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Development of Multimodal Tool to Support Pronunciation Training in Second Language Classroom – Case of Japanese*

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Abstract: Rapid technological advancement in computer and mobile technologies has resulted in inclusion of different multimodal tools for teaching and learning language. Most of these software and tools are designed to assist learning process of adults and mostly used for remote learning. But there are fewer studies that take into account the needs of such technology in children's language classroom and suggest tool development according to children's intellectual level. While most of the studies focus on English language learners, not many studies focus on acquisition of Japanese as a second language at elementary level. In this study we focused on finding out technological needs of the teachers to understand what kind of tool can actually fit language classroom and meet children's need and intellectual level. From the analysis of user studies, we derived the key functions of the interface that are – lesson customization, personalization and feedback for integrating the tool in classroom. Based on those key components, a multimodal tool containing image and audio functions was developed on iOS platform. The interface was then evaluated by a group of users that received positive feedback. The full result of the evaluation will be reported later.

Keywords: second language acquisition, pronunciation training, multimodal application

1. Introduction

1.1 Research Topic

Emerging technological advancements in the field of information science and technology in the last couple of decades have given rise to remarkable change in the way people gather knowledge and information. Therefore, representation of learning contents have changed from simple text-based reading and writing to mixture of textual, audio and visual modes, which is often referred to as multimodality (Miller, 2007).

With the development of Computer Assisted Language Learning (CALL), researches on the implication of computer for teaching and learning foreign language have increased to a prominent level (Levy, 1997). But Fox (1993) argues that, "there is no generally accepted theory of Second Language Acquisition (SLA) to embrace with confidence". Garton (1992) further suggests that, "One must look carefully at the specific attributes of this learning environment and then consider which model of SLA most closely matches the capabilities of hardware and software." Therefore, prior to implementing CALL courseware for a particular language like Japanese, further understanding of learning context is necessary. According to Weber (1997), the number of people who spoke Japanese as second language was approximately 8 million in 1997. According to the survey of Japan Student Services Organization (JASSO), the number of foreign students studied in Japan was reported to be around 140 thousand in 2012, which includes both adult and children. Since the official language at Japanese educational institutions is Japanese, these students typically have to conduct their study in

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Japanese. They also have to deal with all kind of information in Japanese in their daily life. Moreover, according to the report of Modern Language Association, there is a significant expansion in the number of Japanese learners in U.S. colleges and universities, where an increase was 10.3% from 2006 to 2009. However, the number of studies on Japanese teaching and learning as L2 at elementary level is limited.

1.2 Literature Review

There have been many studies that have examined the effect of CALL in classroom environment. Tsou, Wang & Tzeng (2006) have reported that applying multimedia storytelling website in foreign language learning was effective in developing language proficiency, story comprehension and sentence complexity of students in English classroom. Similarly, Tsou, Wang & Li (2002) have used CALL method for students to find out how computers facilitate foreign language learners to learn abstract words. In their study, the interface helped the students to learn at their own paces and teachers had little contribution to regulate the course material. Johnson et al (2005) have implemented artificial intelligence for developing serious games for learning language.

While most studies tend to focus on the reading skill or acquisition of vocabulary and grammar, studies that focus on the speech and communication development in classroom are limited. As stated by O'Brien, M.G. (2004), classroom pronunciation training should begin early, as prosody (rhythm, stress or intonation) becomes one of the deciding factors of good communication for L2 learners. She also states, "Nonnative pronunciation- what many of us refer to as a "foreign accent"- in a second language (L2) is problematic." But as Levis (2008) mentioned pronunciation was not even classified as a topic of two prominent journals related to CALL from 2001 to 2006. A survey by Mizumachi (2006b) brings into light that there has scarcely been any work related to prosody in Japanese. The survey further suggests that, even though learners prefer Japanese training websites with multimedia features, more than 55% of the sites are text-based. The interface developed by Mizumachi (2006, p. 137) for understanding intonation of target language uses text from English and Chinese. However, dependency on learners' first language (L1) makes it difficult to implement it especially at elementary level, where children are still in the developing state of L1. Furthermore, even though young people these days are called as digital natives who are good at dealing with digital technologies (Prensky, 2010), to design useful applications for learning it is important for information professionals to properly investigate their level of expertise (Selwyn, 2009).

Therefore, further studies are needed for developing multimodal tools that do not solely depend on text but integrate different forms or content representation such as image, audio, and video. Furthermore, such tools should fit in conventional classroom context while meeting pedagogical and technological needs of both teachers and learners.

1.3 Aim of Research and Research Questions

To address the lack of multimodal tools for elementary level L2 learners of Japanese, this study aims to understand the context and needs of language teachers. Based on the findings of user research conducted with Japanese L2 teachers at local schools, we propose the functionalities of the interface that will best serve the purpose. The usability of the interface is then evaluated by the language teachers. Finally, we discuss about future directions for developers. More specifically, this study addresses following research questions:

- What are the conventional methods used in classroom for training Japanese as second language to at elementary level, and what are the challenges faced by teachers in the conventional system?
- How can multimodal tools aid those challenges?
- How should the user interface be designed so that the educators can use the tool without prior technical knowledge and suit classroom pedagogy at the same time?

1.4 Organization

The rest of this paper constitutes of the following sections. Sections 2 describes user research method and outcomes, design process of the tool based on the proposed functionalities and evaluation method.

Section 3 discusses the main findings of this study while looking at the limitations. It also discusses future directions.

2. Methodology

To propose an interface that can address classroom needs of teacher, we emphasize on understanding user needs and the context of implementation. Therefore, we adapted User Centered Design (UCD) as the method for developing interface, which is the practice of taking more human factors into account in system design (Mathis, 2011), rather than technology centered perspective.

2.1 User Centered Design (UCD)

User Centered Design is an iterative process that goes from user research to design to implementation (Mathis, 2011). We followed Mathis (2011) to generate questions for user research. Specific objectives for finding problems are 1) Find out what people are currently doing, 2) Find out what people have to do but really dislike doing, and finally, 3) Find out what they would like to be doing. Similarly, objectives for solutions are 1) Find a way of making what they are already doing easier and more efficient, 2) Find a way of making the things they dislike obsolete, or at least more fun, and finally, 3) Find a way of making what they want to be doing possible.

The user research is then analyzed and followed by design process, which involves steps like concept development, prototyping and development of the user interface. Additionally, we have followed the methods and principles of UCD from Gulliksen et al. (2003) which suggest user focus, active user involvement, evolutionary system development, simple design representations, prototyping, evaluation and holistic design. More detailed description is given in each section later.

2.2 User Research

There were three formal interviews with three Japanese language teachers from different elementary schools. All the participants were selected based on their long time experience in teaching Japanese where the average teaching year was 11. The questions of interviews were open ended, which had ensued subset of questions not mentioned in the primary questionnaire. For example,

- What type of difficulties children face while communicating in L2?
- What kind of teaching method is used to improve communication skill of kids in classroom?
- Whether the teachers have experience of using multimedia interface in classroom and or not? If yes, then what are the types of those tools?
- What type of needs cannot be fulfilled in conventional method?
- What are the difficulties felt while communicating with kids?
- What methods are used in classrooms to encourage positive interaction and hold concentration?

2.3 Deriving Key Functionalities

This section describes how we derived key functions from the outcome of user interviews.

2.3.1 Outcome of user research- phase 1 (User needs)

From the information gathered from user interviews, we extracted the common activity that needs to be supported and how can those be aided with technologies. The activities needed support and the conventional teaching methods are summarized in Table 1. We have then extracted the technical and pedagogical needs to support, as shown in Table 2.

2.3.2 Key functions of interface

Based on the findings of user research, we determined the key functions of the interface as follows:

Table 1 User needs and SL classroom pedagogy

	Activities to support	Conventional methods used in classroom (SLA pedagogy)	Use of technology in classroom
Teacher A	Guide pronunciation of individual student	Natural language acquisition process by showing physical expression, read aloud, collaborative learning in pairs; i.e. native and non-native	Not used for teaching. Laptops are used for subjects such as Math and English.
Teacher B	Keep record of student's speech	Read aloud, present in the target language on given subject, conversation practice between students of similar level	Not used for teaching. There is computer room in school but not used for language class
Teacher C	Guide prosodic skills to students so that the student can listen to different speaker's pronunciation and intonations	Physically expressed to teach the meaning and context of using words, draw picture that describes a story and ask the student to explain	Not used for teaching

Table 2 Challenges and probable solutions

Challenges	Probable solution
The learning material should be applicable for different range of learners	Give teachers the flexibility to create learning material instead of offering fixed curriculum.
Individual guidance is necessary	Being able to follow personal response would make it possible to understand the difficulty of each student's pronunciation.
Fit into the classroom pedagogy	Give flexibility to teacher to create own curriculum.
Decode the words pronounced by a user, understand the intonation	Be able to listen to native speaker's response and compare with own.
Giving feedback to motivate communication is necessary	Provide grading option on student's response and comment on the difficulty of particular student.

Customization: The freedom to customize practice lessons is given preference in the initial development of application since it was a common user need. As it is suggested from user research that, "the difference in cognitive ability of different group of children makes it difficult to generalize the set of practice problems." So, unless a tool developer has comprehensive knowledge about that language and has teaching experience, the appropriateness of lessons for a particular target group cannot be verified. Also, in the language classroom, students can have different L1 (first) language, which can cause difficulty with particular pronunciation. To emphasize on the pronunciation difficulties particular to a L1 group is necessary to improve overall comprehensibility of the second language learner (Levis, 2007). Customization of lessons also allows the teacher to understand and guide with difficulty of individual student.

Personalization: Another important need expressed by participants was an ability to personalize the tool. Since it is difficult to follow the progress or difficulty of individual student's pronunciation in classroom unless the guidance in classroom is 1:1, keeping record of each student's pronunciation is one of the basic needs of the teachers. As one of the teacher said, "Personalized

training also makes it possible to study after school hours which can be reviewed by teacher later". Therefore this function makes the interface more potent for use in different settings.

Feedback: Giving feedback on pronunciation training is another challenging issue, but is considered as an important one by the users. In teacher's words, "even simple feedback can give the feeling of accomplishment to the children and keep them motivated." Therefore we have focused on how to give feedback to the children so that it is easily understood and also be helpful.

2.4 Prototyping

Following the UCD method, we performed interface prototyping based on the analysis of user research. At first we focused on the technical functions necessary to meet the user needs. Then, gradually we developed the idea of user interface by prioritizing most important functions and sketching the screen transitions. Initially the prototyping was done on paper by pencil sketch. Later by using computer created a clearer graphical representation. The final implementation was done on iOS platform as described in the interface development section (Section 2.5). The second phase of interview was to evaluate the prototype. The interview time was 1 hour where the detailed functions of the interface were described using paper prototype and the user was asked whether there is any particularly difficult part and to advice on total design.

2.5 Interface development

In this study we have deployed the interface for iPad. A development middleware called PhoneGap (http://phonegap.com/) was used for coding and building the application. PhoneGap is a web-based mobile development framework, based on the open-source Cordova project (http://cordova.apache.org/) that allows using standard web technologies such as HTML5, CSS3 and JavaScript for cross-platform development. For creation of database of the system SQLite was implemented. Also jQuery was used for providing animation between screen transitions and other functions of the interface. The interface is mainly divided into two sections: Teacher's section and Students' section. From the home page teachers and students can access their designated pages. We implemented our key functionalities as follows.

Customization of lesson: The teacher is given the authority to create lessons for students, edit and delete. Lesson can consist of text, image and audio (Figure 1a). Personalization: Students can create own account by entering name and image (optional). Each student can practice the lessons, save their response, come back to check feedback and also listen to fellow students response (Figure 1b). Feedback: After the students respond to practice questions, teacher can review them and give feedback with number and comment (Figure 1c). Only teacher has the authority to provide and change feedback.

Figure 1. (From left to right) a. Lesson creation page, b. Students' response page, c. Feedback page

2.6 Evaluation of Interface

The interface was later evaluated with a local teacher and their students in a real life classroom environment. We had some promising feedback about our interface. However, the full result will be reported elsewhere due to a lack of space.

3. Concluding discussions

From this study we can understand that, even though there are many technological advancements taking place, the cases where tools are used at elementary level classroom and they reflect the user needs can be limited. However, teachers do feel the need of digital tools to guide pronunciation, as it is difficult to follow each student's progress in conventional classroom. Also it is important that the tools match the intellectual level of children, as it can be different for different age groups of students. So customization option gives the flexibility to create lessons for different group of users and by personalizing the tool, it makes it possible to follow each student's progress. Also simple user interface and easy navigation is a must so that users can use without much prior technical knowledge.

The outcome of this study is limited due to the small number of user interviews. Since more interviews with Japanese language teachers would help to achieve further comprehensive insight of their needs, the outcomes here might not represent global needs of teachers. This multimodal interface is currently in its preliminary version, which supports simple image and audio functions. It can be augmented in many ways in future. The future upgrades can include the functions like Text To Speech (TTS) and Pitch Tracings. While the availability of TTS application for Japanese is quite low in mobile app developing environment, integration of this system would result in decreasing instructor's labor of creating lessons by automated conversion of speech from text. Also collaborative learning should be considered in future versions since it is very common in classroom pedagogy and can be beneficial to develop better communication among second language learners.

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