The Effects of Using WordSift in English Vocabulary Teaching on Student Vocabulary Retention and Depth at a Thai Secondary School

Flying Officer Supatida Dumchoo

A Thesis Submitted in Partial Fulfillment of the Requirements for the Master of Arts Degree in Teaching English as an International Language

Prince of Songkla University

2018

Thesis Title	The Effects of Using WordSift in English Vocabulary Teaching on Student Vocabulary Retention and Depth at a Thai Secondary School
Author	Flg.Off. Supatida Dumchoo
Major Program	Teaching English as an International Language

Major Advisor

…….....

(Asst. Prof. Dr. Zainee Waemusa)

Examining Committee:

...……...Chairperson

(Dr. Wararat Whanchit)

……Committee

(Assoc. Prof. Dr. Nisakorn Charumanee)

……Committee

(Asst. Prof. Dr. Zainee Waemusa)

The Graduate School, Prince of Songkla University, has approved this thesis as partial fulfillment of the requirements for the Master of Arts Degree in Teaching English as an International Language

…….…….

(Prof. Dr. Damrongsak Faroongsarng)

Dean of Graduate School

This is to certify that the work here submitted is the result of the candidate's own investigations. Due acknowledgement has been made of any assistance received.

……..……. Signature
(Asst. Prof. Dr. Zainee Waemusa)
Major Advisor

……. Signature
(Flg.Off. Supatida Dumchoo)
Candidate

I hereby certify that this work has not been accepted in substance for any degree, and is not being currently submitted in candidature for any degree.

..……. Signature
(Flg.Off. Supatida Dumchoo)
Candidate

ชื่อวิทยานิพนธ์ ผลของการใช้โปรแกรมเวิร์ดซิฟต์สอนคำศัพท์ภาษาอังกฤษที่มีต่อความคงทนในการจำคำศัพท์และความเข้าใจคำศัพท์เชิงลึกของนักเรียนในโรงเรียนระดับมัธยมศึกษา

ผู้เขียน เรืออากาศโทหญิงศุภธิดา ดำชู

สาขาวิชา การสอนภาษาอังกฤษเป็นภาษานานาชาติ

ปีการศึกษา 2561

บทคัดย่อ

งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาผลของการใช้โปรแกรมเวิร์ดซิฟต์สอนคำศัพท์ภาษาอังกฤษที่มีต่อความคงทนในการจำคำศัพท์และความเข้าใจคำศัพท์เชิงลึก รวมทั้งเพื่อสำรวจทัศนคติของนักเรียนที่มีต่อการเรียนคำศัพท์โดยการใช้และไม่ใช้โปรแกรมดังกล่าว กลุ่มตัวอย่างเป็นนักเรียนชั้นมัธยมศึกษาปีที่ 5 ในโรงเรียนแห่งหนึ่งของจังหวัดพัทลุง ซึ่งถูกคัดเลือกด้วยวิธีการสุ่มแบบเจาะจง จำนวน 37 คน โดยแบ่งออกเป็น 2 กลุ่ม กลุ่มทดลองเรียนคำศัพท์ผ่านวิธีการเรียนรู้แบบร่วมมือด้วยโปรแกรมเวิร์ดซิฟต์ กลุ่มควบคุมเรียนจากการฟังครูสอนโดยตรง ผู้วิจัยใช้เครื่องมือวิจัยดังนี้ แบบสำรวจคำศัพท์ แบบฝึกหัดคำศัพท์ ข้อสอบวัดผลสัมฤทธิ์ด้านการรับรู้ความหมายคำศัพท์และด้านความเข้าใจคำศัพท์เชิงลึก ข้อสอบวัดความคงทนด้านการรับรู้ความหมายคำศัพท์และด้านความเข้าใจคำศัพท์เชิงลึก และคำถามสัมภาษณ์แบบกึ่งโครงสร้าง ศึกษาผลคะแนนภายในและระหว่างกลุ่มโดยสถิติ Paired *t* test และ Independent *t* test ตามลำดับ และวิเคราะห์เนื้อหาจากการสัมภาษณ์กลุ่ม

ผลการวิจัยพบว่า นักเรียนกลุ่มควบคุมมีคะแนนความคงทนในการจำคำศัพท์สูงกว่ากลุ่มทดลองอย่างมีนัยสำคัญ, $t(35) = 3.609$, $p = .01$ อย่างไรก็ตาม การเปรียบเทียบคะแนนภายในกลุ่มชี้ให้เห็นว่า คะแนนความคงทนในการจำคำศัพท์ไม่มีการลดลงอย่างมีนัยสำคัญเมื่อเปรียบเทียบกับคะแนนการรับรู้คำศัพท์ (กลุ่มทดลอง $t = -.08$, $p = .93$, กลุ่มควบคุม $t = 6.78$, $p < 0.01$) กล่าวอีกนัยหนึ่ง นักเรียนทั้งสองกลุ่มมีความคงทนในการจำคำศัพท์ ด้านความเข้าใจคำศัพท์เชิงลึกระหว่างนักเรียนสองกลุ่ม ไม่พบความแตกต่างอย่างมีนัยสำคัญ, $p = .09$ การวิเคราะห์ข้อมูลจากการสัมภาษณ์ พบว่านักเรียนกลุ่มทดลอง มีความพึงพอใจต่อการเรียนคำศัพท์ด้วยเวิร์ดซิฟต์มากกว่าการเรียนแบบมีครูเป็นผู้บรรยาย ในขณะที่นักเรียนกลุ่มควบคุมคิดว่าการเรียนโดยฟังจากครูผู้สอนอย่างเดียวทำให้บรรยากาศในการเรียนมีความน่าสนใจน้อยลง อาจกล่าวได้ว่า หากมีการจัดสภาพแวดล้อมการเรียนรู้และนำไปประยุกต์ใช้อย่างเหมาะสม การใช้โปรแกรมเวิร์ดซิฟต์สามารถช่วยพัฒนาการเรียนคำศัพท์ได้ อย่างไรก็ตาม มีข้อเสนอแนะว่า ควรมีการออกแบบการใช้โปรแกรมเวิร์ดซิฟต์ใหม่เพื่อใช้สอนคำศัพท์และให้ผลการเรียนที่ดีขึ้น

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Author Flg.Off. Supatida Dumchoo

Major Program Teaching English as an International Language

Academic Year 2018

ABSTRACT

This study aimed to investigate the effects of using WordSift in English vocabulary learning on student vocabulary retention, and depth, and to gain perceptions they had of the use and non-use of the program. The subjects, 37 Mathayomsuksa 5 students at a secondary school in Phatthalung Province, were selected through purposive sampling and divided into two groups. The experimental group was treated through collaborative learning with WordSift while the control group learned vocabulary through a teacher-directed method. The researcher employed the following research tools: vocabulary survey forms, exercise handouts, vocabulary achievement and immediate depth tests, vocabulary retention and delayed depth tests, and semi-structured interview question sets. The researcher compared the scores within and between groups utilizing Paired *t* test and Independent *t* test respectively while content analysis of the focus group interviews was carried out.

The results showed that the control group significantly outperformed the experimental one in vocabulary retention, $t(35) = 3.609$, $p = .01$. However, the within group scores did not present significant decrease between the retention and the achievement tests (experimental group $t = -.08$, $p = .93$, control group $t = 6.78$, $p < 0.01$). In other words, both groups could retain their vocabulary. A significant difference in vocabulary depth between groups was not found, $p = .09$. The content analysis revealed that the experimental group favored learning through WordSift over the teacher-directed method while the control group considered the sole lecture as having lowered their interest in learning. It was suggested that, if carefully designed and implemented, using WordSift could improve vocabulary learning conditions. A redesign of WordSift use for teaching vocabulary is recommended in the future for better learning outcomes.

ACKNOWLEDGEMENTS

I would like to take this opportunity to express my sincere gratitude to my advisor, Asst. Prof. Dr. Zainee Waemusa, for his professional guidance, enthusiasm, and constructive critiques which have helped make this accomplishment possible. Throughout two years under his supervision, I have gained a lot of knowledge and learned to push myself to the limit. I am especially grateful for his kindness and moral support that kept me motivated. My deep appreciation also goes to the thesis committee, Dr. Wararat Whanchit, Assoc. Prof. Dr. Nisakorn Charumanee and Dr. Usa Intharaksa, for their valuable time and insightful recommendations which helped eliminate flaws in this study.

I am very grateful to the M.A. instructors and staff at Teaching English as an International Language Program, Department of Languages and Linguistics, Faculty of Liberal Arts, Prince of Sonkla University, who gave me support and cooperation. I would like to thank Mrs.Sammireh Nagaratnam and Miss Stefania Vignotto for their assistance with the proofreading of my work. Statistical analysis provided by Miss Buabucha Boonyapassawee is also very much appreciated.

I wish to acknowledge the valuable opportunity given by Miss Uraiwan Raungpet who allowed me to substitute for her in an English course during the data collection phase. My special thanks are also extended to all participants who cooperated in this study.

Finally, I am truly grateful for my family. I would especially like to thank my mother for always being supportive. It would have been difficult for me to achieve any goals in life without her.

Supatida Dumchoo

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Dumchoo, S, & Waemusa, Z. (in press) Using WordSift in English Vocabulary Teaching in a Thai classroom: Student Vocabulary Retention. *Journal of Liberal Arts, Prince of Songkla University Hat Yai Campus, 10(2)*

LETTERS OF ACCEPTANCE

Our reference : UPNM (FPP)10.02/02 Jld 3 (195)
Date : 10 April 2018

Prof. / Assoc. Prof. / Dr. /Mr. /Mrs,

Name of Presenter: Supatida Dumchoo

Paper ID: ICHISS 10 102

Theme: 7 - TEACHING AND EDUCATION

Status of Paper: Conference proceeding

LETTER OF ACCEPTANCE FOR 10th ICHiSS 2018

Thank you for your kind interest in participating in the 10th International Conference on Humanities and Social Sciences (ICHiSS) 2018 which will be held this year from 11th – 13th May 2018 at The Royale Chulan Kuala Lumpur, Malaysia.

We are pleased to inform you that your abstract is accepted to be presented in the 10th ICHiSS 2018.

The panel of evaluator is in opinion that your paper does contain information linking with one of the sub-themes of our conference. It will be better and more relevant if it shows linkage to the main theme of the conference which is "Understanding Regional and Global Integration on Humanities and Social Sciences". We hope, if possible, you will try to improve on this when you write your full paper.

Kindly submit your full paper, registration form and copyright form via online to submission@upnm.edu.my with the subject of e-mail: 'Your Paper ID: ICHiSS 2018' before 15th March 2018. You are advised to edit and adhere to the format stated in our website when submitting your full paper and copyright form either Option 1 or Option 2.

For registration fees and payment method, please refer to our conference website at: http://ichiss.upnm.edu.my/index.php/2016-02-12-09-20-52/registration-fees. Kindly take note on the advantage of the 'early bird' registration fee promotion and send the evidence of payment and a copy of active student card (only for student) to submission@upnm.edu.my.

Should you have any inquiries or require further clarifications, kindly contact us at: submission@upnm.edu.my. Thank you for your kind cooperation and attention on the above matter. We look forward to see you at the conference.

"DUTY, HONOUR, INTEGRITY"

With best regards,

Organizing Committee of 10th ICHiSS 2018

ที่ ศธ 0521.1.11/953

คณะศิลปศาสตร์
มหาวิทยาลัยสงขลานครินทร์
อ.หาดใหญ่ จ.สงขลา
90112

2 สิงหาคม 2561

เรื่อง ตอบรับการตีพิมพ์บทความ

เรียน นางสาวสุภธิดา ดำชู

ตามที่ท่านได้ส่งบทความเรื่อง Using WordSift in English Vocabulary Teaching in a Thai classroom: Can It Boost Student Vocabulary Retention? เพื่อตีพิมพ์ในวารสารศิลปศาสตร์ มหาวิทยาลัยสงขลานครินทร์ รายละเอียดทราบแล้วนั้น บัดนี้บทความของท่านได้ผ่านการพิจารณาจากผู้ทรงคุณวุฒิและกองบรรณาธิการวารสารศิลปศาสตร์ฯ เรียบร้อยแล้วและยินดีให้บทความของท่านลงตีพิมพ์ในวารสารศิลปศาสตร์ฯ ปีที่ 10 ฉบับที่ 2 เดือนกรกฎาคม – ธันวาคม 2561 ทั้งนี้ กองบรรณาธิการวารสารศิลปศาสตร์ฯ จะจัดส่งวารสารมายังท่านต่อไป

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

(รองศาสตราจารย์มนตรี มีเนียม)
บรรณาธิการวารสารศิลปศาสตร์ มหาวิทยาลัยสงขลานครินทร์

งานวิจัยและวารสาร
โทรศัพท์ 0 7428 6675
E-mail: waraporn.no@psu.ac.th

ที่ ศธ 0521.1.11/1320

คณะศิลปศาสตร์
มหาวิทยาลัยสงขลานครินทร์
อ.หาดใหญ่ จ.สงขลา
90112

17 ตุลาคม 2561

เรื่อง แจ้งแก้ไขการตอบรับการตีพิมพ์บทความ

เรียน นางสาวศุภธิดา ตำชู

อ้างถึง ที่ ศธ 0521.1.11/953 ลงวันที่ 2 สิงหาคม 2561

ตามหนังสือที่อ้างถึง กองบรรณาธิการได้ส่งหนังสือตอบรับการตีพิมพ์บทความไปยังท่าน เพื่อตีพิมพ์ในวารสารศิลปศาสตร์ มหาวิทยาลัยสงขลานครินทร์ ปีที่ 10 ฉบับที่ 2 เดือนกรกฎาคม-ธันวาคม 2561 ตามความทราบแล้วนั้น ในการนี้คณะศิลปศาสตร์ขอแจ้งแก้ไขชื่อเรื่องจาก "Using WordSift in English Vocabulary Teaching in a Thai classroom: Can It Boost Student Vocabulary Retention?" เป็น "Using WordSift in English Vocabulary Teaching in a Thai classroom: Student Vocabulary Retention" ทั้งนี้ กองบรรณาธิการวารสารศิลปศาสตร์ฯ จะจัดส่งวารสารมายังท่านต่อไป

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

(รองศาสตราจารย์มนตรี มีเนียม)
บรรณาธิการวารสารศิลปศาสตร์ มหาวิทยาลัยสงขลานครินทร์
วิทยาเขตหาดใหญ่

งานวิจัยและวารสาร
โทรศัพท์ 0 7428 6675
E-mail: waraporn.no@psu.ac.th

1. INTRODUCTION

1.1 Rationale

Vocabulary is considered as a vital fundamental component in languages. As a medium of communication, a language functions as a tool to carry messages (Hyland, 2015). A person will be able to comprehend input information only when dominant vocabulary in discourses is recognized. On the other hand, in the productive skills, which are speaking and writing areas, the ability to produce a quality language requires a sufficient vocabulary bank (Schmitt, 2014). As noted by Folse (2004), although grammar has been overwhelmingly emphasized in English as a second language (ESL) learning, vocabulary knowledge is more crucial. An explanation is that language competence and performance are commonly evaluated on the basis of vocabulary knowledge which needs to contain at least two features, which are size or breadth (the number of vocabulary items known) and depth (how well a learner knows about the words) (Wesche & Paribakht, 1996). Vocabulary then, does not concern only meaning, but also other complex aspects. Word depth can hold many different specific aspects, including spelling, syntax, and morphology (Qian, 1999).

When a language learner moves to a higher proficiency, his/her vocabulary size grows consistently in order to communicate more effectively. The larger size of vocabulary not only improves the four language skills, but also leads to success in further learning (McKay, 2000). Folse (1999) pointed out that language learners who possess sufficient vocabulary will be able to demonstrate the ability to guess the meanings of unfamiliar words using context clues. In order to do as such, they should know at least 90 % of the words in the context (Hsueh-Chao & Nation, 2000). It is then clear that successful language learning is highly related to the possession of vocabulary size (Nunan, 1991; Al-Qahtani, 2015).

Over the years, a number of studies, including McKay (2000); Montero Perez, Peters, Clarebout, and Desmet (2014); Nelson (2016) and Bartolotti and Marian (2017), have examined effective tools for vocabulary teaching. However, pedagogical approaches used in the classroom have not been investigated extensively, as claimed by Folse (2004). Folse stated that the teaching approach was essential and also needed to be taken into account when research on vocabulary is conducted in the future.

In addition to pedagogical issues, ways to enhance the ability to retain vocabulary meanings in a long memory trace is of concern to many researchers as known word counts when one recognizes the meanings of orthography one sees, sounds one hears, or is able to pick up a word in the repertoire and use it in one's production. For example, it was claimed that the strategies used by learners when encountering a new word can affect the aforementioned capabilities (Thuy, 2013). Visual aids such as pictures, animations, semantic maps have been used to enhance vocabulary retention and the benefit is well documented (Rahman, 2014). In his paper, however, Rahman (2014) stated that a delicate question like the impact of presentation types on diverse learning styles was still undiscovered. Thus, a vocabulary teaching tool with multimedia property (the combination of different data forms in one presentation, e.g. texts, images, animations, graphics, and others) like WordSift is worth investigating, for it may reveal new facts about vocabulary teaching in a particular context (Talang & Mahmoodi, 2013; Smith & Qayyum, 2017).

Although what usually comes to mind when mentioning vocabulary learning is a lexical meaning comprehension, as stated earlier, a word deals more than that one aspect. Seal (1991) proposed that having a rich vocabulary repertoire could not guarantee the ability to communicate. His development in the theory of language instruction contributed to a new aspect of vocabulary teaching, focusing more on actual language use (word depth). This concept was raised again in Nation (2001), asserting that vocabulary teaching is not an instruction on entire literal translation. He acknowledged grammatical functions in addition to word meanings, and finally defined the three aspects of a word in form, meaning, and use.

Contextualized vocabulary acquisition has been paid more attention to by researchers. Many studies affirm the benefit of using context as part of vocabulary teaching because it will afford the opportunity for learners to be exposed to authentic language that will lead to greater competence (Merawati, 2003; Ahmadian, Amerian, & Goodarzi, 2015). However, despite its essential role, vocabulary depth is less investigated compared to studies on size (Teng, 2014). This current study, therefore, studied on vocabulary depth simultaneously with vocabulary size.

The potentials of new technology in the 21st century, which provide effective presentation in multimedia form are deemed as a great help in evoking memory (Dubois & Vial, 2000). As seen in many current studies on vocabulary teaching, such as by Santos et al. (2016), Kennedy, Rodgers, Romig, Lloyd, and Brownell (2017), Rivera, Hudson, Weiss, and Zambone (2017), multimedia technology has started to be integrated into classrooms more than it used to be. Wolsey, Smetana, and Grisham (2015) insisted on improved language ability when technology was integrated. Moreover, technology obviously interests and engages learners in learning (Walsh, Sun, & Riconscente, 2011).

As an educational technology, WordSift is a free word cloud generator website that was purposefully created for vocabulary teaching (Hakuta, 2011). The program provides a visual display in different modes which relates to a clicked word in the cloud (i.e. pictorial representation, videos, thesaurus, and context). The application offers ample opportunities to play with the language and teachers can design classroom activity and compatible pedagogy that meet learning needs. However, little is known about the effects of using this program to support students' learning vocabulary, especially in the Thai educational context.

In this research study, the researcher adopted and investigated the benefits of WordSift, as this application had not been studied previously in any Thai context. This research study helped examine the credibility of its positive impacts on vocabulary retention, as reported by Talang and Mahmoodi (2013), and assessed the impacts on students' vocabulary depth which had not been investigated up to now. It also furthered the implication in Talang and Mahmoodi (2013), suggesting that a compatibly pedagogical approach used with WordSift should be explored simultaneously in future studies.

As reported by Srimanee and Laohawiriyanon (2014), limited English vocabulary was a dominant problem for Thai students. A justification is that English is used as a foreign language and most learning occurs in formal classrooms where the students might not have adequate opportunity to be exposed to words. Jingjit (2015) also pointed out that inaction on vocabulary teaching in Thailand, especially the lack of technology integration, decreased students' interest and dampened their enthusiasm for learning. As a result, recent educational policy

encouraged a move towards technology integration into the classroom. The same phenomenon has happened worldwide in this digital age. However, although current teaching methods are technocentric, many educational technologies are applied without proper understanding (Mishra & Koehler, 2006).

Jingjit (2015) noted that in the Thai context, if technology were integrated into vocabulary teaching, what would be utilized generally would not meet learning objectives due to the lack of understanding in selecting educational materials and integrating them into teaching. This WordSift-integrated study, therefore, was conducted on the notion of technological pedagogical content knowledge or TPACK (Mishra & Koehler, 2006) since the model emphasizes on the interplay among technology, teaching approaches, and contents to be taught.

1.2 Research Questions

This study aimed to investigate the effects of using WordSift in English vocabualry learning on student vocabulary retention and depth, including their perceptions of the use and non-use of the application. The study focused on the following questions:

1.2.1 Are there any significant differences in vocabulary retention between a student group using WordSift in learning English vocabulary and a group learning through teacher-directed method?

1.2.2 Are there any significant differences in vocabulary depth between a student group using WordSift in learning English vocabulary and a group learning through teacher-directed method?

1.2.3 What are the student perceptions of the use of WordSift and non-WordSift in vocabulary learning?

1.3 Definition of Key Terms

The following are the definitions of the terms used in this study.

1.3.1 WordSift[1] is a free word cloud generator website that provides the data in multimedia presentation (Hakuta, 2011).

1.3.2 Vocabulary retention refers to the ability to remember the meaning of a word for at least 14 days after it was instructed. This time length is commonly considered as long term memory (Gu, 2003).

1.3.3 Vocabulary depth refers to the ability to choose the right word forms or parts of speech when completing sentences in a multiple choice test for at least 14 days after the vocabulary was taught (Qian, 1999).

1.3.4 Multimedia refers to the combination of different data forms in one presentation, e.g. texts, audios, images, animations (Dubois & Vial, 2000).

1.3.5 Teacher-directed method refers to a teaching technique in which the teachers explicitly deliver a lecture.

1.3.6 Collaborative learning (CL) refers to a learning approach that emphasizes on individuals' engagement in every stage of learning while performing their mutual task (Beatty & Nunan, 2004).

2. LITERATURE REVIEW

The researcher examined interrelated grounding in content, teaching approach and a specific educational technology in order to shape and develop a research design that fitted the classroom context. This section initially presents a conceptual framework established in the study. The literature and related studies are reviewed under the following topics.

- Technological pedagogical content knowledge (TPACK)
- TPACK: Application to a curriculum design with WordSift
- Academic vocabulary for instruction
- Theories of vocabulary acquisition and collaborative learning
- WordSift application

[1] More details can be found at https://wordsift.org

2.1 Technological Pedagogical Content Knowledge (TPACK)

Technological pedagogical content knowledge or TPACK (Mishra and Koehler, 2006) is a model emerging from the notion that technology integration in teaching requires teachers' knowledge of the interplay among technology, teaching approaches, and a subject matter that is to be taught.

TPACK is comprised of three domains (i.e. technological knowledge, pedagogical knowledge, and content knowledge). These three domains overlap on one another, stressing on the complex interdependence among them (Mishra & Koehler, 2006). According to the theorists, isolated content knowledge (CK) represents the knowledge of particular subject matters to be taught. Pedagogical knowledge (PK) is insightful understanding about the process of teaching and learning. The last component, technological knowledge (TK) refers to the ability to operate software and hardware devices. The intersection point in the middle where every domain is blended (TPACK) is the heart of this model. It is believed to be the foundation of carefully-designed teaching, understanding how to utilize a specific technology to enhance the right teaching approach on a particular content.

Its high degree of parsimony has gained TPACK an ongoing growth in interest among researchers worldwide (Graham, 2011). In their application of technology in the classroom, teachers have their own options as to what to situate in each of the three domains and how to unite them altogether (Koehler & Mishra, 2009). This framework is not restricted to technology integration but anything else, e.g. aiding devices that best suit a particular context. However, when it comes into practice, those teaching aids will not be the only instructional mediums, but will "transform the nature of a subject at the most fundamental level" (McCormick & Scrimshaw, 2001, p. 47).

2.2 TPACK: Application to a Curriculum Design with WordSift

In order to have TPACK as a theoretical framework in this study, it was a requisite at the early stage to realize the content to be instructed before moving to responsive pedagogies until an applicable technology was opted for. Figure 1 shows interrelated theories reviewed through the TPACK perspective in this study.

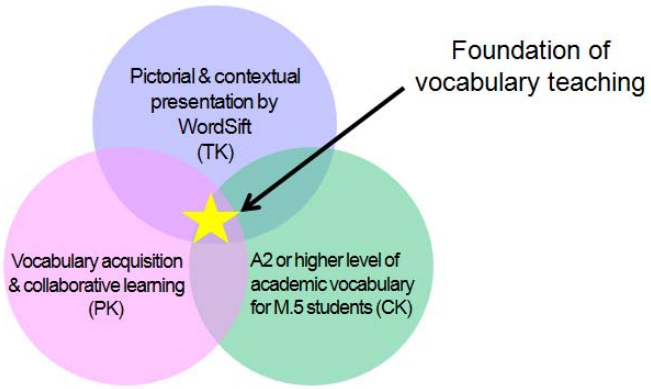


Figure 1. Interrelated theories for WordSift implementation

2.2.1 Academic vocabulary for instruction (CK domain)

This research study was conducted with the students who were required to take Basic English 32102 as a compulsory subject. According to the school's curriculum planning, these students had to master English at A2[2] or a higher level academic vocabulary in the prescribed textbook or other sources that contained vocabulary at the same levels (Read more under Section 3.3.1). The two main objectives were that the students could tell the meanings of the target vocabulary items and be able to use varied parts of speech of each vocabulary item to make sentences grammatical.

2.2.2 Vocabulary acquisition and collaborative learning (PK domain)

Since insufficient word exposure was claimed as a factor behind limited vocabulary in Thai learners (Srimanee and Laohawiriyanon, 2014), the PK domain initially states channels through which input can be received. Word exposure is generally regarded as a fundamental in vocabulary acquisition. For example, Zhu (2015) and Graves (2016) suggested that one way to increase learners' vocabulary size was to encourage them to listen, speak, read, and write the language. These actions involved closely related issues – quantity and quality of the input received. Based on Pimsleur's (1967) graduated interval recall notion, it is more effective to

[2] Based on Common European Framework of Reference for Languages or CEFR

study a small number of words over several short periods of time than to study a larger amount in one longer period because learners may immediately forget them after the first exposure, unless those words are frequently reminded again, which is quite impractical for a large lexical size. He also claimed that if a student could remember vocabulary after s/he studied it once in a normal classroom; s/he perhaps studied it at home, too. Pimsleur (1967) discussed the issue of how teachers can manage an allocated time to help the students in storing a considerable number of the words they have already learned. The schedule of repetitions was raised in his paper, signifying that word exposure had to be recalled very soon after the first introduction, continued, and great enough to refresh the learners' memory. An example given depicted a vocabulary learning situation, namely that after a second the new word was encountered, a learner would still remember it almost 100% accurately. As time went by without the repetitions, the word would fade away rapidly. If it was repeated again in the sixth second, at which time the possibility of precise remembrance was still at 60% approximately, the memory would be jogged and the perception of the word would be back up to 100%. Of course, the word would fade from memory again, but the more times it was reminded, the longer it took until a new forgetting began. Hunt and Beglar (2002) stood by the same concept, proposing the appropriate number of vocabulary items to be learned each time as five to seven because learners can have more time for review. A study that accredited the significance of quantity and also regarded superior quality of learning conditions was that of McKeown and Beck (2014). In their work, it was suggested that vocabulary learning would be most effective when: 1) both definitional and contextual information are provided; 2) learners actively work with word definitions; and 3) learners encounter new words several times. Many studies on vocabulary underpinned the aforementioned belief. For example, Merawati (2003) reported that learning vocabulary from context could help improve reading skills while a study of Shokuhi and Pishkar (2015) found that a group of Iranian learners in a language institute in Kahnouj who collaboratively practiced to use vocabulary in diverse contexts with peers in each study period outperformed the other group who learned through a teacher-centered approach.

In regard to the aforementioned findings, one responsive approach that can be adopted in vocabulary teaching is collaborative learning (CL) (Laal & Laal, 2012). Although a very superficial definition of CL is working in groups, and it is used interchangeably with cooperative learning in general, CL holds some distinctiveness in practice (Laal & Laal, 2012). The distinction between the two approaches is drawn in this part.

CL is an approach that emphasizes on individuals' engagement in every stage of a group task until their mutual goals are achieved (Beatty & Nunan, 2004). When CL is employed, every group member will deal with all aspects of the task. It is important that each individual advances, exchanges, and articulates his/her ideas with the others to find solutions together before further actions are taken. This approach is different from cooperative learning in terms of group members' responsibility and engaged interaction. In cooperative learning, interpersonal communication is less encouraged. How group members accomplish their task through cooperative learning is breaking it into pieces for ones to be completed. They are responsible for their own parts and will finally assemble them together as the group's accomplishment (Laal & Laal, 2012). The nature of cooperative learning, therefore, may not afford adequate opportunity of socialization as CL does. The interactional requirement of CL practice creates opportunities for listening, speaking, reading, and writing the language. These actions can be effective ways to increase vocabulary knowledge according to the aforementioned claims by Zhu (2015) and Graves (2016).

Fujiwara and Sato (2015) examined vocabulary use performance in Japanese EFL university students' writing. Within a limited time, 60 students in the experimental group had to narrate stories based on a series of six pictures in pairs (30 pairs in total). The other 30 students in the control group did the same task individually. All 60 texts from both groups were analyzed, and the findings that presented the higher performance of the experimental group helped maintain that CL could facilitate and enhance vocabulary learning. There is evidence that the exploitation of CL in a small-group working context even produces more satisfactory learning outcomes when compared to learning through CL in pairs.

Dobao (2014) investigated whether the number of learners, when working collaboratively, could affect their performance on dialogue and second language (L2) vocabulary learning. The research was conducted with 110 native English speakers who studied Spanish as their L2 in a public university, the USA. Sixty students worked in groups of four (15 groups) and the other 50 worked in pairs (25 pairs). The treatment was given throughout the regular class. In each class, a set of 15 pictures was given to the students, and they had to write new stories based on the pictures. The writing task required the use of uncommon words. A pre-test was administered at the beginning while the post-test was conducted on the 7^{th} and 8^{th} weeks to assess the development in vocabulary use. The findings from this study showed that the groups had better vocabulary retention than the pairs while a significant difference in word depth was not found. Dobao (2014) pointed out that a larger number of students in one group may diminish their chances of speaking or interacting but it would yield a rich source of ideas.

When integrated into technology, research-based evidence showed that using CL can enhance language learning in a Thai context (Waemusa, 2016). Other studies from diverse contexts showed the results to be consistent with this study such as those of Du (2013) and Chih-Cheng, Hsiao, Tseng, and Hsin-jung, (2014).

2.2.3 WordSift application (TK domain)

WordSift is a free word cloud generator website that was purposefully created for vocabulary teaching (Hakuta, 2011). The properties provided by this website are of great help to enrich academic vocabulary-learning conditions across content areas (Farkas, 2009). To operate this application, users can insert their texts into a provided box. After clicking the “Sift” button, the program will generate the text into a colorful cloud of 50 most frequently found words from the extract. Visual displays which are shown on the same page under the cloud are image, video, thesaurus, and context windows. When clicking on one word, users can choose which features to play with. For instance, a purpose is to have the students learn the meanings of the target words by exploiting information from pictures and the word context. After a teacher clicks on a target word, he/she enlarges the image window which contains related pictures. The window of context where the word is, from then on can be opened up in order to

clue its meaning (Figure 2). The properties afforded by WordSift work on a dynamic classroom where interpersonal activity is encouraged (Talang & Mahmoodi, 2013).

Talang and Mahmoodi (2013) carried out a research study with Iranian students aged from 17 to 24 to examine the effects of WordSift on their long-term vocabulary retention. Sixty subjects were selected based on their Nelson Standardized English Proficiency Test scores for homogeneity, and were grouped into two groups. During 12 sessions, the first group learned 100 vocabulary words on meanings and in contextualized text through WordSift whereas the second group was instructed through printed paper and dictionaries. The researchers left two-week interval before administering the post-test. The results indicated that the first group of students significantly outperformed the other group in long-term vocabulary retention. Khiyabani, Ghonsooly, and Ghabanchi (2014) confirmed the benefits of using multimedia on vocabulary retention. Their study result showed that learning new words through text, graphics, videos and sound helped promote the students' retention.

Smith and Qayyum (2017) asserted in their work that although newer information platforms were being established ceaselessly, a web search engine remained so popular among many students that they could not exploit other existing resources to the full. Thus, the researchers conducted a study in order to investigate searching manners of the students at Charles Sturt University, Australia, through a specific tool for word learning. In one phase of the study, the researchers focused on using WordSift to facilitate the students in their word learning before they could utilize their own customary approach for information searching such as googling. The study revealed impressive findings as the eye tracking software showed that the students read information thoroughly via WordSift, and spent more time focusing on word cloud, thesaurus, and contextual visualization as compared to other data source platforms.

According to Carpenter and Olson (2012), when new vocabulary items are introduced with multimedia, retention is better enhanced than when learning from a written text alone because visuals and word forms are dually coded.

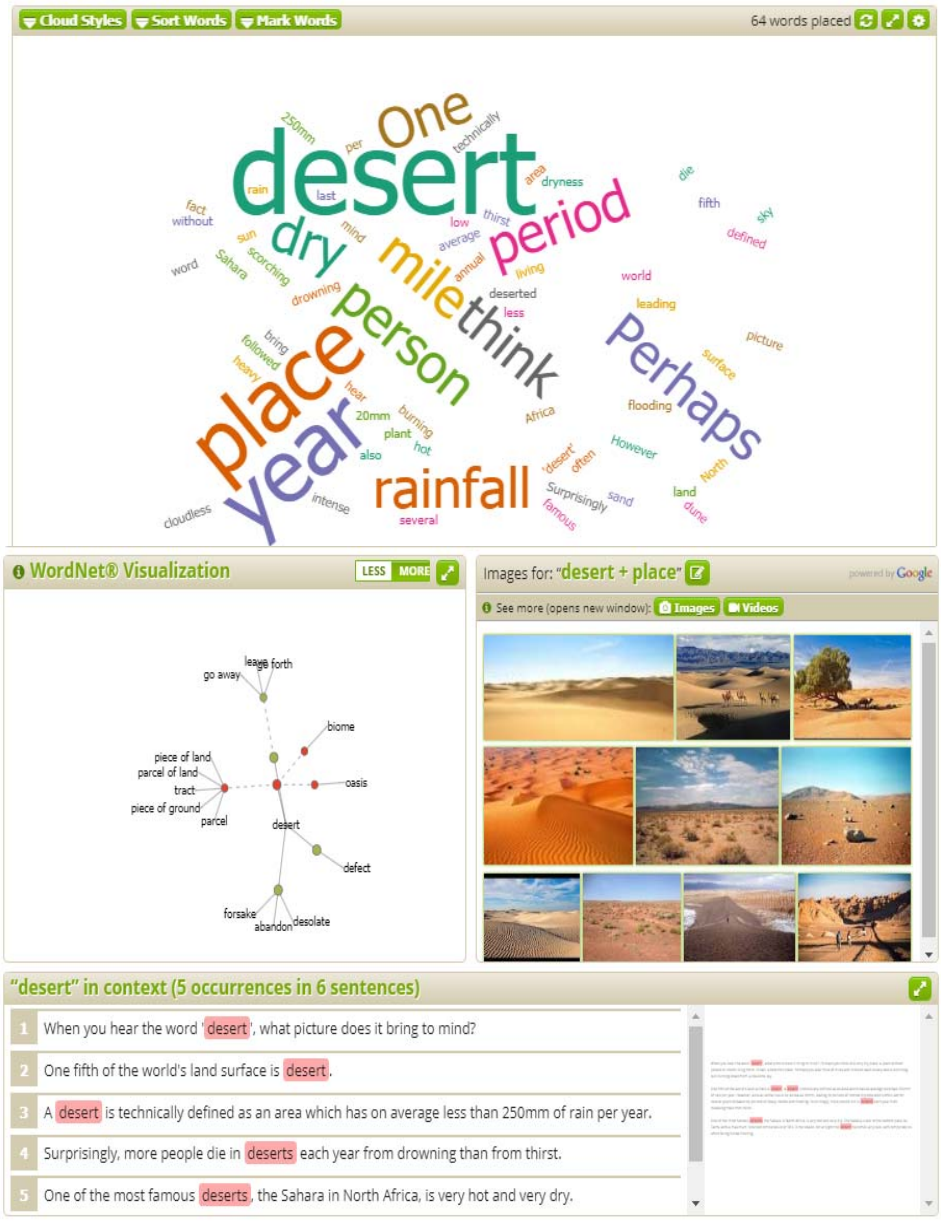


Figure 2. Multimedia representation by WordSift

The researcher exploited the aforementioned theories and findings from previous empirical studies, shaping the treatment for the students in the experimental group, and hypothesized that WordSift could boost the students' vocabulary retention and depth better when compared to learning through the teacher-directed method. In detail, the teacher utilized image and context modes of WordSift to teach academic vocabulary to the students. Six vocabulary items were introduced to the students in

each session, so that they could have more time working on them. To provide them with ample opportunities to be exposed to the words through listening, speaking, and reading, the experimental group would collaboratively learn the two aspects of new words, namely size and depth through group discussion.

3. RESEARCH METHODOLOGY

3.1 Research Design

The explanatory sequential mixed-method design (Creswell, 2013) was applied in this study. In the initial phase, quantitative data was collected from L2 translation and multiple choice tests to answer research questions 1 and 2 (RQ 1 & RQ2). In the following qualitative phase, focus group interviews[3] were conducted in order to answer research question 3 (RQ3), and explore in-depth data from the quantitative findings.

3.2 Student Groups

The subjects were 37 Mathayomsuksa 5 students who were taking Basic English 32102 in the second semester of academic year 2017 at a secondary school, in Phatthalung Province, Thailand. Through a purposive sampling, they were selected and divided into two groups (i.e. control and experimental ones) based on their regular classes. The number of students for each group was 19 and 18 respectively. To ensure homogeneity between groups, vocabulary survey tests were administered to them before the treatment began. The results showed that none of them achieved scores higher than 25 percent (22.5 out of 90 items). Homogeneity, then, was assumed.

[3] A focus group interview is “a group comprised of individuals with certain characteristics who focus discussions on a given issue or topic” (Anderson, 1990, p.241).

3.3 Research Instruments

Apart from WordSift, the same instruments were used to collect the data from both groups, as follows:

3.3.1 Vocabulary survey form

Before the treatment started, the student subjects from both groups were required to complete a vocabulary survey test by filling up the definitions of the provided words in Thai (L2 translation test form). The purposes were to seek for words unfamiliar to them, and also for the homogeneity between the groups to be established. This survey form (see Appendix A) contained 90 A2 or higher level academic vocabulary items from nine topics in the school's textbook and other online sources (ten vocabulary items selected from each topic). Finally, 54 unknown vocabulary items (six items from each topic) were picked up as the target words to be instructed (see Appendix B). Table 1 shows the topics chosen to be instructed in the treatment.

Table 1. The nine topics to be instructed

Topics for Instruction		
1. The minister for exams	2. The chemistry of love	3. Abuse and addiction
4. A mermaid and a magic comb	5. Diary of a tenacious teen	6. What is happiness?
7. Irregular verbs	8. Christmas songs	9. Child labor

3.3.2 Vocabulary exercises

The exercise handouts were used to familiarize the students with the definitions of the target words, and to drill them in using the different parts of speech in diverse contexts. There were nine sets of handouts altogether (one set for each topic). Each handout set consisted of two parts. The first part provided a table of the six target words in which the students had to fill the right meanings while receiving the interventions. The second part provided incomplete sentences and varied forms of the six target words that changed in accordance with parts of speech. The students had to choose the most appropriate words to fill in the blanks to make sentences meaningful (see Appendix C).

3.3.3 Vocabulary achievement and retention tests

Vocabulary achievement tests were used to measure the extent of vocabulary the students could acquire after three days of the treatment. Thus, each set contained the same six words from the topic the students had already learned three days earlier (see Appendix D). There were nine sets of tests altogether. The achievement tests were in L2 translation test forms. The students had to fill in the right definitions of the given words in Thai. A vocabulary retention test was in the same form as the achievement one, but the items contained were shuffled. This test was used to measure the students' ability to remember the meanings of the words after 14 days from the first encounter. This time length is considered as long term memory (Gu, 2003). In total, there were nine sets of retention tests. The reliability of the tests was estimated after they were piloted to another group of M.5 students who were not the target sampling. The reliability was computed, and its Cronbach's Alpha was found at .71, showing that the tests were reliable.

3.3.4 Immediate and delayed vocabulary depth tests

The immediate vocabulary depth tests conducted after three days of the treatment were in multiple choice forms (see Appendix E). They were administered to measure the students' ability to use varied parts of speech of the target words in diverse contexts. Only three choices were provided for each item of the test as parts of speech was a new understanding to the students, so they were allocated a specific amount of time to consider the correct answers. The delayed vocabulary depth tests, containing the same shuffled items, were administered to measure the same ability in the long term (or after 14 days of the treatment). The reliability of the tests was estimated. Cronbach's Alpha at .74 showed they were reliable.

3.3.5 Interview question sets

In the qualitative phase, open-end question sets were used in semi-structured interviews in order to explore how the students perceived each intervention and to seek for in-depth data to justify the quantitative results. The questions for the control group were adapted from those for the experimental group, and the validity of the

question sets was checked by three experts. Language clarity, later, was amended prior to the implementation (see Appendix F).

3.4 Data Collection Procedures

3.4.1 Pre-treatment phase

• Ethical issues

An approval letter was sent to the school before any research process was conducted, as were consent forms (see Appendix G). The students in the control and experimental groups voluntarily signed the forms after the researcher clearly stated the purposes and process of this study to them. The students were informed that the test scores they obtained from this study would not affect their English grades (Basic English 32102) and all their personal information would be treated confidentially.

• Test piloting

The validity and reliability of the instruments used in this research study were assessed before use. All vocabulary tests were piloted to other group of M.5 students who were not the target sampling. The results of reliability then were computed by statistical analysis. The interview question sets were checked by the three experts before implementation.

• An orientation

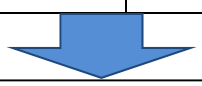
Before the treatment started, the researcher explained to the students about the process that was going to happen in detail. The orientation let the students be aware of the interventions, so they could understand their roles and the teacher's when doing activities in class.

3.4.2 Treatment phase

Data from the experimental and control groups were collected under the same procedures. The only different variables were the given interventions. When the treatment phase started, the English class was divided into two sessions a week. The students in each group attended class twice a week according to their regular timetable. Starting from the first session of the first week, six unfamiliar words selected from the first topic were introduced to the students. They learned the new

words through different interventions according to lesson plans (see Appendix H). In the second session of the first week, the five-minute achievement test and ten-minute immediate depth test were administered at the beginning of the session. The five-minute retention test and ten-minute delayed depth test of the first topic were administered in the subsequent 14 days or the first session of the third week. Therefore, starting from the third week of the treatment, the students had to take: 1) the retention and delayed depth tests of the topic learned from the last two weeks; and 2) the achievement test and the immediate depth test of the topic learned in the earlier session. The same arrangement was preceded repeatedly until all 54 vocabulary items from the nine topics were instructed. Figure 3 pinpoints the data collection schedule of this study.

Week	**Sessions**	**Treatment (meanings & depth)**	**Achievement test**	**Retention test**	**Immediate depth test**	**Delayed depth test**
1	1	Topic 1				
	2		Topic 1		Topic 1	
2	1	Topic 2				
	2		Topic 2		Topic 2	
3	1	Topic 3		Topic 1		Topic 1
	2		Topic 3		Topic 3	
4	1	Topic 4		Topic 2		Topic 2
	2		Topic 4		Topic 4	
5,6,7,8		.....	.....	.....	.....	.....
9	1	Topic 9		Topic 7		Topic 7
	2		Topic 9		Topic 9	
10	1			Topic 8		Topic 8
	2					
11	1			Topic 9		Topic 9
	2					



Qualitative phase (Interview)

Figure 3. Data collection schedule

Two different types of the interventions were implemented in this study.

3.4.2.1 Intervention without WordSift

The students in the control group learned new vocabulary through the teacher-directed method, having the teacher play the key role in teaching lecture-based lessons in the classroom. The exercise handouts were distributed to each student to note down the meanings while the teacher was telling the definitions to them in lecture form. In the second part of the exercise, it was also the teacher's role to explain how to use varied parts of speech of the six target words in sentences. The students noted the definitions and completed the exercise according to what they were taught.

3.4.2.2 Intervention with WordSift and collaborative learning (CL)

The students in the experimental group were divided into small groups of 3-4 in each session. They also received the exercise handouts from the teacher. The students were assigned to find out word definitions and study how varied parts of speech of the target words differently functioned and used through group discussion. The teacher inserted a text from the chosen topic into WordSift and generated it into a cloud. When a target word was clicked, the image window was enlarged showing a related pictorial presentation. Then the context window which presented the list of sentences from the insertion was maximized. The students were encouraged to use information shown on the screen as a source to discuss with their peers in groups collaboratively, meaning that everyone was required to contribute to the conversation, and suggest, exchange, and articulate their ideas until they got the answer for each question. It was important that the group members worked simultaneously on the exercise item by item, not dividing their task into pieces and assembling them at the end. The students were encouraged to use English during the discussion, but Thai also was allowed if they encountered difficulties in communication. During the group discussion activity, the teacher walked around encouraging the students to deliberate on the discussion, so that they could equally be exposed to the words through listening, speaking, and reading. The teacher also assisted them, in case of need. For example, when the students could not understand the example sentences clearly, the teacher would give some indication as to their meanings. Learning through CL,

everyone was responsible for accomplishment. They had to elaborate on the reasons for their ideas, and needed to listen to different perspectives. When the first part of the exercise was done, the answers would be given by the teacher before the students moved on to the second part of the exercise. Then the correct answers for this part would be given. Time allocated for this activity was 30 minutes approximately.

3.4.3 Focus group interviews

After the quantitative data was completely collected and analyzed, the focus group interviews were carried out, using semi-structured interview question sets (see Appendix I). The researcher selected eight students as the representatives from each group. They were the four students who had the most improved score range and the last four who had the least improvement. To prevent the low proficiency students from being dominated by the higher proficiency ones, the teacher did not tell them the scores they got from the quantitative phase. Pseudonyms A1-A4, and A5-A8 were adopted for the best performers to the poorest performers in the control group respectively. In the experimental group, the researcher used pseudonyms B1-B4, and B5-B8 for the best to the poorest. An audio recorder was used during the qualitative data collection.

3.5 Data Analysis

The data analysis was administered in the following steps. For the sake of simplicity, the raw scores from the tests were converted into percentages. In order to investigate the difference of vocabulary retention between groups, an Independent *t* test was utilized to compare the means of the retention tests between the control and experimental groups. A Paired *t* test was utilized to compare the means between the achievement and retention tests within groups. The purpose was to examine the levels of word definitional retrieval the students attained in the long term or after a two-week interval.

Similarly, the researcher utilized the Independent *t* test to compare the means in the vocabulary delayed depth tests between groups to examine whether they demonstrated a statistically different level. The Paired *t* test was utilized to compare the means between the immediate and delayed depth tests within groups to assess the

students' development in vocabulary depth after a two-week interval. Table 2 illustrates types of statistical analysis in relation to each research question.

Content analysis was carried out in order to get the answers for the last research question, which is to investigate the students' perception toward learning vocabulary. Content analysis is a systematic technique of analyzing messages in text, verbal or non-verbal communication, and categorizing the content under intellectual concepts (Cole, 1988; Krippendorff, 1980). The researcher transcribed the students' recorded conversations verbatim, and the transcription was analyzed. Figure 4 is a flowchart showing data collection and analysis procedures as a whole.

Table 2. Research questions and types of statistical analysis

RQs	**Data Analysis**
1. 1 Are there any significant differences in vocabulary retention between a student group using WordSift in learning English vocabulary and a group learning through teacher-directed method?	Independent *t* test Paired *t* test
2. Are there any significant differences in vocabulary depth between a student group using WordSift in learning English vocabulary and a group learning through teacher-directed method?	Independent *t* test Paired *t* test
3. What are the student perceptions of the use of WordSift and non-WordSift in vocabulary learning?	Content analysis

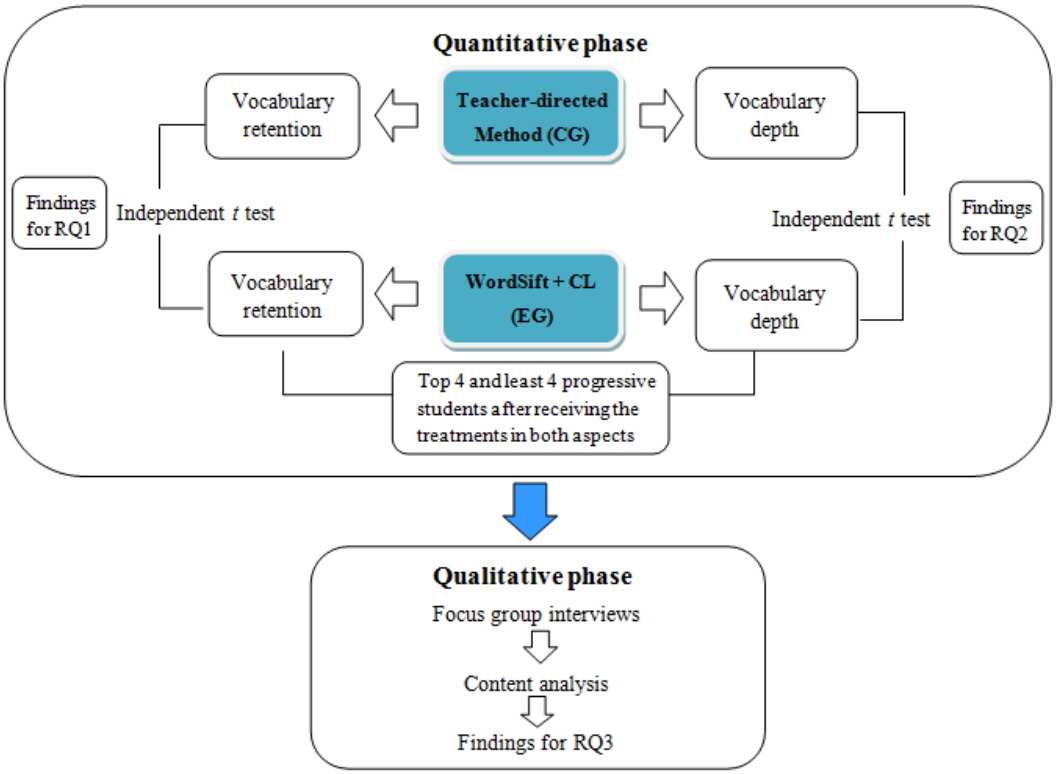


Figure 4. Holistic view of data collection and analysis

4. FINDINGS AND DISCUSSION

The findings for the three research questions are reported and discussed as follows.

4.1 Vocabulary Retention Outcomes

In answering RQ1, Table 3 shows a significant difference of the retention means between the control group (M = 76.02, SD = 10.95) and the experimental group (M = 63.07, SD = 10.88) conditions; $t(35)$ = 3.60, p = .01. Cohen's effect size value (d = 1.22) suggested a high practical significance. The higher scores indicated that the students in the control group significantly outperformed those in the experimental one in the retention tests. However, when comparing the mean scores between the retention and achievement tests within groups, a significant decrease in both groups was not found. This indicated that the students from the two groups could retain their word definitions in the long term.

Table 3. Comparison of retention scores between groups

Part	Control Group : 5/1 (n=19)		Experimental Group : 5/2 (n=18)		t-test	df	sig	Effect size
	Score in %		Score in %					
	Mean	S.D.	Mean	S.D.				
Achievement	61.21	10.84	63.27	12.39	.540	35	0.59	0.18
Retention	76.02	10.95	63.07	10.88	3.609**	35	0.01	1.22

** Significant at 0.01 level

In comparing the results within the group, a significant difference in the means between the achievement and retention tests of the control group was found (Table 4). The scores highly increased from 61.21 to 76.02 (t = 6.78, p < .01), meaning that the students in this group not only showed their vocabulary retention but also the growth of vocabulary size.

Table 4. Comparison of achievement and retention scores within the control group

Paired	Control Group : 5/1 (n=19)				Diff	t-test	df	sig
	Mean	S.D.	Mean	S.D.				
Achievement-Retention	61.21	10.84	76.02	10.95	14.81	6.781**	18	.000

** Significant at 0.01 level Diff = Difference

For the experimental group, the statistics suggested insignificant changes between the achievement and retention means (t = -.08, p = .93), indicating that after a two-week interval, their vocabulary definitional retrieval was maintained at the same level as 11 days earlier. In other words, the students could retain vocabulary in the long term. The non-increase scores in the retention tests showed a different result from that of the control group. That is, although their retention was evident, the experimental group's vocabulary size did not grow (Table 5).

Table 5. Comparison of achievement and retention scores within the experimental group

Paired	Experimental Group : 5/2 (n=18)				Diff	t-test	df	sig
	Mean	S.D.	Mean	S.D.				
Achievement-Retention	63.27	12.39	63.07	10.88	-.21	-.081	17	.936

Diff = Difference

4.2 Vocabulary Depth after Two-Week Interval

In answering RQ2, the findings revealed insignificantly different means in delayed vocabulary depth between the control group (M = 53.70, SD = 8.86) and the experimental group (M = 51.24, SD = 9.42) conditions; $t(35) = 0.82$, $p = .42$ (Table 6). This indicated that after a two-week interval, both groups demonstrated vocabulary depth knowledge at the same level. However, when scrutinizing the scores within groups, a significant improvement in the delayed depth tests was found in the control group while the experimental group's depth scores remained constant.

Table 6. Comparison of delayed vocabulary depth between groups

Part	**Control Group : 5/1 (n=19)**		**Experimental Group : 5/2 (n=18)**		**t-test**	**df**	**sig**	**Effect size**
	Score in %		**Score in %**					
	Mean	**S.D.**	**Mean**	**S.D.**				
Immediate	48.73	7.31	51.54	11.33	-.902	35	0.37	-0.30
Delayed	53.70	8.86	51.24	9.42	.822	35	0.42	0.28

In comparing the results within the control group, the means in the delayed depth tests significantly increased from that of the immediate depth tests (t = 2.12, p = .48). That is, the students in this group showed their development in vocabulary depth after a two-week interval (Table 7).

Table 7. Comparison of immediate and delayed depth scores within the control group

Paired	**Control Group : 5/1 (n=19)**				**Diff**	**t-test**	**df**	**sig**
	Mean	**S.D.**	**Mean**	**S.D.**				
Immediate - Delayed	48.73	7.31	53.70	8.86	4.97	2.12*	18	.048

* Significant at 0.05 level Diff = Difference

Based on (Table 8), the figures showed insignificant change in the means between the immediate and delayed depth tests (t = -.15, p = .87). It indicated that the experimental group demonstrated a consistent level of vocabulary depth knowledge within a two-week time span. The non-increase scores in the delayed depth tests showed that no development had occurred.

Table 8. Comparison of immediate and delayed depth scores within the experimental group

Paired	Experimental Group : 5/2 (n=18)				Diff	t-test	df	sig
	Mean	S.D.	Mean	S.D.				
Immediate - Delayed	51.54	11.33	51.24	9.42	-.31	-.15	17	.87

Diff = Difference

4.3 Student Perceptions of the Interventions and Practices

In answering research question 3 (RQ3), and giving further justification for the quantitative findings, content analysis was carried out. The researcher categorized the questions from the interview into four main aspects, as follows.

4.3.1 Voice from the experimental group

4.3.1.1 Overall perception of WordSift

The interview data revealed that the students in the experimental group had a positive attitude towards the use of WordSift. Two out of six interviewee students rated the application in overall use as average whereas the rest rated it as a very good alternative teaching tool. The image mode was a dominant property of WordSift all the interviewees satisfactorily referred to, while the benefit of the word context was mentioned only by some of those in a higher proficiency group. One fourth of the students (2 out of 8) pointed out issues that worsened the application quality. They were: 1) weak Internet signal, and 2) a blurred visualizer screen when looked at from a distance which affected their attitudes towards the use of technology. In the big picture, however, the experimental group felt the properties of WordSift could help capture their attention, and make the lessons more interesting. Some excerpts from the interviews are shown, as follows:

> “I like WordSift because of its pictorial presentation. It was interesting”
>
> B6*. (2018, January 23). Group Interview

> “WordSift provided a good new experience of vocabulary learning. It has an image window and shows parts of speech for the words.”
>
> B4*. (2018, January 23). Group Interview

> “I like WordSift because it provided picture mode and example sentences.”
>
> B3*. (2018, January 23). Group Interview

> “I think it was average because sometimes when the Internet signal was weak, it slowed down the learning pace. But the pictures were something that kept me focused and turned the boring lessons into enjoyable ones. […] When the list of sentences was shown, I learned grammatical structures from the patterns.”
>
> B1*. (2018, January 23). Group Interview

> “Overall, it was fair. The pictures were good. But when I sat in the back, I couldn’t see it clearly.”
>
> B7*. (2018, January 23). Group Interview

4.3.1.2 New learning strategies

According to the interviewed students in the experimental group, their previous experience of vocabulary learning was receiving a list of words from the teacher, and then looking them up in the dictionary for meanings. They had never realized that varied lexical forms could indicate different parts of speech which carry divergent meanings. By learning vocabulary through WordSift, the students were trained to exploit the presented information, e.g. pictures, identified parts of speech, and the word context, to figure out the word meanings. These students revealed that they employed new strategies for maintaining their vocabulary size and depth (memorizing the word meanings and how they were used in diverse contexts). Three new adopted strategies reported by the students were: 1) Associating the learned words with the pictures, 2) considering orthography as a clue for the word meaning and its function, and 3) learning and memorizing word meanings and their functions from example sentences. Some excerpts from the interviews are shown as follows.

> “When I encountered the words again, I tried to recall the pictures on the screen instead of doing literal translation, so it was easier to remember.”
>
> B8 *. (2018, January 23). Group Interview

"Yes, our experience in studying a new word was superficial (we only memorized its definitions). But when we learned through WordSift, we could see the pictures. We sighted parts of speech. We realized that in a noun form, a word carries one meaning. When it is in an adjective form, it conveys something different"

B2, B4 *. (2018, January 23). Group Interview

"It is very important to know that in different parts of speech, a word gives different meanings."

B7 *. (2018, January 23). Group Interview

"I adopted a new strategy in learning vocabulary. Usually, I only find the definitions of unfamiliar words by looking them up in the dictionary. But when I saw the sentence patterns (provided by WordSift), I also could memorize (the word meanings and) how to place the words in a sentence, and what modified what."

B1*. (2018, January 23). Group Interview

4.3.1.3 Experiences in classroom (CL matters)

WordSift was utilized through the TPACK perspective which concerned the teaching approach or CL in this particular study as a crucial variable in learning. The researcher, therefore, also explored how the students perceived the employment of CL in classroom. When the students were asked whether CL was found to be difficult in practice, they all disagreed. This information, to some extent, displayed a positive sign.

Teacher: What do you think? (CL was mentioned earlier)

B1-B8: It is not difficult in practice.

Teacher: Why not?

B1 : We are all classmates. It didn't give that awkward feeling when we had to work together.

(2018, January 23). Group Interview

In addition, the students reported the benefits of CL, namely that it provided more opportunities for the group members to negotiate with each other. Some excerpts from the interview are shown as follows:

"We can share and exchange ideas through this approach."

B3*. (2018, January 23). Group Interview

"Working collaboratively is necessary because it provides opportunities to discuss with peers."

B6*. (2018, January 23). Group Interview

"Collaborative learning is a good approach because the higher proficiency classmates can help share their ideas with the weaker group members."

B8*. (2018, January 23). Group Interview

4.3.1.4 Experiences outside the classroom

In order to investigate whether the amount of word exposure affected vocabulary retention and depth or not, the researcher interviewed the students about their activities outside the classroom, related to vocabulary learning. None of the students in this group performed such extra activity, owing to two reasons: 1) heavy workloads, and 2) the intention to examine the effectiveness of the application. Seven out of eight (B2-B8) set out the first reason for not doing the word reviews outside the classroom. The highest proficiency student was the only one who claimed she did not review vocabulary after the class because she intentionally evaluated the effectiveness of WordSift in enhancing her vocabulary retention (depth was not referred to).

"I already have a heavy workload."

B2- B8*. (2018, January 23). Group Interview

> “As we have never experienced learning through technology like this before, I want to see if it can help me recognize the words after class.”
>
> B1*. (2018, January 23). Group Interview

4.3.2 Voice from the control group

The other focus group interview was conducted with the control group in order to find additional justification. Texts were coded and categorized into three main perspectives as follows.

4.3.2.1 Overall perception of teacher-directed method.

According to the interview data, the control group’s positive learning outcomes appeared to contradict their preference. Although the students were satisfied with detailed knowledge transmitted by the teacher, they unanimously felt that the teacher-directed method was a humdrum teaching method that could not provide any new learning strategies to attract them, so it created an apathetic atmosphere in learning. The way the teacher prepared all the lessons and the exercise answers for the students hindered autonomous learning in terms of critical thinking and language skill drills. Some excerpts from the interviews are shown as follows:

> “It was boring.”
>
> A1*. (2018, January 23). Group Interview

> “It was good that everything was provided by the teacher. It probably did a self-taught student good, but it couldn’t encourage the lazy students to learn more outside formal classes.”
>
> A3*. (2018, January 23). Group Interview

> “Yes, it was good when the teacher explained parts of speech, meanings, and how to use each word in detail. On the other hand, we hardly answered the questions ourselves. We missed opportunities to drill in linguistic problem-solving skills.”
>
> A4*. (2018, January 23). Group Interview

"It was not fun at all, classroom activities. The sufficient information provided by the teacher was good. In one sense, it limited and discouraged us from thinking."

A8*. (2018, January 23). Group Interview

4.3.2.2 Practice outside classroom

When the conversation developed to some degree, it was revealed that after the first week, the students envisioned the curriculum design. They realized that vocabulary learned in an earlier session would be tested later. Consequently, all of them had an extra review one day prior to the class.

"I studied vocabulary one day before taking the test."

A1*. (2018, January 23). Group Interview

"Yes, we did the same."

A2 - A8*. (2018, January 23). Group Interview

4.3.2.3 Strategies used in the extra vocabulary reviews

The students in this group mentioned the process of rote learning as a strategy used when performing extra study outside the classroom. They spelled out the words letter by letter, memorized parts of speech and the Thai definitions. For vocabulary depth, they studied from the exercise handouts received in class. They memorized how a particular target word was put in a sentence, and how its varied forms were used.

"I just spelled it like… F-i-s-h — Fish — noun— ปลา I tried to memorized its other forms, and how they were placed in sentences."

A1*. (2018, January 23). Group Interview

"Yes, we did the same things."

A2- A8*. (2018, January 23). Group Interview

4.4 Discussion

The findings of this study respond to the three addressed research questions. 1) The student group learning vocabulary through the teacher-directed method (CG) significantly outperformed the student group using WordSift (EG) in vocabulary retention. 2) There were no significant differences in vocabulary depth between the students in two groups, and 3) the experimental group showed their positive perceptions of the use of WordSift in the classroom. More details on these and some possible justification are given below.

4.4.1 Vocabulary size

As the statistics show, the control group achieved a large increase in vocabulary retention scores while neither a substantial increase nor decrease was found in the experimental group. Taking account of qualitative data, the amount of word exposure might have been a key variable affecting these outcomes. As reported by the eight interviewees from the control group, these students had vocabulary review one day before the tests. This extra study was done on purpose as a preparation for the tests. Hence, the students must have worked on the words until they could remember their definitions. The amount of time spent on the review would have been different depending on each one's learning pace. But for certain, one would give his/herself sufficient revision time (word exposure) until they were set for the test on the following day. The researcher, therefore, suggests that the substantial increase in retention scores was mainly because of word exposure. This lends support to Pimsleur (1967), Zhu (2015), and Graves (2016), reporting that adequate word exposure could promote vocabulary retention.

On the contrary, although none of the students in the experimental group performed this extra activity before the tests, their vocabulary size in the retention tests was maintained at the same level as 11 days earlier. It then might be that the intervention with WordSift affected their word retrieval.

Launching into an explanation by the TPACK perspective, the provided features of WordSift (i.e. visualization and context), and the pedagogical approach (CL) might be claimed as stimulus that evoked memory, as supported by the experimental group during the interview. In terms of technology integration, WordSift

provided multimedia presentation and its benefits on vocabulary learning were evident. When a display came into sight, the brain would interpret the meanings of the input through both orthography and pictorial presentation. This phenomenon was in line with the doctrine advocated by Carpenter and Olson (2012), asserting that when new words and images are concurrently introduced, memory is better enhanced because both lexis and pictures are dually coded. The findings from this study were also consistent with Du (2013) and Chih-Cheng, Hsiao, Tseng, and Hsin-jung (2014) whose works affirmed that using multimedia in vocabulary teaching could help promote the students' retention. Another explanation could be that through the CL process, the experimental group already had had plenty of time being exposed to the words. As observed in class by the researcher, the students reiterated the words when trying to discuss their meanings to peers and had already heard them several times from the other group members. The whole process not only connected their sight and pronunciation with the schema, but also increased word exposure that would definitely lead to enduring memory (Du, 2013; Zhu ,2015; Graves, 2016)

The size of the words introduced to the students was also considered as a relevant factor affecting their retention. The results from this study showed that six vocabulary items were an appropriate number to study each time as it was not too high, so that each word could be thoroughly discussed by all group members. This was in line with Pimsleur (1967); Hunt and Beglar (2002). The researcher thus suggests that a moderate learning load matters because it affords sufficient time for learning.

4.4.2 Vocabulary depth knowledge

In contrast to the literal interpretation aspect, the two groups did not show a significant difference in vocabulary depth after 14 days of the treatment. However, when probing into the within-group scores, a different situation of internal development was found. The control group showed their significant improvement in vocabulary depth while the experimental one demonstrated the sustainability of their competence. The researcher proposed plausible explanations for these phenomena based on the students' experiences of vocabulary learning as follows.

In the control group, the extra study before the tests could be a fundamental cause, fostering the students' development. To restate, the students in this group performed this activity on purpose. Thus, they must have worked on vocabulary depth until they felt ready for the tests on a certain level. This would allow them exposure to the words in varied contexts. McKeown and Beck (2014) claimed that vocabulary learning would be effective if words were encountered a number of times.

As some excerpts above show, the strategies that the control group used in learning vocabulary depth somewhat depended on rote learning, e.g. memorizing how a specific form of a word was placed in a sentence. The students did not mention any other new strategies in addition to the cognitive approach such as using context clues to hint what was missing in a sentence. It then might have been possible that they were familiarized with this learning strategy so that they could do the tests well.

Without the extra review over the 14-day interval, it turned out that the vocabulary depth of the experimental group continued to exist unchangeably. It might be claimed that the intervention given to them was effective enough to help maintain their standard. In understanding how the treatment could affect their performance, a thorough critique is provided through the TPACK perspective. More data from the interview and classroom observation will be given.

First, classroom observation from this particular study showed that via the WordSift display, the students intently concentrated on the projection screen. As revealed by the interviewees, the example sentences in the context feature of WordSift could better grab their attention compared to general printed texts in worksheets or textbooks. This report concurred well with Walsh, Sun, and Riconscente (2011), contending that technology integration would draw learners' attention and engage them in learning. More explanation from the researcher is that, the target words in the sentences shown by WordSift were highlighted. The spelling that jumped out at the students could make it easier to spot. This is the benefit of WordSift that was also stated in Talang and Mahmoodi (2013) and Smith and Qayyum (2017). Furthermore, some quoted excerpts from the experimental group implied that the presentation of the context helped them focus on a whole sentence, not just one target word in isolation, and changed their literal translation habits into more meaningful interpretation. It then might be claimed that over several hours of

the treatment, the students drilled themselves in vocabulary depth until they achieved a reasonable level of understanding. Therefore, they could maintain this competence without any extra reviews. This was in line with Merawati (2003), McKeown and Beck (2014), and Shokuhi and Pishkar (2015), suggesting that vocabulary learning would be effective if it is learned through contextual use.

Second, returning to the TPACK model, the pedagogical use in class also determines learning outcomes. The implementation of CL in this study was seen beneficial for its affordance of language exposure and critical thinking. Expanding on this point, vocabulary depth questions requires more intellectual process to solutions. Before the students got an absolute answer, some concerted actions within group were performed through reading, speaking, and listening (word exposure). Be it thinking up an idea, exchanging it, articulating, or drawing a logical conclusion, the students must have utilized critical thinking skills along the way. Similarly, Dobao (2014), and Fujiwara and Sato (2015) found that word elaboration brought about preferable results compared to one way communication. The researcher of this current study claimed that CL could reinforce genuine contribution to accomplishments. Consequently, it undoubtedly influenced on the learning outcomes in the experimental group. Previous studies proved the advantages of CL use with multimedia-integrated teaching such as observed by Du (2013); Chih-Cheng, Hsiao, Tseng, and Hsin-jung (2014); Waemusa (2016).

4.4.3 Perception of the interventions

4.4.3.1 The teacher-directed method

The findings from the interview data showed that the teacher-directed method received unfavourable viewpoints from the control group. It is quite understandable when all of the students regarded this teaching method as a monotonous style because they had experienced this setting for over a decade. If seeking insights into the students' perceptions through the TPACK perspective, a plausible explanation could be that the conventional teaching approach might not suit some academic content. In ESL learning, interpersonal communication needs a push. Wolsey, Smetana, and Grisham (2015) asserted that technology could bring about classroom engagement. An absence of it, therefore, might result in a tepid reaction from the students.

Hence, when classroom engagement was less encouraged, the control group failed to perform essentially social skills which eventually led to a loss of enthusiasm and interest in learning.

4.4.3.2 The use of WordSift

Conversely, further replications from the experimental group revealed their attitudes towards WordSift in a positive way. In response to RQ3, most of the interviewees deemed the employment of WordSift beneficial and evaluated it as a good teaching tool. Although some students rated this application averagely, the reasons they gave were from some outer factors rather than from the features of WordSift itself. For example, when a student claimed that an unstable Internet signal obstructed the learning pace, the trouble was caused by insufficient network connection. It is suggested that, to ensure that technology be fully exploited, other relevant issues should be considered additionally, e.g. the readiness of its implementation. The following is an in-depth discussion as to why WordSift gained student preference.

As reported by the students, they could focus on the lessons longer in the WordSift-integrated classroom. Moreover, the learning environment seemed to be more enjoyable. It could be claimed that multimedia technology has its potential in exciting students' interest. As the information was presented in colourful and varied forms, it tended to be more stimulating, compared to data in plain written form. This supports the studies of Talang and Mahmoodi (2013); Rahman (2014); and Khiyabani, Ghonsooly, and Ghabanchi (2014). In Carpenter and Olson (2012), it was suggested that if pictures were displayed together with orthography, input data would be interpreted via two channels, resulting in better memory. The report from the students in this study was aligned with this notion. Furthermore, analyzed conversation implied that pictures helped connect the students to authentic visuals. When they faced the learned words again, it was the related picture that helped them recognize their meanings. In terms of vocabulary depth, WordSift provided a list of example sentences. When the target word was shown in context, the students reported they could easily understand its function and usage.

5. CONCLUSION AND IMPLICATIONS

This study has reported in its findings on the effects of using WordSift on vocabulary retention and depth. The results showed that in the definitional retention aspect, the control group significantly outperformed the experimental one. However, the retention scores within groups showed that both groups could retain vocabulary in the long term. For depth aspects, the findings showed no significant differences between groups. However, the comparison between the immediate and delayed depth tests within groups, significant development could be seen in the control group while significant improvement or regression was not found in the experimental group. This indicated that the experimental group could maintain their vocabulary depth knowledge in the long term. In addition, the experimental group showed their positive perceptions in the use of WordSift in the classroom.

The implications from the findings suggest that using WordSift for vocabulary retention and depth needs a redesigned curriculum if this approach is expected to provide better learning outcomes, as compared to the teacher-directed method, as claimed by technology-integrated learning theories such as TPACK. However, using WordSift through the TPACK perspective gives insights into the properties of this technology and the other two knowledge domains in relation to pedagogical purposes in teaching vocabulary. Successful learning outcomes depend on how to employ the appropriate technology based upon learning objectives, suit theories, and compatible teaching approaches. The findings from this study indicate that using WordSift could help retain vocabulary and maintain depth knowledge in the long term. The application also received a positive perception from the students. The following suggestions will be discussed for the benefit of future studies.

6. SUGGESTIONS FOR FUTURE STUDIES

Future studies should focus on how teachers should adopt other available technology to support students in learning vocabulary. More importantly, teachers need to change their attitude toward the use of technology and its practice. They should adopt new roles of education with technology (Laal & Laal, 2012). That means being a designer and facilitator. For example, they can manage how and when to utilize the properties of each device for practical effectiveness.

In terms of technology implementation in this study, the teacher was the only person who operated WordSift. In the future, having the students directly interact with the tool or other different technologies could be another practice that may encourage their eagerness in learning and may reinforce them to accomplish their mutual tasks.

Orientation about collaborative learning should be provided to emphasize the importance of building knowledge together and to ensure that learning procedures are on track. Moreover, a longer period should be allocated for the CL approach. In other cases, if CL opposes learning objectives or does not support specific types of technology, teachers should be responsible for re-designing curricula to ensure the ultimate learning goals. Vocabulary size might be adjusted to suit student level and proficiency.

Technology employment will call for high quality resources, adequate equipment, and the readiness of stakeholders such as policy makers, school administrators, and teachers. A research setting will be a key independent variable that researchers who are about to conduct studies in relation to educational technology should be aware of.

6.1 Limitations

In this study, some limitations should be mentioned. First, this study was conducted on groups of M.5 students who were not familiar with varied forms of parts of speech. They did not experience learning vocabulary by context before. The findings, therefore, may not be applied or generalized to a different condition or other settings. Second, as the researcher used multiple choice tests which already provided choices for each item (the objective test) to measure student word depth performance, they might not have been able to demonstrate the best performance in using the words, and the results could have been different if they had performed the subjective form test. Third, the findings from this study revealed the effectiveness of the treatment when a small number of vocabulary items were introduced to the students in each session. The merit may not be conclusive for a different learning load for students such as when a larger size of vocabulary is introduced over a longer period of time.

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APPENDICES

Appendix A Vocabulary Survey Form

แบบสำรวจคำศัพท์ภาษาอังกฤษ

Vocabulary Survey Form

ชื่อ.....นามสกุล.....
ชั้นมัธยมศึกษาปีที่ .....เลขที่.....
วันที่.....เดือน.....พ.ศ. .....

<u>คำชี้แจง</u>

1. ข้อสอบฉบับนี้เป็นแบบเติมคำ จำนวน 4 หน้า 90 ข้อ
2. การทำข้อสอบแบ่งเป็น 2 ช่วง มีเวลาพักระหว่างทำข้อสอบ 5 นาที
   ช่วงที่ 1 ข้อ 1-45 เวลาในการทำข้อสอบ 15 นาที
   ช่วงที่ 2 ข้อ 46-90 เวลาในการทำข้อสอบ 15 นาที
3. เวลาที่ใช้ในการทำข้อสอบทั้งหมด 30 นาที

ช่วงที่ 1

<u>คำสั่ง</u> จงเติมความหมายที่ถูกต้องของคำศัพท์เป็นภาษาไทย หากไม่ทราบหรือไม่แน่ใจให้เว้นว่าง

คำศัพท์	ชนิดของคำ	ความหมาย
1. Shallow	adj.	
2. Desert	n.	
3. Expel	v. (base form)	
4. Weight	n.	
5. Grief	n.	
6. Taste	v. (base form)	
7. Tongue	n.	
8. Sweep	v. (base form)	
9. Constantly	adv.	
10. Lost	adj.	
11. Row	n.	
12. Exist	v. (base form)	
13. Appetite	n.	
14. Energetic	adj.	
15. Attentive	adj.	
16. Passionate	adj.	
17. Split up	phrv.	
18. Discover	v. (base form)	
19. Decrease	v. (base form)	
20. Get over	phrv.	
21. Abuse	n.	

คำศัพท์	ชนิดของคำ	ความหมาย
22. Purpose	n.	
23. Substance	n.	
24. Predict	v. (base form)	
25. Addict	n.	
26. Suicide	n.	
27. Abolish	v. (base form)	
28. Isolation	n.	
29. Symptom	n.	
30. Solution	n.	
31. Mythical	adj.	
32. Waist	n.	
33. Inhabit	v. (base form)	
34. Sink	v. (base form)	
35. Cave	n.	
36. Depict	v. (base form)	
37. Dwellers	n.	
38. Extinct	v. (base form)	
39. Manatee	n.	
40. Unfamiliar	adj.	
41. Incredible	adj.	
42. Voyage	n.	
43. Sail	v. (base form)	
44. Challenge	n.	
45. Set off	phrv.	

* สิ้นสุดแบบทดสอบช่วงที 1

ช่วงที่ 2

คำศัพท์	ชนิดของคำ	ความหมาย
46. Terrible	adj.	
47. Epic	adj.	
48. Tiny	adj.	
49. Tenacious	adj.	
50. Leave	v. (base form)	
51. Exotic	adj.	
52. Opinion	n.	
53. Won	v. (past simple)	
54. Victory	n.	
55. Crime	n.	
56. Workaholic	n.	
57. Stressed	adj.	
58. Powerful	adj.	
59. Content	adj.	
60. Rest	n.	
61. Blew	v. (past simple)	
62. Caught	v. (past simple)	
63. Fought	v. (past simple)	
64. Taught	v. (past simple)	
65. Stuck	v. (past simple)	
66. Threw	v. (past simple)	
67. Lit	v. (past simple)	
68. Shot	v. (past simple)	
69. Lent	v. (past simple)	
70. Hid	v. (past simple)	

คำศัพท์	ชนิดของคำ	ความหมาย
71. Rock	v. (base form)	
72. Bright	adj.	
73. Swell	adj.	
74. Distance	n.	
75. Recognize	v. (base form)	
76. Wrap	v. (base form)	
77. Fool	v. (base form)	
78. Rely on	phrv.	
79. Tore	v. (past simple)	
80. Around the clock	adv.	
81. Phenomenon	n.	
82. Revolution	n.	
83. Field	n.	
84. Alternative	n.	
85. Exhausted	adj.	
86. Allow	v. (base form)	
87. Poverty	n.	
88. Receive	v. (base form)	
89. Income	n.	
90. Condition	n.	

* สิ้นสุดแบบทดสอบช่วงที่ 2

ขอบคุณนักเรียนทุกคนที่ให้ความร่วมมือ

Appendix B Selected 54 Unknown Vocabulary Items

คำศัพท์	ชนิดของคำ	คำศัพท์	ชนิดของคำ
1. Shallow	adj.	28. Terrible	adj.
2. Desert	n.	29. Leave	v. (base form)
3. Grief	n.	30. Tenacious	adj.
4. Taste	v. (base form)	31. Exotic	adj.
5. Sweep	v. (base form)	32. Won	v. (past simple)
6. Constantly	adv.	33. Crime	n.
7. Row	n.	34. Workaholic	n.
8. Exist	v. (base form)	35. Stressed	adj.
9. Appetite	n.	36. Powerful	adj.
10. Energetic	adj.	37. Fought	v. (past simple)
11. Attentive	adj.	38. Taught	v. (past simple)
12. Discover	v.(base form)	39. Lit	v. (past simple)
13. Abuse	n.	40. Shot	v. (past simple)
14. Purpose	n.	41. Lent	v. (past simple)
15. Predict	v. (base form)	42. Hid	v. (past simple)
16. Addict	n.	43. Swell	adj.
17. Suicide	n.	44. Recognise	v. (base form)
18. Isolation	n.	45. Fool	v. (base form)
19. Mythical	adj.	46. Rely (on)	phrv.
20. Inhabit	v. (base form)	47. Tore	v. (past simple)
21. Sink	v. (base form)	48. Wrap	v. (base form)
22. Depict	v. (base form)	49. Phenomenon	n.
23. Dweller	n.	50. Alternative	n.
24. Extinct	v. (base form)	51. Exhausted	adj.
25. Voyage	n.	52. Poverty	n.
26. Sail	v. (base form)	53. Receive	v. (base form)
27. Challenge	n.	54. Condition	n.

Appendix C Vocabulary Exercises 1and 2

The Ministers for Exams

Exercise 1

<u>คำสั่ง</u> จงเติมความหมายที่ถูกต้องของคำศัพท์เป็นภาษาไทย

คำศัพท์	ชนิดของคำ	ความหมาย
1. Shallow	adj.	
2. Desert	n.	
3. Grief	n.	
4. Taste	v. (base form)	
5. Sweep	v. (base form)	
6. Constantly	adv.	

Exercise 2 จงเติมคำที่ถูกต้องลงในช่องว่าง

1. Shallow

- shallow (adj) ตื้น
- shallowly (adv) อย่างตื้นๆ, ไม่ลึก
- shallowness (n) ความตื้น

1. The river is _____.
2. Because of the _____of the water, we could see the fish.
3. He breathes _____.

2. Desert

- desert (n) ทะเลทราย
- desertion (n) การหนีทหาร
- deserter (n) คนหนีทหาร

1. _____ is the act of leaving without permission.
2. If Bill leaves the military, he is a _____.
3. The Sahara is the largest _____.

3. Grief

- grief (n) ความเศร้าโศก
- grievious (adj) ที่ทำให้เศร้าใจ
- grievously (adv) อย่างเศร้าโศก

1. Paul shows his _____.
2. He talks to his son _____.
3. Her death is a _____loss.

4. Taste

- tasty (adj) อร่อย
- taste (v) ชิม
- tasteful (adj) ซึ่งมีรสชาติดี

1. This soup is very _____.
2. She cooks a_____ meal.
3. _____ this soup! It is yummy.

5. Sweep

- sweeping (adj) คลอบคลุม กว้างขวาง
- sweep (v) กวาด
- sweeper (n) คนปัดกวาด

1. A road _____ is cleaning the road.
2. I _____ the kitchen floor.
3. I drive on a _____ driveway.

6. Constantly

- constant (adj) ต่อเนื่อง
- constantly (adv) อย่างต่อเนื่อง สม่ำเสมอ

1. The _____ noise drives me crazy.
2. He exercises _____.

* drive (someone) crazy ทำให้ (ใครบางคน) หงุดหงิด

Appendix D Vocabulary Achievement and Retention Tests

Name.....M.5/.....No.....

Vocabulary Achievement Test (Week 1)

The Minister for Exams

Directions: Please fill in the definitions of the following words in Thai.
Time allocated is 5 minutes.

คำศัพท์	ชนิดของคำ	ความหมาย
1. Shallow	adj.	
2. Desert	n.	
3. Grief	n.	
4. Taste	v. (base form)	
5. Sweep	v. (base form)	
6. Constantly	adv.	

►----------◄

Name.....M.5/.....No.....

Vocabulary Retention Test (Week 1)

The Minister for Exams

Directions: Please fill in the definitions of the following words in Thai.
Time allocated is 5 minutes.

คำศัพท์	ชนิดของคำ	ความหมาย
1. Sweep	v. (base form)	
2. Taste	v. (base form)	
3. Constantly	adv.	
4. Desert	n.	
5. Shallow	adj.	
6. Grief	n.	

Appendix E Immediate and Delayed Vocabulary Depth Tests

Name.....M.5/.....No.....

Immediate Vocabulary Depth Test (Week 1)

Directions: Please mark the correct answers. Time allocated is 5 minutes.

1. The canal is _____.

   a. shallow b. shallowly c. shallowness

2. A camel is an animal that lives in _____.

   a. desertion b. desert c. deserter

3. He makes a _____ error.

   a. grief b. grievous c. grievously

4. _____ this sauce and tell me if it needs seasoning.

   a. Taste b. Tasty c. Tasteful

5. He got a job as a road _____.

   a. sweeping b. sweep c. sweeper

6. Please drive at _____ speed.

   a. constanting b. constant c. constantly

Name.....M.5/.....No.....

Delayed Vocabulary Depth Test (Week 1)

Directions: Please mark the correct answers. Time allocated is 5 minutes.

1. A camel is an animal that lives in the_____.

   a. desert b. desertion c. deserter

2. He makes a _____ error.

   a. grief b. grievously c. grievous

3. He got a job as a road _____.

   a. sweeping b. sweeper c. sweep

4. Please drive at _____speed.

   a. constant b. constanting c. constantly

5. The canal is _____.

   a. shallowly b. shallow c. shallowness

6. _____ this sauce and tell me if it needs seasoning.

   a. Tasteful b. Tasty c. Taste

Appendix F Interview Question Sets

Interview Questions (EG)

1. Do you like to learn vocabulary through WordSift? Why?
2. What are the advantages or disadvantages of using WordSift?
3. What features of the tool you like the most and least? Why?
4. Do you learn any new learning strategies through the use of WordSift?
5. How do you feel about working collaboratively in a small group?
6. What are the advantages or disadvantages of working in groups?
7. Does technology integration have any impact on your study compared to learning through the teacher-directed method?

►----------◄

Interview Questions (CG)

1. Do you like to learn vocabulary through the teacher-directed method? Why?
2. What are the advantages or disadvantages of this method?
3. Do you learn any new learning strategies through this method?
4. How do you feel about learning through the teacher-directed style?
5. Does the teacher-directed method have any impact on your study?

Appendix G Consent Form

เอกสารแบบแสดงความยินยอม
ของอาสาสมัครเข้าร่วมการวิจัย (Consent Form)

โครงการวิจัยเรื่อง....ประสิทธิผลของการใช้โปรแกรมเวิร์ดซิฟต์สอนคำศัพท์ภาษาอังกฤษที่มี.....
ต่อความคงทนในการจำคำศัพท์และการนำไปใช้ สำหรับนักเรียนชั้น ม.5 รร.ควนขนุน จ.พัทลุง

ให้คำยินยอม วันที่..... เดือน.....พ.ศ .....

ก่อนที่จะลงนามในใบยินยอมเข้าร่วมเป็นกลุ่มตัวอย่างหรืออาสาสมัครในโครงการวิจัยนี้ ข้าพเจ้าได้รับการอธิบายถึงวัตถุประสงค์ของโครงการวิจัย วิธีการวิจัย และรายละเอียดต่างๆ ข้าพเจ้าเข้าใจคำอธิบายดังกล่าวครบถ้วนเป็นอย่างดีแล้ว

ผู้วิจัยรับรองว่าจะตอบคำถามต่างๆ ที่ข้าพเจ้าสงสัยเกี่ยวกับการวิจัยนี้ด้วยความเต็มใจ และไม่ปิดบังซ่อนเร้นจนข้าพเจ้าพอใจ การเข้าร่วมการวิจัยนั้นไม่มีผลกระทบต่อคะแนนหรือเกรดของรายวิชา อ 32102 ที่ข้าพเจ้าจะพึงได้รับต่อไป

ผู้วิจัยรับรองว่าจะเก็บข้อมูลเฉพาะเกี่ยวกับตัวข้าพเจ้าเป็นความลับ จะเปิดเผยได้เฉพาะในรูปที่เป็นสรุปผลการวิจัย การเปิดเผยข้อมูลของข้าพเจ้าต่อหน่วยงานต่างๆ ที่เกี่ยวข้องต้องได้รับอนุญาตจากข้าพเจ้า

ข้าพเจ้าได้อ่านข้อความข้างต้นแล้วมีความเข้าใจดีทุกประการ และได้ลงนามในใบยินยอมนี้ด้วยความเต็มใจ

ลงนาม .....ผู้ยินยอม
(.....)

ลงนาม .....พยาน
(.....)

ลงนาม .....ผู้ทำวิจัย
(.....ร.ท.หญิง ศุภธิดา ดำชู.....)

Appendix H Example of the Lessons

Listen and read the poem. Fill in the gap with the missing word or expression.

'The Minister for Exams'

When I was a child I sat an exam.
The test was so simple.
There was no way I could (1)_____.

Q1. Describe the taste of the moon.
It tastes like Creation I wrote,
It has the (2)_____ of starlight.

Q2. What colour is Love?
Love is the colour of the water a man
lost in the (3)_____ finds, I wrote.

Q3. Why do snowflakes melt?
I wrote, they (4)_____ because they fall
onto the warm tongue of God.

There were other questions.
They were as simple.

I describes the (5) _____ of Adam when he
was (6) _____ from Eden.
I wrote down the exact weight of an elephant's dream.

Yet today, many years later,
For my living I sweep the streets
or clean out the toilets of the fat hotels.

Why? Because I constantly failed my exan
Why? Well, let me set a test.

Q1. How large is a child's imagination?
Q2. How (7) _____ is the soul of the Minister
for exams?

Brian Patten (1996)

Appendix I Lesson Plans

LESSON PLAN WEEK 1

(Experimental Group)

Topic: The Minister for Exams

Objectives: 1.The students can tell the meanings of 6 target vocabulary items through group discussion activity, using the information provided by WordSift.

2. The students can choose the right word forms which give the appropriate meanings when completing sentences.

Target vocabulary:

1. Shallow
2. Desert
3. Grief
4. Taste
5. Sweep
6. Constantly

1st session: Word meanings and vocabulary depth

Materials: WordSift presentation, exercises

Time allocated: 35 minutes

1. Warm-up

- The teacher shows some pictures related to the day's lesson and has the students guess the story they are going to read.

- The teacher shows the content through WordSift presentation, giving them a little more time to determine if the words closely clue to what they predicted.

- The teacher tells the students what they are going to read, asks them to share some ideas to tap into prior knowledge.

(5 minutes)

2. Activity and exercise

- The teacher divides the students into small groups of 3-4, and distributes exercise worksheet (see Appendix C) to everyone. She presents selected 6 unknown words from the lesson (one at a time), using images and the contexts of the words provided by WordSift as the hints. In group discussions, the students have to fill in the word definitions after proposing, discussing, and elaborating the ideas with peers (Exercise 1).

- After each group accomplishes their task, they will share their answers among groups. The teacher then will give the correct answers.

(15 minutes)

- The teacher distributes the exercise 2 to everyone. The exercise provides the other forms of the target words and the different meanings according to their parts of speech. By discussing in the same group, the students complete the provided sentences by choosing the appropriate word forms and filling in the blank. When every group is done, the teacher encourages them to give explanation to the class and helps them find the correct answer.

(15 minutes)

2nd session: Word achievement (and retention) tests, Immediate (and delayed) vocabulary depth tests

Materials: vocabulary achievement (and retention) tests, immediate (and delayed) vocabulary depth tests

Time allocated: 35 minutes

Before class in the second session of the week begins, vocabulary achievement and immediate vocabulary depth tests will be conducted. Starting from the third week, the retention and delayed vocabulary depth tests will be distributed altogether.

Note: Time allocated:

- 5 minutes for word achievement test
- 5 minutes for word retention test
- 10 minutes for immediate vocabulary depth test
- 10 minutes for delayed vocabulary depth test

WEEK 1 LESSON PLAN (CONTROL GROUP)

Topic: The Minister for Exams

Objectives: 1.The students can tell the meanings of 6 target vocabulary items by learning through the teacher-directed method

2. The students can choose the right word forms which give the appropriate meanings when making sentences.

Target vocabulary:

1. Shallow	4. Taste
2. Desert	5. Sweep
3. Grief	6. Constantly

1st session: Word meanings and vocabulary depth

Materials: Whiteboard, markers, exercises

Time allocated: 35 minutes

1. Warm-up

- The teacher shows some pictures related to the day's lesson and has the students guess the story they are going to read.
- The teacher tells the students what they are going to read, asks them to share some ideas to tap into prior knowledge.

(5 minutes)

2. Activity and exercise

- The teacher distributes exercise 1 which requires the students to fill in the definitions of the six target words in Thai. She dictates the meanings to the class to jot down.

- After handing out exercise 2, the teacher introduces other varied forms of the target words that carry different meanings in accordance with parts of speech. The teacher explains how to use the words in detail. The students complete the sentences having the teacher guide them item by item.

(30 minutes)

2nd session: Word achievement (and retention) tests, Immediate (and delayed) vocabulary depth tests

Materials: Word achievement (and retention) tests, immediate (and delayed) vocabulary depth tests

Time allocated: 35 minutes

Before class in the second session of the week begins, vocabulary achievement and immediate vocabulary depth tests will be conducted. Starting from the third week, the retention and delayed vocabulary depth tests will be distributed altogether.

Note: Time allocated:

- 5 minutes for word achievement test
- 5 minutes for word retention test
- 10 minutes for immediate vocabulary depth test
- 10 minutes for delayed vocabulary depth test

PUBLISHED ABSTRACT

Using WordSift in English Vocabulary Teaching in a Thai classroom: Can It Boost Student Vocabulary Retention?

10th International Conference on Humanities and Social Sciences, 10th ICHiSS 2018
Kuala Lumpur (Malaysia) 11th May 2018-13th May 2018
Understanding Regional and Global Integration on Humanities and Social Sciences

Using WordSift in English Vocabulary Teaching in a Thai classroom: Can It Boost Student Vocabulary Retention?

Supatida Dumchoo[1] and Zainee Waemusa[1]
[1]Prince of Songkla University

Abstract

WordSift, a free word cloud generator website, can be utilized to provide students with ample opportunities to engage with learning. However, little is known about its pedagogical applications in classroom use, especially its effects on student retention in learning English vocabulary collaboratively. The objectives of this paper are to report the effects of using WordSift, as an educational technology in English vocabulary teaching on student vocabulary retention and the student perception towards this tool. The treatment was conducted based on the notion of technological pedagogical content knowledge or TPACK (Mishra & Koehler, 2006). A mixed method design was conducted with two groups of secondary students, one group learning vocabulary collaboratively through the intervention by utilizing WordSift, and the other one through the traditional, teacher-directed method. Vocabulary retention tests were administered to both groups to measure student retention while the interviews were conducted with them to explore in depth data. Results showed that both groups showed their retention in learning vocabulary. However, the control group significantly outperformed the experimental group who revealed that they favored learning vocabulary with WordSift and perceived this tool can evoke their memory. The authors argue that using WordSift can promote student vocabulary retention if it is carefully designed and implemented.

Keywords: WordSift, vocabulary retention, collaborative learning, Thai EFL students, TPACK

PUBLISHED PAPER

Using WordSift in English Vocabulary Teaching in a Thai classroom: Student Vocabulary Retention

การใช้โปรแกรมเวิร์ดซิฟต์สอนคำศัพท์ภาษาอังกฤษในชั้นเรียนไทยกับความคงทนในการจำคำศัพท์ของนักเรียน

Using WordSift in English Vocabulary Teaching in a Thai classroom: Student Vocabulary Retention

ศุภธิดา ดำชู[4]
Supatida Dumchoo
ไซนี แวมูซอ[5]
Zainee Waemusa

บทคัดย่อ

เวิร์ดซิฟต์ คือเว็บไซต์สร้างกลุ่มคำออนไลน์ที่พัฒนาขึ้นสำหรับการสอนคำศัพท์ แต่งานวิจัยที่ศึกษาประสิทธิผลของโปรแกรมนี้ต่อความคงทนในการจำคำศัพท์ยังมีจำกัด บทความนี้มีวัตถุประสงค์เพื่อ 1) เปรียบเทียบความคงทนในการจำคำศัพท์ภาษาอังกฤษของนักเรียนกลุ่มทดลองที่เรียนคำศัพท์ผ่านเวิร์ดซิฟต์ กับกลุ่มควบคุมที่เรียนโดยมีครูเป็นผู้ชี้นำ 2) นำเสนอทัศนคติของนักเรียนต่อการเรียนดังกล่าว งานวิจัยนี้ใช้หลักการตาม TPACK บูรณาการความรู้ด้านเนื้อหา การเรียนการสอน และเทคโนโลยี โดยกลุ่มตัวอย่างเป็นนักเรียนชั้นมัธยมศึกษาปีที่ 5 จำนวน 37 คน ในโรงเรียนมัธยมศึกษาแห่งหนึ่งในจังหวัดพัทลุง จำนวน 2 กลุ่ม มีเครื่องมือวิจัยคือ แบบสำรวจคำศัพท์ แบบฝึกหัดคำศัพท์ ข้อสอบวัดผลสัมฤทธิ์ ซึ่งสอบหลังเรียน 3 วัน ข้อสอบวัดความคงทนในการจำคำศัพท์ในระยะยาวหรือหลังเรียน 14 วัน และคำถามสัมภาษณ์แบบกึ่งโครงสร้าง ผลการศึกษา โดยใช้ Independent *t* test พบว่า นักเรียนกลุ่มควบคุมมีคะแนนสูงกว่ากลุ่มทดลองอย่างมีนัยสำคัญ, $t(35) = 3.609$, $p = .01$ อย่างไรก็ตาม การเปรียบเทียบคะแนนภายในกลุ่ม โดยใช้ Paired *t* test ไม่พบว่าคะแนนการทดสอบคำศัพท์ของทั้งสองกลุ่มลดลงอย่างมีนัยสำคัญเมื่อเปรียบเทียบกับคะแนนผลสัมฤทธิ์ (กลุ่มทดลอง $t = -.08$, $p = .93$, กลุ่มควบคุม $t = 6.78$, $p < 0.01$) ชี้ให้เห็นว่ามีความคงทนในการจำคำศัพท์ นอกจากนี้ข้อมูลจากการสัมภาษณ์พบว่าเวิร์ดซิฟต์มีส่วนช่วยส่งเสริมการเรียนและการจำคำศัพท์ในทางบวก การวิจัยในอนาคตควรศึกษาวิธีประยุกต์ใช้เวิร์ดซิฟต์เพื่อช่วยเพิ่มปริมาณคำศัพท์ที่นักเรียนจดจำในระยะยาว

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[4] นักศึกษาระดับปริญญาโท สาขาการสอนภาษาอังกฤษเป็นภาษานานาชาติ ภาควิชาภาษาและภาษาศาสตร์ คณะศิลปศาสตร์ มหาวิทยาลัยสงขลานครินทร์ วิทยาเขตหาดใหญ่
M.A. Student, Teaching English as an International Language, Department of Languages and Linguistics, Faculty of Liberal Arts, Prince of Songkla University, Hat Yai Campus
[5] ผศ.ดร. ภาควิชาภาษาและภาษาศาสตร์ คณะศิลปศาสตร์ มหาวิทยาลัยสงขลานครินทร์ วิทยาเขตหาดใหญ่
Assistant Professor, Ph.D., Department of Languages and Linguistics, Faculty of Liberal Arts, Prince of Songkla University, Hat Yai Campus

คำสำคัญ: เวิร์ดซิฟต์, ความคงทนในการจำคำศัพท์, การเรียนรู้แบบร่วมมือ, การเรียนภาษาอังกฤษในฐานะภาษาต่างประเทศของนักเรียนไทย, TPACK

Abstract

WordSift is a word cloud generator website developed for vocabulary teaching. However, few empirical studies have examined its effects on vocabulary retention. This study aimed to 1) compare students' English vocabulary retention between an experimental group learning new words through WordSift and a control group learning through the teacher-directed method; 2) report on students' perceptions in vocabulary learning. The technological pedagogical content knowledge (TPACK model) was utilized as a theoretical framework. The subjects were 37 Mathayomsuksa 5 students in a secondary school in Phatthalung Province, Thailand, who were divided into two groups: the experimental group and the control one. The researcher used the following research tools: vocabulary survey forms, exercise handouts, achievement tests administered after 3 days of the treatment, retention tests administered after 14 days of the treatment, and semi-structured interview question sets. The results showed that through the Independent *t* test, the control group significantly outperformed the experimental one in vocabulary retention, $t(35) = 3.609$, $p = .01$. However, through the Paired *t* test, the scores within groups did not show significant decrease from the achievement tests (experimental group $t = -.08$, $p = .93$, control group $t = 6.78$, $p < 0.01$) and thus indicated vocabulary retention. Moreover, the interview data revealed that WordSift helped students' learning and vocabulary retention in positive ways. It is suggested that future studies should focus on the effects of WordSift use on increasing vocabulary size in long term retention.

Keywords: WordSift, vocabulary retention, collaborative learning, Thai EFL students, TPACK

Introduction

Vocabulary is the gist of English teaching because lexis is basically a fundamental element in languages (Lessard-Clouston, 2013). In the English as a foreign language (EFL) context, language learners tend to acquire unfamiliar words through their normal classrooms, while native speakers have plenty of opportunity to be exposed to a large amount of new vocabulary throughout their entire life (Siyanova-Chanturia & Webb, 2016).

According to Goulden, Nation, and Read (1990), an estimated size of vocabulary that an educated English native speaker knows is around 20,000 word families, whereas the vocabulary size of a well-educated non-native speaker of English is smaller than a half of that or around 8000–9000 word families (Nation, 2006). Sadeghi, Khezrlou, and Modirkhameneh (2016) reported that advanced language learners will possess a larger size of vocabulary compared to those low proficiency users. Adequate word bank contributes to better language quality by extending word choice when producing output and enhancing thorough understanding in receptive skills. Vocabulary teaching, therefore, is central for EFL.

Vocabulary acquisition is intertwined with retention when ones recognize the meanings of orthography they see, sounds they hear, or are able to pick up a word in the repertoire and use for their production. Despite a vital role of vocabulary learning, many Thai students struggle with their limited English vocabulary (Srimanee & Laohawiriyanon, 2014). A possible justification is that English is used as a foreign language in Thailand and most of the learning occurs in formal classrooms where students might not have adequate opportunity to be exposed to the English language. Jingjit (2015) also pointed out that inaction on vocabulary teaching in Thailand, especially the lack of technology integration, decreased students' interest and dampened their enthusiasm for learning. As a result, recent educational policy encourages teachers to utilize the potentials of new technology into the classroom. The same phenomenon happens worldwide in this digital age. However, although current teaching methods are technocentric, many educational technologies are applied without an understanding of proper pedagogical approaches (Mishra & Koehler, 2006).

Literature shows that a well-integrated technology in education could help learners learn a foreign language, especially vocabulary. In Dubois and Vial's (2000) study, it was evidenced that the use of multimedia technology[6] could help evoke learners' memory in learning Russian vocabulary as a foreign language. WordSift[7], for example, is one of the multimedia representations that was purposefully created for vocabulary teaching (Hakuta, 2011). The program provides a visual display in different modes which relates to a clicked word in the cloud, i.e. pictorial representation, videos, thesaurus, and context. The application offered ample opportunities to play with the language and teachers can design classroom activities together with a compatible pedagogy that meets the learning needs.

WordSift is a free word cloud generator website, and its benefits on vocabulary retention were documented in Talang and Mahmoodi (2013) and Smith and Qayyum (2017). This application, however, has not yet been investigated in any Thai context. Talang and Mahmoodi (2013) also suggested that a compatible pedagogical approach used with WordSift should be explored simultaneously in the future.

Jingjit (2015) noted that, in the Thai educational context, the way technology is integrated into vocabulary teaching seemingly does not meet learning objectives due to a lack of understanding in selecting appropriate educational materials. To fill this gap, the present study was conducted on the notion of Mishra and Koehler's (2006) technological pedagogical content knowledge (TPACK model) which emphasizes the interplay among technology, teaching approach, and the subject matter that is to be taught. Therefore, it helped examine the credibility of the positive impact WordSift had on vocabulary retention in a Thai context in particular.

In investigating the applications of WordSift in a large project, this paper merely presents the findings of student retention in learning English vocabulary between a WordSift-using group and a non WordSift-using group, and the student attitudes toward learning through the application.

Literature Review

1. TPACK Model

This research study draws on technological pedagogical content knowledge or TPACK (Mishra & Koehler, 2006) as the theoretical framework for the practical application of WordSift in an EFL classroom. TPACK emerged from the integration of

[6] Multimedia technology refers to the combination of different data forms in one presentation, e.g. texts, audios, images, animations, graphics, and others.

[7] The uniform resource locator (URL) of the site is https://wordsift.org

new technology in 21st century into teaching for the purpose of even more effective pedagogy. The framework comprises of three main components that overlap one another, stressing on the complex interdependence among them. Isolated technological knowledge (TK) refers to the ability to operate software and hardware devices while pedagogical knowledge (PK) is insightful understanding about the process of teaching and learning. The last component, content knowledge (CK), represents the knowledge of a particular subject matter that is to be taught. The intersection point where every construct is blended (TPACK) is the heart of the framework. It is believed to be the foundation of good teaching, understanding how to use a specific technology to enhance the right teaching method on a particular content.

Its high degree of parsimony makes TPACK gain the ongoing growth of interest among researchers worldwide (Graham, 2011). In their application of technology in the classroom, teachers have their options about what to situate in each of the three domains and how to unite them altogether (Koehler & Mishra, 2009). This framework is not restricted to technology integration but include other things, e.g. aiding devices that best suit a particular context. However, when it comes to practice, those teaching aids will not be the only instructional mediums, but will "transform the nature of a subject at the most fundamental level" (McCormick & Scrimshaw, 2001, p. 47).

2. TPACK: Application to a curriculum design with WordSift

The following figure illustrated practical knowledge situated in each TPACK domain for this study (Figure 1).

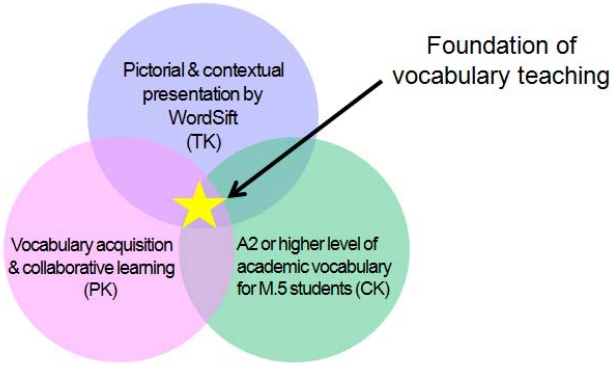

Fig. 1: Boundaries of knowledge based on Mishra and Koehler (2006)'s TPACK model

According to the TPACK model used as a principal model in vocabulary teaching, at the early stage, teachers should realize subject matters to be instructed before moving to responsive pedagogy until applicable technology is opted. For teachers, the foremost facts are the content in the CK domain, for example, subject matters in each subject or academic vocabulary as required for students to learn in each level of language learning. On the PK domain, the theories of vocabulary acquisition were laid with the effort to understand the nature of how vocabulary is acquired and what should be the most appropriate reinforcement to promote student retention. Based on Pimsleur (1967)'s graduated interval recall theory, it is more effective to study a small number of words over several short periods of time than to study a larger amount in one longer period. The appropriate number of vocabulary items to be learned each time was proposed as five to seven in Hunt and Beglar (2002) with the explanation that learners can have more time for reviews. Graves (2016) also suggests that one way to increase learners' vocabulary size is to encourage them to have adequate word exposure through listening, speaking, reading, and writing. This is in line with McKeown and Beck (2014), who insist that vocabulary learning is most effective when learners encounter new words several times. The researchers also claimed that repetition and review should take place almost immediately after the words are introduced.

Collaborative learning (CL) can be situated in the same domain as a responsive teaching approach. CL emphasizes individuals' engagement in every stage of the learning process while performing their mutual task (Beatty & Nunan, 2004). Thus, it facilitates communication among learners. The approach is different from cooperative learning in terms of group members' responsibility and engaged interaction; in cooperative learning, each group member is responsible for their individual task, but will finally gather to complete the activity. Research-based evidence showed that using CL and technology together can enhance student language learning in a Thai context (Waemusa, 2016). Other studies from diverse contexts which indicated that the results are consistent with this notion are those of Paulson and Faust (2002), Chih-Cheng, Hsiao, Tseng, and Hsin-jung, (2014)

WordSift can be adopted in the TK domain because it was purposefully created for vocabulary teaching (Roman, Thompson, Ernst, & Hakuta, 2016), and can help enrich academic vocabulary-learning conditions across content areas (Farkas, 2009). Moreover, it can be used as a supplementary tool in an attempt to enhance collaborative learning among students. To utilize this application, users can insert their texts into a provided box. After clicking the "Sift" button, the program will

generate the text into a colorful cloud of 50 most frequent words from the extract. Visual displays which are shown on the same page under the cloud are image, video, thesaurus, and context windows. Users then can choose which features to play with. For instance, a teacher can have students learn the meanings of the target words by exploiting information from pictures and the word context. After the teacher clicks on a target word, s/he may enlarge the image window which contains related pictures. The window of context where the word is from then is open up in order to provide helpful context clues about the meaning of the word (Figure 2). The properties afforded by WordSift work on dynamic classrooms where active and collaborative learning is encouraged. The benefits of the tool on vocabulary retention improvement were reported in Talang and Mahmoodi (2013) and Smith and Qayyum (2017). This positive outcome can be explained by an underlying theory about the potentials of multimedia. It is insisted that multimedia can facilitate memory. According to Carpenter and Olson (2012), when new vocabulary items are introduced together with multimedia, retention is better enhanced than when learning from a written text alone because images and words are dually coded.

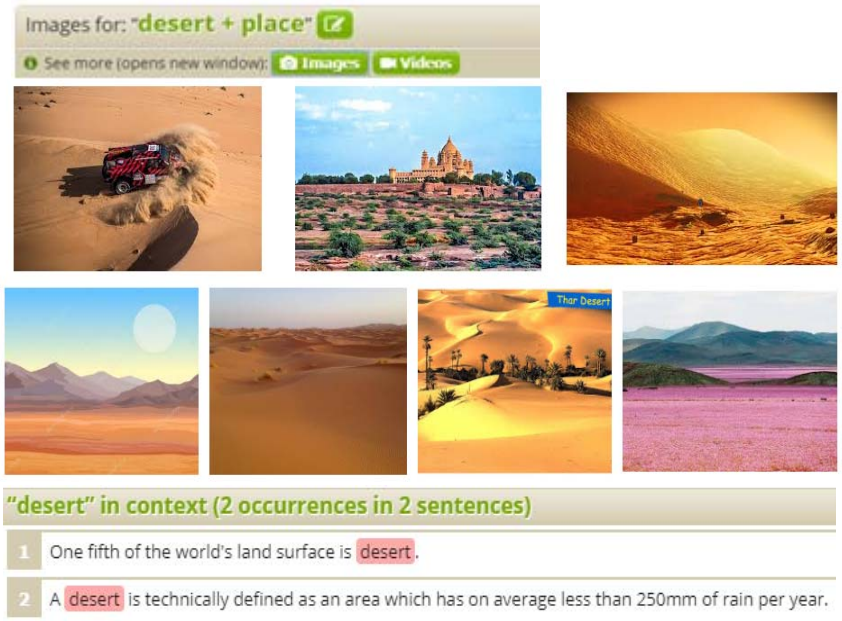

Fig. 2: Image and context modes of WordSift

The researcher exploited the aforementioned theories from the three knowledge domains, shaping the treatment for the students in the experimental group, and hypothesized that WordSift could boost the student retention better when compared to learning through the teacher-directed method.

Research Methodology

1. Research Design

To explore the effects of the use of WordSift on learning vocabulary and students' perception, the explanatory sequential mixed-method design (Fetters, Curry, & Creswell, 2013) was applied in this study. Vocabulary achievement and retention tests were set to collect quantitative data. Focused group interviews were conducted to explore in-depth data from the qualitative findings.

2. Research Questions

Two research questions were raised as follows.

• Are there any significant differences of vocabulary retention between a student group using WordSift in English vocabulary learning and a group learning through the teacher-directed method?

• What are the student perceptions of the use of WordSift in vocabulary learning?

3. Student Groups

The students were 37 Mathayomsuksa 5 students who were taking Basic English 32102 subject in the second semester of academic year 2017 at a secondary school in Phatthalung Province, Thailand. They were chosen and divided into two groups, i.e. control and experimental groups based on their regular classes. The number of the students for each group was 19 and 18 respectively. To ensure the homogeneity between groups, vocabulary survey tests were administered to them before the treatment began. The result showed that none of them achieved the scores higher than 25 percent (22.5 out of 90 items). The homogeneity then was assumed.

4. Research Instruments

In addition to WordSift, the following instruments were used to collect data in this study.

4.1 Vocabulary survey test

Before the treatment started, the student subjects from the control and the experimental groups were required to complete a vocabulary survey test by filling up the definitions of provided words in Thai. The purposes were to seek for their unfamiliar words and to find the homogeneity between groups. This test contained 90 A2[8] or higher level vocabulary from nine topics in the school's textbook and other sources (ten vocabulary items selected from each topic). Finally, 54 unknown

[8] Based on Common European Framework of Reference for Languages or CEFR

vocabulary items (six items from each topic) were chosen as the target words to be taught in the treatment.

4.2 Vocabulary Exercises

The students in each group learned new six vocabulary items from each topic in the selected textbook through the designed interventions (see 5.1.1). The tables of the six target words with parts of speech were distributed to them to complete the definitions in Thai while receiving the treatment. In total, there were nine sets of exercises under nine topics.

This study was conducted with Mathayomsuksa 5 students who were required to take Basic English 32102 as a compulsory subject. According to the school's curriculum planning, these students had to master English at A2 or higher level academic vocabulary in the prescribed textbook or other sources that contained vocabulary at the same level. In this experiment, 54 unknown words from nine topics were selected as the target words to be instructed, six words from each topic to be precise. The vocabulary was selected from the topics as shown in Table 1.

Table 1. Nine topics from the textbook

1. The minister for exams	2. The chemistry of love	3. Abuse and addiction
4. A mermaid and a magic comb	5. Diary of a tenacious teen	6. What is happiness?
7. Irregular verbs	8. Christmas songs	9. The Child labor

4.3 Vocabulary achievement and retention tests

A vocabulary achievement test was used to measure the student vocabulary acquisition in each lesson. It was conducted in the following session after a lesson the new vocabulary was introduced. Therefore, each achievement test contained the same six target words the students learned in the previous session, and there were nine sets of the tests. The achievement tests were in L2 translation test forms. The students had to fill in the right definitions of the given words in Thai. A vocabulary retention test had the same form as the achievement one but the items contained were shuffled. This test was used to measure the students' ability to remember the meanings of the words after 14 days of the first encounter. This time length is considered as a long term memory (Gu, 2003). In total, there were nine sets of the retention tests. The reliability of the tests was estimated after the tests were piloted to the other group of M.5 students who were not the target sampling. The reliability of the test was measured, and its Cronbach's Alpha was at .71, showing that the tests were reliable.

4.4 The interview question sets

In order to explore the perception of students both in the experimental and control groups, the researcher conducted focused group interviews in Thai using a semi-structured interview question sets. The validity of the questions was checked by three experts, and the language clarity was amended before implementation.

5. Intervention Administration, Data Collection and Analysis

5.1 Quantitative phase

As this paper aims to report some part of the large research study, only the results concerned will be referred. Data from the experimental and control groups were collected under the same procedures. The only different variables were the interventions given. When the treatment phase started, the English class was divided into two sessions a week, and the students in each group attended class twice a week according to their regular timetable. Starting from the first session of the first week, six unfamiliar words selected from the first topic were introduced to the students. They learned the new words through different interventions (see 5.1.1). In the second session of the first week, the five minute achievement test was administered. The ten minute retention test of first topic would be administered in the subsequent 14 days or the first session of the third week. Starting from the third week of the treatment, the students had to take: 1) the retention test of the topic learned from the previous two weeks, and 2) the achievement test of the topic learned in the earlier session. The same arrangement was administered repeatedly until all 54 vocabulary items from the nine topics were delivered (see Figure 3 for details).

Quantitative phase (Interventions)				
Week	**Sessions**	**Interventions**	**Achievement**	**Retention**
1	1	Topic 1		
	2		Topic 1	
2	1	Topic 2		
	2		Topic 2	
3	1	Topic 3		Topic 1
	2		Topic 3	
4	1	Topic 4		Topic 2
	2		Topic 4	
5,6,7,8....				
9	1	Topic 9		Topic 7
	2		Topic 9	
10	1			Topic 8
	2			
11				Topic 9
Qualitative phase (Interview)				

Fig 3. Data collection schedule

5.1.1 Two different types of the interventions

• Intervention without WordSift

The students in the control group learned new vocabulary through the teacher-directed method, having the teacher play the key role in delivering lecture-based lessons in the classroom. The exercise or a table of six vocabulary items was distributed to each student who noted down the given meanings while the teacher was telling the definitions.

• Intervention with WordSift

The students in the experimental group were divided into groups of 3-4 in each session. They received the tables of vocabulary from the teacher to complete the definitions. In this group, the students were assigned to find the word meanings through their group discussion. The teacher inserted a text from the chosen topic into WordSift and generated it into a cloud. When a target word was clicked, the image window was enlarged showing related pictorial presentation of the

word. Then the context window which showed the word context was opened up. The students were encouraged to use information shown on the screen to collaboratively find out the word definitions by discussing with their peers, meaning that everyone in the groups was required to suggest and exchange their ideas until they came to a conclusion. Everyone helped figure out the meanings of each word, not breaking their task into pieces and assembling them at the end.

The teacher also walked around encouraging every group member to deliberate on the discussion so that they could equally be exposed to the words through listening, speaking and reading. The teacher also facilitated them in case of need. Through collaborative learning, everyone in each group was responsible for the task accomplishment. They had to contribute the conversation and elaborate on the reasons for their ideas until they found the right answers. They then wrote the meaning in the tables. When all the six words were done, the right answers would be shared and discussed by the teacher. Time allocated for this activity was 15 minutes approximately.

5.2 Qualitative phase

After the data from the quantitative phase was completely collected and analyzed, the focused group interviews were conducted to explore the perceptions of the students in both groups. The researcher selected eight students from each group. They were the top-four and the lowest four of the students based on their retention scores. The audio recorder was used during the interview.

To answer the research question 1, the raw scores were converted into percentage for simplification. The independent *t* test was utilized to compare the means of the retention tests between the two groups. To examine the level of retention development, the paired *t* test was further computed to compare the means between the achievement and retention tests within each group.

The content analysis was carried out to answer the research question 2. The student conversations during the interviews were transcribed verbatim and the transcription was analyzed in depth.

Results

To answer the research question 1, the result showed that there was a significant difference in the means of vocabulary retention between the control group (*M*=76.02, *SD*=10.95) and the experimental group (*M*=63.07, *SD*=10.88) conditions; *t*(35)=3.60, *p*= .01 (Table 2). The higher scores indicated that the control group substantially outperformed the experimental one in the retention tests, *p* = .01. However, the comparison of the scores within groups showed that, like the control group, the students in the experimental group could maintain vocabulary retention after two weeks.

Table 2: Retention Scores between Groups

Part	Control Group (n=19)		Experimental Group (n=18)		t-test	df	sig	Effect size
	Score in %		Score in %					
	Mean	S.D.	Mean	S.D.				
Achievement	61.21	10.84	63.27	12.39	.540	35	0.59	0.18
Retention	76.02	10.95	63.07	10.88	3.609**	35	0.01	1.22

** Significant at 0.01 level

In comparing the results within the group, a significant difference in the means between the achievement and retention tests in the control group was found, *t*=6.78, *p* < 0.01 (Table 3). That was, the students in this group showed retention in vocabulary learning, their vocabulary size has been maintained, yet grown afterwards.

Table 3: Difference between Achievement and Retention Tests within Control Group

Paired	Control Group : 5/1 (n=19)				Diff	t-test	df	sig
	Mean	S.D.	Mean	S.D.				
Achievement-Retention	61.21	10.84	76.02	10.95	14.81	6.781**	18	.000

** Significant at 0.01 level Diff = Difference

For the experimental group, the results indicated a non-significant difference between the achievement and retention tests (t=-.08, p=.93), yet the students could retain the vocabulary definitions because significant decrease in the retention scores was not found. In other words, their vocabulary size was still maintained after two weeks (Table 4).

Table 4: Difference between Achievement and Retention Tests within Experimental Group

Paired	Experimental Group : 5/2 (n=18)				Diff	t-test	df	sig
	Mean	S.D.	Mean	S.D.				
Achievement-Retention	63.27	12.39	63.07	10.88	-.21	-.081	17	.936

Diff = Difference

In answering the research question 2, as to how the students perceived the use of WordSift in their vocabulary learning, it was found that the students who were treated by using WordSift showed a positive attitude towards the tool. These students considered visualization from interacting with the WordSift screen and example sentences as the potentials of WordSift that helped promote their vocabulary retention through different strategies. Furthermore, the visualization made their learning more pleasant. Some excerpts from the interview are shown as follows.

"What I saw on the screen especially pictures really could evoke my memory in both meanings and use."

B4*. (2018, January 23). Group Interview

"[....]. Later, when I encountered the words in the textbook, I recognized they were shown on the screen. [....]. I memorized the meanings from the context."

B1*. (2018, January 23). Group Interview

"I like WordSift because it could show related pictures. That was enjoyable"

B6*. (2018, January 23). Group Interview

"When a word and pictures are shown together, it is easier to think of its meaning later"

B8*. (2018, January 23). Group Interview

They also mentioned about the usefulness of the collaborative learning approach implemented in the classroom with WordSift by allowing them to share word meanings among group members and then providing a learning opportunity to explore word meanings and word contexts together on the WordSift screen.

"Collaborative learning is a good approach because the higher proficiency peers can help share their ideas with the weaker group members"

B3*. (2018, January 23). Group Interview

Discussion

The results of this study showed a significant difference in vocabulary retention between the control and experimental groups, and the control group significantly outperformed the experimental one. For the control group, the vocabulary meanings were not only retained after 14 days, but also grew in size. However, despite the unexpected results, insignificant change in retention scores of the experimental group indicated that the students could retain vocabulary at the same level after 14 days. The interview data also showed that using WordSift in learning vocabulary was perceived satisfactorily, compared with a learning way of a textbook-driven curriculum they had experienced in the past.

As results from this study showed some unexpected findings, namely that the control group significantly outperformed the experimental one in retention, the interview was also conducted to the control group to look for possible explanations. The data from the interview showed that the control group had the word reviews one day before the tests outside the classroom. This act could be an intervening variable that substantially affected their increased retention scores, allowing them to experience word exposure during their reviews before the retention tests.

In contrast, the interview data showed that none of the students in the experimental group performed this extra activity due to heavy workload and their intention to test the effectiveness of the WordSift on their vocabulary learning. However, there was no significant change in the retention scores. It then might be possible that the word exposure from the group discussion activity was great enough to help maintain their retention, but could be greater to increase vocabulary size if they had repeated the words more than one time.

Using the TPACK perspective, the retention in the experimental group might be a result from multimedia integration into classroom. This goes in line with Talang and Mahmoodi (2013) and Smith and Qayyum (2017). In understanding this result in-

depth, the data from the interview also was taken into account. As informed by the interviewee students, all of them considered pictures as a great tool that kept them focusing on their learning and turned boring lessons into enjoyable ones. Thus they could pay full attention to the treatment. This finding was consistent with Chih-Cheng, Hsiao, Tseng, and Hsin-jung (2014) whose work affirmed the benefit of multimedia in vocabulary teaching. The qualitative data also revealed that when the students encountered the already learned words again, it was the pictures they had in mind that helped them recognize their meanings. This was consistent with Carpenter and Olson's (2012) report that retention was better enhanced when words were introduced with pictures. In addition, some students pointed to a new strategy of using the context they explored during learning through WordSift. Previously, they only had tried to remember the meaning of a new word through its Thai translation. After they learned to guess a word meaning using context clues, they found a new way to memorize its meaning from the context it appeared in.

Being stated in the PK domain, the number of words introduced to the students each time also could be a factor affecting student retention. The results from this study showed that six vocabulary items gave satisfactory learning outcome in terms of retention. Time allocated for group discussion was long enough for the students to sufficiently work on each item. This aligns with Hunt and Beglar (2002) and Pimsleur (1967). Using WordSift as a tool to support collaborative learning could be a way to help store the word meanings in a long memory trace. When figuring out word definitions became the student mutual task, it reinforced group interaction, providing more opportunity to deliberate on the discussion. From the observation, the researcher found that the students and peers worked collaboratively when they reiterated the words, guessed their meanings, and heard the words several times during their group discussion. The whole process not only connected their sight and audition with the schema, but also increased word exposure that would lead to enduring memory (Graves, 2016).

In spite of the unexpected results, using WordSift through the TPACK perspective could, at some points, offer a penetrating insight about the properties of this technology and the other two knowledge domains. The results of this study revealed that learning outcomes depend on the ability to employ the appropriate technology based upon learning objectives, suit theories, and compatible teaching approach, but this needs a more carefully designed curriculum in the future. For the sake of future studies on vocabulary retention, the implications about how WordSift could be used through the TPACK model will be discussed in the following section.

Conclusion and Implications

The findings from this study indicated a difference between the control and the experimental one in retention and that the control group significantly outperformed the experimental one in retention. Moreover, the use of WordSift gained a positive perception from the students. It is recommended that using WordSift for vocabulary learning needs teachers to carefully design curriculum. It is expected that the use of this technology could enhance the quality of student learning especially in learning vocabulary. To support students in learning vocabulary with the use of technology, teachers need to change their practice and attitude toward technological use. To do this, new roles of teachers for technology-integrated education should be adopted (Laal & Laal, 2012). This means being a learning designer and facilitator, for example.

Using technology through the TPACK model could be beneficial if it is carefully designed and implemented. In terms of technology implementation, the teacher in this study was the only person who operated WordSift. Having the students directly interact with the tool could be another practice that encourages their eagerness in learning. As WordSift provides many different features, teachers can manage how and when to utilize each property for practical effectiveness.

In addition, the orientation of collaborative learning should be provided to emphasize the importance of building knowledge together and to ensure that the learning procedures are on track. Vocabulary size might be adjusted to suit the student level and proficiency. The findings from this study also suggest that how to utilize WordSift to grow vocabulary size should be further investigated in the future.

1. Limitations

•This study only investigated the effects of using WordSift with the collaborative learning approach on student receptive skills. Its benefits for a productive ability should be examined likewise.

•This study was conducted on students who were not familiar with the differentiation of parts of speech. Therefore, the findings may not be applied or generalized to a different condition or other settings.

•The findings from this study revealed the effectiveness of the treatment when a small number of vocabulary items were introduced to the students in each session. The merit may not be conclusive for a different learning load.

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VITAE

Name Flg.Off. Supatida Dumchoo

Student ID 5911121032

Educational Attainment

Degree	Name of Institution	Year of Graduation
Bachelor of Arts (English) (Second Class Honors)	Srinakharinwirot University	2009

Scholarship Awards during Enrolment

1. Research Grants for Student of Faculty of Liberal Arts
2. Graduate School Dissertation Funding for Thesis Fiscal Year 2018

List of Publications

Dumchoo, S, & Waemusa, Z. Using WordSift in English Vocabulary Teaching in a Thai classroom: Can It Boost Student Vocabulary Retention? Abstract published at the 10th International Conference on Humanities and Social Sciences (ICHiSS 2018), Kualalumpur, Malaysia, 11-13 May. (p. 85).

Dumchoo, S, & Waemusa, Z. (in press) Using WordSift in English Vocabulary Teaching in a Thai classroom: Student Vocabulary Retention. *Journal of Liberal Arts, Prince of Songkla University Hat Yai Campus, 10(2)*