

A Study on the ICT-based Educational System Development for ESL Learning Using Smart Phones and Practical Educational Experiments

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Abstract—This paper presents an experimental ESL(English as a Second Language) learning system development using smart phones and it's practical experimental results. Practical experiments revealed an English proficiency on our college students, which was also compared with Indonesian and American high school students. Further experimental results also allowed us to analyze a long-term proficiency development characteristics, which were also discussed in terms of the response time and correct answer rate.

Primary categories— Informatics, Business

Secondary categories— Media Informatics/Database, Software, e-Business

Keywords— contents development; data analysis; data processing; ESL education; smart phone; vocabulary building

I. INTRODUCTION

Recently ESL(English as a Second Language) learning has become an important skill for engineer candidates, while international cooperation and collaborations have become a major aspect in many industrial engineering developments. In our college that has been established and dedicated for young engineer candidates after completing 9th grade through 13th grade with 5-year intensive course, named 1st year to 5th year class in our college. Successful students earn associated degree and about a half of them become engineers in all sort of major companies including Panasonic, Canon, and other electronics companies after the graduation. Another half continue their study for two years to earn bachelor degree that allows them to enter any graduate school, in our college or by entering other universities as junior students. For those youths who designated their carrier in engineering in their younger days, ESL learning is a rather difficult subject while their performances in engineering subjects are talented, as most of them have a tendency to like engineering related issues. Another background is their mother language's nature that rely on the ideographic character, named Kanji in Japanese, and not yet been matured enough to adapt themselves to another communication nature.

Based on the author's** experience as a leading engineer in a global electronics company, young engineer's QRP(Quick Response Performance) is believed to play an important role to develop their further communication capability. We assume

that the training QRP in ESL should enhance the further development of their skill especially for the students whose native language uses ideographic characters while English uses phonographic characters.

On the other hand the author has long played a leading role to develop early prototypes of Panasonic's Lumix digital cameras including a world first Internet based meta data enriched camera in which each photograph is recorded with it's photographed location data. The development was first disclosed and exhibited with a prototype at CEATEC2003[1] and launched on the market further enriched functionality with mobile phones and the data server[2, 3, 4]. Based on those product R&D experience the author also believes that a mobile device such as smart phone should be used as an educational platform as which can be easily linked with any data server at anywhere or anytime, and become a practical educational tool to realize an ESL learning application based on the QRP training assumption. Especially recent advancement on smart phones, such as iPhone, equipped with a touch panel interface on the display screen, benefits the students to train their QRP of English, as they can grasp the information displayed on the screen instantly, and response by touching without any unnecessary time delay by handling any input means like keys or a joy stick.

Meanwhile many studies have been contributed in this ICT-based educational research area especially utilizing mobile devices such as cell-phones including smart phones, but most of them were contributed to new contents developments, though some contributions were dedicated to develop the new contents development tool [5], response evaluation system [6], and adaptive question delivery for English words study [7]. In these studies, e-Learning were widely used and recently mobile e-Learning have been focused on. But most process of e-Learning depends on a server processing on the Internet. Therefore no feedback is available without the Internet connection. Furthermore the response time behavior was hardly measured.

In this study, we have aimed to develop a consolidated educational system using smart phones linked with a data server that allows us to utilize it as a practical education system as well as an evaluation system to examine the QRP training

assumption. In system development, we have also aimed to construct a system that allows students to use whenever they like.

THE STUDY

In order to realize a practical implementation to examine the educational experiments based on the QRP training assumption, an English word definition display and equivalent word selection user interface was designed as shown in Fig.1. A practical implementation on the iPhone screen with the teacher's message display and answer reply function on the iPhone screen is also shown in Fig.2

An examination procedure where a question is displayed in the form of definition of each English word, and the equivalent word should be chosen among the four choices displayed together with the definition, was designed in order to evaluate and train the QRP in English. As the nature of English using phonographic characters, Japanese students and even native speakers of English tend to read the definition rather than grasping the meanings of ideographic characters instantly.

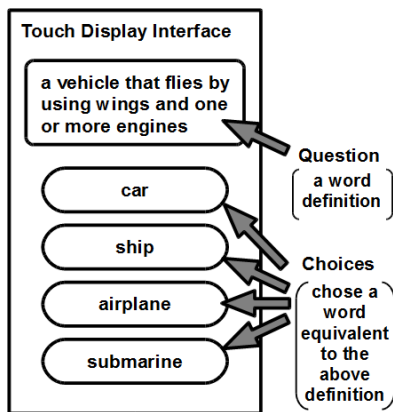


Fig.1. Touch display interface design

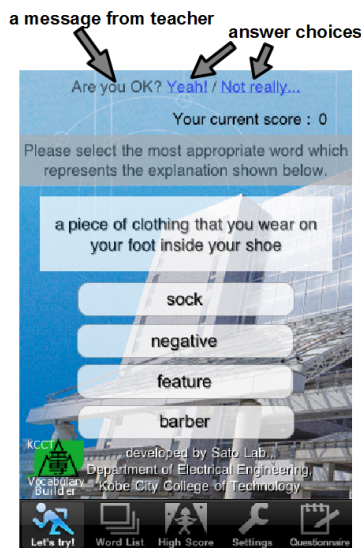


Fig.2. A practical implementation on iPhone

Examinees(students) were encouraged to grasp the meaning of definition as quick as possible without trying to translate it into their native language's counterpart, and chose the equivalent word among the choices provided below as fast as possible. Upon the successful selection of equivalent word, the score will be added by one, while it is decreased by one if the chosen choice was wrong. Therefore the score may have negative value. Only after the successful selection, a new question(a new word definition) is displayed, for which the examinees(students) can earn another score. In our system, 4000 English words and word definitions are implemented and randomly selected as question. This procedure is repeated, and stops any way after the time expiration. This scoring rule encourages examinees(students) to insist both of the accuracy and response speed at the same time. After the time expiration all examination data including the each response time data together with the score data, were stored into a smart phone automatically. And then researchers can correct and analyze all examination data on a data server.

The reasons why this definition-word-choice procedure was designed in order to examine the QRP in ESL were: (1) A word definition is relatively short enough to encourage examinees(students) to grasp the meaning instantly without translation. (2) The equivalent word can be easily chosen from the choices, and the correct and/or wrong choices can be counted for data analysis. (3) The response time from the definition display till the choice selection can be measured for each definition and word combination. (4) Some level classifications can be made by the length of word or definition, and by use frequency in ordinary English sentences and phrases.

Schematic data flows with the linked data server are diagrammed in Fig.3. As explained above, all experimental data are automatically sent and accumulated on the data server linked with examinees' iPhones on a network availability, that allows us to analyze the examinees' learning(response) characteristics [8]. We named this system "KCCT VocaBuilder", meaning a vocabulary builder developed at KCCT(Kobe City College of Technology).

Furthermore, in this paper practical long-term experimental results are reported and discussed, as we have newly developed an automatic data process and feedback function on the server.

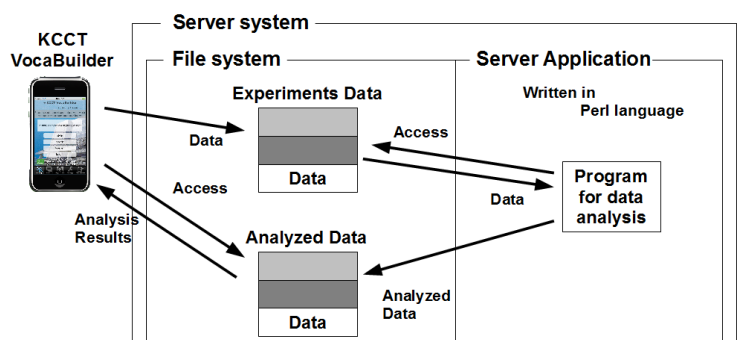


Fig.3. Schematic data flows with the linked server

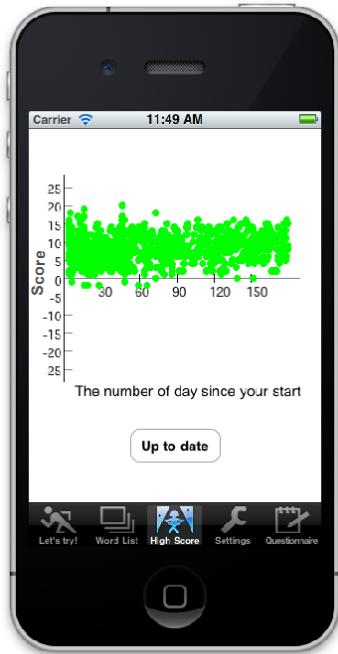


Fig.4. An individual score development chart feedbacked from the server

A most preliminary feedback to each long-term examinees firstly we have implemented on our system is an individual score development chart. As shown in Fig.4. each student can check it's score development chart by simply touching the update button anytime online so that the data server will process all data accumulated on the server and send back the score development chart data to each iPhone to be displayed on it's screen.

II. FINDINGS

After the examination data sent to the data server, the response time required to choose the correct word equivalent to the definition, as well as the correct answer rate for the first choice, were analyzed to find the ESL learning development from the 1st year to the 5th year students, further in order to find the relation to their mother languages. Furthermore the long-term learning developments were recorded on the server for the 16 students who had been volunteering to become experimental examinees for this practical research for about 6 months since June, 2012.

A. Learning development and mother language difference

To analyze the learning development from 1st year students (equiv. 10th grade) to 5th year students (equiv. 14th grade) in our college, complete examinations were carried out for all students in 5 classes as specific experimental conditions were detailed in our former report [8]. Furthermore 23 Indonesian high school students and 10 American high school students were examined in order to analyze the mother language difference as Indonesian students use the phonographic characters in their mother language while Japanese students use ideographic characters.

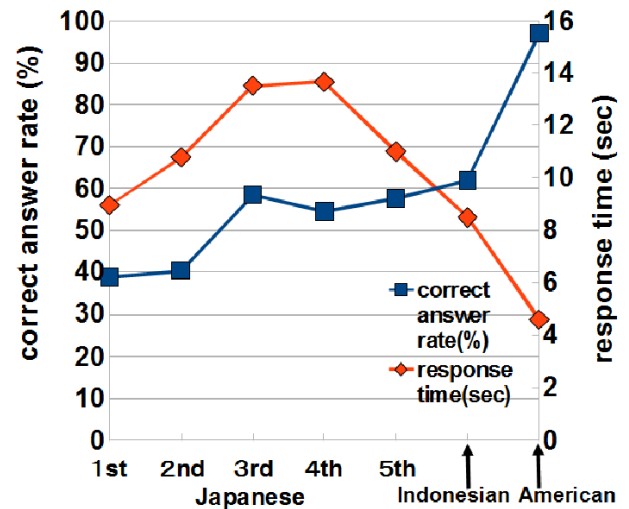


Fig.5. Learning development data summary comparing with Indonesian and American students

As the data summarized in Fig.5. in terms of the correct answer rate and the response time depending on the 1st to 5th year learning progress as well as the data for Indonesian and American students, our developed system practically revealed the facts that:

- (1) firstly 1st year students start the stage where they can not find the answer no matter how long they try to understand,
- (2) in the second stage, 3rd year students can grasp the meaning if they spend enough time,
- (3) furthermore 5th year students now can grasp the meaning without spending too much time, and
- (4) Indonesian students were found almost in between 5th year students and American students.

Although the correct answer rate are not so different, the response time for Indonesian students are much less than the 5th year students' counterpart. We believe this should be attributed to the mother language difference, as Indonesian students use phonographic characters, which we believe to play an important role on the course of learning ESL.

B. Long-term experiments on the newly developed system

In order to look into the individual student's long-term English proficiency development characteristics, we have developed a new system which allows us to process accumulated data on the server using a server application program written in Perl language as schematically shown in Fig.3.

A typical score development data along with the learning times are shown in Fig.6. Please note that the learning times are almost equal to the days passed since the start of long-term learning experiment, as the long-term learning examinees are instructed in principle to participate the 1 minutes examination everyday. The system clearly feedback the fact that the student's score increases gradually along with the learning times despite of substantial variations.

III. CONCLUSIONS

A practical educational system using smart phones linked to a data server has been developed and used in a practical ESL education. Examination data were accumulated and analyzed in order to examine the training QRP(Quick Response Performance) skill assumption to develop ESL communication capability for non-native speaker. Experimental results revealed the ESL learning process in terms of the accuracy and speed to grasp the meaning of English words, as well as the relation with the mother language nature. Furthermore our newly developed system on which all accumulated data can be processed by a server application program written in Perl language, revealed the long-term learning characteristics. The findings include the drastic decrease of the average response time in the early stage followed by the gradual decrease approaching to around 4 seconds asymptotically which is identical to the native speaker's average response time. Based on these characteristics we have assumed that the continuous increase of the score even after the drastic response time decrease period should be attributed to the continuous increase of the correct answer rate. We believe the system developed using iPhones and a data server has been proven to be useful for a practical ESL education as well as an examination tool for students learning characteristics in terms of word recognition accuracy and speed.

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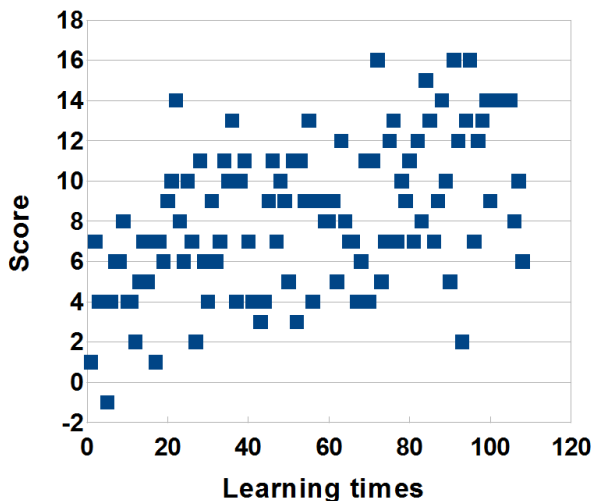


Fig.6. Long-term score increase along with the learning times

We believe that our newly developed system has successfully recognized and unveiled the learning development characteristics, those are the facts that:

- (1) in the early stage the average response time decreases drastically,
- (2) in the following stage the average response time still continue to decrease but approaching to around 4 seconds asymptotically.

An analyzed result in terms of the response time along with the learning times is shown in Fig.7. We further believe that the first drastic decrease should be attributed to the student's consciousness to minimize the response time to train the QRP. Furthermore we can think that the continuous increase of score even after the drastic response time decrease period should be attributed to the continuous increase of the correct answer rate.

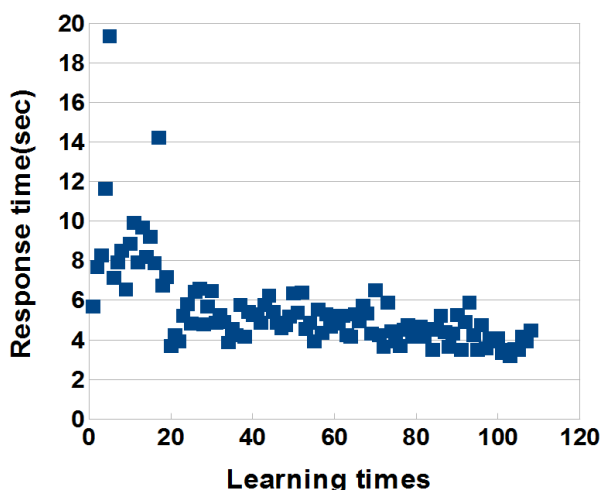


Fig.7. Long-term response time decrease along with the learning times