A Study on ESL Learning in Early Engineering Education using Smart Phones

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Abstract: This paper is a report on the findings of a study conducted on an early engineering educational college regarding ESL(English as a Second Language) learning using smart phones with learning data analysis accumulated into a data server. The college has been established and dedicated for young engineer candidates with the intensive 5-year course after completing 9th grade. A challenge for such youths includes the ESL learning that is an essential skill for all prospective engineers. To maximize their learning efficiency an smart phone and server based educational system has been developed for ESL education assuming that honing QRP(Quick Response Performance) must befit their improvement of ESL. According to the practical experiments on 1st to 5th year students in our college, their learning process was examined based on their response time and correct answer rate, revealing the decrease of response time in 5th year students, after the increase of both of response time and correct answer rate in 3rd and 4th year students. Further studies comparing with Indonesian students and American students suggest that the further decrease of response time plays an important roll to make a step toward the native speaker of English.

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 recently. 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 quasi-bachelor 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 honing the QRP aspect 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.[2-4] 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, and become a practical educational tool to realize an ESL learning application based on the

QRP honing assumption. Especially recent advancement on smart phones, such as iPhone, equipped with a touch panel interface on the display screen, benefits the students to hone the QRP aspect 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 eLearning 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 this study, we have aimed to develop a consolidated eLearning 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 honing QRP assumption.

The Study

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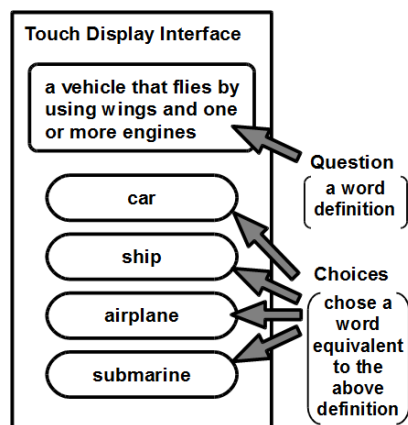

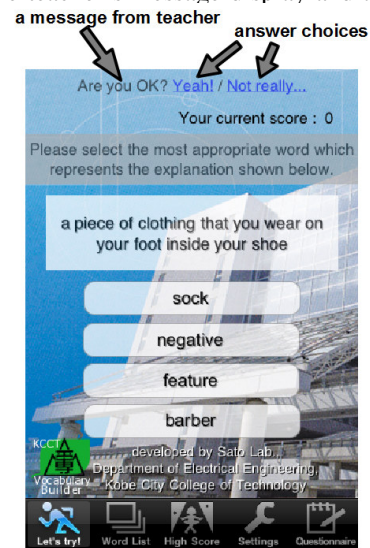Fig.1. Touch display interface design

Fig.2. A practical implementation on iPhone

A Q&A 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 horn the QRP aspect in English. As the nature of English using phonographic characters, they tend to read the definition rather than grasping the meanings of ideographic characters instantly. Examinees(students) were encouraged to grasp the meaning of definition as fast as possible without trying to translate it into it's their native language's counterpart, and chose the equivalent word among the choices provided below as quick 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. Only after the successful selection, a new question(a new word definition) is displayed, for which the examinees(students) can earn another score. This procedure is repeated for 3 minutes, 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 3 minutes expiration all examination data including the each response time data together with the score data, were sent to the data server to evaluate and analyze students' performance.

The reasons why this definition-word-choice Q&A procedure was designed in order to examine the QRP aspect in ESL were: (1) A word definition is relatively short enough to encourage examinees(students) to

grasp the meaning instantly without translation or consideration in their mind. (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 sort of level classification can be made by the length of word or definition, and by use frequency in ordinary English sentences and phrases.

Findings

After the examination data sent to the data server, the response time required to choose the correct equivalent word were analyzed. No correlation was observed between the response time and the word length, as the response time depending on the word length in characters was shown in Fig.3. Besides the increase of the response time on definition length was revealed as the response time depending on the definition length in characters was shown in Fig.4. This relation should be attributed to the necessary reading time for each definition paragraph, while the meaning of each word can be grasped regardless the word length.
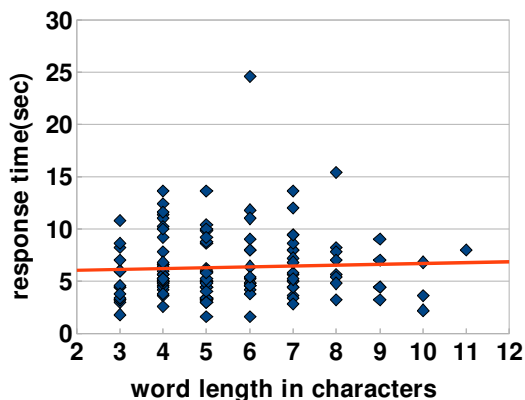
Fig.3. The response time depending
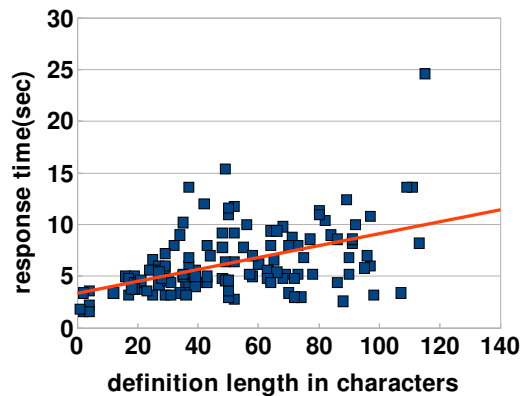on the definition length

Fig.4. The response time depending
on the word length

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. 4000 most frequently used practical words were selected for the examination, and further classified into 4 levels according to the use frequency in ordinary English. The average score for 1st to 5th year class, and the individual score in each class are shown in Fig.5 and fig.6 respectively. Thought there seems to be an increase in terms of the average score in Fig.5, 1st and 2nd year students looked similar in Fig.6. 3rd, 4th and 5th year students looked also similar in Fig.6.
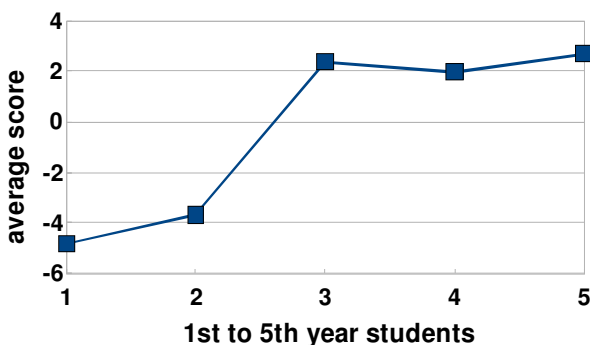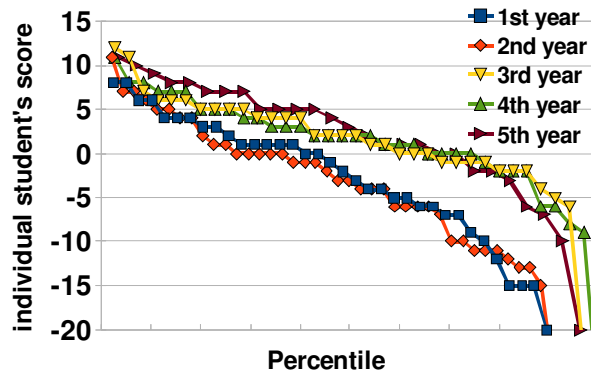
Fig.5. The average scores for each class

Fig.6. Individual student's score for each class

In order to reveal the dependence on the words level, how frequently the words used in ordinary English sentences and phrases, the examination data for each year class were analyzed in terms of the correct answer rate as well as response time. For all classes in general the correct answer rate decrease along with the words level as shown in Fig.7. High level words, in other words less used words in ordinary English, show lower correct answer rate in general, while only 5th year students shows higher average score for 4th level words. Regarding the response time higher level words require longer time in general as shown in Fig.8. Furthermore the dependency of the response time on the words level is greater for higher grade students than younger students. This tendency is attributed to the fact that higher grade students are capable to understand even high level words so that they need more time to digest higher level words than the time required for low level words. On the other hand, as younger students can not understand high level words, they don't have the tendency to spend longer time to digest high level words. We can see a clear tendency for 4th year students, for the 4th level words compared to the 3rd level words, a clear decrease of correct answer rate was observed together with a clear decrease of response time, due to the fact that they don't need longer digest time to grasp the meaning of those words since they are too difficult for them.
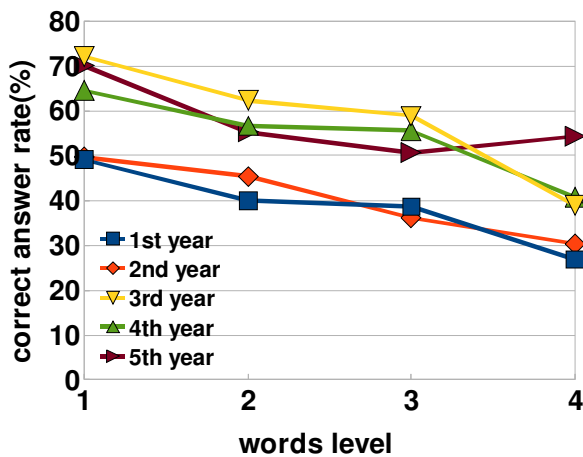

Fig.7. The correct answer rate depending
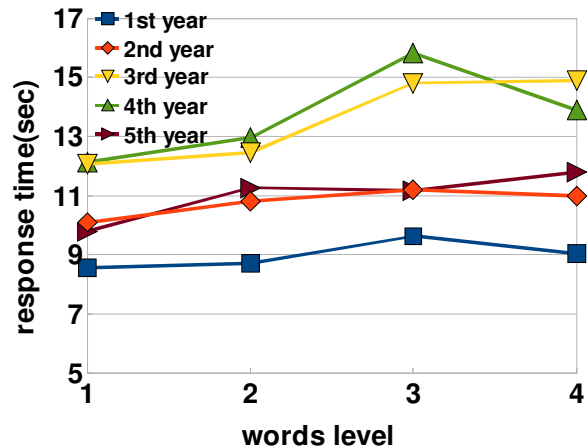on the words level

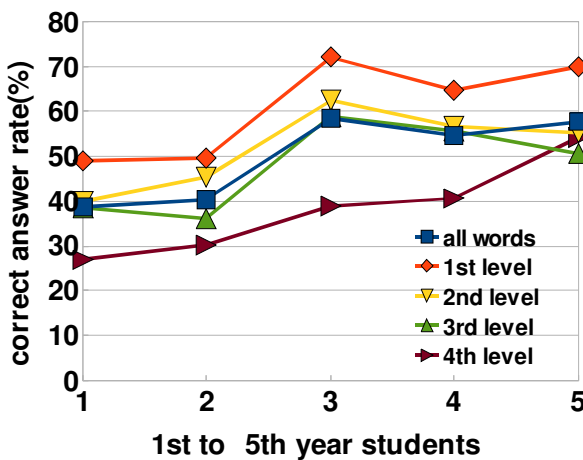Fig.8. The response time depending
on the word level

Fig.9. The correct answer rate depending
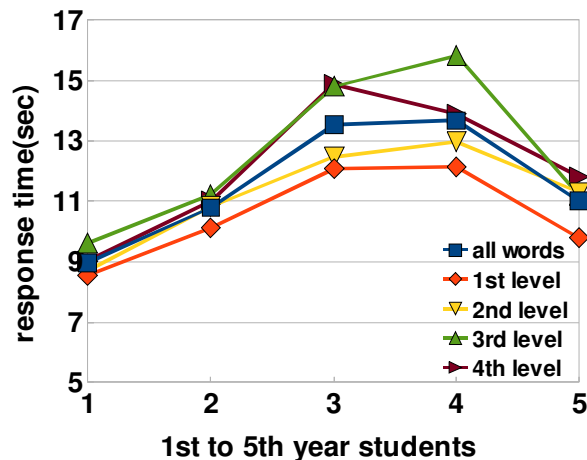on the 1st to 5th year students

Fig.10. The response time depending
on the 1st to 5th year students

For the dependence of correct answer rate on students class, the most difficult 4th level words showed highest dependency which was more than a double in terms of correct answer rate for 4th level words as shown in Fig.9. Regarding the response time, for all level words, the response time increases from 1st year class till 3rd year class, but decreases in 4th level words to 4th year class, and further decreases in all level words from 4th year class to 5th year class as shown in Fig.10. The correct answer rates and the response times are summarized in Fig. 11. according to the 1st to 5th year students. We believe these results correspond to the learning process,

(1) firstly students start the stage where they can not find the answer no matter how long they try to understand,
(2) in the second stage they can grasp the meaning if they spend enough time, and
(3) finally they now can grasp the meaning without spending too much time.

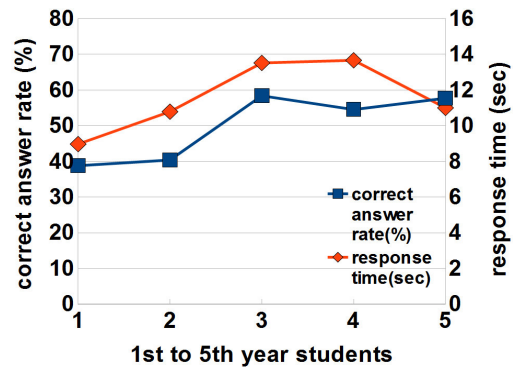We believe the result for 5th year students should be attributed to the (3) final stage.

Fig.11. The correct answer rates and the response times, depending on the 1st to 5th year students

Furthermore, in order to examine the relation with mother language nature, completely identical practices were carried out for 23 students from science courses in Indonesian high schools invited by the Ministry of Foreign Affairs of Japan, to Kobe-city in July, 2011, as well as 10 American students from northern California. Indonesian 23 students' mother language is Indonesian which is based on phonographic characters (Latin alphabet). 10 American students are all native speaker of English.

As results, the average score for 23 Indonesian students and 10 American students are compared with Japanese students in 1st to 5th year class in our college in Fig.12. Indonesian students scored more than the double of the counterpart for our 5th year students, while American students scored outstanding as native speaker of English.
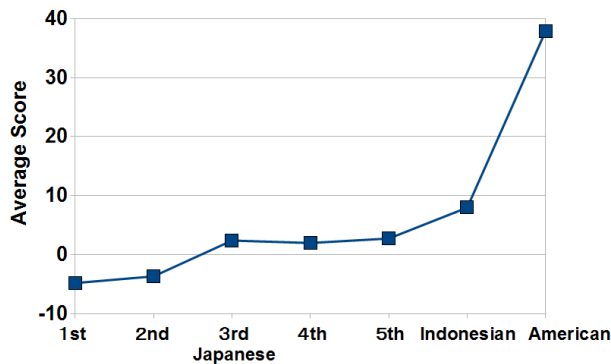

Fig.12. The average score of Indonesian and American students compared with Japanese 1st to 5th year students
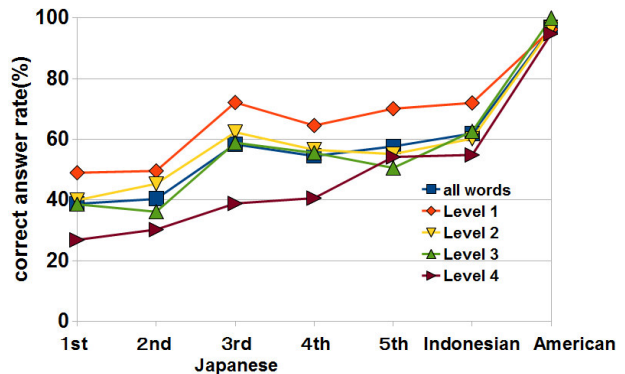

Fig.13. The correct answer rate of Indonesian and American students compared with Japanese 1st to 5th year students

In order to analyze the relation with mother language nature, the correct answer rate and the response time for Indonesian students as well as American students were compared with their counterparts for Japanese 1st to 5th year students in our college in Fig.13 and Fig.14 respectively. Though the Indonesian students scored more than the double of Japanese 5th year students in our college as shown in Fig.12, no significant difference is observed for their correct answer rates in all level words. In contrast the response time for Indonesian students were far shorter than the counterpart for our 5th year students, though our 5th year students started to minimize their response time as revealed in Fig.10. As the correct answer rates and the response times are summarized in

Fig. 15, Indonesian students' response time is closer to the native speaker of English compared to the Japanese 5th year students, though their correct answer rate is not so much higher. Indonesian students' higher score attributes to their QRP(Quick Response Performance) and their mother language nature based on the phonographic characters, which we believe to play an important role on the course of learning ESL.
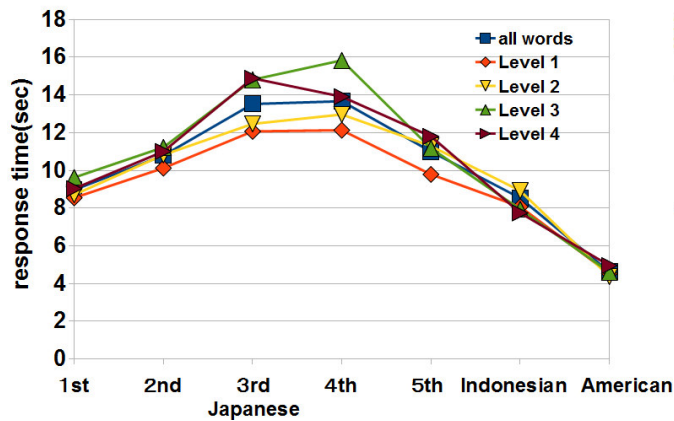

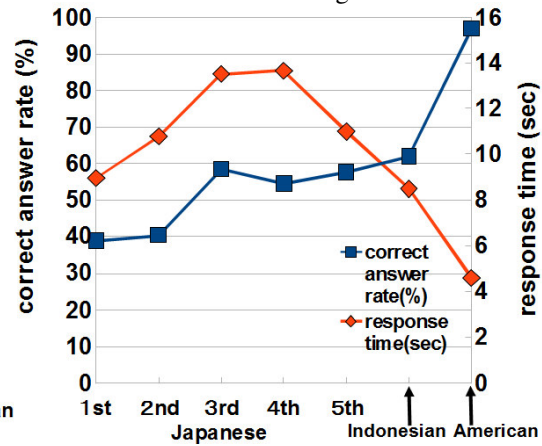Fig.14. The response time of Indonesian and American students compared with Japanese 1st to 5th year students

Fig.15. The correct answer rates and response times of Indonesian and American students with Japanese counterparts

Conclusions

A practical educational system using smart phones(iPhone) 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 honing 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 depending on the words level, as well as the relation with the mother language nature. According to those results, 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 behaviors in terms of word recognition accuracy and speed.

References

1) Matsushita Electric Industrial Co., Ltd., development publicity and exhibition at CEATEC2003, Makuhari, Chiba, 2003.(in Japanese)
2) Tetsuya Sato et al, Matsushita Electric Industrial Co., Ltd., "Image processing system, method, and it's image capturing device", Japanese Patent registered 4158538, filed on 29th Jan., 2003, patented on 1st Oct., 2008.(in Japanese)
3) Keimu Tsuda, "PHS data communication for Lumix camera, demonstrated by Matsushita Electric Industrial Co.,Ltd.", Ketai watch, Impress Watch, published on 16th Feb., 2004. (in Japanese)
http://k-tai.impress.co.jp/cda/article/news_toppage/17628.html
4) Panasonic product information, a mobile communication adopter for DMC-FX5,
http://panasonic.jp/support/product/video/01/DMW-WT1.html (in Japanese)
5) Toshiaki Ohta, "A development of easy-development tool for eLearning contents using cell-phone", a report in IEICE(The Institute of electronics, Information and Communication Engineers), ET, Educational technology, 106(507), 55-58, 2007. (in Japanese)
6) Keizo Nagaoka, "A response analyzer system using cell-phone", Human Science, 18(1), 119-125, 2005. (in Japanese)
7) Jimmy Hermanto et al., Content Awareness by Providing Location-dependent and Action-dependent Words in English Learning, The Journal of Information and Systems in education, 8(1), 48-57, 2010.