following the output of computer. It also provides grammar explanations and reports to summarize students study records. Teacher tools in Tell Me More Pro offer opportunities for teachers to create learning paths and adapt the learning system to each student's level. In the student-teacher communication mode, that students can be put in contact with the teacher by a simple click of the mouse within the software, which, like a language school, shows its uniqueness for classroom learning activities.

Talk To Me



Fig. 1-3 Intonation evaluation



Fig. 1-4 Close dialogue system

Talk To Me, like Tell Me More Pro, introduces interactive dialogues, pronunciation mode and exercises. The interactive part is designed with

multiple choices following a background introduction. In order to respond the question by computer, learners choose a proper answer from the multiple choices prepared on the screen and talk to the microphone. According to the learners choice, the system check the pronunciation and goes to the next part of dialogue if it is right, or learners have to stay at this stage and do the pronunciation practice. Seven ranks are planned for the pronunciation recognition rate. The pronunciation practice part too, provides samples for learners to follow. Learners can listen to their own pronunciation and reports of voice data is prepared for comparison. It has grammar exercises too, like fill-in blanks, word order as well as word association. It provides translation functions for the dialogue.

Talk to Me English Ver.3.5, one of the series of Talk to Me, focuses on pronunciation training and evaluation. The Spoken Error Tracking System engine tells learners where they make a mistake, and learners can tell the difference of the intonation between themselves and the sample by the pitch curve. It also offers 3D animation explanation to show how to pronounce a certain word. It stores learners' voice data for later comparison.

Echo-me



Fig. 1-5 Intonation evaluation



Fig. 1-6 Close dialogue system

Echo-me has many similar characteristics as Talk to Me. It ranks 7 levels to meet learners' pronunciation progress and to evaluate voice data

waves by comparing with the samples. It prepares three multiple choice for interactive dialogue practice. Learners choose an appropriate response from the three on-screen options which they read aloud through microphone to the computer. It focuses on intonation, rhythm and accent of learners. Grammar exercises are also available.

Native World



Fig. 1-7 Intonation evaluation

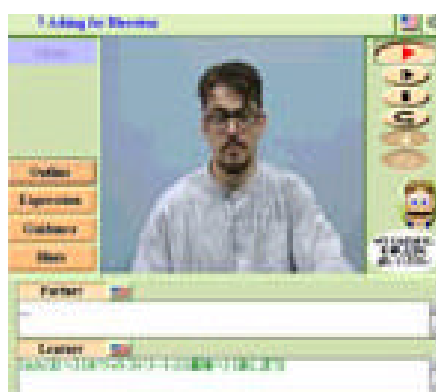


Fig. 1-8 Close dialogue system

Perhaps the most well-known voice recognition technology assisted language learning system is Native World. It has some of the same features as the Tell Me More Pro, Talk To Me and Echo-me, such as the comparison of the voice to that of a native speaker. It contains Exercise Stage and Conversation Stage with multiple learning activities such as video for listening, grammar explanation, interactive dialogue practice and vocabulary study in the Exercise Stage. The Conversation Stage offers expression practice and conversation practice assisted by Japanese interaction. In this learning system, half of the items focus on intonation practice. The exercise section in Exercise Stage and the expression section in Conversation Stage concentrate on the intonation analysis with the help of voice pitch. In these sections, learners record their own voices, then, listen to both sample and their own voice. This learning activity can be repeated to the learner's needs. Learner's recorded voice is reflected with curves, on which, intonation

evaluation is processed by the consideration of stress, intonation and the length of a word with degrees such as wonderful, excellent, very good, good and below average. The Vocabulary Section too is evaluated by these degrees. The conversation section in the exercise stage offers conversation with voice recognition technology and displays with interaction of similar choices to aid learners to progress. Learners can read their dialogue shown on the screen to the computer when refer to the hint button. The system evaluates learners output and give them immediate feedback. Learners can try again when the recognizer does not accept their output, but when learners' output is inadequate, the program always responds with "pardon me". When utterances are made more than two or three times the program shows the output, though sometimes does not match what the learner says. In the free conversation section, the content of dialogue is limited by navigators of the home language for reference to process the conversation. Finally, learners progress report is provided with scores and study experience.

Table 1 Features of the current English conversation software assisted by voice recognition technology

Function	CR	GE	PPE	RR	PST
Tell Me More Pro	*	*	*	*	
Talk To Me	*	*	*	*	
Echo Me	*	*	*		
Native World	*	*	*	*	*

CR: Closed Response

GE: Grammar exercise

PPE: Pronunciation practice & evaluation RR: Result reports

PST: Pre-speaking training

As shown in Table 1, all these software introduced above share some basic features. First, they all focus on developing a fully rounded mastery of

intonation assisted by voice recognition technology. The emphasis on intonation evaluation by curves and graphics, as they believe, can lead to some pronunciation achievement. Voice graphs and pronunciation scores are quite elaborate though it is doubted by Hao-Jan H. Chen [6] whether second language learners can really improve their pronunciation and intonation by examining the speech spectrum. He points out that the educational value of this activity would be significantly enhanced if learners could understand the meaning of the voice graph or why their utterances do not match the model. So far, researchers have not yet provided clear experimental evidence for the effectiveness of this type of visual feedback [7]. Second, grammar exercises domain all of these software. Third, most of the software provide study report to evaluate language studies. In terms of dialogue mode, they are all designed as closed response in which learners must choose one response from a number of responses provided on the screen. In a summary, the above software 1) emphasize intonation practice, 2) to some extent focus structure exercises, 3) offer final reports of learning activity, and 4) provide interactive dialogue.

In this study, the voice recognition assisted learning system is developed in a much different orientation, which places great emphasis systematic learning and open response dialogue system based on a newly proposed language learning approach and technique concepts for the development. It is designed to bridge language input and output and consequently arrive at the central goal of language fluency building.

In order to complete the task of fluency building successfully, an experimental study was carried out to find the real issue on language production. Then an appropriate approach was proposed and was tested in the language classroom. Finally, based on the practical results, a voice recognition assisted software was developed for foreign language learning.

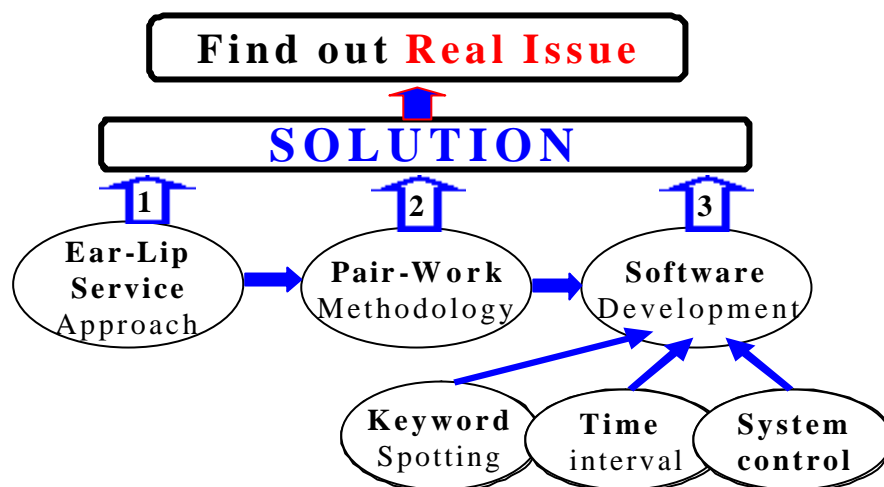


Fig. 1-9 Research flow

II. REAL ISSUE

People are learning English as their first foreign language. In Japan, 90% nowadays do at least six years of English at school. In addition, a large number go to private schools in their spare time. According to some estimates, as much as thirty billion U.S. dollars are spent each year in Japan on English language education [8, 9]. However, the exact reason that causes low language production is seldom pursued. In this chapter, an experimental study on learners' both language input and output has been conducted and the real issue was found out that the lack of oral practice is responsible for low language production.

Experimental study on language input

In order to highlight the problems of low language production, 100 of first and second year university students in Japan were asked to read 100 pieces of mini dialogues from the conversation book of "English Conversation 110 [10]. The purpose for this observation is trying to see 1) the degree of fluency

of the target language; 2) the relationship between pronunciation and intonation and fluency; 3) if they have the same problems when they read as they speak and 4) what hinders the student language production? Four items were observed: intonation, inter-language, fluency and pronunciation. Table 2-1 and 2-2 show the results of this observation.

Table 2-1. The results of the reading of mini-dialogues by 100 university students

Problems	No Problem	inter-language	pronunciation	fluency	inter-language & fluency	intonation
N = 100	47	31	10	9	3	0

Table 2-2 Inter-language for Japanese speakers

Problem	Example
Phonetic	above afraid call certainly cheers cheese commercial contrary dessert hall handwriting matter other pleasure radio road slippery sure terribly there trading train triangle worry
Japanese influence	Compliment out suit wet end excited good had pleased said supposed understand witnessed evening everything
Foreign words	coffee orange camera tomato cake chocolate radio television coat ice volleyball beer Christmas computer apple bike door glass identity jacket note pan sweater text

Table 2-1 shows a very positive phenomenon in the language input and a high degree of language fluency as input. First, 47% of the students did not have any problems on pronunciation or fluency. Second, no one was found to have any intonation problems, and only 10% of the students had some pronunciation problems, and those mispronounced words, as I observed, are

not used frequently. Third, only 9% of them had some hesitation, tentativeness, repetition and stumbling behaviors when reading. Fourth, their inter-language does not influence the degree of fluency in the target language. These results suggest a profound basic knowledge of linguistics after six years careful study in high school and one or two years in university. With this outstanding basic, language production might also be as well. However, the experimental result showed the opposite.

Experimental study on language output

58 first and second year university students were interviewed on their output ability. The interview is between students and the author working on a dialogue of making a phone call under the situation of: the author called the student family and wanted to speak to her mother, but unfortunately, her mother was out. The dialogues were tape-recorded and the evaluation was ranked from 1 to 5 as shown in Table 2-3.

Table 2-3 Language output abilities of university students

Ranking	1	2	3	4	5
N(58)	5	23	22	8	0
%	9%	40%	38%	14%	0

The results of language output revealed something quite different from the input ability. According to Table 2-3, 49% of the students' communicative ability was below the average and only 14% of them were found capable at language output. Furthermore, no students could be found on the rank of 5. Many students stop at the position of single words. For instance, when I said "Please tell her to call me when she's back", over half of the students tried to convey that she did not know when her mother would be back. In the dialogue, many of them omitted "s" in the above sentence. The lack of such

language skills suggests insufficient training on the usage of the target language. The Chinese proverb: “Skill comes from practice” is not only suited to beginner car drivers and pianists, it fits language learning as well. Many of such practice so far contributes to pronunciation training, like “west-vest” [11], but little practice can be found on lip training with comprehensible context. It is not surprising to see these communicative mistakes because of the present methodologies, but it gives language teachers and linguists much food for thought. This painful aware of the failure of the foreign language teaching and learning of communicative ability calls for a much more appropriate approach to help students work their way out with the language knowledge they already have.

The sharp contrast between the language input and output indicates that there is no close relationship between learners’ perceptual ability and their production. Armed with an outstanding linguistic knowledge as shown in Table 2-1, why then many students hesitate when to speak? In order to find the answer, observation of kids talking was carried out.

Observation of kids talking

Why some people cannot talk in English even after about 10 years study of the target language in high school and university? Why kids are good at learning a second/foreign language? With these questions in mind, 3-year old kids in Misono Kindergarten were watched and video-taped for an hour. As expected, the kids talked all the time either to their partners or to themselves. In contrast, how much does an adult talk? Table 2-4 is a questionnaire result on the amount of time students spend on reading the target language.

Table 2-4 Time spend on reading aloud by university students

Minutes	N=58	%
0	34	59%
1—10	17	29%
11—30	7	12%

As shown in Table 2-4, almost 60% (34) of the students have no lip practice at all on English, about 30% (17) of them read 1 to 10 minutes. It is also not surprised to see that only 12% of 58 students read 10 to 30 minutes, because, as far as I have experienced, reading aloud is not a request in most of the language classrooms.

In most of the research on children language learning, age is the ultimate research question. In terms of the time children spend on the language as well as how they deal with the language is seldom reached. Let's suppose, if adult students talk as much as children, or even 30 minutes a day instead of an hour, what will happen to the progress of spoken language?

Gabriel Lee [9] reports Koike & Tanaka's findings in an eleven-year nationwide survey that 74.5% of all respondents felt that they were weak in speaking. The main reason is that they lack fluency of using the language, and sometimes they have to be interfered with their own.

S.D.Krashen and T.D.Terrell point out that the key component of the course of language must allow the students to use the language for real communication and that exercise and drill are neither necessary nor sufficient. They also stated that:

To acquire the ability to communicate in another language, one must use that language in a communicative situation. Communicative ability is usually acquired quite rapidly; grammatical accuracy, on the other hand, increases only slowly and after much experience using the language. The mistake the innovators have made is to assume that a conscious understanding of grammar is a prerequisite to acquiring communicative competence. Thus, any grammar-based method which purports to develop

communication skills will fail with the majority of students. [1, p16]

It can be concluded from the discussion above that the lack of oral practice is responsible for the delay of language production. This conclusion lends the highlight for the design of the system, focusing on the training of communicative ability.

III. BASIC DESIGN CONCEPT

Recent progress in voice recognition technology is remarkable in word processing, document dictating, translating and so on. The use of these technologies for language learning system is also of interest. However, such progress of the hardware technology of voice recognition contributes only to native speaker's language. It can be much more practical if it can be used for non-native speakers, too. Therefore, three main techniques were proposed to meet this requirement: (1)System control, (2)Time interval control and (3) Key word spotting.

In order to guide learners successfully to the communication stage, this system strictly controls the learning process by an activated controlled button, which leads learners step by step to complete the learning task. The second technique of time interval control helps the smoothness of the learning system. When learners talk to the machine, what they are most interested in is whether their speech is recognized, which delays their response; Moreover, computers cannot catch speech the real time as that between human beings. Therefore the time interval control plays very important role in the process of talk between man and machine. In the development of the software, the approximation methodology and algorithm programming discover artificial intelligence, which makes the machine possible to analyze key words in the process of voice recognition activities and to produce appropriate responses like the dialogue between human beings. This system is called open response dialogue. In contrast, the existing software offers close response dialogue to avoid the low accuracy of voice recognition for non-native speakers. When the above two techniques can not

meet the requirement of routine dialogue and “Yes” “No” questions, a new use of pitch technique is suggested to make a special treatment on such language phenomenon.

Since it is language learning software, an appropriate language learning approach should be offered for the development to follow. Therefore, in the following chapters, the existing approaches were reviewed and a new approach and method were proposed and evaluated in language classrooms, which prepare the system well on the way to the development.

IV. EAR-LIP SERVICE APPROACH

4-1 Introduction

The aim of this chapter is to give a brief view of the history of language approaches and the current state of the theory in second/foreign language teaching and learning and to propose an appropriate approach and method for language learning in foreign setting.

Approaches for second/foreign language learning

The approaches for language learning have undergone many dramatic shifts over the years. In the early 19th century, the study of the grammar of Classical Latin became popular which resulted in the analytical Grammar-Translation Approach. This approach consists of an explanation of grammatical rules with some example sentences, as the name suggest, which provides little opportunity for oral practice. By the end of 19th century the Direct Approach was brought out by Gouin to react to the grammar-translation approach and its failure to produce learners who could use the foreign language [12]. Direct Approach involves all discussion in the target language. Students are to try to guess the rules of the language by the examples provided. Again the swinging of the trend continued. Since few teachers could use foreign language well enough to sue a direct approach,

Reading Approach came into being to focus on reading comprehension. However, according to Marianne, World War II made it an urgent task for U.S military to teach foreign language learners how to speak and understand a language quickly and efficiently. Hence, Audio-lingual Approach emerged in a reaction to the structure-based Reading Approach and its lack of emphasis on spoken language. In an Audio-lingual setting, students mimic the dialogue and eventually memorize it. After the dialogue comes pattern drills, focusing on simple repetition, substitution and translation. By the 1970s, Cognitive Approach again placed grammar rules in the important position against the behaviorist features of the Audio-lingual Approach.

It is not difficult to see that certain approaches outlined above “arose in reaction to perceived inadequacies or impracticalities in an earlier approach or approaches” [12, p8]. These approaches either emphasize rule formation, like Grammar-Translation Approach, Reading Approach and Cognitive Approach, or focus on exercise and drill training for habit formation, like Direct Approach and Audio-lingual Approach. Only until recently, since 1980s, comprehension- and production-based approaches have brought a new era in language teaching and learning, which emphasize the importance of communicative ability.

Comprehension-Based Learning

The failure of production by the traditional approaches results in more practical approaches before the turn of the 20th century. They focus on listening comprehension and do not attempt to train oral production because they consider it pre-production period. Oral fluency is expected to emerge naturally and gradually out of the comprehensible input. They mainly include Total physical response and the natural approach.

Total Physical Response

As the comprehension-based approaches believe that learners should learn to understand a great deal long before they try to speak. The Total Physical

Response, brought up by James J. Asher [12], involves the students listening and responding to commands given by teachers, such as “close your eyes” and “touch your nose”, etc. Like a game in which learners demonstrate through observable actions.

The Natural Approach

The natural approach proposed by Tracy D. Terrell is based on a number of hypotheses about learning procedures and conditions for learning. It insists that acquisition is more important than learning. In order to acquire, two conditions are necessary: comprehensible input containing $i+1$ and a low affective filter to allow the input in. As a result, language production is expected to emerge instead of artificial practice. “Real language acquisition develops slowly, and speaking skills emerge significantly later than listening skills...the best methods are therefore those that supply comprehensible input in low anxiety situations.” [13, p7]. These methods do not force early production in a new language, but allow learners to produce when they are ready. Unlike Production-Based Approaches, it focuses the attention to what the language learners hear before they try to speak.

Production-based approaches

Comprehension-based approaches are promising vehicle for providing learners with massive amounts of input and they believe that language production emerge naturally. The production-based approaches, however, doubt its emerging consequences and produce more radical approaches than comprehension-based ones. Against a basic principle of comprehension-based approaches, production-based ones push speech from the first. Among the three production-based approaches described by Marianne [12], Silent Way Learning is regarded the best known.

Silent Way Learning

Caleb Gattegno’s silent way learning is based on the premise that the

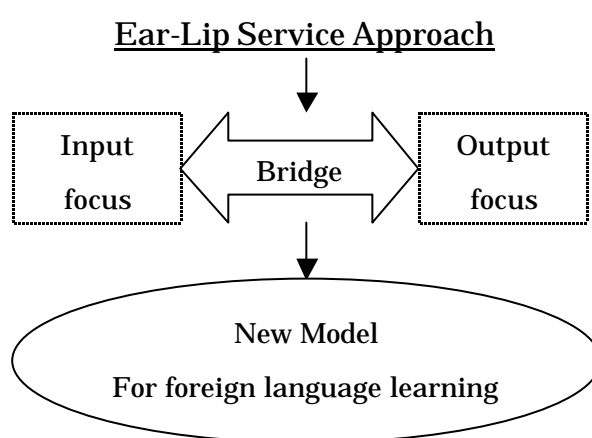
teacher should be silent in classroom as much as possible and the learner should be encouraged to talk as much as possible, as the name suggests. Learning proceeds mainly as the learners try their tongues at speech. Learning tasks and activities encourage students oral response without direct oral instruction or unnecessary modeling by the teacher [12, 14]. Marianne also describes the roles of a teacher in the silent way as a guide by means of gestures and silent lip movements. Teachers are patient for learners to make meaning come from their own lips in acceptable form, as they believe that “the more the teacher does what the learners can do for themselves, the less they will do for themselves.” [12, p31].

The two kinds of approaches have quite different goals to focus. The comprehension-based approaches offer one-way communicative environment in which learners listen to or read the target language [15]. It expects an emerge of language production from massive input learner received. They believe that comprehensible input will prepare learners for later speech production [16], but little is mentioned how long the pre-production period should be and what should be done to help the emerge comes into being. As a result, learners lose what they have received partially or totally on the way to the language production. Hence, most foreign language students never make it through to the production stage. In contrast, the production-based approaches emphasize the language output as early and as much as possible, but “how the learner is to do this is not altogether clear.” [14, p101]. This phenomenon is also summarized in a quote from Marrienne:

If one aim of comprehension approaches could be encapsulated in a few words, these might be: “From much, little” or “Know much, say little,” referring to the fact that the massive input one receives in CBL translates into a relatively limited capability to say much even though one may understand a great deal. In contrast, one of the aims of SWL is the reverse of that: “From little, much,” or “Know a little, say much,” referring to the fact that from the meager input learners receive they are urged to make as much of it as they can, to push their communication envelope outward. [12, p32].

The failure of language production in Comprehension-Based

Approaches and the lack of appropriate methodologies to language output in Production-Based Approach require a much more successful language approach, especially for a foreign setting, to replace. Hence in this research, a new approach, Ear-Lip Service Approach, was proposed in an attempt to bridge the “know much” in Comprehension-Based Approaches and the “say much” in Production-Based Approaches in the target language. It establishes a new language learning model for a foreign setting.



4-2 Concept of Ear-Lip Service Approach

The approaches mentioned above bear different goals of learning which cannot meet both language input and output with any of the single approach, especially in foreign setting. The aim of Ear-Lip Service Approach is to offer a practical learning through information task based ear-lip practice. It tries to work around limitations of the previous approaches and to bridge the language input and output.

Ear-Lip Service Approach relies heavily on the insights of the author’s personal learning experience of English as a foreign language and Japanese as a second language. It is also a summary of 20-year experience of teaching second/foreign language home and abroad. It is also a fine adoption of some appropriate strategies and techniques from the traditional approaches, mainly from Audio-lingual Approach.

As the beginning of this chapter indicates, throughout the history of

language teaching and learning, language teachers and linguists have never stopped seeking new and better ways to facilitate and accelerate language learning. Though some old approaches have not met with great success for the lack of a thorough methodological basis [1, 14], some of the strategies are still quite useful for communicative purpose, especially the ones in Audio-lingual Approach, on which the basic technique of the Ear-Lip Service Approach is based on.

The Audio-lingual Approach was born in the Second World War, when American soldiers found themselves unprepared to deal with simple communication in foreign language areas [1, 12, 14]. It consists two sessions: dialogue practice and drill practice. It begins with a dialogue and students mimic the dialogue and eventually memorize it. After the dialogue comes pattern drills practice which contains grammatical structure and syntactic introduced in the dialogue. The drill practice focuses on simple repetition, substitution and translation. The dialogue and drill training is processed for the belief that language performance consists of a set of habits in the use of language structures and patterns. To achieve the goals of established behavior and habit, the classroom activities were focused on dialogue training, pattern drills practice until the structures became unconscious habits for the learners. After a period of study, students were believed to arrive at the stage of establishing habits and could communicate in the target language. This belief brought the Ear-Lip Service Approach out with added features, which are similar to and different from Audio-lingual Approach.

The key feature of Ear-Lip Service Approach is the repetition of the target language on behalf of training foreign ears and lips, a habit formation in the words from Audio-lingual Approach. But Ear-Lip Service Approach avoids drill practice at all cost, which is a central technique for Audio-lingual Approach. Moreover, Ear-Lip Service Approach encourages talking in pairs between students instead of that between the teacher and student. Another clear difference between the two approaches lies in the attitude towards

learners' errors in the learning process. The former one emphasizes accuracy of the language, while the later one focuses on communication. Ear-Lip Service Approach shares the same techniques of repetition and mimicry, but go through different methodologies, hence, expect different results. The following is a outline of the two approaches.

Table 4 Comparison of Ear-Lip Service Approach and Audio-lingual Approach

Techniques	Ear-Lip Service Approach	Audio-lingual Approach
Repetition	Students repeat a mini-dialogue aloud as soon as he has heard it and without looking at a print text for advanced level students. For beginners, repeat does not process until students understand the message with written text. Also, repetition is based on information gap task.	Students repeats an utterance aloud as soon as he has heard it without looking at a printed text.
Mimicry	Mimicry is used to train flexible ears and lips based on that language is a "feel" or a habit formation, but memorization is not required.	Mimicry is used for memorization based on that language is habit formation.
Dialogue	Dialogue center around communicative functions.	Demands memorization of structure-based drills
Learning	Effective learning is sought	Over-learning is sought
Pronunciation	Pronunciation is not stressed separately from the text on the assumption that quality comes from quantity. Comprehension is sought.	Pronunciation is stressed from the beginning and native-speaker-like pronunciation is sought.

Correction	Caretaker talk, foreigner talk are allowed. Errors correction is only encouraged from student partners.	Accuracy is a primary goal.
Drilling	Mini dialogues are focused instead of drills.	Drills are often manipulated without regard to meaning or context.
Communication	Communicative activities are stressed immediately after several repetition and reading aloud the dialogue.	Communicative activities only come after a long process of rigid drills and exercises.
Controls	Students are allowed to participate any activity by volunteer.	Teachers control learners from doing anything that conflicts with the theory.
Interaction	Pair work between learners is centered with activities	Between teacher and student with control by the teacher

While the repetition and mimicry of dialogues and drills form the basis of audio-lingual classroom practices between the teacher and students in Audio-lingual Approach, the repetition and mimicry are used for the training of ears and lips between both teacher-student and student-student in pairs. While the repetition of drilling and pattern practice without meaningful context are distinctive features in Audio-lingual Approach, communicative and comprehensible mini-dialogue is repeated based on information gap task in Ear-Lip Service Approach. This context-based repetition and mimicry provide learners with genuine opportunities to engage in communicative interaction, which is believed to bridge the “Know much” in Comprehension-Based Approaches and “say much” in Production-Based Approaches.

Based on what have been described in the previous sections, the following definition is provided:

That information gap task based repetition is considered the philosophy of Ear-Lip Service Approach, which involves students listening, repetition and mimicry of comprehensible context, aiming at the training of foreign ears and lips — a habit formation of foreign language. The quality of language learning is resulted from the quantity of ear-lip practice with interaction between learners, which can be vividly described in the Chinese proverb: Practice makes perfect. The primary goal of Ear-Lip Service Approach is to make language input and output simultaneously after a massive training on both ears and lips. Pair-work based cooperative learning is highly emphasized in both inside and outside the classroom for the maximum opportunity of using ears and lips.

Before the new approach for foreign language learning is adopted in the development of software, it could now turn to the design of language teaching courses and software learning system. In the next chapter, pair-work methodology is proposed based on the Ear-Lip Service Approach and an experimental study is carried out to check their effectiveness.

V. PAIR-WORK METHOD

In the previous chapter, a new approach, Ear-Lip Service Approach, was proposed, which aims at the simultaneous occurrence of language input and output. In this chapter, pair-work method will be discussed and evaluated by putting Ear-Lip Service Approach into practice in language classrooms. First, the recent research into pair-work method will be looked at and the purpose of the cooperative learning will be outlined. This is followed by a questionnaire survey on language teachers to get general ideas of how pair-work is dealt with in other language classrooms. Then, Ear-Lip Service Approach based pair work learning is conducted in two university classrooms. Finally, a discussion is done about the results of the pair-work learning and conclusion is given on the experimental pair-work study.

5-1 Introduction

Learning together to complete shared goals can have profound effects on students. Krashen and Terrell [1] define pair-work as Dyads, involving students working in pairs and probably the most common method in language classroom. Fujita [17] claims pair-work a magic tool in the classroom as students learning by doing. Czarl Bernadett [18] points out that pair-work provides a natural, face-to-face setting for students participation and negotiation. He also quotes Long and Porter's findings of significant practice opportunities in pairs as over 500% if 50% of the class time spent on oral practice in pairs for a class of 30 students. "Dyads allow for more sincere interpersonal communication between the participants and give each student more opportunities for speech in a given class hour" [1, p126]. Groups need to be small in order to provide maximum opportunities for oral production [19]. Also, one of the main points of pair-work is to help students increase their confidence and reduce the anxiety that is often found in a purely teacher-centered classroom [20]. David Armour [21] suggests six ways of pairing the students according to the function of activities. Leo van Lier [22] regards classroom activity as a shortcut to language development. All the above interactive and cooperative learning researchers show positive attitudes towards pair-work method and consider it successful in the language classroom. However, in terms of how pair combinations affect language acquisition, that is, how to make good pairs are not touched by the language researchers. Also, research on the techniques to make effective pair-work learning is seldom considered.

According to the Natural Approach theory, classroom is a primary setting for the activities of language acquisition, and the activities must be done in a low affective filter of the students to encourage more comprehensible input [1]. The production-based approaches encourage learners to attempt verbal communication as soon as possible [12]. In order to meet the needs of the two schools to build language fluency, the objective of the pair-work learning in this research is to provide less scared

cooperative learning environment based on Ear-Lip Service Approach for students to participate as much as possible. By pair-work learning, students work together to accomplish shared goals with two responsibilities: to maximize their own learning and to maximize the learning of the partner [23]. With the shared goal, students help each other, encourage each other and supporting each other to work hard toward the same goal. David also calls this kind of learning “positive interdependence”. However, if two strong students happen to be paired, participation is expected no problem, but it is possible to find no participation from weak pairs. In order to solve this problem, I designed my pair-work by different pair combinations: pairs with different personality and pairs with close neighbors. The combinations used here are the decision based on a questionnaire survey on pair-work learning.

5-2 Questionnaire of pair-work combination on language teachers

Before the experiment on pair-work learning, a questionnaire in both English and Japanese languages was designed in order to get as much information as possible on the present pair-work learning information used by language teachers. It was given to high school language teachers in Japan. The main three questions with eight ways of pairing students for multiple choice include: 1) Do you use pair-work method in your class? 2) How do you make pairs? 3) Which pair combination do you think is better? 48 data were collected and 94% (45) of them were found using pair-work method, which were summarized in Table 5-1.

Table 5-1. Present Pair-work Combination used by language teachers

Pair combination	<u>PPC</u>		<u>IPC</u>	
	N	%	%	N
Different personality	0	0	18	8
Same personality	5	11	9	4
Different level	3	7	11	5
Same level	4	9	24	11
Different sex	11	24	18	8

Same sex	16	36	13	6
Random	21	47	24	11
Neighbor	28	62	20	9

PPC: Present pair-work combination used by language teachers

IPC: Ideal pair-work combination considered by language teachers, which they may not use.

As shown in Table 5-1, it is extremely interesting to notice that the ways language teachers pair their students are not always the same as they wish to. No teachers make pair by different personality in the present teaching method, but 18% (8) of them claimed it as an ideal combination. Conversely, over half of the teachers use pairs by neighbors in their classrooms, but only 20% (9) considered it a good way to pair. This sharp contrast led the decision of a research on the combinations of pairs by different personality and by neighbors as fixed pairs. Fixed pair is a long-term cooperative learning group with stable membership to give the support, help, encouragement, and assistance the partner needs to make academic progress [23].

Questionnaire to language teachers

1. Which grade are you teaching?
 1st grade, junior high school 2nd grade, junior high school
 3rd grade, junior high school
2. How many students are there in your class?
 About 10 About 20 About 30 More than 30
3. Is conversation drilled in your class?
 Yes No
4. Do you use the Pair-work method in conversation drills?
 Yes No
5. When using the Pair-work method, how do you make pairs?
 Neighboring students Boy and girl Same sex Same level

- () Different levels () Similar personality () Different personality () Random
6. In doing Pair-work, have you ever considered how to make good pairs (boy and girl, same sex, same level, etc.)?
- () Yes () No
7. If the answer to Question 6 was “yes”, which do you think is better?
- () Close students () Boy and girl () Same sex () Same level
 () Different level () Similar personality () Different personality () Random
- Please give the reason if possible.
- ()
8. If the answer to Question 6 was “no”, which do you think might be better?
- () Neighboring students () Boy and girl () Same sex () Same level
 () Different level () Similar personality () Different personality () Random
- Please give the reason if possible.
- ()
9. Please describe below any of your opinions on Pair-work in language education.
- ()

5-3 Experimental results of pair-work method in language classroom

The subjects for this study were 81 undergraduate students in two classes taking a Chinese language selective course at Kochi Women’s University, Japan. All subjects were native speakers of Japanese who had no previous experience of the Chinese language. Most of them were freshmen. One class of 39 students worked on the neighbor pair learning (NPL), and the other class of 42 students worked on different personality based pair-working learning (DPPL). The students’ personality was judged with the author’s personal observation by the volunteer presentation during the first two weeks of the experiment and with their own declaration as introversion or extroversion. The classes were conducted by the author in normal classroom settings. Each class was exposed to 90-minute session per week for one

school term. One course of the participants' interactions was videotaped.

The class activities were conducted into two stages: 1) fluency building stage including pre-pair-work learning and pair-work learning and 2) pair-work presentation stage. Each activity is focused on Ear-Lip Service Approach.

STAGE ONE: Fluency building stage

Fluency building stage offers large quantity of ear-lip training opportunities to help students form a habit of the target language and to help them feel more confident when they speak. This stage is designed into pre-pair-work learning and pair-work learning.

1. Pre-pair-work learning

Pre-pair-work learning is done between the teacher and students. The main technique is content-based repetition and mimicry after or following the teacher.

According to Ear-Lip Service Approach, the main task is to train listening comprehension and to practice lip flexibility for output purpose. The content is processed by the activities of Listen and Repeat and Mimicry between the teacher and students. The lesson is content-based for communicative purpose. After a brief explanation of the content, practice begins until the content is familiar to the ears and lips of the students. Pre-pair-work learning can be further broken down into three steps.

Step One: Listen and Repeat.

The first thing to do after students understand the meaning of the content, they were required to read after the teacher to experience the rhythmic features of the language. .

Step Two: Written form based mimicry

After students got familiar to the new rhythm in the Listen and Repeat

activities, they were allowed to mimicry with the teacher together, instead of repeat after. The students could mimicry in a low voice with books open, while the teacher did it in a loud one. This activity was repeated until the class was sounded in good harmony. This is to train learners flexibility of ears and lips.

Step Three: Non-written form based mimicry

In the Listen and Repeat and written form based mimicry activities, students were allowed to look at the books. This time, students were encouraged to mimicry with books closed. One third of the students could do it successfully in the first try, half in the second and three fourths in the third. This task went on until all the students could follow harmoniously with no written materials for reference, which was the criterion mark of the end of the pre-pair-work learning.

2. Pair-work learning

Students were not allowed to work in pairs until the teacher thought they were ready to talk and had the linguistic ability to help each other.

In pair-work learning, students mainly practice with their fixed pairs, while they are required to work with temporary pairs either. In pair-work activities, students change roles and act as a teacher to each other. They correct each other's mistakes, guide each other to complete a communicative task and responsible for each other's fluency on the target language. All the pair-work activities are based on information-gap task, which is designed for participants exchanging different information verbally [12]. Students have to use repetitions, explanations and confirmation checks in order to complete the information-gap tasks as required. For example, when worked on the following dialogue:

A. Where do you live?

B. I live in Tokyo.

A. How many people are there in your family?

B. Four.

A. Who are they?

B. My parents, my brother and I.

Throughout the activities, students have to work with different partners to complete the parts underlined in the above dialogue according to real information of the family, which is known as information-gap task. It is divided into four steps.

1. Fixed pair-work activity

Fixed pairs were required to sit together for the convenience of pair activities anytime necessary. After the pre-pair-work stage, information-gap task started immediately between fixed pairs until they felt ready to move on to work with temporary pairs.

2. Temporary pair activity one

After plenty of information-gap task practice between fixed pairs, students were required to do the same task again with temporary pairs sitting in the front and at the back. Then, they were required to go on to the next activity, which was much more exciting and motivating.

3. Temporary pair activity two

In this activity, the whole class was required to complete at least three information-gap tasks with anyone randomly. All the students stood up, moving around the classroom seeking for a partner to join. After each pair finished, they switched partners again and tried to deliver the same talk and at the same time got new information from new partners. The goal was to give the same talk three times and get new information from three different partners.

4. Pair-work report activity

When they finished the temporary pair activity 2, students came back to

their seats with fixed pairs and reported to each other about at least two of the temporary partners. Then the conversations became introductions like the following:

... lives in Osaka. There are three people in her family, her parents, brother and she.

All the classroom activities were conducted in pairs, as it was pair-work learning. In principle, students must work in fixed pairs, but when one of the partners was absent, they were allowed to join other pair into triple or form a temporary pair with another single one if possible. In this way, all the students could enjoy different roles for real information with fixed partners and temporary ones. Through these pair-work activities, the number of hesitations decreased and confidence to make production increased. In such task, students got to know each other better about themselves and about the families. All the students were involved in the real communication in the target language in limited class hour.

Before they knew it, students had opportunities to do ear-lip service activities about 46 times, including 23 times of comprehensible input and 23 times of language production, as shown in Table 5-2. With such massive practice of the ears and lips, students were sure ready to present themselves, bravely and confidently.

Table 5-2. Ear-lip training program by pair-work method

Items Functions	LR	MA 1	MA 2	FPA	TPA1	TPA2	PWR
Ear training frequency	3	4	5	2	4	3	2
Lip training Frequency	3	4	5	2	4	3	2

LR: Listen and Repeat.

MA1: Mimicry activity 1

MA2: Mimicry activity 2

FPA: Fixed pair activity

TPA 1: Temporary pair activity 2

TPA 2: Temporary pair activity 2

PWR: Pair-work report activity

STAGE TWO: Pair-work Presentation

Now comes the most crucial part of the pair-work learning, which was the final process to test how well students had been doing in the previous pair-work activities. This stage required students to do the information-gap task in front of the whole class. Students did all the presentation activities in fixed pairs by volunteer. In order to draw close attention to the pair-work presentation, the next pair had to fill in the information-gap task the previous pairs provided (give summary of what the previous pair said). In this way, both students presenting in the front and those listening all had the input and output activities simultaneously. Since partners were responsible for each other, they gave hint when their partners hesitate, also, they turned to partners automatically when they had output problems. All the students' attention was focused on the task rather than on the form, because the teacher did not deal with any structural errors or with any forgetting word. Teacher only assists learners with the learning task rather than providing error correction [24]. The learning environment is supportive, tolerant of errors, and trusting [25]. When more than two pairs took action at the same time, a toss was conducted for the decision, which was done in the target language, too.

Throughout the pair-work learning activities, students are encouraged not to see the written form until the last moment. The presentation in front of the class is definitely with no reference to any written information. Moreover, little attention is paid, according to Ear-Lip Service Approach, to accuracy in grammar forms. Error correction from the teacher is avoided at all costs, since "a grammatical focus will usually prevent real communication" [13, p26]. However, when learners failed to get help with the production from the partner in the pair presentation, they can get help or hint from anyone from the class orally if they asked for. So far, no one has had hard time at presentation, because they have had enough ear-lip

training before they do it, and above all, they do it by volunteer. Most of the time, students do self-corrections by “feel” and habit, which shows great success of Ear-Lip Service Approach.

After 4 months experiments, data were collected from the two classes and the frequency of presentation was compared. A questionnaire was also completed by the participants.

For 4 months, the total number of presentation by DPPL was 386 times, compared with 265 times by NPL (Fig. 5-1). This revealed great success in both pair combinations under Ear-Lip Service Approach. Also, the results indicated the significant differences between the two pair combination groups on the active participation of language output. Obviously, the class with the combination of different personality was more active than that of neighbors. At the end of the school term, 32% (13) of the DPPL presented from 11 times to 15 times, compared with 21%(8) by NPL to this amount. Moreover, nearly 10%(4) from DPPL gave presentation as much as about 20 times while no one came to this high frequent participation in NPL. Only 17%(7) from DPPL was found for the low participation, while 38%(15) from NPL, twice of that of DPPL, belonged to the low participation.

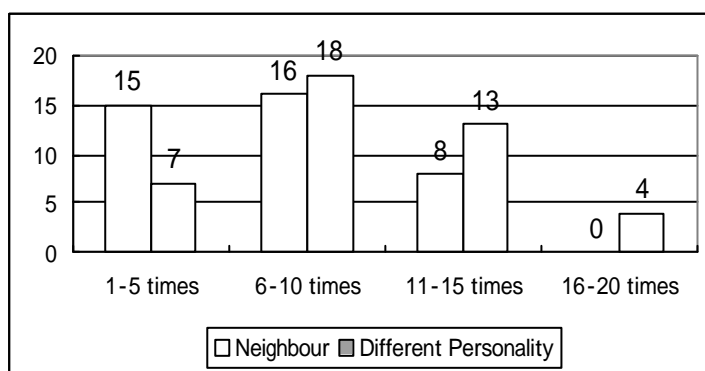


Figure 5-1. Number of presentation by both pair groups

In terms of silent period before the first presentation, DPPL did much better than NPL (Fig.5-2). DPPL advanced almost as much as twice of that from NPL. 11 students left no presentation in DPPL compared with 23 in NPL in the second month. There was only one student left with no speech in

DPPL compared with three in NPL in the third month. In the fourth month, two students from NPG still kept silent while all of the students from DPPG overcame the silent period.

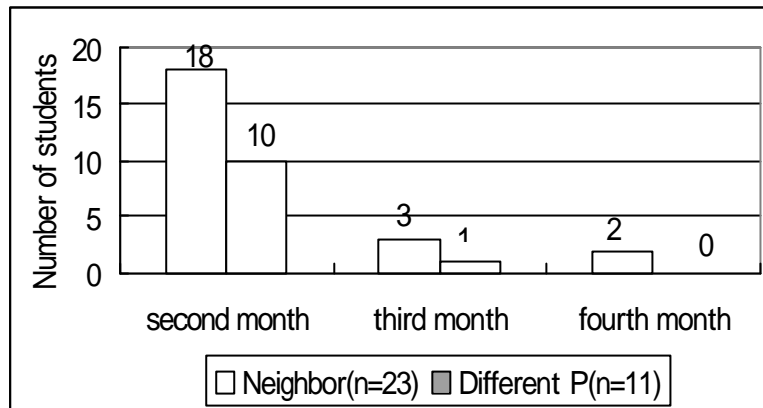


Figure 5-2. The silent period by two groups

A questionnaire was designed for all participants in the pair-work learning, both DPPL and NPL after the experimental project, as shown in Figure 5-3. 84% of the participants stated that they were motivated by pair-work learning. 77% of them said they were nervous when working alone, but this number dropped to 49% when working in pairs. Moreover, 81% of the participants felt confidence to give presentations in front of the class in pairs. Most attractively, 78% of the participants claimed that they often came earlier to occupy the front seats for an easy competition when giving presentation.

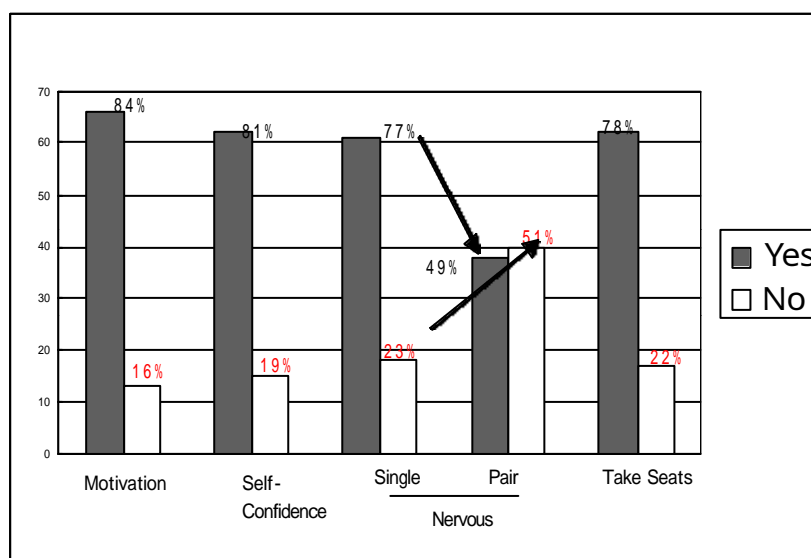


Figure 5-3. Motivation effectiveness from pair-work learning system

Questionnaire to experimental students

1. What do you think of the pair-work learning?

Very good Good Have no idea Not good

2. Do you feel relax at pair-work learning?

Yes No

3. In pair-work learning, are you willing to teach your partner when she has problems?

Yes No

4. In pair-work learning, are you willing to let your partner to help you when you have problems?

Yes No

5. When you have problems, did your partner give you any help?

Yes No

6. Do you like to help each other in the pair-work learning?

Yes No

7. Do you think you have the same frequency of presentation without working with your partner?

Yes No

8. Do you often rely on your partner?

Yes Sometimes No

9. Does your partner relies on you?

Yes Sometimes No

10. When your classmates give presentation in front of the class, what's your interest in the speakers?

Pronunciation Facial expression Contents Others

11. Have you ever feel that your classmates' presentation is great?

Yes No

12. If the answer is Yes in Question 11, do you wish to be like that?

Yes No

13. Do you feel confident to work in pairs in front of the class?

- Yes No
14. Do you feel shy if speak alone in front of the class?
 Yes No
15. Do you feel shy when you present in pairs in front of the class?
 Yes No
16. Have you ever been to the class earlier in order to take “good seats”?
 Yes No
17. Do you still do the presentation if there is no concern with the grade?
 Yes No
18. Do you think pair-work learning is effective?
 Yes No
19. Do you like the previous partner or the present partner?
 Previous Present
20. Do you think you have the same personality with your partner?
 Yes No
21. What personality do you think you are?
 Extraversion Introversion
22. Do you have personal problems with your partner?
 A little No
23. Do you think you have more help from your partner than from the teacher?
 Yes No
24. Do you think you are always motivated by your partner?
 Yes No
24. In pair-work learning, who plays an important role?
 I Partner Both
25. Do you want to change your partner next year?
 Yes No
26. If yes in Question 25, what kind of partner do you wish to work with?
 Higher lever Lower level Same level
 With different personality Whoever

5-4 Discussion

A variety of studies have been done examining the efficacy of comprehension-based approaches which focus on providing comprehensible input and waiting for production ability to emerge, however, how long does it take for its emergence is not clearly stated. According to Krashen's [13] summarization of the period of time learners spent before language production, Gary's experimental groups of learning Spanish did not speak for the first 14 weeks; Postovsky's group of Russian study did not speak for the first four weeks; Swaffer and Woodruff examined a first year college German course who did not speak for the first two weeks and which was considered the best. (Unfortunately I could not find the similar data on production-based approaches). In this study, the students from both DPP and NP began to speak the first hour of the lesson, following Ear-Lip Service Approach. This outstanding contrast proved the effectiveness of Ear-Lip Service Approach.

The success of the language production in this research can be attributed to the effective techniques in Ear-Lip Service Approach and the cooperative learning in pairs, by which learners teach learners [26]. According to Marianne and David, the most appropriate and effective classroom organization is pair and group work, which increase student opportunities to perform with the target language and in which each learner is held accountable for his or her own learning [27, 28, 29, 30, 31, 32, 33]. From Wendy McDonell's point of view [34] that pair or small groups provide non-threatening situations so that each learner talks readily and is encouraged to talk. In pair-work activities, they can enjoy feelings of increased motivation and increased desire to support their partners [35]. Peer tutors can function effectively and benefit in their own language proficiency [36]. The achievement of production and the earlier emerge of talk from participants in the target language are glaring examples of successful cooperative learning, which supported by David's point of view. He states that working together to achieve a shared goal produces higher achievement and greater productivity than does working alone. "The more individuals work cooperatively with others, the more they see themselves as

worthwhile and as having value, the greater their productivity “ [23, p33]. E. Kapa [37] evaluated cooperative learning as a supportive learning with students helping each other and working together effectively and as a excellent tool to develop higher level cognitive skills and meaningful, communicative language skills [38].

One possible interpretation for the sharp difference in productive participation and in silent period between the two groups was that the class paired from different personality reduce learner anxiety about producing communicative output with an extroversion student leading the introversion partners, hence, produced more language output. On the contrary, the comparatively low participation with the class of neighbor pairs could be suggested that if two introversion students happened to be paired, language production might be a problem. E. Kapa shares the similar overview that students paired by different personality may be increasing the level of sharing processes. Since presentation activities are undergone by volunteer, motivation, self-confidence as well as the level of anxiety are extremely crucial in the cooperative learning. According to Krashen’s affective filter hypothesis, DPPL provides much motivation, self-confidence and low anxiety, which are decisive factors for language acquisition. Hence, it is natural to find a lower participation in NPL, because weak students might have a less motivation, less self-confidence and more anxiety if they are happened to be paired with other weak students.

Also, the competition of taking “better” seats, as shown in the students’ questionnaire, reveals a highly motivation which makes great contribution to the early and massive language production.

All of the above achievement proved the effectiveness of Ear-Lip Service Approach and the Krashen’s quotation of Brown’s term: “if you concentrate on communicating, everything else will follow”.

Although the classes were always noisy with reading aloud, dialogue practice, fight for winning the toss as well as claps after each presentation, the atmosphere of learning was lively and free from any stress.

The results of the 4-month experiment proved Ear-Lip Service

Approach an effective approach for fluency building. The techniques of information-gap task based repetition and mimicry plus pair-work-based cooperative learning successfully bridged the comprehension-based input and production-based output and well on the way to develop fluency on the target language. This practical experience will pave the way for the development of the language learning software.

VI. SOFTWARE IMPLEMENTATION

This chapter first briefly summarizes the current speech recognition technology assisted language learning software, then, the limitation of speech technology for non-native speaker use is examined, which provides valuable ideas on the design of the system. At last, this system will be evaluated by Computer Assisted Language Learning evaluation criteria. The final part of this chapter contributes to the discussion.

6-1. Introduction

In recent years, the use of speech recognition technology in language teaching and learning has been increasing dramatically. The four software products reviewed in Chapter One are such examples. Although the quality of the learning experience that the software offers can vary widely from one piece of courseware to another, they have two main features: 1) intonation evaluation; and 2) close response dialogue system.

The four software products all offer intonation practice with visual displays. Learners listen to a selected word or sentence and try to reproduce it into a microphone, then their utterance is digitized and pitch-tracked, and then they can see a display of their own pitch curve directly under that spoken by a native speaker model for comparison. With visual pitch, learners are able to see both a native speaker's and their own pitch curve simultaneously. Learners' pronunciation is rated in different ranks according to how well it matches a native speaker's model. Most of the time, the

programs simply ask learners to repeat without indicating the cause of the problem. For example, in a typical exercise of Native World, learners record themselves, then replay their utterance and see a visual display of their intonation curve comparing to the native speaker's. However, other than the display, no further feedback of any interpretation is provided. Visual feedback should be accompanied by other types of feedback and for which learners need help in interpreting the display [6, 7]. Chen also suggests that the education value of this activity would be significantly enhanced if learners could understand the meaning of the voice graph or why their utterances do not match the model. He said "If the feedback could pinpoint learners' weaknesses, the learning experience would be more useful and pleasant". Concerning the signals, Chun [39] introduces Wichern's experimental report and states that the participants had considerable difficulties in relating visual and auditory signals. Chun also dictates De Bot's point of view that the problem in the application of visual feedback is that the visual feedback does not indicate which parts of the signal are perceptually relevant and which ones are irrelevant for learners to follow. Furthermore, this kind of display is not user-friendly because learners are not told how to interpret them. Also, excessive detail in the area of pronunciation can be distracting and counterproductive [40]. The visual display system is to some extent confusing because the intensity, speaking rate and pitch vary greatly from one individual to another [41].

The other main feature of the software viewed is the interactive learning through close response dialogue. Learners take their turns in conversations by selecting and reading into a microphone one of three or more choices shown on the screen. Or learners translate their turns according to the interactive information provided by the system. For example, if learners are asked to answer a question, they can either read aloud one of the written choices or translate the sentence they see on the screen in the native language. The path of the conversation is dependent on one of these multiple choices. So this interactive learning is similarly restricted to repeating fixed responses, rather than engaging in a meaningful

conversation. Such repetition hardly contributes to the learning of spoken language in any meaningful way [42]. Eskenazi [41] uses Bernstein's comments on this interactive learning as a passive role. Eskenazi argues that in both cases, the answers are ready-made with responses chosen and translated. As a result, learners have no practice of their own, namely, they cannot actively make language production of their own. The lack of opportunities for learners to participate actively constitutes one major pedagogical weakness and a major problem identified by a number of researchers [6, 41]. Tomoaki [43] concludes that the interactive learning does not allow learners to express his/her own meanings and therefore cannot accurately be called "communicative".

It seems that the above disadvantages of speech recognition assisted language learning software also lie in the limitation of current techniques. First, speech recognizers work better in closed response designs [7] which restrict learners to passive roles like reading aloud from written choices [41]. Under open response systems, learners can generate their own expressions but the recognizer may have difficulties working out all of the appropriate answers. Sometimes, the system interrupt students to tell them that they are wrong when, in fact, they are right, because underlying speech recognizers require a high degree of predictability to perform reliably. Secondly, the recognition system is not yet precise enough to be able to sufficiently recognize what is said by a non-native speaker without prior knowledge of the context of the sentence.

The ultimate goal of the current speech recognition assisted software is to foster the ability of learners to participate actively in meaningful conversations. However, because of the limitation of the present speech recognition technology, focus of intonation evaluation and close response dialogue, learners cannot be led to the communicative skills. In this research, more intelligent considerations are made so that learners can focus their attention on communicative skills.

Purpose of the system

Based on voice recognition technology, the system focuses on three goals: 1) to develop a systematic learning system, following Ear-Lip Service Approach which was proved to be effective in the language classroom; 2) to create natural dialogue patterns and 3) an open response dialogue system. In order to complete the above goals, the potentials of voice recognition technology for language learning was reviewed. Then, the design of the system tried to move voice recognition technology into the linguistic field with an effective way in a foreign setting. Following that, theoretical evaluations on the system were conducted.

6-2. Technical background

This section will first briefly review the possibility of speech recognition technology for language learning. Then, concentration will be given on IBM's ViaVoice, on which this learning system is based.

In recent years, there has been a rapid growth in research into speech recognition. Speech recognition is a relatively new input technology that lets a user talk into a microphone connected to the computer through natural speech instead of using a keyboard. Users just speak into a microphone and the speech recognition system will translate their words into commands or a text. However, this marvelous tool is only limited to native speakers. The following quotation best describes this point of view.

In the last several years programs have begun to appear which allow word processing and other kinds of computing tasks to be accomplished through voice input. Programs like IBM's ViaVoice or Dragon System's Naturally Speaking have become mainstream software products and have been extended to a variety of languages. These are, however, productivity products, not language learning software. In fact, the needs of language learners in respect to speech recognition software are quite different from those of regular consumers. The commercial speech recognition products are typically

trained to recognize an individual user's voice input, with the assumption that there will not be significant changes in that user's speech patterns. Clearly this is not the case for language learners, whose spoken language will change as they learn. The programs, in fact, are designed to recognize the speech of native speakers, not of struggling beginners [44].

The main purpose of speech recognition technology is clearly interpreted in the above descriptions as an ideal tool for native speakers, and not for language learners. Larry & Rita [45] too said the same thing: "all speech recognition programs are intended for native speakers with their basic lexicon native speaker based". Since the recognition system must have stability of pronunciation as input to the machine system, users have to pronounce words in a consistent way and a stable fashion, which hinders the process of non-native speakers. Non-native speaker's variability is one of the major problem in accurate speech recognition and the degree of accuracy or the user friendliness of the program was illusory and far from being satisfactory. The experimental results with DragonDictate is 85.10% for native speakers and only 51.40% for non-native speakers [45]. Moreover, as Chun [39] quotes Weltens and de Bot's reports that the limitations of the hardware and software that caused a slight delay in feedback might hinder the effectiveness of their display system. IBM's ViaVoice, on which this software based, has the similar features, which require this system to work around these limitations for non-native speakers.

The first time people use the system, they have to create their own voice model by recording aloud a story in the system in a normal speaking voice. This procedure records and analyzes the main characteristics of the user's voice. This training enables ViaVoice to recognize the user's particular speech pattern and adapt to their pronunciation. The reading task, observed by the author, takes about 30 minutes by fluent speakers and over an hour, sometimes as long as two hours for language learners. Once a voice model has been created, users can go on to the dictation task, which provides the opportunity for the design of the system.

Dictation

User speaks through a microphone and the voice recognition system recognizes the speech and converts it automatically into text. User can dictate directly into text boxes in dialogue windows. The purpose of the dictation system is to let users dictate text into documents like reports. ViaVoice completes the above tasks when users speak clearly and in a normal, natural speaking voice, not too fast and not too slow.

Accuracy

ViaVoice is primarily for US English speakers. From the results of the reviews by Savitska [46], the accuracy level of ViaVoice rated at approximately 85% for voice dictation for native speakers. Even under quiet conditions the recognition of words is difficult, because no one ever says a word in exactly the same way twice. Some words also have the same pronunciation even though they have different spellings.

Possible occurrence in dictation

1. A single mis-recognized word with the same or similar pronunciation
2. A word recognized as two or more words by slight pause between syllables.
3. A word not spoken inserted in the text by noises and background sound.
4. Two or more adjacent words recognized as one word by talking too quickly.
5. A word capitalized incorrectly.
6. Text appears slower than the speech when talking fast or when machine works slower.

ViaVoice dictation system requires normal natural speech for accurate recognition, however, language learners' pronunciation changes considerably which is definitely slower for voice system to adapt than native speakers. Moreover, the accuracy is about 85% even for native speakers, let alone language learners. Together with the possible mis-recognition listed above, software designers and language experts are challenged in developing

appropriate systems for language learning by working around the limitations of voice recognition technology.

6-3. Development of the software

Lack of oral practice was found to be the real issue in language learning in Chapter 2. In order to increase the opportunity for oral practice, Ear-Lip Service Approach and pair-work method were proposed and tested effectively in Chapter 4 and 5. What has been done so far forms a practical basis for the development of the software. Also, the features and limitations of the current voice recognition technology for non-native speakers were analyzed which provide a technical basis for the design of the software. All those discussed so far lead to the next consideration in the development.

Table 6-1. Basic concept and creations

New concept	Creations
System control	Systematic learning
Time interval	Natural dialogue patterns
Key-word spotting	An open dialogue system

Principles and goals

- a. Focus on fluency building based on Ear-Lip Service Approach.
- b. Offer a systematic learning system
- c. Adaptable for non-native speaker use.
- d. Close to natural speech by an open response dialogue system
- e. Solving pronunciation problems by inter-language interference.

In order to reach the five goals, the learning system will be designed into three parts which is subdivided into several steps offering systematic learning activities and natural communicative setting. A separate curriculum

will be devoted to inter-language practice.

Part One: Fluency Building

Step 1: Listening comprehension

Step 2: Listening for information

Step 3: Listening for accuracy

Step 4: Listening for repeat

Step 5: Participation

a. Comprehensible input

b. Communicative output

Step 6: Following

Step 7: Listening comprehension

Part Two: Natural Conversation Experience

Lesson One

Lesson Two

Lesson Three

Part Three: Point-focus

Part Four: Inter-language practice

For Japanese

a. phonetic practice

b. accent practice

c. foreign words practice

For Chinese

a. vowels

b. consonants

c. consonant clusters

Functions of each part

Part One: Fluency building

As the name suggests, Part One offers active opportunities for learners to participate in learning activities using the target language. Learners must progress systematically through Step 1 to Step 7. The system controls over what, when and how much to practice through the use of an “activated” command button. (see Fig. 6-1 and Fig. 6-2)



Fig. 6-1. Systematic learning by system control

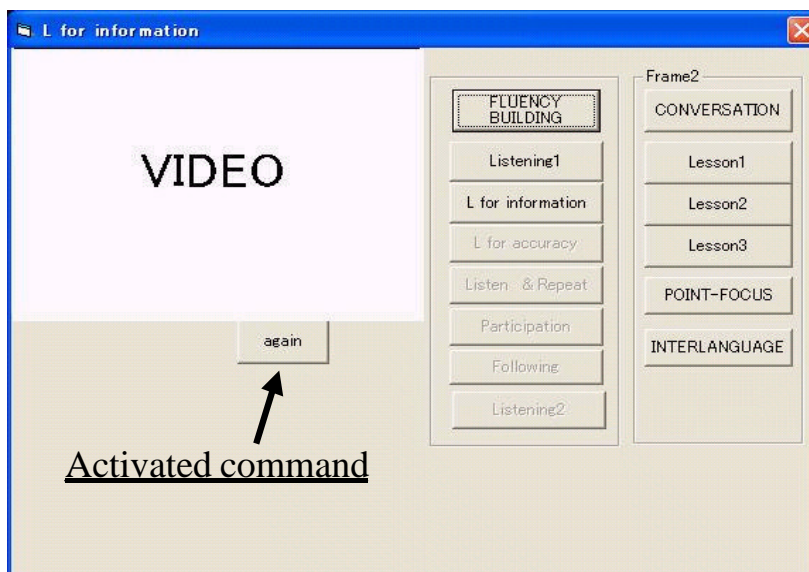


Fig. 6-2. Systematic learning by system control

Step 1: Listening comprehension

Learners listen to the dialogue for comprehensible purpose. It is also served as a test of learners' level on the learning materials they are working on. Learners are required to listen to it twice.

Step 2: Listening for information

Learners listen to fulfill the information task prepared by the system. They have to type the answers below the questions in a textbox. When learners complete or want to finish this exercise, they can press the check button, then, a separate window will open to provide learners with the answers to the questions they are supposed to complete. Learners can control this process and decide by themselves when to finish.

Step 3: Listening for accuracy

Learners listen to fill in the brackets dotted throughout the dialogue for this

lesson. Learners complete this task by typing while listening. Like Step 2, they can press the check button, and the answers are provided on a separate window for learners to check their work. Even if they have done a poor job, they are to be encouraged to go to the next step. Like Step 2, learners can control this process and decide by themselves when to finish.

Step 4: Listening for repeat

Learners listen to repeat with written information for reference this time. The system based on voice recognition technology provides the learners enough time for the repeat and will remind them orally and ask them to repeat in a loud voice if they are found silent or passive.

Step 5: Participation

A. *Comprehensible Input*

This is a video pair-work presentation on the same dialogue content by native speakers to provide comprehensible input as much as possible. The presentation is done four rounds with four different characters acting as both A and B. For example, when practicing on Introduction, the pair-work presentation goes like the following:

ROUND ONE

Speaker A: Hello, I'm Mike. What's your name, please?

Speaker B: My name's Jane.

Speaker A: Where are you from?

Speaker B: I'm from Canada. And you?

Speaker A: I'm from America. Nice to meet you!

Speaker B: Nice to meet you, too.

ROUND TWO

Speaker B: Hello, I'm Jane. What's your name, please?

Speaker C: My name's John.

Speaker B: Where are you from?

Speaker C: I'm from England. And you?

Speaker B: I'm from Canada. Nice to meet you!

Speaker C: Nice to meet you, too.

ROUND THREE

Speaker C: Hello, I'm John. What's your name, please?

Speaker D: My name's Smith.

Speaker C: Where are you from?

Speaker D: I'm from Australia. And you?

Speaker C: I'm from England. Nice to meet you!

Speaker D: Nice to meet you, too.

ROUND FOUR

Speaker D: Hello, I'm Smith. What's your name, please?

Speaker A: My name's Mike.

Speaker D: Where are you from?

Speaker A: I'm from America. And you?

Speaker D: I'm from Australia. Nice to meet you!

Speaker A: Nice to meet you, too.

B. *Communicative Output*

This is pair-work practice between learners and video partner on the screen on the same dialogue content. The practice is done six rounds with three different characters on the screen acting as both A and B. It is a little different from the Comprehensible Input practice. First, learners play B three times continuously with different three video As, and then play A three times with three different video Bs. Let's take the same example as the above, the pair-work practice goes like the following:

ROUND ONE to THREE

Speaker A1(A2; A3): Hello, I'm Smith(John; Mike). What's your name,

please?

Learner: My name's Mayi.

Speaker A1(A2; A3): Where are you from?

Learner: Im from Japan. And you?

Speaker A1(A2; A3):I'm from Australia(England; America). Nice to meet you!

Learner: Nice to meet you!

Round Four to Six

Learner: Hello, I'm Mayi. What's your name, please?

Speaker B1(B2; B3): My name's Smith (John; Mike).

Learner: Where are you from?

Speaker B1(B2; B3): I'm from Australia (England; America). And you?

Learner: Im from Japan. Nice to meet you!

Speaker B1(B2; B3): Nice to meet you!

In this pair-work practice for language output, a separate window with written dialogue is prepared for learners to refer to when necessary, but they are encouraged not to look at it as much as possible. The system based on voice recognition technology will remind learners to speak aloud if they are found to be silent or in a passive speech fashion.

Step 6: Following

Learners are required to follow at the same speed with the video. For the first time, a separate window with written dialogue is provided for learners to go to for reference when necessary. For the second time, no written information is available. Voice recognition assisted feedback will be offered to remind learners to speak aloud if they are being silent or passive.

Step 7: Listening

Learners are required to listen to the dialogue one more time after a series of listening and speaking practice, which allow learners to compare it to that at the beginning of the study.

Systematic learning

The 7 steps in Part One offers a systematic active learning methodology for language input and output under tightly controlled conditions.

First, the learning is strictly controlled by the system. Learners are led throughout the learning activities by only one activated button, which is extremely easy to follow. The control buttons of “start, again and next” are designed dead until learners finish the required tasks in all of the items except for Step Two and Three. Learners are not able to omit one step or jump over to others throughout the learning activities until they finish Step 7, following the step by step procedure. That is, only when they finish Step 7, all the learning activities become activated for learners to decide whether to go to the next part or stay in the first for further study on any of the steps. Learners can go back to any of the previous items to practice again at their own pace. Learners should be notified that they could talk successfully with computer if they finish all the tasks in Part One, which motivate learners to follow positively. They can take a rest between steps or quit or log out of the study, but when they come back to the system next time, they have to start from the beginning. The voice instruction at the beginning of each part and each step is carried out in both native and target language offers addition convenience for learners to follow. The instruction in native language stops the service when learners have gone over 20 complete tasks.

Second, it offers learning criteria in Step 6 and 7 for learners to judge their own learning progress and decide whether to continue or review. If learners can follow the video without any written information to consult and can relax when doing so, they are encouraged to continue to Part Two, otherwise, they are suggested to do more practice in Part One at their own pace. This time Part One is open for them to choose freely. In Step 7, learners listen to the dialogue once more and compare the result to the first time they listened to at the beginning of the study. They can clearly see their own progress, which is believed by this author a positive way to motivate the

learning.

Third, learners are encouraged not to look at the written form of the content as much as possible. They are not able to see the written form until they progress to Step Four, after much effort is made on the first three tries. This method makes learners concentrate on the task, and hence, motivate active learning. Two thirds of the learning are conducted without written forms except for Step 4, half of Step 5 and 6.

Fourth, information-gap based listening practice provided in Step 2 and 3 make great contribution to accuracy and focus on the listening task. This activity aims at training learners what to listen in a conversation setting and understand the meaning of spoken language quickly and accurately. These two steps are excellent practice for listening comprehension [47] and is believed to attract the learners' attention to the most extent.

Lastly, the pair-work learning system on both input and output in Step 5 provides great deal of opportunities to build communicative abilities. Pair-work incorporate the benefits of cooperative learning, and are excellent vehicles to help students communicate [48]. The massive interaction with different video partners on the same topic present learners with valuable communicative experience. "In order to teach for communication, teachers must develop a store of interactive teaching techniques that can be adapted to specific instructional environments, resources, and learner characteristics". [49]. Learners acquire more by using it in communicative situations [50].

In the 7-step systematic learning process, one learning task leads into the next, which familiar learners with the context step by step and by the last step, learners will have achieved a considerable facility and breadth in the target language [51]. This systematic learning lends learners marvelous ear-lip training opportunities based on communicative context. The repetition of a dialogue throughout the 7 steps would result in improvement in both the fluency and accuracy of the language used and will give learners the confidence of actually using the language [52, 53]. It naturally leads learners a habit formation on foreign ears and lips, which lays a solid foundation for the natural conversation practice designed in Part Two.

Part Two: Natural Conversation Experience

This part will attempt to concentrate on the natural speech patterns developed on the following considerations:

- 1). Natural conversation patterns with consideration of personality in real communication and the limitation of voice recognition technology by time control.
- 2). Open response dialogue with consideration of foreigner talk, caretaker talk and the limitation of voice recognition technology for non-native speakers by key-work spotting.

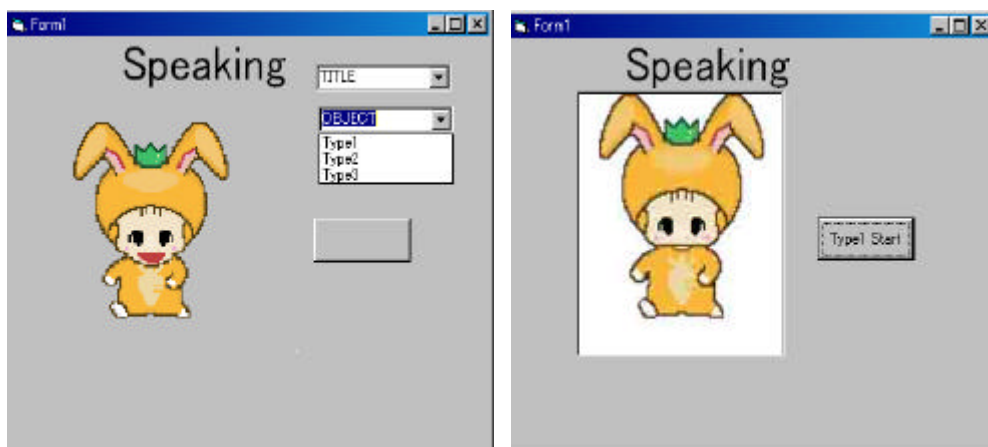


Fig. 6.3 Natural conversation patterns and open response dialog system

Technical treatment

Based on the above two considerations, three lessons are designed to complete the natural conversation learning task between the learner and the video partner, following a series of linguistic and voice recognition techniques.

First, the feature of open response takes language learning a step further to natural speech processing. This is challenging for learners and

also for the speech recognizer because it has to be able to recognize a wide range of possible answers [6]. It is very important to determine how the system treats different responses. The system must continue the dialogue when receiving any acceptable response from the learners. Both speech recognition and the artificial intelligence of this system enable the machine to understand learners' speech and then analyze it and finally generate a meaningful response by taking different tasks depending on the responses that learners make.

Second, in each lesson, the video partner leads the conversation by playing A, and the learner follows as Role B by responding to the video partner. The open-response system provides learners opportunities to experience free communicative learning.

Third, the system gives additional simplifying supportive dialogue when learners have problems to reply, or the voice recognition technology fails to work properly. When, for instance, learners do not talk aloud, the system reminds them to speak aloud; When the learners' speech is too low for the system to follow, the system kindly asks them to repeat by "Pardon, please"; Or when the system fails to recognize the inter-language, the video partner gives the same information again by simplifying the way of asking:

What's your name, please? → What's your name? → Your name, please?

Fourth, key words spotting and time interval control are designed to meet different functions in each lesson. For one thing, it offers an ideal environment for foreign language learning. Like a caretaker talk to a baby, or a native speaker talk to a foreigner, or a language teacher talk to a language learner, the system is designed to capture main ideas and provide communicative opportunities by key word spotting, instead of pursuing accuracy of everything which is impossible for the current voice recognition technology, and by a longer time interval control than that in normal dialogue between human beings. For the other, the technique of key word spotting and time interval control is also adapted for the consideration of personality combination between learners and video partners. Like in real

communication, learners have to meet different people with personalities of introversion and extroversion. Hence, the system too provides such features for learners to experience with the natural conversation partners on the screen, which is believed to benefit much when they have a real conversation in the future.

Fifth, the communication between learners and video partners are developed like in a real conversation with no on-screen prompts of any written form, which offers the main feature in the active learning activities. Eileen W. Glisan [54] too believes it a nice technique for listening skill development without written correspondences. Such a condition provides a motivating language environment. It helps motivate learners to listen carefully in order to answer correctly. When learners have difficulties in the process of the conversation, they are suggested to consult the “help”, which shows again the sample dialogue they practiced quite a lot in Part One. Then, they will be put back again to the conversation from the beginning, not from where they leave. This technique offers free conversation rather than a solid sentence or phrase or a single response to a certain question like in a close response dialogue.

Lastly, special treatment is conducted to work around the limitation of voice recognition technology. When dealing with routine languages like greetings, the system helps learners reach the end goal by pitch capture instead of key word matching. For example, when the reply is certain from learners like “goodbye” or “yes” or “no”, problems can be raised if the system treat such routines the same way as it does others, since the voice recognition is not 100% reliable to recognize everything from speakers, especially from unstable utterance by non-native speakers. There are two other reasons for this special treatment except for the voice recognition technical limitation: 1), learners are sure to have the ability for the routine-reply after the massive training in Part One; 2), learners are sure to have no problem for such “greetings” with a basic knowledge of six-year study of the target language in high school. Moreover, special treatment is considered on the words with similar pronunciation, like ‘too’, ‘to’ and ‘two’;

'bye', 'by' and 'buy'.

PROCEDURES

Lesson One

Lesson One is carried out between learners and video partners with an “introverted personality”, who is supposed to be not talkative. As a result, the system has a slow interaction and the learners have to speak as much as possible to continue the conversation. The system offers 7 second of the time interval and requires two key words for a match before the next response. Once learners' output meet the requirement of two key words, the system continues the conversation in two seconds after learners finish the talking. If learners' output does not meet the key-word requirement within 7 seconds, the system either asks them to talk aloud, or asks them to repeat, or the system tries again the previous sentence in a simpler way to support the understanding of the learners. The last process repeats twice and suggests learners verbally to see the sample dialogue, which allows learners to recall what they have learned earlier if they still cannot make a proper response a third time. After consulting the sample dialogue in a separate window, they are guided back to the conversation practice again, but have to do it from the very beginning. Only when they finish the conversation interaction continuously without going to the sample dialogue, are they allowed to continue to Lesson Two.

Lesson Two

Lesson Two has the same procedure as Lesson One, but this time the video partner is supposed to have neutral personality. As a result, different from Lesson One, the time interval between the dialogue is set up for 5 seconds and one key word is required.

Lesson Three

Lesson Three has the same procedure as Lesson One and Lesson Two, but this time the video partner is supposed to have the personality of an extrovert. As a result, different from the previous lessons, the time interval between dialogue is set up for 3 seconds to reflect the outgoing characteristics. Only one key word is needed to give video partners more chance to talk as required of the personality.

Like Part One, the three lessons must be processed orderly until learners finish Lesson Three. Then they can try any lesson freely as they like. The natural conversation patterns and an open response dialogue system are summarized in Fig. 6-4 and Fig 6-5.

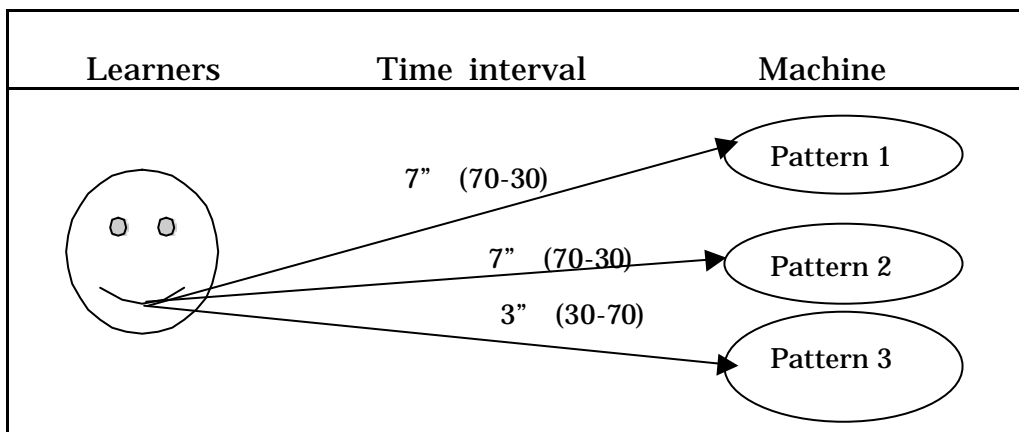


Fig. 6-4 Natural conversation patterns by time interval

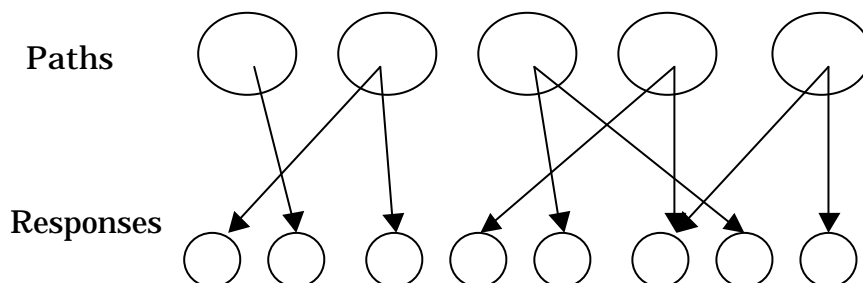


Fig. 6-5 Open response dialogue system by key-word spotting

Part Three: Point-focus

Since this system offers systematic learning methodology, Part Three serves as a summary of the key point of the study on the content, like in a methodological classroom. Video shots are repeated to focus learners' attention on the key points again, which helps learners to sum up the study learned so far. Four characters act in the video shots like the following:

- 1) Speaker 1: What's your name?
Speaker 2: My name's John.
Speaker 1: Where are you from?
Speaker 2: I'm from England.

- 2) Speaker 2: What's your name?
Speaker 3: My name's Mike.
Speaker 2: Where are you from?
Speaker 3: I'm from America.

- 3) Speaker 3: What's your name?
Speaker 4: My name's Jane.
Speaker 3: Where are you from?
Speaker 4: I'm from Canada.

- 4) Speaker 4: What's your name?
Speaker 1: My name's Smith.
Speaker 4: Where are you from?
Speaker 1: I'm from Australia

These meaningful repetitions are sure to help learners lay a solid foundation on the way to spoken language.

To sum up, the learning activities throughout the three parts provide a

systematic language learning methodology separately and as a whole. It offers plenty of opportunities for learners' participation in natural learning practice. One touch of the activated button acts as a guide to lead learners to the ultimate goal of communicative skills.

Part Four: Inter-language practice

There is no literature available for reference on inter-language learning on the screen at present. While communication is the end goal for this learning system, problem-based pronunciation practice is also stressed in this study. It is also crucial for this voice recognition based learning since it should be used by non-native users. The results from 100 mini-dialogue reading, as stated in Chapter 2, reveal no intonation problems with the target language, but they do have problems with the pronunciation influenced by the mother tongue, which is supported by Swan & Smith [40]. In their study, the inter-languages of the learners are specific and distinct, so that it makes sense to talk about Japanese English, Chinese English, and so forth. The influence by mother tongue is seen as accounting for most of the characteristic problems. Hence, emphasis on the pronunciation problems caused by a particular mother tongue instead of general intonation practice is one of the main purposes in this learning system. The pronunciation practice here is designed according to the characteristic problems of a particular group of learners. Let's take Japanese and Chinese as examples.

For Japanese

The pronunciation problems for Japanese are classified into three categories: phonetic problem, accent problem and foreign word interference. The source of contents for each category is based on Table 2-2 in Chapter 2. According to the reading of mini-dialogues from 100 students, three problem patterns can be concluded. First, a wide-spread influence comes from the mother tongue, especially in the final position. For instance, the 't' is pronounced as the Japanese 'to'; 'd' is pronounced as 'do' and 'g' as 'gu' in words like 'out', 'end'

and 'good' . Second, influence comes from the limited Japanese pronunciation, like /r/ and /l/ in 'afraid' and 'call'. The third influence comes from the great amount of foreign words borrowed and used as the Japanese katakana, like 'river' and 'side'. Therefore, during the practice in this system, learners concentrate on only the target language by offering only the problematic words without any interference of the native language.

For Chinese

Chinese and English belong to two different language families as well. Like the relation of Japanese and English, they have many structural differences. The pronunciation system too is very different from that of English. For instance, according to Swan & Smith, the contrast between the vowels of /i:/ and /i/ has no equivalent in Chinese, so learners confuse pairs such as 'eat' and 'it'; /a/ does not occur in Chinese, and often confused with /a:/ or /e/, like 'bad' and 'bed'; In terms of consonants, Chinese speakers have a problem realizing /f/ and /v/, which are absent from most Chinese dialects. As a result, sometimes 'live' is pronounced 'lif'; Similar as Japanese, there are no /ð/ in Chinese either. For southern Chinese, /r/ and /l/ are extremely difficult to pronounce. The most serious problems are those which are voiceless in Chinese, but voiced in English, such as /b/, /d/ and /g/. Therefore, considerable practice is necessary for Chinese speakers in these areas. According to the phonology, three categories are divided based on the source from Swan and Smith: vowels, consonants and consonant clusters. Table 6-2 gathers some examples.

Table 6-2 Inter-language for Chinese speakers

Problems	Examples
Vowels	It fool full cap shot shout
Consonants	Invite live this birth rise duck wife
Consonant clusters	Spoon study dogs crisps appropriate

This system offers a positive learning atmosphere by explaining the differences of the most problematic utterance like /r/ and /l/ for both Chinese and Japanese speakers, while the system takes over those aspects of pronunciation practice. In the inter-language practice, learners, this time, can practice at their own pace and their own convenient, according to their own weakness. It provides learners with some basic knowledge on the differences between the mother tongue and the foreign language which shows what elements of the target language phonology are likely to cause problems [55].

6-4. Evaluation of the system

“The intent of CALL courseware evaluation is to ensure that the learner encounters not only relevant, accurate, and well-presented content but also the smoothest possible interactions with the computer. Courseware evaluation should attempt to determine quality in courseware content, instructional presentation, the interaction between the computer and the learner”. [56, p479]

Richard & Janice [56] proposed three-phase criteria to evaluate language learning software: Phase One is to evaluate content and instructional presentation, Phase Two, the smoothness of the learning experience and Phase Three, the software’s value in the curriculum. Phase One focuses entirely on the content’s quality and on whether it is organized and presented in an instructionally sound manner. Phase Two centers the software’s mechanical and aesthetic features which might influence the entire learning experience. Phase Three examines the software’s usefulness in meeting learners’ needs. This system will be evaluated following these criteria.

Phase One: Evaluating content and instructional presentation

There are 5 main standard criteria to evaluate content and instructional presentation.

1). Clear goals: Goals and objectives should be clearly stated and should serve as useful, relevant guidelines to the instructional content. It should be arranged in meaningful, logical segments with appropriate emphasis on the most relevant or important information.

This system met these criteria by the systematic active learning offered in Part One. Part Two and Part Three too serve as a meaningful and logical segments in the whole set of curriculum. Communicative learning is emphasized throughout the learning process by Ear-Lip Service based pair-work learning activities.

2) Methodology: It should offer a methodology of learning.

Offering an effective learning methodology is the main goal in this system. The activated buttons lead learners step by step toward the end goal. Like a classroom instruction, the three parts contributes to the learning process by a series of communicative learning activities, to the testing process of the effectiveness of the learning process by the natural conversation practice and to the summary process by focusing the main points of the study.

3) Instruction: The operation of the system should be easy to follow without any additional explanation from a human instructor.

The system is extremely easy to follow by only one activated command button to guide learners when, how and where to go throughout the learning process. The voice instruction in both native and target language provide additional conveniences for the learning activities.

4) Questions: Questions for learner responses should be frequent enough to ensure active, continued learner involvement. And the questions should be absolutely clear to the learner without having to guess.

This requirement is met by the considerations of simplifying dialogue support, foreign talk and caretaker speech, key word spotting and time interval control, which provide more chance for learners to follow. The feature of open response too offers smoothness in the participation and the voice instructions throughout the system ensure learners to follow actively to complete the learning task.

5) Answer judging: Like a human judge, software must be designed to anticipate in advance a variety of valid, alternative learner responses. It must be accurate to ensure that specific responses produce the results intended in every interaction between the learner and the computer.

The technical treatment for the design of Part Two best serves this requirement. First, the system is designed with the ability to receive open response. Second, key word spotting and time interval control offer accurate judge by working around the limitation of the voice recognition technology for non-native speakers. Third, the voice instruction is reliable basing on the voice recognition. Fourth, the special treatments of routine language and the vocabulary with similar pronunciation are carried out to avoid the interference by the low recognition of non-native speakers.

Phase Two: Evaluating the smoothness of the learning experience

Two features are provided for the evaluation of the smoothness of the learning.

1) Mechanical Features: All instructions about how to proceed through the software should be easily accessible or clearly displayed. A learner should never have to guess which key to press or what type of response is required to proceed in a desired direction.

This system leads learning activity by only one activated button at a time, which is the easiest way to follow so far to my knowledge.

2) Aesthetic Features: Screen design should not distract learners from their learning activities. The design should be easy for learners to distinguish between the content that is relevant. Extraneous details should be avoided.

As shown in Fig 6-1, Fig. 6-2 and Fig 6-3, the screen design is easy to understand. The content on the right side is to show learners the study plan, the working shop on the left is guided by only one activated command button. This screen design causes learners to concentrate on a clear learning method.

Phase 3: Evaluating the software's value in the curriculum.

1) The degree to meet specific learner needs as well as specific curricular goals and objectives.

The system offers this feature in two ways. First, it provides a systematic learning methodology and ideal environment for learners' goal on spoken language. Second, it offers treatment on inter-language problems.

2) Its value in relation to alternative means of instruction that claimed to serve the same purposes.

The Ear-Lip Service Approach adopted in the system is proved to be successful in language classrooms described in Chapter 4 and 5. This system is Ear-Lip Service Approach based development and is considered to serve equal purposes.

3) To see how well it is by comparing to and by ranking among the similar software.

Concerning how well it is by comparing to the similar software, it needs further research. However it surely offers different features from the current systems. I would like to compare this system with those described in the introduction of Chapter One.

Table 6-2 Comparisons of the current voice recognition assisted English conversation software products and this system

Functions	OR	LM	IT	PST	CR	GE	PPE	RR
Software								
This software	*	*	*	*				
Tell Me More Pro					*	*	*	*
Talk To Me					*	*	*	*
Echo Me					*	*	*	
Native World				*	*	*	*	*

OR: Open response

LM: Learning methodology

IT: Inter-language treatment

PST: Pre-speaking training

CR: Closed response

GE: Grammar exercise

PPE: Pronunciation practice & evaluation

RR: Results report

The value of this system will be summarized by the quotation from Chapelle[57]

“It is useful to view multimedia design from the perspective of the input it can provide to learners, the output it allows them to produce, the interactions they are able to engage in, and the L2 tasks it supports.”

6-5 Discussion

The instructional focus of the software is to offer a systematic curriculum to teach learners how to learn spoken language by ear-lip training activities and help them develop listening and speaking skills quickly and accurately. The three parts are designed to provide learners an ideal environment focusing on listening and speaking, which are considered the prime goal in language learning. Seven steps are designed in Part One for fluency building of ears and lips and three lessons are prepared for natural speech practice. Part Three sums up the content of study and helps learners once more focus on the main points. These ear-lip focus activities immerse learners in a habit formation of the target language and forget that of his/her own. Moreover, this system provides a natural way of learning by emphasis of listening comprehension, lip flexibility and natural way of speaking, because translations and, to a great extent, no written information are provided for reference. Learners are expected to learn a foreign language the way they learn their first language. The striking difference between this system and others is that the former ones focus on intonation evaluation and a close response dialogue, while this one concentrates on a natural learning system with an open response dialogue and natural conversation patterns. This system guides learners strictly towards the final goal with easy to follow procedures. In the design, the potential of voice recognition technology is explored in utilization for non-native speaker use. The software will bring language learning closer to natural learning and will prove that open response in voice recognition assisted language learning will open a new era

for foreign language learners.

The system, like classroom activities between students, offers features of task-based instruction, such as pair work and information-gap task with the video partners, which are though considered not currently possible in computer-assisted language learning [58].

This system does not offer any visible intonation practice. Intonation is the glue that holds a message together [24], but the problem is not intonation for language production, as shown in Table 2-1. In other system, learners take their turns in conversations by selecting and reading into a microphone one of three or four utterances or translate the dialogue from the hints shown on the screen. In such system, learners know exactly what they are allowed to say in response to any given prompt. By contrast, in this system with open response dialogue system, the possible responses remain hidden and learners are challenged to generate the appropriate responses as many and as free as they can. The oral practice allows students doing all of the input and output work themselves, so that they can concentrate on producing fluid speech and be exposed greatly to natural conversation patterns. The technique of information-gap task in Part One gives learners an active rather than passive role. The key-word spotting and time interval control are designed to avoid incorrect feedback which is a major challenge to the use of speech processing [24]. The software will hopefully work effectively to strengthen learners' spoken ability and should work well during a real conversation.

VII. APPLICATION TO BUSINESS

___ Establish an English Immersion School ___

The family investment in children education and the number of private schools have increased rapidly in the past several years and the growth is expected to continue at a strong pace, which offers excellent opportunities for new type and high level schools to enter this market. The distinguishing characteristics of the school planning will be top quality school, special

emphasis on the international language __ English. Our school differs from competitors in that we offer a complete set of new education system to train new type students. Our intention is that the school will become the leading provider of excellent international people with all kinds of advanced skills. With the international cooperation, excellent personnel and the best equipment of computer science, we have great potential for success and for becoming a leader in the new type education.

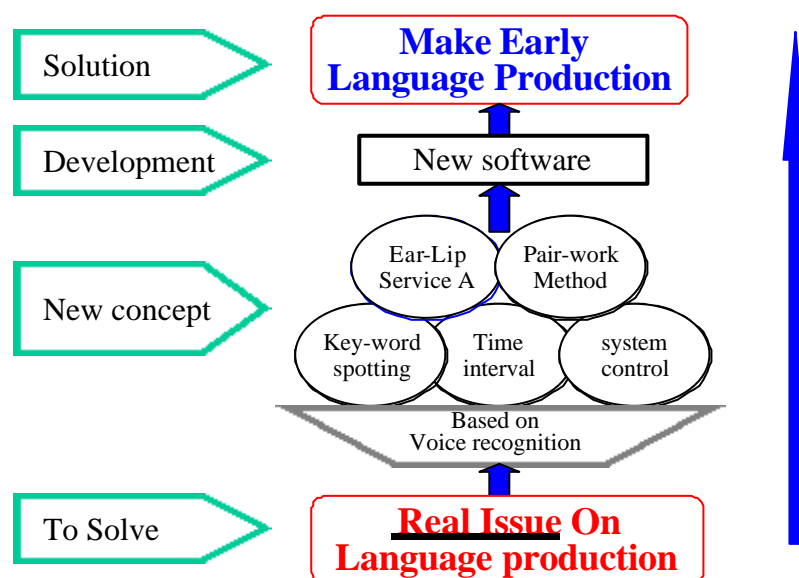
The language learning software will be used in the school curriculum, which will help learners reach the ultimate goal of communication earlier than ever before. Therefore, the school will benefit much financially, since the school does not have to hire so many native speakers teachers. Otherwise many native teachers have to be employed since an English immersion school has been planning. Moreover, it is impossible for us to hire native speaker teachers because of the difference currency value.

We are a start of a totally new type of school in China. The principal owner is DU Guirong who has rich background of education and teaching experience. The key partners include Professor KANO Gota of Kochi University of Technology, Yosita, headmaster of a private high school, LU Chaochen, owner of Beijing golf square. At this time we are seeking additional investment to compliment our own investment. We hope to start our school within 2 years with final financing arrangements. The major challenge our school will face is the scale in order to attract the best attention. We intend to respond to this challenge by first-class equipment, English education and international exchange. With the family planning started 20 years ago, we still have 21 million children born and in a few years, when the one-child get married, the number of children will grow again for the new policy of allowing two children in one family. The large number of children and the robust overall economic situation in big cities offer a good business opportunity on education.

The success of our school will be the new-type first-class education quality: superior equipment, new education system, extra attention to the training of ability and the application of the new developed language system

in the curriculum. In particular, what really sets us apart from the competition is that we are the ONLY one providing internet education, the ONLY one with a vast international exchange, the ONLY one with English immersion from elementary to high school, and the ONLY one focus on the training of the development of children’s ability, instead of focusing on text books. Another major asset is our highly talented and experienced management team. The three key partners complement each other well for their rich financial and managing background. Professor KANO Gota brings expertise in finance and management in general, Mr. Yosita, the headmaster of Meitoku High School, expertise in international exchange and also a main financier, Mr. LU Chaochen, the owner of Beijing Golf Square, has a close relation with the Chinese government and a strong financing ability too. Together, these strengths cover all of the major aspects of our school running with solid experience and high potential of success.

VIII. SUMMARY



Conceptual drawing of this research

As shown in the above figure, the purpose of this study is three-fold 1) find the current problems on learners language production, 2) propose new language approach and design concept for solving the problem, and 3) develop voice recognition assisted software for language learning in a foreign setting.

The first chapter offers literature reviews of current research on voice recognition assisted language learning and sets up goals for this study. While the use of the recognizer for intonation evaluation and close response dialogue practice, this study proposes a new language learning approach: Ear-Lip Service Approach and deals mainly with open response dialogue development and works out a systematic language learning system.

Chapter Two finds out the real issues on language production: the lack of oral practice is responsible for the low language production.

Chapter Three offers basic design concept to help smooth the task and solve language learning problems on both theory and practice. Three techniques are offered: key-word spotting, time interval control and system control

Chapter Four briefly reviews some of the language learning approaches of both Comprehension-Based Approaches and Production-Based Approaches, which are not considered suitable for language learning in a foreign setting. Hence, a new approach: Ear-Lip Service Approach, is proposed to provide appropriate learning methods and activities. As the name of the approach suggests, it focuses students on ear-lip training through a series of information-based task.

Chapter Five offers pair-work methodology and an experimental study is conducted to prove its effectiveness before the utilization of it in the design of the voice recognition assisted learning system. An experiment was carried out for four months at Kochi Women's University with 81 participants. The methodology is focused on pair-work learning which is further divided into pair combination of different personalities and close neighbors with consideration of the result from a questionnaire survey on high school language teachers. The achievement is evaluated by the frequency of oral

presentation in fixed pairs. The positive results from both pair combinations, especially from the pairs of different personality reveals great effectiveness of pair-work methodology based on Ear-Lip Service Approach.

Chapter Six is contributed to the careful design of the software assisted by voice recognition technology. First, literature review is once more conducted for the highlight of this software development. Second, the features of voice recognition technology is studied which helps this system explore its strengths while working around its limitations for non-native speakers. Third, based on the Ear-Lip Service Approach and the above research, the software is developed with three parts and an additional section for inter-language practice. Part One aims at fluency building supported by massive ear-lip training practice through learning activities like listening, repeating, information-gap task completion, role playing and following along with the video partners. Based on the fluency practice in Part One, learners are allowed to experience the natural conversation in Part Two. In the natural language practice, open response dialogue system with three conversation patterns is created assisted by the techniques of key word spotting and time interval control. Part Three helps learners summarize the main points of the study. This systematic learning system is strictly controlled at the first round of study, which leads learners to the end goal by an activated command button which is extremely easy to follow. Inter-language practice is designed as a separate section for learners to explore at their own pace.

The evaluation of the system is also carried out according to the three-phase evaluations on computer assisted language learning software proposed by R.Schreck and J.Schreck. First, this system fits the evaluation on the content and instructional presentation in Phase One, because it offers clear goals and principles for the system to work on. The systematic learning system provides opportunities for learners to complete the required task and reach the end goal of communication. The open response function supports learners learning experience in any possible way, like conversations between human beings. Second, the easy to follow activated instruction buttons and

the systematic design on the screen meets the evaluation on mechanical and aesthetic features in Phase Two. The evaluation on its value in the curriculum is extremely remarkable in this system. It fills the gaps in computer assisted language learning by the creation of open response dialogue with three natural conversation patterns.

In Chapter Seven, the application of the software to the English immersion school being planned is briefly introduced.

IX. CONCLUSION

The ultimate goal in this research is to develop new language software assisted by voice recognition technology to aid foreign language learners with their spoken skills. In order to provide an appropriate approach for the design of the software to follow, a new language learning approach, Ear-Lip Service Approach, has been proposed and examined in the language classroom. Like classroom activities between learners, a similar learning system was developed on the screen.

Ear-Lip Service Approach was proved effective in the language classroom through a series of ear-lip learning activities and information-gap tasks by pair-work learning. The results from the four months experiment reveals the valid power of the concentration on task-based listening and speaking. Students' active participation in the classroom activities and the presentation establishes the positive position of pair-work learning, especially the pairs with different personality.

The controlled learning activities designed in the three parts develop systematically with one supporting another. The Fluency Building stage offers a great deal of ear-lip training activities based on information-gap tasks which lay a solid foundation for the conversation practice. The summary in the last part again focuses learners on the main points of the lesson. The three parts suggest a systematic learning methodology separately and as a whole and are verified by the evaluations of computer assisted language learning.

The readings from 100 students, the dialogue interview as well as the investigation of the interference from the mother tongue highlight the common problems of learners' language output. Although the interference from the first language is heavy, it does not hinder the fluency of the language, which suggests that learning activities should center on language production instead of pronunciation evaluation. Inter-language practice should be focused if pronunciation training is used instead of general phonetic practice.

Finally, the open response dialogue system with three conversation patterns provides learners opportunity to come up with a response totally on their own, without any help from the system. Such system offers natural language processing capabilities for learners to experience what might be going on outside the classroom. This natural learning system makes a big step forward from the close response to the natural communication between human being and the machine.

In a word, the new learning approach and the non-native speaker based natural language learning system assisted by voice recognition technology present a distinct challenge and starts a new orientation for foreign language learning.

The key contribution of this system is to offer a natural language learning system featured with open response and three natural conversation patterns assisted by voice recognition technology. However, the dialogue is started by video partners, that is, dialogue developed from the machine, learners are in a position of responding as Role B at the beginning, though open responses are available. In the near future, with the continuous new advancements of voice recognition technology and with the help of artificial intelligence, the machine should have the ability to start a dialogue from learners, too. Although it is difficult and time-consuming [31], it is extremely important for higher-quality software to guide the learning of spoken language. Moreover, if the machine can format learners' input in Part One, the Fluency Building stage, and establish the individual language model, the natural conversation in Part Two between learners and the machine will

become smoother and more attractive. For the future, we believe that joint research between linguists and computer experts will eventually make it possible for a more natural dialogue, in which the learner should be able not only to participate in B roles, but to initiate any conversations like those between human beings.

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