【附件三】教育部教學實踐研究計畫成果報告格式(系統端上傳 PDF 檔)

教育部教學實踐研究計畫成果報告(封面)

Project Report for MOE Teaching Practice Research Program (Cover Page)

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以嵌入式線上字彙學習導入科技英文閱讀課程
科技英文閱讀(一)(二)

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一. 報告內文(Content)(至少 3 頁)

1. 研究動機與目的(Research Motive and Purpose)
請描述所選擇研究議題的問題挑戰與背景、教學實務現場遇到之挑戰以及該議題
的重要性與影響力。

1.1. Research Motive

　　Students at universities in Taiwan need to read a large amount of literature and textbooks in English. However, many students' reading ability is very poor. They read in a very laborious way. While English instruction has been introduced already to elementary schools, during the last decade, initial reading rates in my classes have declined for the poorest readers from 20 words per minute (wpm) some 15 years ago to now even less than 10 wpm. Students' biggest obstacle was and still is their small vocabulary size with on average one to two unknown words per each line in the readings so that guessing meaning from context is not an option. Furthermore, in their fields of study, they have to read quite a large amount of academic texts and not the graded readers they read in their regular English classes, such as Freshman English.

　　On the other hand, initial reading rate of the few fast readers in class has increased from around 80 wpm to well above 100 wpm during the last 15 years, with some even reaching more than 200 wpm. Students' vocabulary sizes as measured by http://my.vocabularysize.com last semester varied between 1000 and 10000 words with an average of 2600. Teaching classes of more than 70 students that vary in their English ability to this extent is extremely challenging. However, when reading texts in class, 1/3 of the students felt bored as they had finished reading well before the rest of the class and another 1/3 felt bored because they did not understand much. Thus, I started to group students according to their reading rate and let them work through the texts in their respective groups. While fast readers will focus on developing their reading skills in the class, the vast majority of the students first needs to develop their vocabulary for better comprehension and improving their reading rates. When teaching students to repeat reading to increase their reading rate, I realized that this also improved their vocabulary knowledge (Luo, 2007). Thus, I started to teach students how to evaluate their own results when reading so that they can realize their improvements achieved during a semester. This has led to very positive feedback from the students.

　　However, applying these findings to a Freshman English reading class, students were not able to improve their reading rate as much as students in the 'English Readings in Science and Technology' classes. When investigating this in detail, my colleague and I realized that the problem lay in the increase in difficulty of the reading passages in the textbook used. The difficulty ranged between 5.9 and 13.4 points on the Flesh-Kincaid grade level, an increase of more than 6 points over the two semesters. Consequently, students' improvements were only visible when comparing reading rates with those of students in the control group or when adjusting reading rates for readability (Luo and Shen, 2015).

　　Having these results in mind, I developed a textbook for the 'English Readings in Science and Technology' class (Luo, 2017), that includes the repeated reading technique but where readability only varies between 9.0 and 13.2 over the 2 semesters that the textbook is used. In addition to an introduction to the repeated reading methodology, it also includes development of reading skills such as activating previous knowledge, predicting, skimming, main/supporting ideas, inferences, cause and effect, guessing meaning and skipping words, summarizing, etc. Furthermore, vocabulary skills such as prefixes/suffixes, dictionary use, scientific phrases, unspecific amounts, etc., and academic uses such as citations and references are also included. Finally, it also contains a glossary of the more challenging vocabulary items that might not be

found in a general English dictionary or that have different meanings in the science and technology fields.

In my Spanish classes, I have started to introduce Computer Assisted Language Learning (CALL) into my teaching. In a blended learning approach, I used the platform Conjuguemos (https://conjuguemos.com/) where I created over 200 exercises during the last four years that can be used in conjunction with the two textbooks I have written, ¡Hola! Nivel A1, (Luo & Hsieh Justiniano 2018, revised edition) for my Spanish 1 and 2 courses and ¡Hola! Nivel A2 (Luo, 1013) with the revised edition in preparation) for my Spanish 3 and 4 courses. In addition to Conjuguemos, we are now also using Quizlet (https://quizlet.com), as this platform is much better for vocabulary learning compared to Conjuguemos which is better suited to check one's achievements or understanding of the learning content.

With these positive results in the Spanish classes, I extended online learning to my 'English Readings in Science and Technology' courses. As Quizlet can also be used on mobile devices, it is very much suited for use in our overly large reading classes that saw up to 120 students taking the course in the academic year 106. One of the problems associated with repeated reading is that students need to have their textbooks and their logs where they annotate unknown or forgotten words at hand when rereading. Going mobile, logs are only needed in class, while students can access Quizlet wherever and whenever they want. Thus, implementing spaced repetitions is far easier. Furthermore, while the repeated reading technique only includes reading the vocabulary in context and writing down the unknown words, when combining the technique with Quizlet, far more study options are possible, such as flashcards, dictations, translations and game based learning.

1.2.Purpose of the study

The purpose of using the online platform Quizlet for vocabulary learning in class were:

1. To get students familiar with online learning.
2. To let students experience the use of different learning techniques offered by the platform in combination with spaced repetitions.
3. To teach students how to evaluate their own progress in order to motivate them to later also apply what they have learned to their other fields of study.

The research questions formulated in this study were:

1. Are productive learning modes in Quizlet superior to passive learning modes?
2. Do the results hold true for students of all proficiency levels?
3. Is the use of Quizlet for vocabulary learning superior to students' own study techniques?
4. Are there differences between the use of Quizlet and the repeated reading technique?
5. How does each learning technique influence students' reading rates?

I normally teach one class of the course Readings in Sciences and Technology in the first semester, and two classes in the second semester. Thus, I initially investigated the optimal use of Quizlet in the first semester (107-1) and wanted to compare the use of Quizlet and students own study techniques to the repeated reading technique that I have used for several years now in the second semester. However, in the second semester, I was given only one class of the course Readings in Sciences and Technology. Consequently, I could only compare Quizlet against students own study techniques. However, as I have the results of previous semesters, when I taught students the repeated reading technique for vocabulary learning, I contacted students who had taken the course in the academic year 106 and was able to compare results from those students who gave permission and fulfilled the requirement of not having taken any other English course with results of this research project (107-2).

2. 文獻探討(Literature Review)

請針對本教學實踐研究計畫主題進行國內外相關文獻、研究情況與發展或實作案例等之評析。

2.1. Online and mobile learning

Online and mobile learning have become important research topics during the last decade and according to Ma (2017) are becoming an indispensable tool for facilitating L2 learners' learning. Tozcu and Coady (2004) reported that the learning of frequent vocabulary through CALL improved reading comprehension and speed of word recognition. Li and Kirkup (2007) still found gender differences within different cultural contexts with men being more self-confident about their computer skills than women and British students being more likely to use the computer for studying. In a study on perceptions of the web-based platform Conjuguemos for learning Spanish, Luo (2016) reported that students responded positively to the use of the learning platform in class. She found that although female students were less enthusiastic about using the computer for learning compared to male students, they reported to use the platform outside the classroom more often than their male classmates did. Similarly, Lee, Yeung, and Ip (2016) did not find any gender differences in computer use for language learning. This may be related to the findings of Kim, Rueckert, Kim, and Seo (2013) who reported that students' willingness to use new technology for language learning increased once they felt more comfortable using the technology and experienced its usefulness for learning.

Son (2007) noted that although students viewed online learning as a valuable tool, they complained about a lack of interaction and responses from the teacher. Different from Son's study (2007), the online learning component in Luo's study (2016) was part of the regular class and the teacher present during online study, which enabled one-on-one tutoring during online learning sessions. As she pointed out, the teacher being available during online sessions was important due to the shyness of the students, especially female students, who would not actively ask for help from the teacher. Instead, the teacher would be the one to seek out students who seemed to struggle.

Mobile technology such as tablets and mobile phones is also an important tool to foster learner autonomy by allowing for ubiquitous learning in informal settings (Chen 2013, Hsu, 2013) and has been shown to improve students' grammar and writing (Li & Hegelheimer, 2013), reading and spelling (Attewell, 2005), vocabulary (Bower & Rutson-Griffiths, 2016), and verb conjugations (Castañeda, 2016). However, as Lai and Gu (2011) pointed out, more training of students is needed so that they actively use technology out-of-class to enhance their learning. Seibert, Hanson and Brown (2019) showed that the use of the vocabulary learning app Anki (https://apps.ankiweb.net/) was positively related to students' performance in a Spanish class. Nevertheless, students in their study were reluctant to use the app, as they did not enjoy using it a lot.

2.2. Vocabulary size and reading comprehension

As Nation (2001) has stated, unknown vocabulary slows down reading due to difficulties in text comprehension. Laufer (1992) reported that a coverage of 95% of the vocabulary is needed for readers to be able to understand a text. Chen (1998) reported that students at a Taiwanese university had a passive vocabulary knowledge of only between 2000 and 3000 words, thus similar to my own findings in class (see above). Other long-term observations of my students' initial percentage of unknown words in the texts read in the course 'English Readings in Science and Technology' (unpublished data from this course over more than a decade) have shown that students have a coverage of only 90% to 92%. This is not high enough to guess meaning from context or skip unknown words. A number of studies have demonstrated this relationship

between vocabulary size and reading comprehension (Alderson, 2000; Baleghizadeh and Golbin, 2010; Joshi, 2005; Joshi and Aaron, 2000, Manyak and Bauer, 2009, Martin-Chang and Gould, 2008; Ricketts, Nation, and Bishop, 2007; Zhang and Annual, 2008) as vocabulary knowledge facilitates decoding (Qian 2002). Not surprisingly, a positive correlation exists between tests on vocabulary size tests and reading comprehension (Laufer, 1992; Pringprom and Obchuae, 2011). This elucidates the importance of vocabulary learning to improve comprehension and reading rates.

1.3. Learning techniques

At Taiwanese high schools, a teacher centered learning approach where the teaching and learning of single topics is confined to a short period of time, is still the norm and students' only goal is to reach higher scores in the university entrance exams. However, in this rapidly changing world, students need to be able to initiate and manage their own learning instead of just doing what their teachers tell them to do. Although some students use effective learning strategies, others use relatively ineffective ones (e.g., looking up the answer in the answer key before doing an exercise). To become sophisticated life-long learners, students need to obtain a basic understanding of the encoding and retrieval processes of our memory. They also need to know which learning activities and techniques support long-term retention and how to monitor their progress in order to realize what works best for them.

One of the most popular learning strategies is massing – especially cramming before exams – (Taraban, Maki, & Rynearson, 1999). Many students believe that it is an effective way to learn (Kornell, 2009; Logan, Castel, Haber, & Viehman, 2012; Simon & Bjork, 2001) as they may receive good results on a test because cramming or massing may give a good recall during a short retention interval. However, this information will be forgotten after a short while (e.g., Bjork & Bjork, 2011; Roediger & Karpicke, 2006). For example, when taking advanced language classes, cramming in the basic classes leads to the common phenomenon that during the summer or winter break students seem to forget all they have learned in the previous semester and most of the vocabulary needs to be relearned. Students also perceive cramming or massing to be more effective than spacing (e.g., Kornell & Bjork, 2008, Simon & Bjork, 2001). As processing during study is easier (or more fluent) for massing than spacing, they may assume that easier processing also means better processing (Alter & Oppenheimer, 2009).

Students should start studying earlier and space their learning sessions over several days so that revising the night before the exam will be sufficient (e.g., Bahrick, 1979; Kornell, 2009; Rawson & Dunlosky, 2011). However, retention over an even longer period requires that students space their learning over several months as the retention interval depends dramatically on the gap between the first and the last learning sessions (Carpenter, Pashler & Cepeda, 2009; Cepeda, Vul, Rohrer, Wixted & Pashler, 2008).

One factor influencing ineffective learning behavior is that students can easily be overconfident concerning their learning achievements as current performance or the sense of familiarity (fluency) with the learning materiel may be influenced by recency of learning, predictability of the answer, and other cues that might be present during studying but will be absent during a test. Koriat and Bjork (2005) referred to this overconfidence as an 'illusion of competence'. A high fluency is often considered to equal a high rate of improvement. However, this is not necessarily the case. Other activities such as spacing and interleaving, generating answers, testing oneself, and varying the conditions of learning – also known as desirable difficulties (Bjork, 1994) – seem to hinder learning while they actually enhance long-term retention (Bjork & Bjork, 2011; Carpenter et al., 2009; Cepeda et al., 2009; Lee, 2012; Simon & Bjork, 2001; Taylor & Rohrer, 2010). Dunlosky, Rawson, Marsh, Nathan, and Willingham (2013) awarded the highest utility ratings to practice testing and spaced repetitions, as they are easy to implement and result in positive effects.

Kornell and Bjork (2007) as well as Hartwig and Dunlosky (2012) asked students if they had been instructed on the study methods they used and 80% and 64% of students answered 'no', respectively. However, students' retention over a longer period is far from satisfying. This implies that students do not acquire learning skills by themselves and are not able to manage their learning on their own just through their prior experiences. Nevertheless, Dunlosky et al. (2013) pointed out that most teachers also have not been instructed on efficient learning techniques either.

Due to these findings, this research wants to encourage students to use technology to enhance their learning and to teach them not only effective learning techniques but also how to evaluate their progress in order to make sound decisions concerning their learning. Therefore, this research tried to answer the research questions stated in 1.2.

3. 研究方法(Research Methodology)

The course is a one-semester, two-hour per week English for Science and Technology course. While open to students from all departments and all years, the majority of students typically taking the course are undergraduates in their final year of study coming from different departments. In both semesters, students were asked to volunteer for this study. However, to better control for other factors that might influence the outcome of the study, only those students who were not taking any other English classes that semester were included in the study. Students were assigned to groups of four students according to their English proficiency after taking a reading test at the beginning of the semester, which included reading rate and vocabulary knowledge. As 2 and 3 students dropped the course before the final evaluation, this resulted in 54 and 53 students taking part in the first and the second semester, respectively.

Over the semester, all students read a new reading passage each week. The length of the passages they read depended on students' reading rates, as initial time for reading was set to 20 minutes. This will generally result in 20 to 30 unknown words per reading independent of the length of the reading passage read at that time. Students used their smartphones to control for reading time and for looking up unknown words in their preferred online dictionaries. They annotated unknown vocabulary items and their translations on a log sheet while reading. They could ask the teacher for clarifications if they did not understand the text anytime necessary during reading but had to stop timing until they continued reading.

For each reading passage, students in the Quizlet groups created learning sets on the learning platform Quizlet (https://quizlet.com) that contained their unknown words of the respective passage. Then, they studied these words on Quizlet over a two-day period using different study modes such as flashcards, translations, dictations, matching word and definition, or a test mode which combines translations, multiple choice, matching items and true/false questions. Due to results from the first semester, students were asked to study a set at least 5 times on a day that required studying that respective set and again on the following day in the second semester.

In the first semester, students were asked to first try out the different modes and then decide in their respective groups who would only use productive learning modes and who would use only passive learning modes. Productive learning modes are those where students have to write definitions or translations of the terms in their sets while the passive learning modes include flashcards, true and false questions and matching items. When using the latter learning modes, just watching the definition or choosing the correct one is sufficient, no active writing is involved. As two students per group used either productive or passive learning modes, influence of learning mode could be determined not only for students in general but also for lower and higher English proficiency. Students in the second semester were made aware about the results of the first semester in order to encourage them to use productive modes.

Instead of using Quizlet, students in the control group of the second semester studied their vocabulary in their own ways, but kept records about their modes of learning on their online log sheets. They uploaded a recording of themselves reading the words, or a photo of the paper where they had written down the new words, had made mind maps, or whatever other way they had studied the vocabulary to the school's learning management system 'iLearn 2.0'. They also studied their vocabulary on two days. However, writing down the words several times was the option mostly used. All students uploaded proofs of their vocabulary studying onto iLearn 2.0.

One week later, all students reread the same reading passage they had read the week before, annotating time needed and unknown words on their log sheets. Again, students studied their vocabulary sets of the respective reading passage on two days, either on Quizlet (first semester: all students; second semester: Quizlet group) or according to their preferred way of studying (second semester: control group). Three weeks later, they finished the third reading of the respective texts, again annotating time needed and unknown words and practiced their respective vocabulary again on two days. Over each semester, students completed all three readings of the first 10 reading passages while the remainders were read only twice before the end of the semester. The first reading passage was again read at the end of the semester, i.e. in week 15 to evaluate vocabulary learning and reading rate changes over an even longer period.

To avoid the problems from an earlier study (Luo, 2018) of a too long time at the beginning of the study to obtain reliable data from students concerning their use of Quizlet, from the first week on, students received feedback through the app Remind (https://remind.com) after uploading their data. If they had not uploaded their data by 5 pm on the days of class and/or the following day, they were notified of the missing homework so that they still had enough time to finish on time. Consequently, early on reliable data were obtained.

Methodology for the repeated reading technique was comparable, but in order to study the vocabulary, students reread the same text repeatedly on the first and the second day, whereby time needed was not recorded in the repeated readings of the respective week. Students were asked to only record those words the meaning of which they had forgotten again on the back of the log sheet and look those words up immediately while reading. They read as often as they needed until they could read the text without looking up any word any longer. In general, they needed 4 to 6 reading repetitions to achieve this goal. Evaluations were done after one week and after four weeks just as in the other groups and vocabulary again studied through rereading on two days.

Levene's test was used to test for homogeneity of the variances. To test for significant differences, T-Test or ANOVA were calculated depending on the number of groups included in the test. For significant F values in ANOVA, Tukey-Kramer test for unequal sample sizes was used as post hoc.

Students kept reading logs about their study progress and study behavior (day of reading, amount of reading in 20 minutes (first reading), time needed for the same reading one week and one month later, vocabulary items they did not know or did not remember during each reading). These logs served as a personal confirmation for students where they could trace their progress and provided the data for this study.

At the end of the semester, students were taught to evaluate their log sheets in order to observe their personal study progress as this can help students to take better decisions concerning their learning techniques. Furthermore, it was used as one example in the discussion on how students can evaluate what they are doing, no matter what they are learning or what techniques they are using. In addition, average results for the two groups of each semester were discussed with the students of the respective semester.

4. 教學暨研究成果(Teaching and Research Outcomes)
(1) 教學過程與成果

4.1. Productive vs. passive learning modes

Figure 1 shows the average differences between the use of productive and passive learning modes for the whole semester. Students who used the passive learning modes needed more repetitions for each set before they could remember all vocabulary items. However, although they studied more often, they forgot a higher percentage of vocabulary items in each set. Thus, productive study modes were more effective compared to passive learning modes.
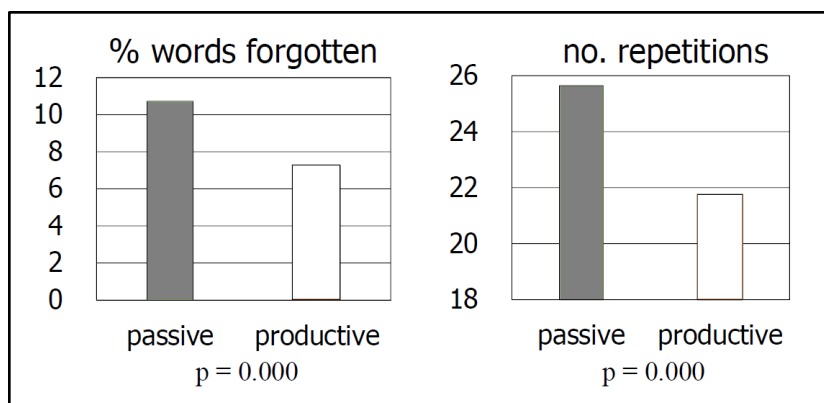

Figure 1: Differences between learning modes

However, when analyzing the data by English proficiency groups, a different pattern emerged. The lower the proficiency group, the higher the differences were between learning modes for percentage of words forgotten again (Figure 2) as well as for number of repetitions done to achieve learning (Figure 3). Students needed about 20 repetitions to study their vocabulary well. Thus, for students whose English proficiency is relatively high, the learning mode they chose did not matter. They did the same number of repetitions and remembered the same percentage of vocabulary studied. However, for students with lower English proficiency the use of learning mode was of great importance. When using productive learning modes, they were able to remember as high a percentage as higher proficient students with the same number of repetitions for studying.
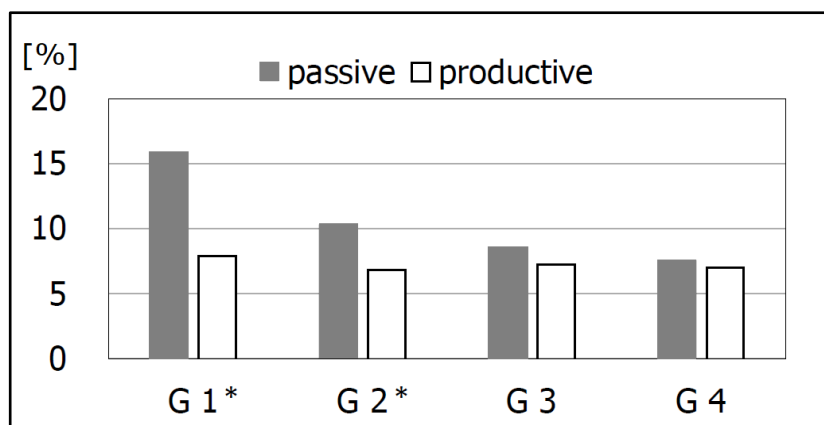

Figure 2: Differences by group (percentage of words forgotten) again
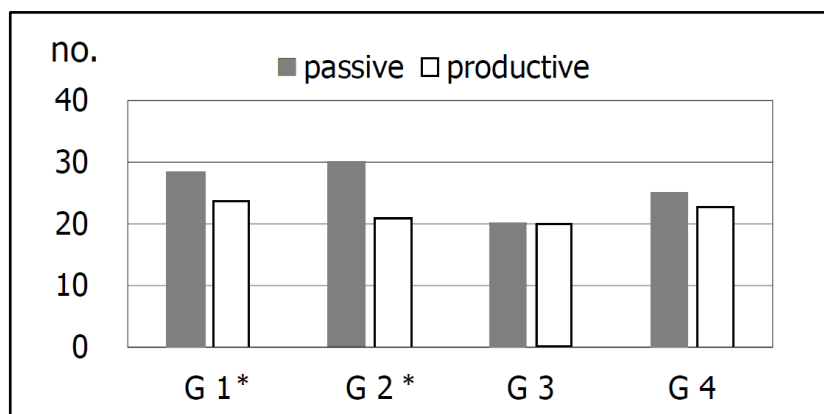*: differences between learning modes are significant ($p < 0.001$)

Figure 2: Differences by group (number of repetitions done)
*: differences between learning modes are significant ($p < 0.001$)

Consequently, in the second semester, students were asked to study their vocabulary 5 times on the first and on the second day each after reading a reading passage but to study more often if they felt this to be necessary. This would allow them to study at least 20 times before the final evaluation in the fifth week. However, after the evaluation, they were asked to study the respective sets once again five times on two days to prolong the time they would remember the vocabulary even further. In the future, I plan to collect data from students who have taken both courses (first and second semester) in order to see if vocabulary items they learned in the first semester will reappear and to what degree after having used Quizlet for almost a year. This year, only four students were able to take both classes as it is difficult to get in and one class had to be canceled due to requirements on part of the Department of Foreign Languages and Literature.

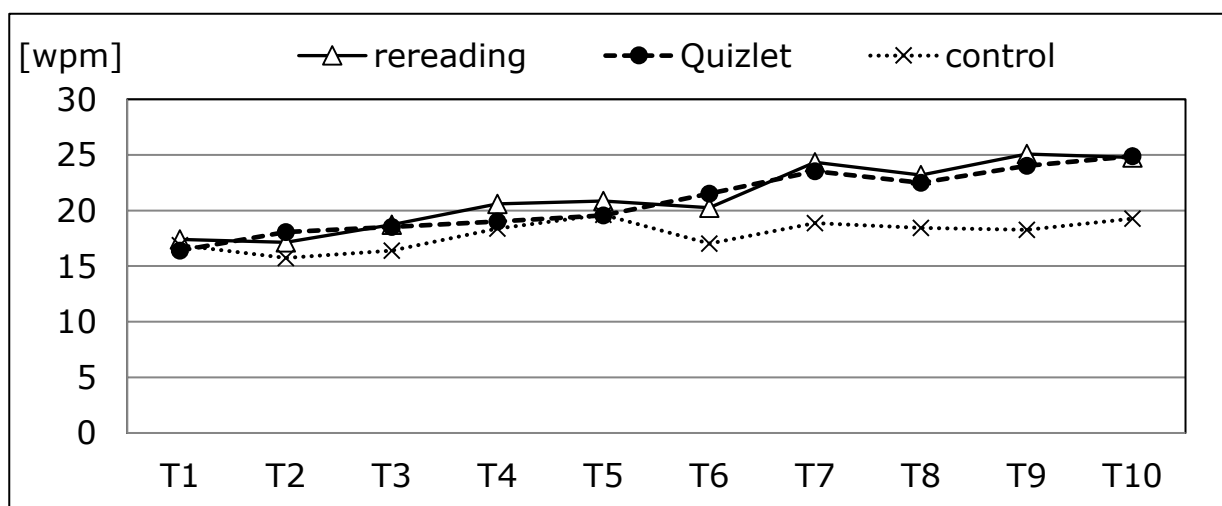4.2. The influence of learning technique on reading rates:

Figure 4: Reading rates in wpm for the first reading of each text

Results comprise only the first 10 readings as students read those readings three times, because there was not enough time to finish the third reading of the remainders before the end of the semester. Students in all three groups increased their reading rates over the semester (Fig. 4 – Fig. 6). Reading rates in words per minutes (wpm) were low for the initial readings of each week (Fig. 4) because reading time also included time to look up vocabulary while reading. They are thus not representative for reading rates of texts that are at a difficulty level appropriate for each student. Thus, the second reading (Fig. 5), when students had studied the vocabulary and were familiar with most words, gives a much more precise representation of increases in reading

rates over the semester. Nonetheless, even initial reading rates increased significantly from 16.4 wpm and 17.4 wpm in the first text (T1) to 24.9 wpm and 24.8 wpm in the last text (T10) in the Quizlet group and in the rereading group with $p < 0.000$ in both groups, respectively. However, differences between T1 and T10 were not significant in the control group ($p = 0.088$) and starting with T9, differences between the control group and the two other groups were significant ($p < 0.05$), while there were no significant differences between the Quizlet and the rereading group.

The increases in reading rates ($p < 0.000$ for all three groups) between first reading and second reading of the same text were due to less time needed to look up words. Firstly, because they still remembered most of the new words after one week which resulted in only about 0.2 words per line students had forgotten a week later. Another reason is that they just needed to find the vocabulary items on their log sheets, which was much faster than looking up words in a dictionary. However, students also increased their reading rates over the complete semester. Students in the Quizlet group almost doubled their reading rates from 43.7 wpm (T1) to 80.6 wpm (T10) and from 58.0 wpm (T1) to 95.4 wpm (T10) in the second (Fig. 2) and the third readings (Fig. 3), respectively. Students in the rereading group increased reading rates from 43.6 wpm (T1) to 73.9 (T10) and from 52.4 wpm (T1) to 83.6 wpm (T10) in the second (Fig. 2) and the third readings (Fig. 3), respectively. Differences to the Quizlet group were not significant for any of the second or the third readings.
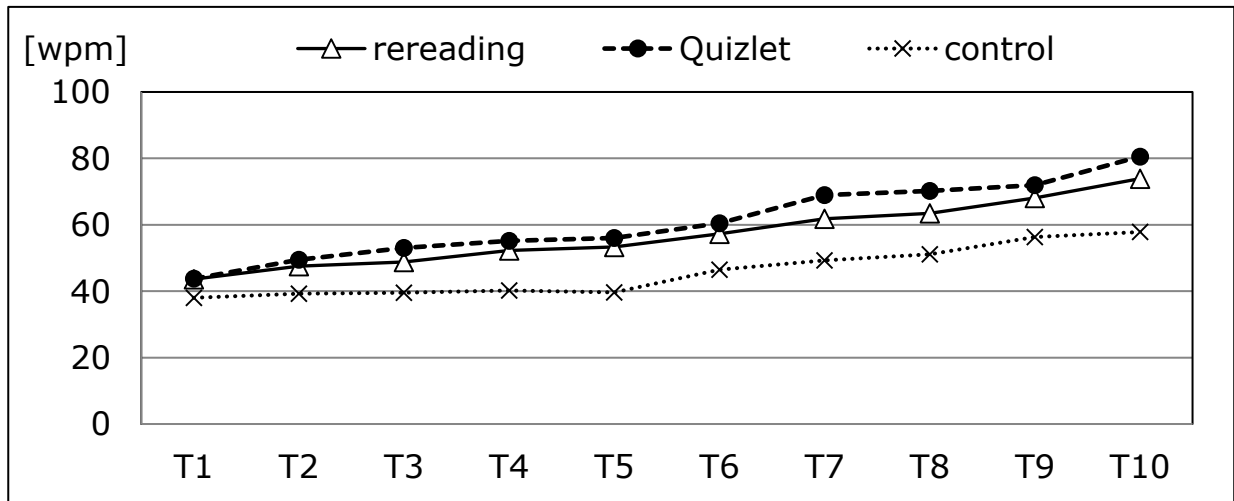

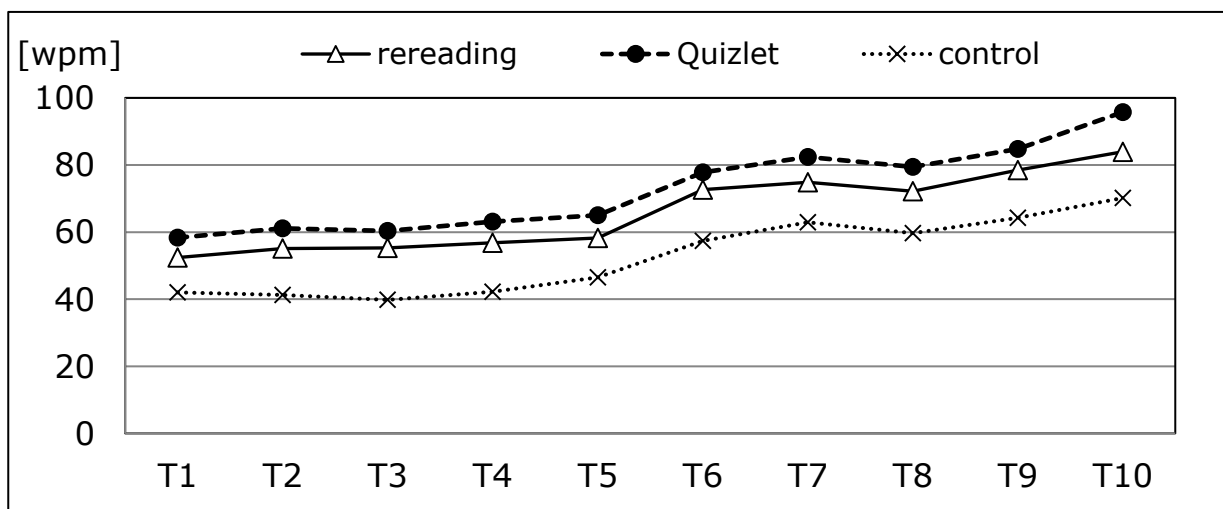Figure 5: Reading rates in wpm for the second reading of each text

Figure 6: Reading rates in wpm for the third reading of each text

Students in the control group also increased their reading rates significantly (p < 0.000) in the second and third readings, but to a much lower extend (Fig. 5 & Fig. 6). Starting from T3, reading rates in the second readings were significantly lower compared to reading rates in the Quizlet group (p < 0.05) and in the third reading, differences between these two groups were significant throughout the semester. While reading rates in the rereading group increased similar to the Quizlet group and differences were not significant, differences to the control group were also not significant due to a much higher variability in the rereading group, which led to a higher standard deviation compared to the Quizlet group.
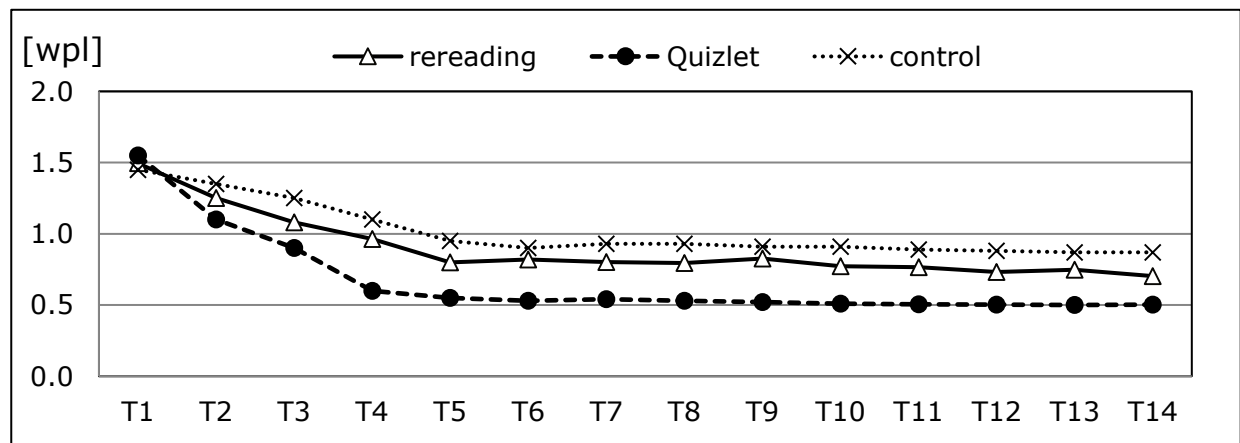
4.3. Vocabulary retention

Figure 7: Number of unknown words per line in the first reading of each text

Figure 7 shows the numbers of unknown words per line when a text was read for the first time. In the Quizlet group, the amount of new words in a text decreased from 1.52 words per line in the first text to 0.50 in the last text. The drop in the first five weeks in all three groups might be due to students relearning vocabulary they had learned at high school but had forgotten again. Thus, when reappearing in later texts these high frequent words would not reappear in students' reading logs while the percentage of low frequency words was more stable. These findings correspond with findings from Tozcu and Coady (2004). However, these data still need to be further analyzed.

On the other hand, the number of unknown words did not drop to the same extent in the other two groups. However, differences between the rereading group were neither significant to the control nor to the Quizlet group (except for T4), while differences between the control group and the Quizlet group were significant from T3 on (p < 0.05). In addition, the percentage of words forgotten again after one week and one month differed significantly (Table 1). One explanation for better word retention in the Quizlet group could be that the use of the app Quizlet allowed students to better control the extent to which they had learned the new words. Rereading and rewriting the new items several times might have led to a familiarity with the learned content that might have induced an illusion of competence (Koriat & Bjork, 2005). The use of Quizlet, however, allows for self-testing. In the learning modes learn, spell, and write, a set is only marked as finished, if all items have been correct twice. As a result, students in the Quizlet group could better predict the extent to which they had learned the vocabulary well. Thus, this study supports findings from Seibert, Hanson and Brown (2019) that vocabulary apps are beneficial for learning. However, satisfaction with the app as expressed orally in class was much higher in this study, probably because students were able to see their progress in the learning logs and because Quizlet provides different learning modes so that students can diversify their learning.

Table 1: Average percentage of words forgotten again after one week and one month

% words forgotten again	Experimental		Control		Rereading	
	Mean	SD	Mean	SD	Mean	SD
(week)	22.65	11.49	33.07	16.80	23.45	14.99
(month)	11.50	9.04	19.64	12.49	20.99	13.35
Significance (p)	0.000		0.000		0.004	

Table 2: Changes in the number of unknown words per line (wpl), first reading passage
same letters indicate no significant differences

Group		Week 1	Week 2	Week 5	Week 15	p (w5*w15)
Experimental	wpl	1.498[a]	0.138[a]	0.098	0.109[a]	0.168
Control	wpl	1.507[a]	0.484[b]	0.239	0.379[b]	0.002
Rereading	wpl	1.509[a]	0.223[ab]	0.164	0.181[a]	0.145

When comparing the number of forgotten words in T1 over the whole semester (Table 2), results show that the decrease in the number of unknown words was higher in the Quizlet group compared to the control group. In contrast, results in the rereading group again were significant to neither the Quizlet group nor the control group as indicated through the letters ab. However, just as in the Quizlet group, students in the rereading group were able to keep their low level of unknown words, while students in the control group started to forget words they had learned before so that there were significant differences between week 5 and week 15 only in the control group.

The difference in vocabulary learning techniques used seems to be the responsible factor for differences in increases in reading rates between the three groups, as no extra English instruction outside this class had been controlled for when selecting participants. Furthermore, initial reading rates in T1 were the same in all three groups. During the semester, students only studied between 200 and 300 new words. Thus, the number of new words learned alone does not explain why students increased their reading speed over the semester to such an extent. Data analyzed so far reveal that students' word lists in all three groups contained more than 50% of the most frequent 3000 words at the beginning of the semester – high frequency words students were supposed to have learned at high school. These words are an important part of each text. Analysis of these data is still ongoing but a better retention of high frequency words might have been a crucial factor in increasing reading speed to a greater extend in the Quizlet group compared to the control group.

4.4. Summary

Productive learning modes were superior to passive learning modes except for students with higher English proficiency. Thus, it is important to make students aware of this problem and encourage students to use productive modes, especially those with lower English proficiency.

Students in all groups increased their reading rates over the semester. The use of Quizlet was superior to students own learning mode, probably because rote learning techniques such as repeatedly writing new vocabulary items is prone to illusion of competence so that students think they have mastered what they are studying while this is actually not the case. Learning modes that include testing oneself are offered by the learning platform and can prevent such an illusion of competence.

While the repeated reading technique resulted in lower reading rates and higher percentage of words forgotten again, differences to the Quizlet group were not significant. However, while

reading rates were higher in the repeated reading group compared to the control group, and percentage of words forgotten again lower compared to the control group, again, these differences were not significant. A reason may be the much higher standard deviations in the repeated reading group that prevented differences to become significant. It may be that the lack of control if repeated readings had actually been done outside class led to some students just filling out the log sheets before class when they had forgotten to do their homework. In former years when the rereading technique had been used to a great extend, some students had been caught cheating in this way. This may have led to the higher than expected standard deviations. However, this cannot be verified. Still, repeated reading just as the use of Quizlet were superior in vocabulary retention so that after several months only students in the control group had started to forget vocabulary items they had learned at the beginning of the semester.

(2) 教師教學反思

While I had expected Quizlet to be far more effective for vocabulary learning than the rote learning techniques students normally use, I actually had expected to see much more significant differences between the repeated reading and the control group. Repeated reading introduces a productive mode of learning because students need to memorize the spelling of the word they had just looked up on the list of the 'first reading' as they need to add it to the list on the back of the log sheet. However, it might be that in the repeated reading group some students cheated on their log sheets and just filled them out without actually having reread the reading passages. This could not be controlled for, as it was important to spread rereading over two days in order to incorporate spaced repetitions. This kind of cheating may have influenced results negatively as students who have been found to just fill in the log sheets instead of reading repeatedly until they know all the words, do not improve their reading rates very much. This has been my experience over the very long time I have used the repeated reading technique in my classes. It becomes most obvious at the end of the semester when students' reading rates just vary widely without any pattern and when asking students with such results, they often admit to having cheated. However, cheating is not always obvious when students use the repeated reading technique. When using online platforms, teachers can observe students' learning behavior so that students cannot cheat as easily. When students then realize the progress they make, they do not want to cheat and may even get more motivated to incorporate this learning technique also into other learning environments. At least some students spontaneously reported doing so during the two semesters that Quizlet has been used in the course. Thus, using a platform such as Quizlet instead of the repeated reading technique can help to get students on board who would otherwise be more likely to forget doing their homework.

(3) 學生學習回饋

Appendix 1 and Appendix 2 show students' evaluation of the two courses. The course is very popular and if I allow the Language Center to open the course for more students, I have to specify my limit as they have given me classes with 100 and even up to 120 students after asking me if they could add "a few more" students and these classes get full within a short time after course selections are open. In addition, many students give positive feedback in class such as one student telling me that he realized that this technique could also be used in other learning situations and that he has started doing so. Another student who was reading at a reading rate of only 9 wpm at the beginning of the semester would not look up to me when I asked him how he felt about the course. He just said that it was very difficult. However, when I asked him again at the end of the semester, he looked up to me and said that, while he still found the course difficult, he now knew that he could make it. Over the semester, his reading rate had increased 3-fold to almost 30 wpm when reading a new text for the first time. Many others thank me, when we

discussed their results and they could see their own personal progress. Only a few students, who always forget to do their homework even when being reminded through their smartphones, might not be satisfied with the course. This academic year, four of the students who took the first course were also able to get into the second course, which is not easy as this course is always immediately full as said above. Three of the students had been in the basic groups (2, 3, and 4) and one in the high intermediate group (10) in the first semester. However, in the second semester, the students of the former groups 2 and 3 had jumped to groups 6 and 7, respectively (low intermediate), while the student of group 4 had climbed to high intermediate (group 9) and the fourth student to an advanced group (14).

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三． 附件(Appendix)

與本研究計畫相關之研究成果資料，可補充於附件，如學生評量工具、訪談問題等等。

App 1: Students' course evaluation, academic semester 107-1

逢甲大學一〇七學年度第一學期課程意見調查結果

單位 人社學院 外文系			教師姓名	羅珮瑄		科目名稱 科技英文閱讀(一)	
班級名稱 應用外語選修					修課人數	65	
回收份數 56(86.15%)	有效份數 55(98.21%)						

	(5)很同意	(4)同意	(3)普通	(2)不同意	(1)很不同意
1．填答這份問卷時，我很認真地思考每一個題目。	46 (83.64%)	9 (16.36%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
	(5)0節	(4)1-6節	(3)7-12節	(2)13-18節	(1)19節以上
2．這學期中，我在本科目的缺課(含請假及曠課)節數	25 (45.45%)	27 (49.09%)	1 (1.82%)	2 (3.64%)	0 (0.00%)
	(5)29%以下	(4)30-49%	(3)50-69%	(2)70-89%	(1)90%以上
3．經努力，我對本科目學習結果的滿意度	1 (1.85%)	3 (5.56%)	8 (14.81%)	34 (62.96%)	8 (14.81%)

	(5) 很同意	(4) 同意	(3) 普通	(2) 不同意	(1) 很不同意	平均值	標準差
4．本科目的教材內容適中。	20 (36.36%)	27 (49.09%)	7 (12.73%)	0 (0.00%)	1 (1.82%)	4.18	0.80
5．本科目上課內容符合教學目標。	22 (40.00%)	28 (50.91%)	3 (5.45%)	2 (3.64%)	0 (0.00%)	4.27	0.73
6．教師教學準備充份。	21 (38.18%)	27 (49.09%)	5 (9.09%)	2 (3.64%)	0 (0.00%)	4.22	0.76
7．教師關心學生對本科目的學習情形。	31 (56.36%)	20 (36.36%)	4 (7.27%)	0 (0.00%)	0 (0.00%)	4.49	0.64
8．教師曾就本科目的教學目標、速度、方法及成績考評等項做說明。	29 (52.73%)	22 (40.00%)	4 (7.27%)	0 (0.00%)	0 (0.00%)	4.46	0.63
9．教師的表達與解說清楚且有條理。	22 (40.00%)	18 (32.73%)	13 (23.64%)	2 (3.64%)	0 (0.00%)	4.09	0.89
10．教師的教學方法靈活調整，有助於提升學習效果。	24 (43.64%)	20 (36.36%)	8 (14.55%)	3 (5.45%)	0 (0.00%)	4.18	0.88
11．教師將作業與試卷的結果回饋給學生，有助於學生學習。	25 (45.45%)	25 (45.45%)	5 (9.09%)	0 (0.00%)	0 (0.00%)	4.36	0.65
12．本科目的成績考評客觀公正。	30 (54.55%)	19 (34.55%)	6 (10.91%)	0 (0.00%)	0 (0.00%)	4.44	0.69
13．本科目的考評方式與配分比例能評量出我的學習成果。	25 (45.45%)	23 (41.82%)	4 (7.27%)	3 (5.45%)	0 (0.00%)	4.27	0.83
14．若有機會，我樂意修習這位教師所開設的其他課程。	19 (34.55%)	23 (41.82%)	10 (18.18%)	2 (3.64%)	1 (1.82%)	4.04	0.92
15．本科目的任課教師是教的好的老師。	31 (56.36%)	20 (36.36%)	2 (3.64%)	1 (1.85%)	0 (0.00%)	4.32	0.70
16．整體而言，我在本科目的收穫豐盛(如專業知識、技能、態度或價值觀等方面)。	21 (38.18%)	28 (50.91%)	5 (9.09%)	1 (1.82%)	0 (0.00%)	4.26	0.70
17．我不擔心這份調查的結果會影響我在本科目的學期成績。	39 (70.91%)	14 (25.45%)	2 (3.64%)	0 (0.00%)	0 (0.00%)	4.67	0.55
18．明瞭本科目教學目標。	31 (56.36%)	20 (36.36%)	2 (3.64%)	2 (3.64%)	0 (0.00%)	4.46	0.74

App. 2: Students' course evaluation, academic semester 107-2

逢甲大學一〇七學年度第二學期課程意見調查結果

單位 人社學院 外文系		教師姓名	羅珮瑄	科目名稱 科技英文閱讀（二）		
班級名稱 應用 外語選修				修課人數	68	
回收份數 53(77.94%)	有效份數 46(86.79%)					

1．填答這份問卷時，我很認真地思考每一個題目。	(5)很同意	(4)同意	(3)普通	(2)不同意	(1)很不同意
	42 (91.30%)	4 (8.70%)	0 (0.00%)	0 (0.00%)	0 (0.00%)

2．這學期中，我在本科目的缺課(含請假及曠課)節數	(5)0節	(4)1-6節	(3)7-12節	(2)13-18節	(1)19節以上
	18 (39.13%)	28 (60.87%)	0 (0.00%)	0 (0.00%)	0 (0.00%)

3．經努力，我對本科目學習結果的滿意度	(5)29%以下	(4)30-49%	(3)50-69%	(2)70-89%	(1)90%以上
	3 (6.52%)	8 (17.39%)	6 (13.04%)	16 (34.78%)	13 (28.26%)

	(5)很同意	(4)同意	(3)普通	(2)不同意	(1)很不同意	平均值	標準差
4．本科目的教材內容適中。	23 (50.00%)	15 (32.61%)	6 (13.04%)	1 (2.17%)	1 (2.17%)	4.26	0.93
5．本科目上課內容符合教學目標。	25 (55.56%)	13 (28.89%)	5 (11.11%)	2 (4.44%)	0 (0.00%)	4.36	0.86
6．教師教學準備充份。	27 (58.70%)	11 (23.91%)	6 (13.04%)	2 (4.35%)	0 (0.00%)	4.37	0.88
7．教師關心學生對本科目的學習情形。	28 (60.87%)	13 (28.26%)	3 (6.52%)	1 (2.17%)	1 (2.17%)	4.44	0.89
8．教師曾就本科目的教學目標、速度、方法及成績考評等事項做說明。	24 (52.17%)	14 (30.43%)	6 (13.04%)	1 (2.17%)	1 (2.17%)	4.28	0.94
9．教師的表達與解說清楚且有條理。	19 (41.30%)	11 (23.91%)	10 (21.74%)	2 (4.35%)	4 (8.70%)	3.85	1.26
10．教師的教學方法靈活調整，有助於提升學習效果。	22 (47.83%)	10 (21.74%)	9 (19.57%)	3 (6.52%)	2 (4.35%)	4.02	1.16
11．教師將作業與試卷的結果回饋給學生，有助於學生學習。	26 (56.52%)	12 (26.09%)	5 (10.87%)	3 (6.52%)	0 (0.00%)	4.33	0.92
12．本科目的成績考評客觀公正。	25 (54.35%)	12 (26.09%)	7 (15.22%)	2 (4.35%)	0 (0.00%)	4.30	0.89
13．本科目的考評方式與配分比例能評量出我的學習成果。	25 (55.56%)	12 (26.67%)	4 (8.89%)	3 (6.67%)	1 (2.22%)	4.27	1.03
14．若有機會，我樂意修習這位教師所開設的其他課程。	23 (50.00%)	9 (19.57%)	10 (21.74%)	0 (0.00%)	4 (8.70%)	4.02	1.24
15．本科目的任課教師是教的好的老師。	29 (63.04%)	10 (21.74%)	5 (10.87%)	1 (2.17%)	1 (2.17%)	4.26	0.95
16．整體而言，我在本科目的收穫豐盛(如專業知識、技能、態度或價值觀等方面)。	24 (52.17%)	10 (21.74%)	7 (15.22%)	4 (8.70%)	1 (2.17%)	4.13	1.11
17．我不擔心這份調查的結果會影響我在本科目的學期成績。	28 (60.87%)	12 (26.09%)	5 (10.87%)	0 (0.00%)	1 (2.17%)	4.44	0.86
18．明瞭本科目教學目標。	29 (63.04%)	10 (21.74%)	5 (10.87%)	1 (2.17%)	1 (2.17%)	4.41	0.93