Learning action verbs with animation

Chih-cheng Lin

National Taiwan Normal University
cclin@ntnu.edu.tw

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This study investigates whether dynamic animation annotations facilitate the learning of motion verbs better than static graphics annotations. Three eighth-grade classes were randomly assigned to a dynamic animation group, a static graphics group and a text-only group. In a one-way ANOVA design, their learning of 20 target words in two reading passages was assessed by production and recognition tests using a pretest and two posttests. Although the two visual groups outperformed the text-only group, differences between the dynamic animation group and the static graphics group were not detected. The findings support visual-aided vocabulary learning and suggest that dynamic animations may be more useful to illustrate unfamiliar, culture-specific concepts in vocabulary lessons.

Introduction

The studies on employing visual aids in vocabulary learning, either static (graphics, pictures and photos) or dynamic (animation and video), have agreed with the theory of dual- and multi-modal presentations (Mayer & Moreno, 2002a, 2002b). The consensus is that learning new L2 words with L1 textual definitions and one more medium, either static graphics or dynamic animation, results in better performance than that with L1 textual definitions alone (Chun & Plass, 1996; Plass, Chun, Mayer, & Leutner, 1998; Kim & Gilman, 2008; Yeh & Wang, 2003; Yoshii, 2006; Yoshii & Flaitz, 2002). The findings vary, however, on which of the two types of visual aids helps more efficiently and effectively. While some researchers favor using static visual aids to enhance vocabulary learning, others conclude that

learning vocabulary with dynamic graphics generates better results (Al-Seghayer, 2001; Hanley, Herron & Cole, 1995).

This study is not intended to argue for a favored medium for vocabulary learning in general. Rather, it aims to address the issue of appropriateness when visual aids, whether static or dynamic, are used as annotations. Specifically, the issue in question is: Which type of vocabulary, nouns or verbs, can be best acquired with the help of dynamic visual aids, namely animation? Since animation is made to express ideas that contain a process or ideas of changes, learning action verbs with animation for EFL beginners is considered a departure point.

Background

Animation as vocabulary annotations has its foundation in multimedia learning, from which the review of previous studies begins. Three areas are related to the present study. They are dual-coding theory, glosses for vocabulary learning, and animation and vocabulary learning.

Dual-coding theory

Paivio (1986) posits that human memory consists of two subsystems, one verbal and the other visual. The verbal system processes and stores language and other abstract information. On the other hand, the visual system processes and stores more-concrete information such as images, sounds, and feelings. They are two independent yet interconnected systems in human memory and cognition. Where vocabulary learning is concerned, pictorial cues will help learners make associations between pictures and words, and make learning effective. Information, therefore, is better remembered when dually rather than singly coded, because when one memory trace is lost the other remains and is accessible. Moreover, pictures are more easily remembered than words because pictures are more likely to activate the image-to-word referential connections. Therefore, we remember words better if they are associated with images.

Based upon dual-coding theory, Mayer (1997) proposes a generative theory for human memory. The theory asserts that information sent through senses needs to be selected, organized and finally integrated with our knowledge in the long-term memory. For instance, in order to meaningfully comprehend a text in a multimedia format, learners must select relevant pictorial and/or linguistic information, organize the input into coherent visual and verbal mental representations, and then integrate the newly constructed representation with some already learned one by constructing referential connections between the two. Visual aids in this case play a crucial role in helping to construct meaning.

Empirical studies on language learning with visual aids support the dual-coding theory. As the theory claims to predict, learners who learn vocabulary without visual aids score lower than those with some, such as pictures (Brown, 1993; Duquette & Painchaud, 1996; Kost, Foss, & Lenzini, 1999) and videos (Neuman & Koshinen, 1992; Snyder & Colon, 1988). Visual aids not only assist learners with linguistic forms but they also enhance learners' comprehension, when, for example, videos are used (Hanley et al., 1995).

Glosses for vocabulary learning

Reading a text with glosses in various forms helps learners learn vocabulary effectively. Both L1 and L2 learners showed that the plainest textual glosses of target words enhanced their vocabulary learning (Jacobs, Dufon, & Hong, 1994; Watanabe, 1992); by reading glosses at the margins, learners learned vocabulary better than those by consulting dictionary definitions (Hulstijn, Hollander, & Greidanus, 1996). Single glosses (Watanabe 1997), multiple-choice glosses (Hulstijn, 1992; Nagata, 1999), sentential glosses (Gettys, Imhof, & Kautz, 2001; Grace, 1998 & 2000) and pictorial glosses (Kost et al., 1999; Oxford & Crookall, 1990) were found effective in improving vocabulary learning.

Similar to glosses, multimedia annotations, when incorporated in computer-mediated texts, are considered beneficial to vocabulary learning. Speedy retrieval of word meanings was the first and major reason that learners turned their attention to using computer-enhanced references (Chun, 2006; Leffa, 1992; Plass & Jones, 2005; Taylor, 2006). Textual definitions alone, however, could not compete with those combined with pictures, sounds, or videos when the learning outcomes were compared. Among the combinations of multimedia annotations, learners learned better with text and pictures than with text or pictures alone (Plass et al., 1998; Yoshii, 2006; Yoshii & Flaitz, 2002), than with text and videos (Chun & Plass, 1996), and than with text, pictures and sounds (Kim & Gilman, 2008; Yeh & Wang, 2003). One exception, though, was reported in Al-Seghayer (2001). In this case, learners with the help of text and videos outperformed those with that of text and pictures.

Animation and vocabulary learning

Animation, which is the rapid display of a sequence of graphics, is often compared and contrasted with static graphics in learning, due to its graphic nature as a visual aid (Weiss, Knowlton, & Morrison, 2002). This is the same as visual-aided learning, or learning with animation is theoretically founded on dual-coding theory (e.g., Mayer, 1997; Mayer & Moreno, 2002a, 2002b; Zhu & Grabowski, 2006). The commonalities found in all the aforementioned models of multimedia learning include two channels for information processing: one is verbal (via the ears) and the other visual (via the eyes). Once entered into our sensory memories, information is selected and organized in our working memory. This newly constructed representation, then, needs to be integrated with some background knowledge retrieved from the long-term memory. In a learning scenario, it is clear that animation is first used to attract viewers'/learners' attention and viewers/learners are then encouraged to create mental images of certain types of information conveyed in the animation. In principle, animation is created to convey concepts of change and considered effective in expressing processes (Mayer & Moreno, 2002a, 2002b; Tversky, Morrison, & Betrancourt, 2002); in practice, however, it is designed to explain concepts that are hard for still images to illustrate (Iheanacho, 1997).

Studies on examining animation as annotation in vocabulary learning and teaching are scarce; yet many programs back in the last century have already incorporated animation in presenting vocabulary items, grammatical structures and other language notes. In this study, animation is employed to teach English action verbs together with their Chinese translations. The reason is that action verbs express a series of movements and are best illustrated by animation. The combination of dynamic images and textual definitions is expected to assist EFL beginners with acquiring target action verbs. **25**

The research questions of this study are: 1) Do textual glosses with some visual aid and text-only glosses differ on facilitating the learning of English action verbs? And, 2) Do dynamic animation cues and static graphics cues differ on facilitating the learning of English action verbs?

Method

Participants

The participants in the present study (N=70) were from three intact classes of eighth-grade students from a junior high school in northern Taiwan. All participants had received at least four years of formal English education since the fifth grade; and they had four 45 minute English classes each week. With the goal of learning 1,000 basic English words suggested by the Ministry of Education, the eighth-graders were expected to have learned 700 of them. Their English proficiency level was considered to be beginner when they participated in the study.

Material and target words

The target words (Appendix A) in this study were selected from two children's stories, *The Frog and the Princess* (554 words) and *The Ugly Duckling* (541 words) (Appendix B). All target words never appeared in the participants' textbooks used in the junior high school. The text readabilities of the first story were 82.9 assessed by Flesch Reading Ease and 4.4 assessed by Flesch-Kincaid Grade Level; and those of the second story were 84.0 and 4.0, respectively.

Each target word in the stories was underlined and highlighted in blue in a text window, and its annotation was displayed in a separate window below the text window. The contents of the words' annotations vary according to the three different groups of the research design, namely text-plus-animation group (animation), text-plus-graphics group (graphics), and text-only group (text). Because of the participants' English proficiency level, Chinese translation of each target word is given. After clicking on a target word, the participants in the animation group could read its Chinese translation and see its animation in a lower window. Those in the graphics group could see the Chinese translation and the graphics of a target word, and finally those in the text group could have the Chinese translation only. Screenshots of the reading passage before (top) and after (bottom) the participants in the graphics group click on a target word are shown below (Figure 1).

Instruments

The instruments in this study included a vocabulary production test and a vocabulary recognition test (Appendix C). Both tests were used in the pretest, the immediate posttest and the delayed posttest. The recognition test and the production test had 24 test items each, including 20 target words and 4 non-target words. The 48 test items were the same across the three tests. However, the order of the test items was different for the three tests.

In the production test, the participants were asked to provide the complete spelling of a cued word, with its Chinese meaning and the first letter and the last letter given. In the recognition test, given an English word, the participants were asked to choose the correct **26** Chinese translation from four options. Each test was presented in one screen, with the
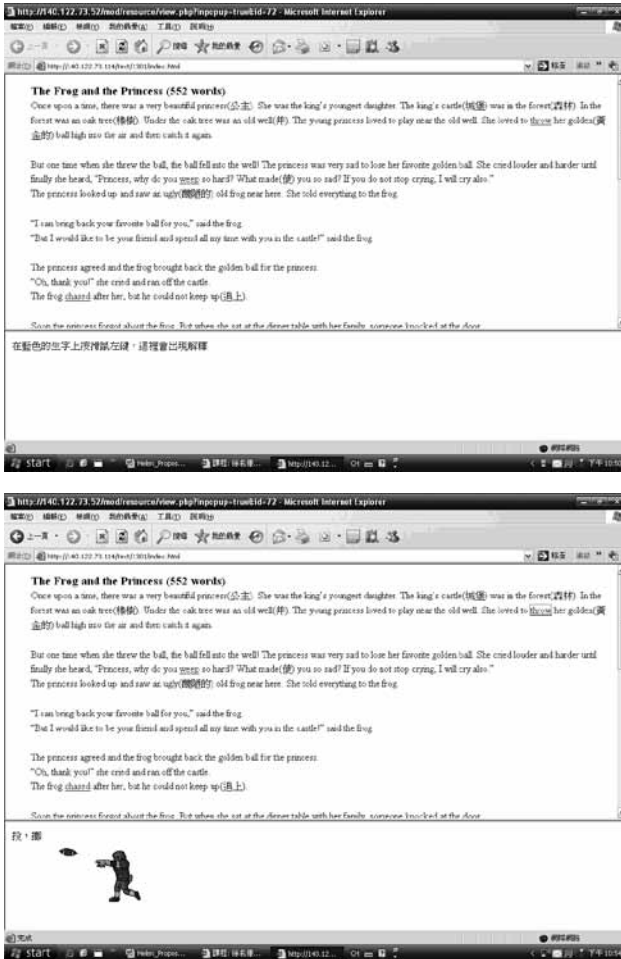
Figure 1. Screenshots before (top) and after (bottom) the target word *throw* is clicked on.

production test preceding the recognition test. Once the answers to the production questions were submitted, the participants were unable to reverse; so were the answers to the recognition questions. The screenshots of the two tests, production above and recognition below, are shown overleaf (Figure 2).

Procedures

Each of the three intact classes was randomly assigned to one of the three groups of the study. They are: the animation group, the graphics group, and the text group. The number of each group was 27 for the animation group, 21 for the graphics group, and 22 for the text group, totaling 70 participants in the study. **27**

Figure 2. Screenshots of the production test (top) and the recognition test (bottom).

The study started on the 7th week of the spring semester in 2007, a week after the participants' first mid-term test, and lasted for 5 weeks, a week before the participants' second mid-term test. On the first week, all participants were introduced to the class English reading website and asked to take the pretest without prior notice. On the third week, they were informed to attend two English classes in the computer classroom on two separate days. In each class, they were instructed to read a story prepared on the class' English reading website (Figure 1) and to take a comprehension test; an immediate posttest was given without prior notice. In the fifth week, the delayed posttest was administered to all participants in the computer classroom without prior notice. The procedures are shown in Table 1, below.

Table 1: Procedures of the study

Week	Class activities	Tests
Week 1	Learning operations on the reading website	Pretest
Week 3	Reading two designated passages I & II	Immediate Posttest I & II
Week 5		Delayed Posttest

Data analysis

Each correct answer was counted one point; and, the highest score of each of the production test and the recognition test is 20 and the highest score of each of the pretest, the immediate posttest and the delayed posttest is 40. After the results obtained from the three tests were tallied and recorded, the one-way **ANOVA** was then applied to examine whether there is a significant difference among the three types of annotation. The null hypothesis was that the results of the three groups would be the same. The expected outcome was that text-plus-animation annotations and text-plus-graphics annotations would have different effects on learning action verbs.

Results

To see the overall patterns of annotation type effects, the vocabulary test scores of the three tests were analyzed by descriptive statistics, *t*-tests and one-way **ANOVA** of three annotation types: animation, graphics, and text. The descriptive statistics for the pretest, the immediate posttest, and the delayed posttest are first presented below in Table 2. Of the three annotation groups, the graphics group scored the highest on the three tests and the text group scored the lowest.

Table 2: Descriptive statistics for the three tests

Group	N	Pretest		Immediate posttest		Delayed posttest	
		M	SD	M	SD	M	SD
Animation	27	12.44	6.22	24.11	8.68	15.89	7.92
Graphics	21	13.67	5.17	25.24	6.17	17.14	7.05
Text	22	11.09	5.26	19.18	4.78	14.23	5.86

Note. Maximum score = 40.

A series of *t*-tests for the three tests were conducted to detect the differences in each group. The participants in the three groups all scored significantly higher on the two posttests than on the pretest at $p < .01$. This showed that all three annotation types had facilitating effects on the learning of the target words. However, the scores of the delayed posttest of the three groups all dropped to a significant level at $p < .01$, compared to those of the immediate posttest. The participants forgot what they had learned after one exposure to each target word in a week. Table 3 shows the *t*-tests for each comparison in each annotation group.

Table 3: *t*-tests for the three tests in each annotation group

Group	N	Pre-IM Post	Pre-DE Post	IM Post-DE Post
Animation	27	−8.749**	−11.606**	8.037**
Graphics	21	−11.900**	−3.938**	6.890**
Text	22	−7.513**	−2.883**	4.749**

Note. ** = $p < .01$; Pre = Pretest; IM Post = Immediate posttest; DE Post = Delayed posttest.

The results of the three tests were analyzed by one-way **ANOVA** to detect whether the differences among the three annotation groups existed. In the pretest, no group differences were found ($F(2, 67) = 1.128$, $p > .05$). This ensures the equivalence of the three groups on the pretest. In the analysis of the immediate posttest, effects of annotations differed significantly across the three groups, $F(2, 67) = 4.801$, $p < .05$. Tukey post-hoc comparisons of the three groups indicate that the animation group ($M = 24.11$) and the graphics group ($M = 25.24$) scored significantly higher than the text group ($M = 19.18$), both at $p < .05$ while the comparison between the animation group and the graphics group was not significant. In the delayed posttest, no group differences were detected, ($F(2, 67) = .923$, $p > .05$).

Secondly, the scores of the production tests and the recognition tests in all three tests were analyzed to detect group differences. The descriptive statistics are presented in Table 4 below.

Table 4: Descriptive statistics for production and recognition tests

		Pretest Production		Recognition		Immediate posttest Production		Recognition		Delayed posttest Production		Recognition	
G	N	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
An	27	1.85	1.94	10.59	4.53	8.26	5.04	15.85	4.33	3.96	2.74	11.93	5.43
Gr	21	1.86	2.06	11.81	3.57	8.95	3.84	16.29	3.20	4.14	3.01	13.00	4.78
Tx	22	1.45	1.92	9.64	3.69	5.18	2.92	14.00	3.89	3.36	2.13	10.86	4.12

Note: Maximum score = 20. G = Group; An = Animation; Gr = Graphics; Tx = Text.

An examination of the scores of the production test and the recognition test in the immediate posttest was necessary to further explain the only group difference found in the immediate posttest. One-way **ANOVA** was used to analyze the scores in Table 4 and the results were similar to the analysis of the total scores. In the pretest, no group differences were found among the three annotation groups in the production test ($F(2, 67) = .311$, $p > .05$) and in the recognition test ($F(2, 67) = 1.590$, $p > .05$). Same as the analysis of the total scores in the delayed posttest, no group differences were found among the three annotation groups in the production test ($F(2, 67) = .521$, $p > .05$) and in the recognition test ($F(2, 67) = 1.041$, $p > .05$). In the immediate posttest, while there was no group differences in the recognition test ($F(2, 67) = 2.160$, $p > .05$), effects of annotation in the production test differed significantly across the three groups, $F(2, 67) = 5.254$, $p < .05$. Tukey post-hoc comparison of three groups indicate that the comparison between the animation group and the graphics group was not significant; but it indicates that the animation group ($M = 8.26$) scored significantly higher than the text group ($M = 5.18$) at $p < .05$ and the graphics group ($M = 8.95$) scored significantly higher than the text group ($M = 5.18$) at $p < .01$.

The analyses of the three tests show that the scores in all three groups improved significantly after the treatment of learning action verbs with annotations. Having read the two passages, the participants using textual annotations with both animation and graphics did significantly better on the immediate posttest than those using text-only annotations. Specifically, both animation and graphics groups outperformed the text-only group in the production test. On the delayed posttest, however, the group differences disappeared. That is, after a week, different effects of having learned vocabulary with either of the visual aids were not detected.

Discussion

Textual definitions with visual aids vs. text-only definitions

The results of the present study give the first research question a positive answer: textual definitions with some visual aid are not only different from but also favored over text-only definitions. This study serves as one example that confirms Paivio's (1986) dual-coding theory, which predicts that additional and meaningful visual cues can help learners make associations between action verbs and their images and, therefore, can make learning more effective. The two independent and yet interconnected subsystems of verbal and visual in human memory help each other when textual and visual information are simultaneously available. Also, as Mayer (1997) and Mayer & Moreno (2002a & 2002b) maintain, to comprehend a multimedia text, learners must select, organize and then integrate information by constructing referential connections. The results of the present study show that visual information accompanied by textual information facilitates learners' learning the target action verbs. The presence of additional dynamic animation or static graphics helps our participants create mental images of the target action verbs, which are stored for future retrieval.

The results are also consistent with those of previous studies (Chun & Plass, 1996; Plass, *et al.*, 1998). With the help of textual and visual annotations, learners learn more vocabulary items than those only have access to textual annotations. As suggested by Al-Seghayer (2001), dual presentations of textual and visual annotations reinforce each other, and thus make learning vocabulary effective. This study also adds one more literature supporting Terrell's (1986) form-meaning connection, which assumes that the binding of form (unknown L2 vocabulary) to meaning (visual representation) is the most effective way for learners to acquire concrete ideas and references. The target words in this study are all concrete action verbs, and our learners' vocabulary learning is greatly helped by the adding of visual representation to unknown vocabulary items, as shown in the production test results of the immediate posttest.

Dynamic animation vs. static graphics

To the second research question that compares the two graphical modes, the results of the present study give a negative answer: dynamic animation and static graphics show no differences in learning action verbs. Concerning the learning of action verbs, static graphics in this study can compete with dynamic animation in terms of their graphical natures. As discussed earlier, instructional animations are created to express concepts of changes and processes (Mayer & Moreno, 2002a, 2002b; Tversky *et al.*, 2002). While action verbs can **31**

be ideal candidates for dynamic animations, static graphics with L1 textual definitions can provide sufficient information for EFL teenage beginners in this study. The concepts in the target action verbs in this study are basic in daily life (Appendix A). Studying the L1 textual definitions in the annotation window may have already given the teenage participants in this study the ideas about the target words; seeing the pictures or watching the animations helped them to construct mental images. To the teenage participants in this study, static graphics and dynamic animations make no differences in learning new words. Its support is found in the further analyses of the learning of the target action verbs below.

An examination of the answers reveals that the dynamic animation group and the static graphics group had learned and acquired similar action verbs. Take the immediate posttest as an example. In the production test, the two groups shared four out of the top five correct answers. They were *bow, lay, shine* and *weep*. Interestingly, the five verbs that the participants in both groups found difficult to produce based on their Chinese translations were the same: *dangle, wrinkle, pout, chase* and *lean*. In the recognition test of the immediate posttest, *splash* and *land* were found among the top five correct answers in both groups; *dangle, chase* and *wrinkle* were among the bottom five in both groups. One note worth mentioning is that all 21 participants in the static graphics group correctly associated *splash, peck* and *land* with their Chinese translations in the recognition test. These data seem to agree that the dynamic animations and the static graphics prepared in this study have facilitating effects on learning the target action verbs.

Other than the semantic explanation, a serious distraction factor was found in the dynamic animation group. Static graphics of action verbs with textual definitions help our teenage learners organize word forms and their meanings into proper mental models and help them engage in active processing. The static property reduces learning burden and reinforces meaningful learning because learners can spend more time on the word and the static graphics to make form-meaning connections. Likewise, because of their dynamic property, animations which are often employed to convey concepts of changes and processes may also help learners establish the text-visual tie. However, the dynamic property of animation somewhat distracts learners' attention from learning and attracts our teenage participants' attention to viewing the display of the animations.

An interesting classroom observation supports the processing of static graphics and that of dynamic animation. When reading the two reading passages in the computer classroom, the participants in the animation group tended to click on the target action verbs more than once so that they could enjoy the presentations of the animations. In other words, more entertainment than serious learning was observed among the participants in the dynamic animation group. Those in the static graphics group, on the contrary, seldom re-clicked on the target words. This static feature of graphics, then, helped them concentrate on the construction of the verbal-visual images in their lexicon.

Production test vs. recognition test

In the immediate posttest, discrepancies between the production test and the recognition test were observed: the participants in both the dynamic animation group and the static graphics group outperformed those in the text group in the production test; however, no group differences were found in the recognition test. A reason that may attribute to the results lies in the given alternatives in multiple-choice questions in the recognition test. The learning task in this study was receptive, rather than productive, and the receptive

task favored a receptive assessment for all groups - namely, the recognition test in the present study. The participants were instructed to read the two passages, encouraged to click on target words, and prompted to finish the tests. One aspect different from a paper-pencil activity, the learning task on a website was irreversible. In the production test, although the participants had the textual definitions as clues, it was difficult for them to spell the target action verbs correctly after only one exposure in the reading passages. Correctly spelling the target action verbs requires more attention to the form-meaning connections in learning. On the recognition test, however, the alternatives could have given the participants some clues. When taking the recognition test, the participants were asked to choose a correct answer from four alternatives to each question. The alternatives gave the participants a hint to recall the target action verbs. Much less mental efforts were made by the participants when doing the recognition test than when doing the production one. This phenomenon was well explained in Yoshii (2006). In his study, the definition-supply test results (production) showed a significant difference between picture and no-picture groups; however, statistics failed to reveal any significant difference between picture and no-picture groups on the recognition test. The author explained:

> … in the definition-supply test, learners had to rely on their memory without any hints to recall the meanings, and the addition of pictures may have helped recall the meaning by assisting the memory trace. On the other hand, in the recognition test, learners were able to see the multiple choices and use them as hints for recalling the meanings. Therefore, the presence or absence of pictorial cues did not have as much effect as they did on the definition-supply tests and, thus, minimized the effect of the addition of pictures. (p. 95)

In this study, dynamic animations or static graphics were given for neither the production nor the recognition tests. The effects of visual aids from dynamic animation or static graphics were clearly shown in the production test in the immediate posttest. However, they disappeared in the recognition test. Textual clues found in the alternatives in the recognition test were sufficient for the participants to recall the link between the form and the meaning.

Conclusion

Associations between L2 words and only L1 textual definitions in vocabulary learning are considered inferior to those between L2 words and L1 definitions with some visual aids. Research findings have agreed that learning new words with textual definitions is less effective than that with more than textual definitions, and they can be learning with photos, graphics, animation, video clips, and other possible medium. In a multimedia context, visual aids with textual definitions become focused, in particular, animation annotations may potentially possess an advantage for learning action verbs. This study aimed at investigating the use of animation annotations in learning English action verbs.

In this study, all three annotation types help vocabulary learning but their effects vary. Regardless of annotation types, the participants' scores improve significantly after the treatment, meaning that three annotation types help participants learn and acquire new words. The effects of visual aids (dynamic animation and static graphics) are shown immediately after the treatment; in addition, an advantage of textual definitions with images, dynamic or static, over text-only annotations is found. The advantages in visual aids, however, did not last longer than one week as no differences were detected in the delayed posttest. In sum, **33**

L1 definitions with images of some kind could enhance beginners' learning L2 vocabulary, and exposures to the new vocabulary glosses are required so as to ensure their retention; thus, the pedagogical implications of the present study, discussed immediately below.

Textbook writers and classroom teachers have underestimated the role of static graphics in vocabulary teaching. An informal survey of the most popular textbooks on the island showed that few illustrations, graphics or photos on students' textbooks are accompanied with vocabulary items. And, vocabulary is considered one of the crucial indexes of English proficiency in both national and on-campus tests. For students to learn and review new L2 vocabulary items, L1 definitions with visual aids, static graphics, for example, are strongly recommended. The static graphics can be in various forms. They include teachers' drawings on the board or cards, vocabulary flashcards with images provided by textbook publishers, and permitted, downloadable graphics or photos on some presentation software. All should help our L2 learners acquire new vocabulary items.

Factors that might have influenced the results of the present study include the length of the two passages, the medium for reading the two passages, and the access to the Internet. The length of the two passages (more than 500 words) was longer than that of the passages the participants usually read in their textbooks (250 for dialogues and 200 for reading passages). Although the participants didn't complain while reading, comprehending a longer passage and learning some new vocabulary items could be tiring at one sitting as the classroom teacher observed. The next factor that might have influenced the results was the medium, that is, the participants needed to read the two passages on a designated website. Such an experience of formal reading was different from what they were used to, reading English passages printed on papers. In particular, they were informed to take a test on their comprehension after the reading. Finally, the case of access to the Internet distracted some participants' attention to reading the two passages. The participants were well instructed that they should not use any resources on the Internet once they logged in the designated website and all of them followed; however, they were allowed to use the computer and the Internet after having finished all the tasks. This encouraged many to finish early and their surfing the net made those who hadn't finished envious. These are to be avoided and improved in the future studies.

For immediate future research on animation annotations, evidence in vocabulary learning and in language learning needs to be collected to attest their support for illustrating unfamiliar concepts. Culture-specific concepts can be candidates. For English learners in Taiwan, learning *rodeo* in cattle herding, *fumble* in American and Canadian football, *sauté* in culinary, to just name a few, may need more explanations or illustrations than Chinese translations. To introduce any of the three examples sometimes requires a passage of comparison and contrast (*sauté* and *pan-fry*) or even an article (about American football). Animation in these cases can be used to assist their learning. The answers to this culture-specific question may shed some light on the role of employing animation in vocabulary learning in an EFL context.

Acknowledgements

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Author biodata

Chih-cheng Lin is now an associate professor in the English Department, National Taiwan Normal University, where he offers CALL courses for graduate and undergraduate students and general English classes. His current research interests are computer-assisted language learning and EFL vocabulary learning and teaching.

Appendix A

Target Words

bow	chase	crack	creep	dangle
float	knock	land	lay	lean
peck	pout	rise	rub	shine
splash	throw	tumble	weep	wrinkle

Appendix B

Reading Passages

(All target words are in bold.)

Passage A: The Frog and the Princess
Once upon a time, there was a very beautiful princess. She was the king's youngest daughter. The king's castle was in the forest. In the forest was an oak tree. Under the oak tree was an old well. The young princess loved to play near the old well. She loved to **throw** her golden ball high into the air and then catch it again.

But one time when she threw the ball, the ball fell into the well! The princess was very sad to lose her favorite golden ball. She cried louder and harder until finally she heard, "Princess, why do you **weep** so hard? What made you so sad? If you do not stop crying, I will cry also.The princess looked up and saw an ugly old frog near here. She told everything to the frog. "I can bring back your favorite ball for you," said the frog. "But I would like to be your friend and spend all my time with you in the castle!" said the frog. The princess agreed and the frog brought back the golden ball for the princess. "Oh, thank you!" she cried and ran off the castle. The frog **chased** after her, but he could not keep up.

Soon the princess forgot about the frog. But when she sat at the dinner table with her family, someone **knocked** at the door. It was the frog coming to the castle. The princess didn't want to let the frog in. "You must keep your promise," said the king.

The frog came into the castle and enjoyed a big meal. After the meal, the frog said, "I am full and sleepy now. Take me to your room, and I'll sleep in your bed on your silk pillow." The princess hated this idea and began to cry. The king grew angry and said to his daughter, "When someone helps you, you should not hate him later! Take the frog to your room!" The princess **pouted** but did as what her father told her. The princess **wrinkled** up her face in disgust and carried the frog away. She held him with only two fingers and **dangled** him by one frog-leg.

She was a very unhappy princess. When she got into her room, she angrily dropped

him into her washbasin. Then she fell onto her bed and began to cry again. The little frog jumped up onto her bed and sat down on her pillow.

"I'm so sorry," said the princess in tears. "I will forgive you," said the frog, "if you will give me a good-night kiss." The princess didn't like the idea of kissing the frog. But because she felt sorry for him, she decided to anyway. She **leaned** over and gave the frog a little kiss right on top of his little froggy head. And then…poof!

She **rubbed** her eyes and just couldn't believe her eyes. Standing in front of her was a princess! The princess **bowed** and smiled at her. He said, "I'm the prince Antonio. I was under a wicked spell, and your kiss set me free!"

Prince Antonio and the beautiful princess fell in love. They were married under the old oak tree next to the well in the forest. They carefully kept the golden ball in a golden box, and they lived happily ever after.

(554 words)

Passage B: The Ugly Duckling
It was summer in the country. Among the dock leaves, on her nest, sat a duck waiting for her eggs to hatch. Soon, the eggs began to **crack** and, one by one, the ducklings poked their heads out. Before long, all the eggs hatched except the biggest one. The duck sat a little longer, until out **tumbled** the last of her chicks. But when she looked at him, she said, "Oh, dear! You're so big and ugly."

The next day was warm and sunny, so the duck took her new family down to the river. She **splashed** into the water and, one by one, her ducklings followed her. Soon all of them were swimming beautifully, even the ugly grey one. Next the ducklings went into the duck yard. "Stay close to me," warned their mother. The other ducks thought the ducklings were beautiful – all except the big ugly one.

The ducklings stayed in the duck yard. But the ugly duckling was very unhappy there. The older ducks **pecked** at him and laughed. He had nowhere to hide, so one day he ran away. The poor little ugly duckling ran away from the great marsh. He ran and ran over fields and meadows. The wind blew and the rain rained. The duckling was cold, wet and very tired.

Just as it was getting dark, the duckling found a little house.

The house was very old and the door was falling off. This left a gap just big enough for the duckling to **creep** inside, out of the cold.

An old woman lived there. She had a cat that purred and a hen that **laid** eggs. She found the cold, starving little duckling in the morning.

The old woman looked at the duckling and said, "You can stay. Now we will have duck eggs to eat, too!" So the duckling stayed. But he didn't lay eggs. "You can't lay eggs, right? Then you must go," said the cat and the hen. So the ugly duckling was alone once again. He walked in the marshes and **floated** on the river, and everywhere he went, all the birds and animals said, "How big and ugly you are."

Winter was coming, but the duckling still had nowhere to stay. One evening a flock of birds flew in the sky. They were beautiful white swans with long necks. "I wish I was like that," the duckling said sadly to himself.

It became colder and the ground froze. The duckling couldn't find food. After some lonely days, the duckling finally found a safe hiding place. There he stayed for the rest of the winter. Then, after many long weeks, the warm spring sun began to **shine** again. The

duckling spread his wings – they were strong wings now. Suddenly he **rose** from the ground and flew high into the air.

Down below, three beautiful swans were swimming on the river. The duckling flew down to look at them. When he **landed**, the lonely bird saw his own reflection in the water.

He wasn't an ugly duckling at all! During the long winter he grew into a beautiful white swan. The other swans looked at him and admired his grace and beauty.

"Come with us," they said.

And he did!

(541 words)

Appendix C

Production Test and Recognition Test

Production Test
(Correct answers are in parentheses.)

拼寫出下列英文單字。

k__ __ __k	中文：敲	(knock)
b___w	中文：鞠躬	(bow)
l__ __n	中文：彎下身子	(lean)
d__ __ __ __ __e	中文：懸吊地拿著	(dangle)
c__ __ __ e	中文：追趕	(chase)
t__ __ __w	中文：丟擲	(throw)
r__ b	中文：摩擦	(rub)
c__ __ __ y	中文：攜帶	(carry)
w__ __ __ __ __e	中文：皺眉	(wrinkle)
p__ __ t	中文：噘嘴	(pout)
w__ __ p	中文：哭泣	(weep)
y__ __n	中文：打哈欠	(yawn)
h__ __ __h	中文：孵蛋	(hatch)
s__ __ __ __ h	中文：濺起水花	(splash)
l__y	中文：下蛋	(lay)
l__ __ d	中文：降落	(land)
t__ __ __ __ e	中文：翻滾	(tumble)
c__ __ __ k	中文：破裂	(crack)
s__ __ __ e	中文：照耀	(shine)
c__ __ __ p	中文：爬行	(creep)
f__ __ __ t	中文：漂浮	(float)
p__ __ k	中文：啄	(peck)
c__ __ __ __ __ __t	中文：收集	(collect)
r__ __ e	中文：上升	(rise)

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Recognition Test
(Correct answers are in **bold**.)

請選出相符的中文意思。

chase (chased)	(1)跳躍	**(2)追逐**	(3)丟擲	(4)攜帶
wrinkle (wrinkled)	(1)閃耀	(2)流淚哭泣	(3)懸蕩	**(4)皺眉**
yawn (yawned)	(1)鞠躬	(2)摩擦	(3)墜落	**(4)打呵欠**
lean (leaned)	(1)敲	(2)照顧	**(3)屈身**	(4)搬運
throw (threw)	**(1)投擲**	(2)離開	(3)接住	(4)鞠躬
knock (knocked)	(1)發生	(2)填滿	**(3)敲**	(4)挖掘
rub (rubbed)	(1)漂浮	**(2)摩擦**	(3)跳躍	(4)捉住
carry (carried)	(1)趕上	**(2)搬運**	(3)傷心	(4)滾動
weep (wept)	**(1)流淚哭泣**	(2)小憩片刻	(3)打;擊	(4)凝視
bow (bowed)	**(1)鞠躬**	(2)蹲下	(3)摩擦	(4)皺眉
dangle (dangled)	(1)心煩意亂	**(2)懸蕩**	(3)帶來	(4)抱住
pout (pouted)	**(1)噘嘴**	(2)大叫	(3)遵守	(4)追逐
land (landed)	(1)快跑	**(2)降落**	(3)走路	(4)飛行
splash (splashed)	**(1)激起水花**	(2)使激動	(3)爬;蠕動	(4)沉入
float (floated)	**(1)漂浮**	(2)沉沒	(3)敲擊	(4)屈身
tumble (tumbled)	(1)攪動	(2)懸吊	(3)摩擦	**(4)滾下;墜落**
hatch (hatched)	(1)激怒	(2)破裂	**(3)孵化**	(4)等待
shine (shined)	(1)使生氣	(2)使難過	(3)上升	**(4)照耀**
crack (cracked)	(1)離開	**(2)裂開**	(3)跳躍	(4)收集
peck (pecked)	(1)摩擦	**(2)啄**	(3)躲藏	(4)濺起水花
creep (crept)	**(1)爬;蠕動**	(2)哭泣	(3)降落	(4)發怒
lay (laid)	(1)啄	(2)睡覺	(3)進食	**(4)下蛋;產卵**
collect (collected)	(1)掉下	(2)裂開	(3)使生氣	**(4)收集**
rise (rose)	**(1)上升**	(2)爬;蠕動	(3)孵化	(4)漂浮