Recognition-Based Physical Response to Facilitate EFL Learning

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ABSTRACT

This study, based on total physical response and cognitive psychology, proposed a Kinesthetic English Learning System (KELS), which utilized Microsoft’s Kinect technology to build kinesthetic interaction with life-related contexts in English. A subject test with 39 tenth-grade students was conducted following empirical research method in order to compare the effectiveness of KELS on both learning and motivation. In addition, we developed one questionnaire to study the perception learning style of the students involved in the experiment in order to determine whether students with different perception styles experienced any difference in learning while using the proposed KELS. Finally, we investigated students’ acceptance of and motivation toward using KELS. The result showed that there was a significant difference between the control group and the experimental group regarding long-term retention. Moreover, the experimental group’s learning was significantly affected by using kinesthetic interaction between peers to facilitate learning to speak and listen in English. The study also found that KELS was effective across perceptual learning styles. Finally, most participants in the experimental group agreed that KELS would effectively increase their motivation to learn English and expressed a strong intention to continue using the system.

Keyword

Learning, Kinesthetic, Language, Interaction, Perception

Introduction

The importance of English proficiency grows in the trend of globalization. Learning EFL (English as a foreign language) in Asia Pacific, however, particularly in Taiwan, is still mostly for the purposes of enrolling in higher education institutions; thus, the examinations pay the most attention to reading, spelling, grammar and writing skills while usually neglecting daily life communication like speaking and listening. The development of long-term retention is necessary in order for EFL learners to be able to retrieve their knowledge of the English language to communicate with others or apply to daily life, although the ability to retain knowledge decreases over time (Ebbinghaus, 1885). EFL learners in Taiwan learn English beginning in elementary school and continuing to college without the benefit of having a supportive context for the language. Because the schools use traditional teaching methods, EFL learners still view English as necessary only for the purposes of examination rather than as an important communication skill or ability that relates to their daily lives or careers. This phenomenon violates the theory of situated learning, proposed by Suchman (1987), which emphasizes that learning occurs in a cultural, practical and meaningful context; knowledge cannot be separated from its context. For this reason, it is important to design and provide English activities for EFL learners to use that involve life-related contexts (e.g., conversation, presentation, or question-and-answer).

In recent years, a variety of teaching methods and technology to promote EFL learning has been widely discussed. For example, research supports the theory that physical movement can enhance the process of learning because involving learners’ interaction by gesture has a positive effect on increasing learners’ attention. Bruner (1996) proposed the theory of systems of representation, which states that the first stage of the learning cognition process is to enact learners to do what they learn, that is, to involve an active representation. Helping learners make physical motions in order to understand what they learned and interact with their surrounding environment improves learning by applying knowledge to related situations. Similarly, Gardner (1989)’s theory of multiple intelligences suggests a connection between learning activities and kinesthetic intelligence, that is, students learn and solve problems using...
physical motion. One of the most well-known teaching methods connected with interaction between limbs is total
physical response (TPR), which is useful for language learning as proposed by James Asher (1966). Using body
motion or behavior to illustrate listening and understanding is one of the key concepts in TPR. Asher proposed that
learners respond to auditory stimulus with body motion (e.g., nodding, shaking hands, and waving) not only to
demonstrate their ability to listen well but also to help internalize what they learned deeply in order to improve and
sustain the effect of their learning. Moreover, experts of brain science have great esteem for TPR. Body motion as a
medium for learning can help to create a strong association between body motion and language, which improves
their auditory learning skills.

Psychological factors play an important role in language learning as well. Krashen (1981) proposed the affective
filter hypothesis, which posits that a good language learning environment must allow learners to be confident and
relaxed and to try and fail without pressure and anxiety. Pressure and fear of failure seriously impede language
learning. So TPR allows language learners at the beginning of their study to present the meaning of what they hear
by using their bodies rather than requiring them to speak. In recent years, the application of the cognition learning
style to language learning has gradually been noticed. Dunn (1983) classified four cognition learning styles: visual,
auditory, kinesthetic, and tactile (VAKT).

Literature review

Multiple representations and interaction

Bruner’s (1996) system of representation theory proposes that the cognitive process of learning converted the
exterior environment to inner development. The theory contains three periods of learning: enactive representation,
iconic representation, and symbolic representation. The task in the first stage is to understand the exterior
environment and events by enacting their motion. In the next stage, the learner converts perceptions received from
the previous stage into iconic memory to explain the exterior events in order to obtain knowledge. In the last stage,
learners convert symbols into meaningful and thoughtful symbol memory to explain what was perceived through the
exterior environment and events.

Gardner (1993) proposed the theory that multiple intelligences are tools that people utilize in order to learn and solve
problems. He cited eight types of intelligence: linguistic, logical, spatial, kinesthetic, musical, inter-personal, intra-personal, and naturalist. Since traditional teaching methods put emphasis on logical and linguistic types of
intelligence, the possible benefits of adding methods that emphasize kinesthetic intelligence are lacking.

Combining representation theory with an emphasis on enactive representation and kinesthetic intelligence, this study
designed four kinds of body-interactive mechanisms to facilitate learning EFL.

Information processing and learning gain

The learning retention effect is the remaining memory volume of learning content as measured a while after the
learning process has ended without providing any further learning activity. Hermann Ebbinghaus (1885) found that
the loss of memory coincided with the passage of time. Ebbinghaus’ forgetting curve showed that the volume of
learning content decreased regularly, and the decreasing rate was highest at the beginning stage while memory was
being generated. Over time, the decreasing rate lowered. Further, while learners performed a better comprehension
with knowledge, the speed of forgetting went slower. If learners were forced to recite knowledge in a short time
period without much comprehension, then the learning effect was negative, and the rate of loss of memory was high.
Aside from the testing conducted after the experiment ended, this study performed a delay test on all participants 21
days following the conclusion of the experimental teaching in order to determine any differences between the control
group and the experimental group regarding learning retention effect.
**Total physical response with context support for language learning**

Total physical response, proposed by James Asher (1966), is a language teaching method. Asher believed that the process of learning a foreign language is similar to that of learning a native language. To learn speaking naturally, children must experience a silent period and is considered as the readiness for production. At this stage, while they are not able to speak naturally, they repeatedly receive auditory stimulation from their family members or other people in their environment through bodily motions such as nodding, shaking the head, or waving. The interaction between listening and body motion can enhance the comprehension and internalization of language input and facilitate long-term retention.

The most important concept of the TPR teaching method is to have learners perform motions with their bodies to express their understanding of what they heard. The teaching process contains a series of motion commands; after listening to and understanding the meanings of words, learners make the corresponding motion to further perceive the meanings of the words through bodily sensation. The interaction between visual, auditory and motor perceptions brings about a better understanding of language. Once learners are able to handle voice factors well, speaking skills should be developed naturally (Richard & Rodger, 1996). Asher also suggested that not asking learners to develop speaking skills at the beginning stage of language learning can effectively reduce anxiety and improve learning.

Suchman (1987) found that learning is context-related and thus cannot be separated from the learners’ context. The acquiring of knowledge is more effective if learning activities are correlated with life tasks and have some real “meaning” to the lives of the learners. In view of these facts, this study proposed to utilize TPR and kinesthetic intelligence to bring together learning activities and meaningful life situations or contexts in order to improve the effectiveness of learning EFL.

Along with the creation of gesture-based interfaces, such as Microsoft Kinect or Nintendo Wii, educators have more opportunities to provide students more convenient way interacting with multimedia learning environments (Johnson, Smith, Willis, Levine & Haywood, 2011). Chang, Chien, Chiang, Lin and Lai (2013) suggested the embodied approach using Kinect was very promising to facilitate students’ cognitive learning outcomes in multimedia learning environments. Chao, Huang, Fang and Chen (2013) utilized Kinect as body-motion interfaces to develop embodied tasks in learning process. The results indicated that embodied tasks did help learners better memorize or recall learning contents in learning process.

Even thought TPR was proposed for language learning in some of the related work mentioned above, there is no interactive digital-learning system presented in these researches. Also, while Kinect was applied in some other related work, they were not specifically for language learning. As a result, this study was the pioneer to develop a Kinect-based interactive system specifically for EFL with which TPR was applied. Furthermore, this study also tried to investigate the behaviors of using our proposed Kinect-based interactive system deeply and their effects on EFL learning.

**Learning motivation and perception style**

The affective filter theory suggests that the attitude of learners affects the learning of a foreign language. For example, EFL learners acquired knowledge more effectively when depression and anxiety were reduced and when they were more positively motivated to learn. Hence, motivating the learner is a very important element of any teaching strategy (Keller, 1987). Keller argued that the traditional teaching design pays less attention to the motivation of learners and thus reduces the effectiveness of learning. To increase motivation, he integrated various theories of learning psychology, including attribution, achievement motivation, and expected value, and proposed the ARCS (Attention, Relevance, Confidence, Satisfaction) model of motivation to address relationships between learning motivation, teaching material design, and learning effect. He also reinforced the systematic teaching material design in order to facilitate learners to participate and interact with learning activities. In this study, we adopted Keller’s Learning Motivation ARCS Questionnaire to test whether the KELS (Kinesthetic English Learning System) can increase learners’ motivation to learn EFL.
A perception style is defined by the way people prefer to process information and by the information type people process skillfully. In the past, researchers paid more attention to the interaction between cognition style, emotional factors and situation demands while studying EFL (Brown, 1974; Ely, 1986; Hatch, 1974; Heyde, 1977; Naiman, Frohlich, & Todesco, 1975; Tarone, Swain, & Fathman, 1976; Tucker, Hamayan, & Genesee, 1976). In his research with American children, Dunn (1983) proposed the VAKT perception style classification: visual, auditory, kinesthetic, and tactile. Visual learners prefer reading text and viewing charts while auditory learners prefer listening to speech or audiotapes. Kinesthetic learners, on the other hand, prefer using body-interactive learning methods to experience knowledge, and tactile learners prefer the learning method that allows them to interact with the learning material through activities such as building models or performing laboratory experiments. Reid (1984) further applied the VAKT perception styles to the research on EFL learners and discovered that most students can correctly choose the style in which they prefer to learn. He also recognized that more EFL learners prefer kinesthetic and tactile learning methods as well as the peer learning model. Also, Lien (2012) proposed an interactive English learning system with Microsoft Kinect and examined what kind of learning style of students could benefit from it. Results showed that the motion-based system could significantly enhance student’s metacognition on reflective, sensing and sequential styles.

System design

Overview

There are two main modules in the proposed KELS: the activity module and the interactive mechanism. The activity module is composed of four learning activities: vocabulary learning, a listening test, a paired interactive speaking activity, and motion-based sentence-making. The interactive mechanism includes four types of interactions: mimicking motions, object recognition, gesture-based relative positioning, and kinesthetic clicking. The system design is shown in Fig. 1.
Body interactive mechanism

Following the four types of interaction mechanisms, learners were able to interact with the learning system and receive information about the vocabulary (e.g., spelling, phonogram, sample sentence or pronunciation) by displaying it on a screen, as shown in Fig. 3.

Motion mimic

This mechanism allowed learners to acquire motion- and pose-related vocabulary. Learners were instructed to make the corresponding pose to demonstrate the meaning of the vocabulary word in order to trigger the display of information about the word. We expected that learners would better understand and internalize the vocabulary by interpreting the meaning of the vocabulary through the performing of motions and poses.

Object recognition

When learners intended to learn the vocabulary of a specific object in their environment, they only needed to pick up the object in order for the KELS to recognize it and provide information about the corresponding vocabulary. The act of picking up an object was expected to enhance the learners’ impression and perception of the vocabulary.

Gesture-based relative positioning

This mechanism was for learners to understand a series of prepositions indicating relative position between objects. When learners put their arms out straight in order to point to a specific orientation, the KELS automatically detected the preposition suitably expressing the relative position between the learners’ location and the orientation the learners were pointing to and displayed information about the preposition. Learners were expected to regard this knowledge as highly life-related through the use of this interactive mechanism.
**Kinesthetic clicking**

The KELS provided a virtual pointer that actively correlates the position of the learners’ hands with the position of the cursor on the computer screen. In order to trigger the system function by clicking the icon, learners moved the virtual pointer to the top of the icon via kinesthetic motion. In addition, a blue circle was designed to count down in order to activate the function.

**Activity module**

**Vocabulary learning**

There were four subjects in the vocabulary-learning activity: action, positioning, objects, and others. The vocabulary in the action subject was about various motion patterns. The objects vocabulary was about physical objects, and the vocabulary in the positioning subject was about prepositions used to indicate relative position. The others subject contained vocabulary that did not fit into the other subjects (e.g., happy, sad, confidence). In this study, four mechanisms that required interactive body movements were designed to trigger the display of information of vocabulary in four subjects, the corresponding physical image of the above four subjects in KELS are shown in Fig. 3. The motion mimic mechanism utilized the learners’ body movements to trigger the display of vocabulary in the “ACTION” subject. The display of information about the vocabulary in the “OBJECT” subject was triggered by the object recognition mechanism. Likewise, the gesture-based relative positioning mechanism triggered the display of information regarding prepositions in the “POSITION” subject. The kinesthetic clicking mechanism was used to display information about vocabulary in the “OTHER” subject. The detailed information and physical images of KELS displayed for learning vocabularies included spelling, a phonogram, and sample sentences (see the left side of Fig. 3). Advanced functions, including the pronunciation of vocabulary or example sentence using text to speech (TTS) and switching between multi-sample sentences (see the right side of Fig. 3), were also implemented.
Listening test

In this stage, learners repeatedly listened to English questions provided by KELS and responded to the listening stimulation with respective body motions. Learners were able to understand and internalize the input through the interaction between listening stimulation and body motion. An English question was generated randomly by KELS and transmitted through TTS to learners, and they were required to respond to the question using the body interactive mechanism. The interface is shown in Fig. 5.

Paired interactive speaking game

In this stage, the game mode was paired cooperation. In each group, there were two learners, each using a separate computer. A socket connection was built between the two computers. KELS randomly generated a question to one of the learners in each pair, and the other learner was given four possible options from which to choose the correct answer. The learner with the question read it aloud through the microphone, and the other learner determined the answer from four options and made the selection using body motion. The two learners then exchanged roles for each subsequent question. The game was designed to train learners to speak English confidently as well as to hear and understand words as they were pronounced by their partners (Figure 6).
Motion-based sentence making

Stevick (1976) investigated the relationship between memory and vocabulary development from the perspective of second language learning. He believed that active involvement was required in order to retain a vocabulary word in the brain for a long time. In other words, using the vocabulary is more effective to the learning process than just listening to, writing, or reading the translation of a given word. Thus, the learning activity at the last stage of the study required learners to make a sentence using body motion. KELS provided the learner with a picture, and the learner was required to respond by making a sentence describing the picture, causing the learner to retrieve vocabulary using the four body interactive mechanisms.

Method

Research participants and experimental time

This study was conducted with 39 tenth-grade students. The participants were selected from one class and were all female. They were divided into a control group and an experimental group, and the number of students in each group was 20 and 19, respectively. The teaching content for both groups was “Studio Classroom September.” Learning procedures were designed so that students read the teaching content during four sessions per week; each session was 30 minutes. The teaching lasted three weeks for a total of twelve sessions.

Research architecture

This study adopted a quasi-experimental method using the proposed KELS as the independent variable, perceptual style as the background variable, and learning achievements as dependent variables. The study further explored the relationship between system usage and learning achievements in the experimental group. The research architecture is shown in Fig. 7.
Activities design

This study was designed to investigate the differences in learning performance between the control group and the experimental group. Three major activities were prepared as follows:

The learning cycle for mastering learning

In this activity, the learning cycle was designed so that each learner went through the process of learning vocabulary and then took a listening test to see whether the vocabulary learning should continue or not. The learning cycle would continue until the participant passed the listening test, indicating the participant had mastered the subject matter. The vocabulary learning was to teach learners vocabulary words, sentences and pronunciation either through a multimedia site (control group) or through KELS (experimental group).

Paired interactive speaking activity

In this activity, one learner in a pair was required to speak while the other learner was required to respond. In the control group, learners were paired and two examination papers were distributed, paper A and paper B. Paper A contained a list of vocabulary words for one learner to read aloud, and paper B contained 4 vocabulary words, one of which corresponded to the vocabulary words listed in paper A, that is, the bearer of paper B was expected to select from the list the correct word based on what the bearer of paper A spoke. The roles were then exchanged. The activity was conducted similarly in the experimental group except that the vocabulary words were provided by KELS instead of by reading paper A and that the response was expressed by body interactive mechanisms instead of by reading paper B.

Sentence-making with pictures

In this activity, a picture was provided that the learner was required to describe in sentences using the vocabulary words that had been taught. The control group made sentences using paper and pencils while the experimental group used body motions to generate vocabulary to make sentences. The body motions were used to increase the learners’ memory and internalization in regard to learning contents.

Results

Analysis of learning effects

Before the experiment was conducted, we examined the learners’ prior knowledge of English in both the control group and the experimental group by using an independent-sample T-test. The results are shown in Table 1. There was no significant difference in prior knowledge between the groups. At the end of the three-week experiment, the post-test scores in the control group and the experiment group increased from the test of prior knowledge; however, there was still no significant difference in the scores. But, while the mean of pre-test scores in the control group was a lot higher than in the experiment group, the post-test scores in the control group was lower than in the experiment group. Also, the t-value changed from pre-test 1.678 to post-test -0.589. Further, the difference of SD value between control group and experiment group shrank from pre-test to post-test. These were all clues indicating that the progress in the experiment group was better than in the control group. We also analyzed the learning gains and found that the experimental group was significantly better than the control group. A delay test was conducted 21 days after the learning activity, and the results showed that the experimental group performed significantly better than the control group on retaining what they had learned during the experiment.

| Table 1. The learning effect by independent-sample t-test |
|---------------------------------|-----|-----|-----|-----|-----|
|                                | N   | Mean| SD  | t-value | Sig.(2-tailed) |
| Pre-test Control               | 20  | 52.60| 12.339|1.678 | .102  |
| Pre-test Experimental          | 19  | 44.89| 16.172|      |        |
| Post-test Control              | 20  | 67.80| 11.998|-.589 | .560  |
| Post-test Experimental         | 19  |      |      |      |        |
Analysis of the relationship between system usage and learning effects

We intended to investigate the effect of system usage on learning effect and study the relationships among different system usages.

Analysis of the relationship between system usage and post-test effects

Pearson’s Relation Analysis between Post-test Effect and the System Usage. The average score and the highest score in paired interactive speaking activity were computed using scores from six learning sessions. These two variables had a positive correlation to the post-test; the correlation coefficients were .501 (p = .029 < .05) and .485 (p = .035 < .05) respectively. There are two possible interpretations or assumptions that can be drawn based on these results. First, if learners were equipped with better English abilities before the experiment, then after participating in all the learning sessions of the paired interactive speaking activity, they would have better learning effects in the post-test than learners with less English abilities. Second, learners who performed well in the paired interactive speaking activity through their practice in this stage might perform better in the post-test learning effects than learners performed worse in the paired interactive speaking activity. To clarify this question, we further examined the relation between the pretest score, the average score of the paired interactive speaking game, and the highest score of the paired interactive speaking game. We examined the relation of the pretest score to both the average score of the paired interactive speaking game and the highest score of the paired interactive speaking game through Pearson’s correlation analysis and found that there were no significant relations (p = .166 > .05; p = .184 > .05). As a result, the first assumption was excluded, and the second assumption was determined to be more likely.

The Forecasting Ability of the System Usage for Post-test Effects. Stepwise regression analysis was conducted to investigate the explanation of variance and to determine whether either the average or the highest score of the paired interactive speaking game corresponded to post-test effects. The result showed that the highest score of the paired interactive speaking game was eliminated. In addition, the explanation of variance of the joint regression model for the average score of the paired interactive speaking game (.207) revealed the explanatory power of 20.7%, F = 5.691 and p=.029, from which the difference was significant. Thus, the average score of the paired interactive speaking game could effectively predict the post-test score. In other words, learners who performed well in the paired interactive speaking game were likely to have better learning effects.

Analysis of system usage on retaining effect obtained by the delay test

The Pearson’s Relation Analysis between System Usage and the Retaining Obtained by the Delay Test. The total learning time refers to the total time learners spent in the vocabulary learning stage. The total test number refers to the total number of listening tests the learners took. The Pearson’s correlation analysis showed that both the retaining effect obtained by the delay test and the total learning time appeared in negative correlation with the correlation coefficient -.468 (p = .043 < .05) and that both the retaining effect obtained by the delay test and the total test number appeared in positive correlation with the correlation coefficient .463 (p = .046 < .05). There are two possible interpretations or assumptions that can be drawn based on these results. First, learners who spent less time on vocabulary learning and more time in taking the listening test might experience better learning effects; conversely, learners who spent more time on vocabulary learning and less time in taking the listening test might experience worse learning effects. Second, learners’ prior knowledge level might affect the results. The learning cycle for mastery was designed for vocabulary learning in which learners were examined by taking a listening test. Learners who did not perform well on the listening test would go through the vocabulary learning again. In this situation, learners with less prior knowledge of English spent more time on vocabulary learning than those whose prior knowledge level was higher.

| Learning gains | Experimental | 19 | 70.11 | 12.463 |
| Control | 20 | 15.20 | 11.547 | -2.517 | .016* |
| Experimental | 19 | 25.21 | 11.093 |
| Learning retention | Control | 20 | 82.80 | 12.743 | -2.133 | .040* |
| Experimental | 19 | 91.47 | 12.646 |

*p < .05. **p < .01. ***p < .001.
knowledge of English was greater. Alternately, learners with greater prior knowledge spent more time taking the listening tests.

To examine the assumptions mentioned above, we examined the relation between the pretest score and the delay test score. The result showed that the pretest and delay test scores had a greatly positive correlation; the correlation coefficient was $0.639 (p = 0.003 < 0.01)$. As a result, we concluded that the second assumption was more likely. The average score of the paired interactive speaking activity and the delay test scores appeared to have a positive correlation; the correlation coefficient was $0.527 (p = 0.020 < 0.05)$. Therefore, we concluded that the paired interactive speaking activity did help learners with long-term retention of their acquired knowledge.

The Forecasting Ability of System Usage to the Retaining Effect Obtained by the Delay Test. Stepwise regression analysis was conducted to investigate the explanation of variance on the retaining effect obtained by the delay test from the system usage which was total learning time, the total test number, and the average score of the paired interactive speaking activity. The result showed that the total learning time and total test number were not able to forecast the extent of long-term retention. The explanation of variance of the joint regression model for the average score of the paired interactive speaking activity was $0.236$, from which the explanatory power of $23.6\%$, $F = 6.547$ and $p = 0.020$ was significantly different. Thus, the average score of the paired interactive speaking activity effectively forecasted the extent of long-term retention. In other words, learners who performed well in the paired interactive speaking activity were equipped with better long-term retention of the English language.

Questionnaire analysis

TAM technology acceptance model

The Cronbach alpha value of the three dimensions in the technology acceptance model (TAM) questionnaire were all higher than 0.7, indicating that the questionnaire was reliable (perceived ease-of-use $0.848$, perceived usefulness $0.902$, user intention $0.727$). The average score of perceived ease-of-use was 3.8 in which the score for object recognition function-related questions were particularly lower than for other functions. As a result, we were made aware that the learners did not like using the object recognition module because the recognition precision was not accurate or easy to use. The average score of perceived usefulness was 3.7. The scores of the object recognition function-related questions were in the range between 3.3 and 3.6, which were lower than other functions. However, upon interview, learners mentioned that:

They were able to deepen the impression of the vocabulary by the action of taking up objects in object recognition and it was easier to learn while comparing to the Kinesthetic clicking.

Even though learners thought the object recognition function did help them acquire knowledge, improvement in both the precision and the speed of recognition was needed; therefore, scores were lower regarding this function. The average score of user intention was 3.9 in which the average score of each question was higher than 3.6, indicating that the learners had positive intention.

Keller’s ARCS model of motivation design

The ARCS questionnaire was given to the study participants to determine whether the KELS would benefit their motivation and willingness to learn. The Cronbach alpha value was higher than .7 for all four dimensions (attention: 0.918; relevance: 0.804; confidence: 0.802; and satisfaction: 0.847), which indicated that the responses to the questionnaire were reliable. The average attention score was 3.9. In interview, Learners mentioned that:

I like Kinect and prefer to learn by it because it is more interesting.
I will think how to do it by using body action.

This showed that learners thought it was very interesting to operate by body action and it could effectively promote their attention and ensure their participants. The average relevance score was 3.7. The second item (“I have enough
time to learn in the KELS.”) and the third item (“I feel the learning contents in KELS is practical and related to my life.”) received lower scores than the other items on the questionnaire. Some of the learners thought that “I feel it waste time in listening test to share my time with partner to test” so they thought the learning time was not enough. In interview, Learners also mentioned that “I don’t have to use English in general days so I feel it have few relation with life.” and this might be the cause that learners thought the KELS had less relation with life. The average confidence score was 3.7. The second item (“I feel that KELS give back scores fairly.”) and the third item (“I am confident that I can learn the contents taught in the system well.”) received lower scores than the other items. Based on the responses given during the interview process and on the questionnaires, we discovered that learners thought their level of proficiency in English was not accurately reflected because a portion of their final scores relied upon how well their partners were able to speak the questions in the paired interactive speaking activity. Learners also reported that although they made progress in learning English using KELS, they still felt resistant to and less confident about learning EFL well because of their past experiences with learning using traditional teaching methods. Some learners found KELS more interesting than the traditional methods but still expressed a general dislike of learning EFL. The average satisfaction score was 3.8. In summary, the average score was higher than 3.6 for all items on the questionnaire, and the average score in each dimension was higher than 3.7, indicating that the learners did experience a greater motivation to learn EFL after using the KELS.

**Analysis of perception learning style for learning**

We intended to investigate whether the non-kinesthetic learners’ attention and retention of knowledge were negatively affected by engaging in highly physical activities that did not present knowledge using their primary perception learning style. Conversely, we also investigated whether the kinesthetic learners benefited from the use of body motion in the KELS. Although we discovered that kinesthetic learners performed slightly better than non-kinesthetic learners on both the learning test given immediately after the experiment and the delay test given 21 days after the experiment (see Table 2), there was no significant difference in the analysis. Based on the responses given during the interview process, non-kinesthetic learners demonstrated their appreciation with the learning mode presented in the KELS and expressed high motivation to continue their participation. In summary, whether learners were kinesthetic or non-kinesthetic, they were able to use and learn through the KELS well.

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*p < .05. **p < .01. ***p < .001.

**The discussion and educational implication**

In summary, the stepwise regression analysis indicated that the paired interactive speaking activity was better able to forecast the results on the post-test and predict the extent the learning would be retained as indicated on the delay test (for long-term retention). This ability coincides with the theorems stating that learning is more effective when interaction with other people is incorporated, as opposed to using videos or tapes, because the learning occurred in a cultural, practical, and meaningful context. Using partner interaction supported the effort to engage the learners’ brains by presenting the knowledge as practical and life-related; therefore, the participants learned more quickly and retained the knowledge for a longer than they were likely to have in a traditional classroom setting.

Open questions and interviews were analyzed to determine any correlations between the responses and our findings: The paired interactive speaking activity was found to be important and beneficial to learning EFL. The interviews indicated that most learners preferred the paired interactive speaking activity not only because it was more interesting with two members of a group cooperating together but also because hearing the sentences spoken by the
partner resulted in better learning than listening to the TTS system alone. In this activity, the learners tended to speak English more confidently.

The results of the ARCS questionnaire indicated that the learners did experience a greater motivation to learn EFL after using the KELS. The results of learning style analysis showed that whether learners were kinesthetic or non-kinesthetic, they were able to use and learn through the KELS well.

Conclusions

In Taiwan, the focus on reading and writing skills in the EFL learning environment neglects the importance of the learning order: first mastering listening comprehension, then speaking, and lastly reading and writing; this approach also requires more effort from learners while reducing the effectiveness of the learning process. Because the learning mostly takes place in the classroom rather than within life-related situations, learners experience less confidence and interest, resulting in lower motivation and learning retention. In contrast to this situation, many studies indicated that interaction with the subject matter using bodily motion could enhance problem-solving and make learning more effective. In addition, using bodily motion to indicate comprehension on a listening test may improve the brain’s ability to link the knowledge acquired with life-related tasks and thus increase the effectiveness of the learning. Therefore, this study incorporated TPR in the proposed Kinesthetic English Learning System (KELS) using Microsoft Kinect technology. The system consisting of four stages of learning activities and four body interactive mechanisms, was designed for high school seniors as a learning tool.

There were no significant differences between the control group and the experimental group on the learning test taken at the conclusion of the experiment; however, the experimental group performed better on the delay test that was given 21 days later to measure long-term retention. We concluded that the KELS effectively enhanced the internalization of EFL learning and promoted long-term retention, increasing the likelihood that learners will be able to apply what they have learned to daily life. In the four stages of the KELS, learners examined themselves and repeatedly continued the body motion to response to Vocabulary Learning and Listening Test. The interactive mode helped learners to better internalize knowledge. We also found that the paired interactive speaking activity promoted long-term retention of EFL. Through the TAM questionnaire, ARCS questionnaire, open questionnaire and interview process, we discovered that most learners in the experimental group thought that the kinesthetic learning mode incorporating body motion was interesting and held their attention. In particular, using body motion to express the meaning of words made the learning process more effective and increased the association of EFL with life-related tasks. Although several learners expressed initial resistance to learning English because of their previous negative experiences with the subject, they did acknowledge that their knowledge increased throughout the experiment while the sense of resistance decreased progressively. Overall, the study participants were equipped with high motivation to continue participating in the KELS. Finally, the results of the experimental group indicated that there was no significant difference between kinesthetic and non-kinesthetic learners in either learning or retaining knowledge.

The limitation of this work is that the number of students participated the experiment is limited and they are with similar cultural background. As a result, in the future work, a large scale of subject test with more sample sizes is on the way in order to further verify KELS. Besides, context factors, such as gender, age, profession or cultural background, will be considered.

References


