MYANMAR EFL LEARNERS' USE OF TECHNOLOGY-MEDIATED LEXICAL APPLICATIONS AND VOCABULARY LEARNING STRATEGIES: PILOTING A QUESTIONNAIRE

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Abstract: The present study reports the development and piloting process of a questionnaire which explores Myanmar EFL learners' use of technology-mediated lexical applications and vocabulary learning strategies (VLS) and examines problematic aspects of vocabulary knowledge for the learners. In second language (L2) vocabulary learning, technology-mediated lexical applications are increasingly used by EFL learners, which may affect their L2 vocabulary learning process and their vocabulary development (Ma, 2017a). This quantitative pilot study aims to design a complex questionnaire based on three main constructs; technology-mediated lexical applications, VLS, and problematic aspects of vocabulary knowledge. Altogether 95 BA students from a public university in Myanmar took part in this study. The preliminary results revealed that Myanmar EFL learners engage with open-online resources, e-dictionaries, online videos, online texts and social communication tools, and dictionary use was found to be the most commonly used strategy. Receptive knowledge appeared to be more problematic than productive knowledge in all aspects. It is hoped that the findings will contribute to a better understanding of Myanmar EFL learners' vocabulary learning habits, which may prove useful in helping EFL teachers to foster the use of technology with the help of effective VLS to order to increase EFL learners' receptive vocabulary knowledge.

Keywords: technology-mediated lexical applications, vocabulary learning strategies, vocabulary knowledge

1 Introduction

The role of technology has been widely accepted and acknowledged in language learning and has received much attention in L2 research (Chapelle & Sauro, 2017). In L2 vocabulary learning, the availability of language learning technologies changes the way L2 learners acquire vocabulary. Among L2 vocabulary researchers, there has been a cumulative effort in researching technology use in L2 vocabulary learning contexts and its impact on vocabulary development. Positive outcomes in technology-use in vocabulary learning have been shown in a number of related studies (e.g., Gürkan, 2018; Nikoopour & Kazemi, 2014; Wu, 2014), confirming that technology-assisted learning aids vocabulary learning and growth.

Considering the different contexts in which learning with technology can take place, computer-assisted language learning (CALL) and mobile-assisted language learning (MALL) have been studied separately in L2 research. Ma (2017a) used the term "technology-mediated lexical applications" to refer to any tools or applications for vocabulary learning which make use of computer and/or mobile technologies. These applications include modern technological lexical

tools which can be used on their own (e.g., e-dictionaries and lexical concordancers) as well as the latest lexical applications which can be used to guide vocabulary learning (e.g., e-vocabulary lists, e-flashcards, and various types of tutoring software). While many L2 vocabulary studies focus on the effectiveness of using technology in vocabulary learning and development, L2 learners' use of the latest technology-mediated lexical applications in vocabulary learning is still to be explored as new lexical applications have become available to learners.

VLS are generally believed to help students learn L2 vocabulary and support their L2 learning process. VLS become a part of the L2 learning process when learners are faced with new vocabulary, and help them to learn new words effectively, to expand their vocabulary knowledge, and to use the newly learned words in their speaking and writing (Gu, 2013). VLS are normally divided into subcategories based on the steps involved in the vocabulary learning process such as word selection, initial learning, retaining vocabulary knowledge and word use.

In fact, technology-mediated lexical applications and VLS are largely intended to develop learners' vocabulary knowledge. Aspects of vocabulary knowledge involve knowing a word's form, meaning and use, and these aspects can be problematic to learners depending on a number of factors including the way they learn vocabulary and the strategies they use in vocabulary learning (Nation, 2001, 2013). Receptive vocabulary knowledge is related to the recognition of word form and meaning while productive vocabulary knowledge is linked with the accurate use of words (Nation, 2001). In fact, vocabulary knowledge forms a continuum with different levels of knowledge ranging from word recognition to production (Schmitt, 2010).

In L2 vocabulary research, many empirical studies have set out to investigate technology-assisted vocabulary learning, VLS, and vocabulary knowledge; however, these studies have mostly researched these areas separately, with only a few studies examining two of the above-mentioned areas together (e.g., Komol & Sripetpun, 2011; Rahimi & Allahyari, 2019). To my knowledge, there is a lack of research which brings all three areas together. Such a study would fill the research gap by revealing the connections and relations which can be found between these areas.

Furthermore, there has been no research carried out with regard to the way in which Myanmar EFL learners at tertiary level education use technology-mediated lexical applications and VLS. My experience of teaching at university in Myanmar for 12 years has been that many BA students in Myanmar seem to struggle with new English vocabulary in reading and listening and have limited productive vocabulary in addition to not being able to use VLS effectively. This study, therefore, aims to propose a questionnaire designed to investigate the use of technology-mediated lexical applications and vocabulary learning strategies as well as the difficult aspects of vocabulary knowledge in order to explore Myanmar EFL learners' vocabulary learning habits. In this paper, data was gathered from BA English-major students from a public university in Myanmar by conducting an online questionnaire study which used an instrument specifically designed for this purpose. The rationale behind the study is to obtain a better understanding of EFL learners' vocabulary learning habits regarding the use of technology, and it is hoped that the study can provide some insight into how technology and VLS could be incorporated into EFL vocabulary teaching to develop students' vocabulary knowledge in a focused manner.

2 Review of the literature

2.1 Technology-mediated lexical applications

It is widely recognized that technology has become an integral part of language learning as L2 learners increasingly use mobile and computer technologies to learn and/or develop the language inside and outside the classroom. Digital technologies are generally believed to have a significant impact on modern communication and language learning contexts (Dalton & Grisham, 2011; Thorn & Reinhardt, 2008). Technology-mediated language applications have been developed for different aspects of language learning such as language skills, grammar and vocabulary. It has been found that digital technologies tend to support vocabulary learning more than any other area (Ma, 2017a). A substantial number of vocabulary applications make use of computer and mobile technologies, which are intended to assist the L2 vocabulary learning process and enhance vocabulary development. Ma (2017a) labelled such applications as technology-mediated L2 lexical applications. Ma categorised these lexical tools and applications into two different types: those who can independently use as a reference or resource for their vocabulary development, and those used to consolidate their vocabulary learning from lexical tools. As described by Ma (2017a, p. 48), technology-mediated lexical tools entail three main tools:

- *e-dictionaries*: web-based online dictionaries and mobile dictionary apps
- *open-online resources*: search functions, thesauruses, and search engines
- *lexical concordancers*: corpora websites.

On the other hand, technology-mediated lexical applications comprise four major categories:

- *technology-mediated incidental learning*: reading, listening, or watching videos online;
- *technology-mediated communication-based lexical learning*: using social communication tools available on mobile devices;
- *e-vocabulary lists/ flashcards/ exercises*: utilising web-based flashcard learning systems, memorising e-vocabulary lists or cards;
- *dedicated lexical applications*: using lexical applications or software which combine tutor functions with tool functions (Ma, 2017a, p. 50).

Ma (2017a) explained connections between lexical tools and lexical applications using a framework which is two-fold: it includes the actual lexical tools or applications assisted by mobile and/ or computer technologies, and these tools and applications are connected with incidental and intentional vocabulary learning. Moreover, the framework seems to be well-justified by Ma's (2014) memory-based strategic model for vocabulary learning in that a learner's cognitive processes (perceiving the word form, accessing the word meaning, building a word entry, or retrieving a word from memory) taking place in the internal memory system correspond to the stages of external strategic behaviours and internal thoughts (discovering the new word, obtaining the word meaning, mapping the word meaning with form, consolidating the

word). The model was tested for its validity and reliability in the same study (Ma, 2014), and it was found to be applicable in the context of second language acquisition (SLA). Overall, it appears that Ma's (2017a) framework for technology-mediated L2 lexical applications clearly explains how modern technologies facilitate L2 vocabulary learning.

Looking at the empirical studies examining the use of mobile or computer technologies in vocabulary learning, considerable efforts have been invested into investigating the effect of MALL on vocabulary learning (e.g., Agca & Özdemir, 2013; Gürkan, 2018; Nikoopour & Kazemi, 2014; Wu, 2014). Used as an intervention in most of the studies, MALL has been shown to produce positive outcomes in vocabulary learning. There have also been attempts by researchers to design and develop mobile-assisted vocabulary learning applications (e.g., Amer, 2010; Miyakoda et al., 2011; Ou-Yang & Wu, 2017). Other studies have focused on the effectiveness of computer games in L2 vocabulary learning (e.g., Cobb & Horst, 2011; Thorne & Reinhardt, 2018), discovering that the participants benefited from the games in terms of their vocabulary learning and performance. Ma (2017b) examined Hong Kong university students' L2 learning experience mediated by mobile technologies via a multi-case study, and found that the students made use of various e-resources and tools for their L2 learning and personalised their language learning. Despite a number of studies conducted investigating the impact of technologies on L2 vocabulary learning, the question of what kinds of technology-mediated lexical applications are used by EFL learners has, to date, been under-researched. This study intends to explore Myanmar EFL learners' use of technology-mediated lexical tools and applications in their vocabulary learning.

2.2 Vocabulary learning strategies (VLS)

The importance of VLS has been recognized and extensively studied in L2 vocabulary research. VLS are included under the category of language learning strategies, which Ellis (2008) referred to as general approaches or specific techniques that L2 learners deploy in L2 learning. Ellis' concept seems to be in alignment with Nation's (2001) notion that language learning strategies are a part of general learning strategies for overcoming learning problems. In L2 learning, it is agreed that vocabulary is one of the most problematic areas for L2 learners; learners tend to struggle when they encounter new words or phrases in L2 reading or listening. Komol and Sripetpun (2011) defined VLS as "any set of techniques or learning behaviours which language learners reported using in order to discover the meaning of a new word, to retain the knowledge of newly learned words and to expand one's vocabulary" (p. 4). This definition mainly focuses on receptive vocabulary knowledge. However, Gu's (2013) notion of VLS covers both receptive and productive aspects: "VLS represent learners' conscious efforts in managing their own learning of vocabulary in order to make it more effective and more efficient, in increasing the vocabulary size and in being able to use the words learned" (p. 1). On the other hand, some scholars put an emphasis on how VLS assists L2 learning. For instance, Nation (2001) claimed that VLS are beneficial throughout the vocabulary learning process to help learners become more independent in their learning in that they rely on themselves and employ particular strategies in different stages of learning vocabulary to develop their lexical competence. This may help them become self-directed vocabulary learners.

Many VLS researchers have spent considerable efforts on classifying VLS and developing VLS taxonomies. As described by Oxford (1990), VLS are mainly divided into direct and indirect strategies, where the former includes cognitive strategies, memory strategies, and compensation strategies whereas the latter involves social strategies, metacognitive strategies, and affective strategies. Based on Oxford's (1990) understanding of VLS, Schmitt (1997) categorised VLS into five groups, namely determination strategies, social strategies, memory strategies, cognitive strategies, and metacognitive strategies. Nation (2001) classified VLS into three aspects: planning, sources, and processes. *Planning* involves choosing what to focus on and what to focus on; *sources* concerns finding information about words; and *processes* is related to establishing knowledge. According to Gu's (2013) taxonomy, VLS comprise two main components: metacognitive and cognitive. The metacognitive component includes four strategies which are grouped along two dimensions:

- **beliefs**: beliefs about vocabulary learning;
- **strategies**: metacognitive strategies;

Gu (2013, p. 2) included 17 strategies under the cognitive component are divided into three main dimensions:

- **initial handling**: contextual guessing, dictionary strategies, note-taking strategies;
- **reinforcement**: rehearsal strategies, encoding strategies;
- **activation**: active use.

Gu (2018) pointed out that there were considerable overlaps in the taxonomies of Schmitt (1997), Nation (2001), and Gu (2013), all of which contain selecting words to learn, initial learning after the selection of words, and further consolidation of the learned words. However, those VLS taxonomies have not been properly validated, so Gu (2018) conducted a large-scale study with 682 English language learners in order to validate Gu's taxonomy through the use of Vocabulary Learning Questionnaire (VLQ). Gu's (2018) study resulted in a questionnaire based on the constructs in Gu's (2013) taxonomy. The questionnaire was shown to have content validity, construct validity, internal consistency reliability, and predictive validity.

In the field of VLS there has been extensive research in discovering types of VLS used by L2 or EFL learners (e.g., Bristi, 2015; Dóczi, 2011; Ghalebi et al., 2020; Lip, 2009; Nie & Zhou, 2017). It should be noted that most of the VLS studies have been carried out using Schmitt's (1997) VLS taxonomy, and have looked into the students' use of determination strategies, social strategies, memory strategies, cognitive strategies and metacognitive strategies based on the taxonomy. Very few VLS studies have employed Gu's (2013) taxonomy, which covers not only the strategies but also the learner's beliefs about vocabulary learning (e.g., Ghalebi et al., 2020; Nie & Zhou, 2017). The present study adopts Gu's (2013) VLS taxonomy to explore EFL learners' use of VLS including their beliefs about vocabulary learning.

In addition, VLS researchers have focused on the relationship between VLS and learning outcomes, teaching VLS and strategy training, VLS in relation to different aspects of vocabulary and language learning, the relationship between VLS and vocabulary breadth and depth, and VLS incorporated into coursebooks and instruction (Gu, 2018). Very little attention has been given to

VLS in relation to technology use in learning vocabulary. Li (2019) conducted a study to observe how vocabulary learning changes in a computer-mediated reading environment. Comparing the differences between L2 learners' use of VLS with or without technology-based support, the study found significant variation in the use of strategies between the two reading conditions. In the study of Rahimi and Allahyari (2019), the researchers investigated the impact of multimedia-assisted explicit vocabulary learning strategy (VLS) instruction on 40 EFL learners' strategy use and vocabulary learning. They discovered that the participants who were given the instruction achieved significantly higher gains in terms of vocabulary knowledge, vocabulary size and the use of VLS. In this pilot study, the author aims to explore the relationship between the use of technology-mediated lexical applications and VLS.

2.3 Vocabulary knowledge

In L2 vocabulary development, vocabulary knowledge is defined in terms of various components, including breadth (size) and depth of vocabulary, and the relationship with language skills and language proficiency. Vocabulary knowledge is seen as a continuum with different levels of knowledge ranging from word recognition to production (Schmitt, 2010). Schmitt's conceptualization of vocabulary knowledge can be said to be compatible with Henriksen's (1999, as cited in Ballance & Cobb, 2020) three types of vocabulary knowledge: form-meaning relationships, ability to use words in context, and speed of access for recognition and production. In both frameworks, recognizing form and meaning represents the lowest level of vocabulary knowledge, while being able to produce or appropriately use the word in the right form represents the highest level. These frameworks imply that learners need to develop the ability to recognize and recall the form and meaning of words and to effectively use them in their appropriate context in order to develop vocabulary knowledge. However, it can also be noted that these descriptions lack a detailed explanation of the components included in vocabulary knowledge. This is indicated in Nation's (2013, p. 49) description of vocabulary knowledge which includes the aspects of knowing a word, which are put into three main categories:

- *form*: spoken, written, and word parts;
- *meaning*: form and meaning, concept and referents, and associations;
- *use*: grammatical functions, collocations, and constraints on use.

Nation (2020) argued that not all aspects of vocabulary knowledge are equally important. The importance of these factors depends on several factors, such as how frequently a word is used, how useful a word is to the learner, in which context the learner encounters the word, and for what purpose the learner requires the vocabulary. It should be noted that the difficulty level for each aspect of vocabulary knowledge may be influenced by learners' language proficiency, exposure to the language, and the way words are learned. As suggested by Nation (2020), learners are required to learn some aspects of word knowledge whereas other aspects develop over time based on the learner's common sense and knowledge of the world. In contrast, Pulido and Hambrick (2008) describe vocabulary knowledge as a fundamental facet of literacy skills, highlighting the importance of the language learner's capacity to understand words and then to produce the language.

Based on the description above, it can be said that vocabulary knowledge consists of different aspects and components and is both complex and multifaceted (Laufer & Goldstein, 2004; Nation, 2001; Qian & Lin, 2020; Schmitt et al., 2001). Despite its multidimensional nature, vocabulary knowledge can be divided into two dimensions: receptive knowledge and productive knowledge. As defined by Nation (2001), receptive vocabulary knowledge is knowing what a word means in a particular context and recognizing its written form and collocations. In other words, it is the ability to recognize word form and meaning. With receptive vocabulary knowledge, learners can retrieve the appropriate meaning of the word when reading and hearing it (Fan, 2000). This type of knowledge is necessary to understand words when they are encountered in spoken and written input and it can be gained incidentally (Webb, 2020). Receptive knowledge is needed for listening and reading (Nation, 2020). On the other hand, productive vocabulary knowledge is defined as the ability to use a word in its correct form and context, which means being able to use a word which is appropriate to a given situation and being able to pronounce it correctly. Productive knowledge is needed to use words (Webb, 2020), and is thus associated with speaking and writing (Nation, 2020). Nation claimed that it is easier to gain receptive knowledge than productive knowledge. In natural settings, most words are learned receptively through extensive exposure; however, only a few words at a time can be transferred to one's productive knowledge (Gu, 2019). Nonetheless, Nation (2020) argued that different aspects of knowledge involved in learning a word can be present at "different levels of strength and detail, and to different levels of fluency" (p. 15).

Applying Nation's (2001) notion of receptive and productive vocabulary knowledge, a number of researchers have conducted numerous vocabulary studies investigating receptive and productive vocabulary size, vocabulary tests, the learning of receptive and productive vocabulary, and strategies related to receptive and productive vocabulary learning (Gu, 2019). Gu emphasised a research gap regarding the differentiation of strategies for receptive and productive vocabulary, and argued that "the way a learner perceives the vocabulary learning task not only influences what strategies will be chosen, but also whether strategic learning of vocabulary will become useful at all" (Gu, 2019, p. 276). Nation (2020) stressed the importance of teachers having knowledge of what is involved in knowing a word when designing a language course in order to develop comprehensive and usable vocabulary knowledge in learners. The current research looks into the which aspects of a word (form, meaning, and use) in receptive and productive vocabulary knowledge are problematic for Myanmar EFL learners.

3 Methods

This questionnaire pilot study aimed to gather data on Myanmar BA university students' use of technology-mediated lexical applications and vocabulary learning strategies as well as the problematic aspects of vocabulary knowledge for the students. To achieve the aims, a quantitative research design was adopted in this study as it is particularly relevant for eliciting information about the participants' language learning approaches and beliefs and to systematically obtain information from a greater population. For this reason, a questionnaire was designed as the main research instrument in the current study to collect data about the participants' use of technology-mediated lexical applications, vocabulary learning strategies, and problematic aspects

of vocabulary knowledge. Through applying designed questionnaire, the present study intended to answer the following research questions:

(1) What kind of technology-mediated lexical applications are used by BA university students in Myanmar for their vocabulary learning?
(2) What vocabulary learning strategies are the most and least commonly used by the participants of the study?
(3) How does the students' use of technology-mediated lexical applications relate to vocabulary learning strategies?
(4) What aspects of receptive and productive vocabulary knowledge are problematic to BA university students in Myanmar?

3.1 Participants

Ninety-five participants aged between 16 and 19, took part in the current study. All participants were BA students specialising in English for Professional Purposes (EPP) at a university in Myanmar. Among the 95 participants, 78 (82.1%) identified as female, 15 (15.8%) as male, and 2 (2.1%) preferred not to say. The participants were from different years of study: 33 (34.7%) were in their first year, 17 (17.9%) in their second year, 32 (33.7%) in their third year, and 13 (3.7%) in their final year. The participants speak Myanmar as their first language and English as a foreign language (EFL). The students took part in English courses from kindergarten to high school, and had all learned English for at least 11 years before enrolling in university. These participants were required to obtain at least 65 marks (out of 100) in the subject of English for the matriculation examination (high-school leaving exam) in order to enroll in the EPP programme at university. Convenience and purposive sampling were used in this pilot study. The selected participants were not only chosen at the convenience of the researcher in that they were studying at a university where the researcher was working, but they also met the criteria of the purpose of the study in that they were EFL learners studying at university and came from a similar English learning background. Their minimum level of English is pre-intermediate, and they took English courses such as Communicative skills, English for Pronunciation, Translation and Interpretation, and Business English as compulsory courses during their university studies. English vocabulary was taught as one aspect of the courses such as Communicative skills and Business English.

3.2 Research instrument: Design and piloting procedures

To construct a questionnaire for the purposes of the investigation, relevant theories from the literature review were first identified and the constructs were established based on the three selected frameworks. The scales used in the study were based on these theories, and regarding VLS a previously designed questionnaire which was validated by Gu (2018) was adopted and modified for this study. After writing the items and drawing the item pool for each scale, a complex questionnaire was compiled. The questionnaire was written in simple English as all the participants possessed at least intermediate level of English. The questionnaire consisted of four sections. In the first section, the use of technology-mediated lexical applications was measured using a 5-point Likert scale ranging from 1 (not at all true) to 5 (absolutely true). This section

included 12 items based on Ma's (2017a) framework focusing on the tools and applications intended for vocabulary learning which make use of computer and/ or mobile technologies. The reason for adopting Ma's framework was that it entails a range of lexical tools and applications which are associated with incidental learning (meaning-focused activities) and intentional learning (form-focused activities).

The second section of the questionnaire gathered data about the participants' use of VLS including their vocabulary learning beliefs. This section was adapted from the ESL version of the Vocabulary Learning Questionnaire (VLQ 6.4) (Gu, 2018). There were two main reasons for choosing this questionnaire: first, the VLQ was designed as a research tool to observe the range of vocabulary learning strategies (VLS) used by students at the tertiary level; second, it focuses on both students' beliefs about vocabulary learning and their use of VLS. Among the different versions of the VLQ, the VLQ 6.4 was selected for this study since it is an updated version of VLQ which has demonstrated content validity, construct validity, internal consistency validity and predictive validity (Gu, 2018). The adapted version of the VLQ designed for this study consisted of eight categories: vocabulary learning beliefs (9 items), metacognitive strategies (7 items), inferencing (7 items), dictionary use (7 items), note-taking (6 items), rehearsal (9 items), encoding (13 items), and activation (5 items). The items in this section were also measured using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

The third section aimed to gain insights into the extent to which different aspects of vocabulary knowledge are problematic to the participants of the study. Based on Nation's (2013) framework, two scales were created: problematic aspects of receptive vocabulary knowledge (9 items) and problematic aspects of productive vocabulary knowledge (9 items). The same 5-point Likert scale was employed for this section, which ranges from 1 (not at all) to 5 (very much). The last part of the questionnaire collected biographical information about the participants (gender, major, and year of study).

After selecting and sequencing the items, the first draft of the questionnaire was reviewed by an expert who commented on the wording and design of the items. Based on the comments, some necessary modifications were implemented: some items were reworded and similarly-worded items were removed from the questionnaire in order to ensure content validity. Before piloting the instrument, one think-aloud session was conducted with a participant from the sample to ensure that the items were interpreted correctly. The participant reported that the items were easy to comprehend and there was no misinterpretation of the phrasing. However, a problematic issue with the questionnaire items is that several questionnaire items contain terminology and require higher level English to understand. It may well happen that students misunderstand or misinterpret certain items in the questionnaire.

The finalized questionnaire (see Appendix) was created online using Google Forms and the items were randomly ordered in the questionnaire. It was then distributed by the researcher to the target participants via Facebook messenger groups. No time limit was given to complete the questionnaire, but it took approximately 20-30 minutes. Altogether 95 students responded to the questionnaire, and the responses to the questionnaire were recorded in Microsoft Excel for data analysis in order to answer the research questions.

3.5 Data analysis

The collected data was entered in SPSS (Statistical Package for Social Sciences) 23.0 for analysis. As a first step, the internal reliability of the questionnaire was checked by calculating the Cronbach's alpha values for each scale (see Table 1). After ensuring the internal reliability of the scales, descriptive statistics were employed to examine the learners' overall use of technology-mediated lexical applications and VLS. Next, mean and standard deviation of the items in each construct were calculated to inspect what kind of technology-mediated lexical applications and VLS were used by the participants of the study and to examine problems achieving receptive and productive vocabulary knowledge. Lastly, a Pearson correlation test was carried out to measure the strength of the relationship between Myanmar EFL learners' use of technology-mediated applications and VLS.

4 Preliminary results

This section presents and discusses the preliminary results of the present pilot study beginning with the reliability of the new scales used in the study. Next, the results of Myanmar EFL learners' use of technology-mediated lexical applications and VLS are presented, followed by a description of the relationship between these two variables. Finally, the problematic aspects of receptive and productive vocabulary knowledge are discussed.

4.1 Reliability of the scales

As the first step of data analysis, Cronbach's alpha coefficients were calculated to examine the internal consistency of the scales used in the study. Next, the principal component analysis was conducted for the scales with low Cronbach's alpha values. Some items were removed from the scales to increase their internal reliability; four items from vocabulary learning beliefs, one item from technology-mediated lexical applications, four items from metacognitive strategies, one item from dictionary use, and three items from inferencing. It has resulted in a total of 80 items in the re-resign of the questionnaire.

Scales	Number of items	Cronbach-alpha
Note-taking	6	.84
Encoding	13	.84
Problems achieving productive vocabulary knowledge	9	.79
Activation	5	.76
Problems achieving receptive vocabulary knowledge	9	.76
Rehearsal	9	.72
Vocabulary learning beliefs	5	.68
Technology-mediated lexical applications	11	.67
Metacognitive strategies	3	.67
Dictionary use	6	.64
Inferencing	4	.60

Table 1. Reliability coefficients of the scales

The new scales were then created and they yielded Cronbach's alpha coefficients (see Table 1) well above the acceptable cut-off of .60 suggested by Hulin et al. (2001). Altogether six out of eleven scales (note-taking, rehearsal, encoding, activation, receptive vocabulary knowledge, and productive vocabulary knowledge) demonstrated Cronbach's alpha values above .70. Although Cronbach's alpha values are quite acceptable, it must be noted that the number of items is rather uneven, between 3 and 13 per scale. The reliability of the present instrument could be raised by including an even number of items.

4.2 Myanmar EFL learners' use of technology-mediated lexical applications

Next, the frequency of the use of technology-mediated lexical applications was calculated using descriptive statistics (see Table 2). The participants' average use of technology-mediated lexical tools and applications was 3.42 (*SD*= .51). Among the technology-mediated lexical applications, the most commonly used by Myanmar EFL learners was open-online resources (*M* = 4.23, *SD* = .84), followed by e-dictionaries (*M* = 4.2, *SD* = .91), watching online videos (*M* = 4.17, *SD* = 1.02), reading online texts (*M* = 3.92, *SD* = .89), writing via social communication tools (*M* = 3.74, *SD* = 1.10), and talking via social communication tools (*M* = 3.64, *SD* = 1.13). On the other hand, corpora websites (*M*= 2.54, *SD*= 1.12) and web-based flash card learning systems (*M* = 2.20, *SD*= 1.02) were found to be the least used by the participants.

Technology-mediated lexical applications	M	SD
Open-online resources	4.23	0.84
E-dictionaries	4.2	0.91
Watching online videos	4.17	1.02
Reading online	3.92	0.90
Writing via social communication tools	3.74	1.10
Talking via social communication tools	3.64	1.13
Listening to online news	3.15	1.17
Google Translate	3.01	1.20
Dedicated lexical applications	2.86	1.23
Corpora websites	2.54	1.12
E-flashcards	2.2	1.02

Table 2. Myanmar EFL learners' frequency of technology-mediated lexical applications

4.3 Myanmar EFL learners' use of vocabulary learning strategies

Regarding vocabulary learning strategies, the same procedures were employed and descriptive statistics were computed (see Table 3). The results demonstrated that students' vocabulary learning beliefs were fairly low (*M* = 3.04, *SD* = 0.73). Out of the given strategies, the most commonly used was dictionary use (*M* = 4.22, *SD*= .47) followed by activation strategies (*M* = 3.98, *SD* = .65), inferencing (*M* = 3.88, *SD* = .59), and metacognitive strategies (*M* = 3.68,

SD = .67). In contrast, students' use of rehearsal (*M* = 3.22, *SD* = .64), note-taking (*M* = 3.38, *SD* = .88) and encoding (*M* = 3.40, *SD* = .67) was found to be quite low.

Vocabulary Learning Strategies	M	SD
Dictionary use	4.22	0.47
Activation	3.98	0.65
Inferencing	3.88	0.59
Metacognitive strategies	3.68	0.67
Encoding	3.40	0.67
Notetaking	3.38	0.88
Rehearsal	3.22	0.64
Vocabulary learning beliefs	3.04	0.73

Table 3. The frequency of the students' use of vocabulary learning strategies

In order to examine the relationship between the use of vocabulary learning strategies and technology-mediated lexical applications, a Pearson correlation test was conducted. It was revealed that there was a low correlation between the use of technology-mediated lexical applications and encoding (*r* = .433, *p* < 0.01), followed by activation (*r* = .399, *p* < 0.01), and rehearsal (*r* = .346, *p* < 0.01). A significant weak relationship was found between the use of technology-mediated lexical applications and notetaking (*r* = .278, *p* < 0.01), followed by their beliefs about vocabulary learning (*r* = .264, *p* < 0.05), and metacognitive strategies (*r* = .204, *p* < 0.05).

4.4 Problematic aspects of vocabulary knowledge

With regard to the aspects of vocabulary knowledge which are problematic to the selected participants, the descriptive statistics revealed that receptive vocabulary knowledge was more problematic than productive knowledge in all aspects (see Table 4). Constraints on use was the most problematic aspect in both receptive vocabulary knowledge (*M* = 3.23, *SD* = 0.79) and productive knowledge (*M* = 3.14, *SD* = 0.87). The second most problematic aspect in receptive vocabulary knowledge was concept and referents (*M* = 3.14, *SD* = 0.87), followed by collocations (*M* = 2.97, *SD* = 0.93), grammatical functions (*M* = 2.94, *SD* = 0.86), associations (*M* = 2.91, *SD* = 0.86), and word parts (*M* = 2.81, *SD* = 0.87). On the other hand, grammatical functions (*M* = 2.81, *SD* = 0.87) were seen as the second most problematic area for productive vocabulary knowledge. The participants also found difficulty in collocations (*M* = 2.76, *SD* = 0.86), word parts (*M* = 2.6, *SD* = 0.82), form and meaning (*M* = 2.56, *SD* = 0.81), and concept and referents (*M* = 2.55, *SD* = 0.90). Written form and spoken form were reported to be the least problematic areas to the students in both receptive and productive vocabulary knowledge. This might be due to the fact that both teachers and learners focus more on the meaning and form of words compared to their use. It is suggested that teachers and learners pay attention to the use aspect of vocabulary knowledge in teaching and learning vocabulary.

Problematic Aspects of Vocabulary Knowledge	Problems achieving receptive knowledge		Problems achieving productive knowledge	
	M	SD	M	SD
constraints on use	3.23	0.79	3.14	0.87
concept & referents	3.14	0.87	2.55	0.90
collocations	2.97	0.93	2.76	0.86
grammatical functions	2.94	0.86	2.81	0.87
associations	2.91	0.86	2.45	0.91
word parts	2.81	0.87	2.6	0.82
form & meaning	2.76	0.86	2.56	0.81
spoken form	2.55	0.90	2.23	1.05
written form	2.45	0.91	1.96	0.82

Table 4. Results of the problematic aspects of vocabulary knowledge

5 Discussion

The descriptive statistics reveal that students' average use of technology-medicated lexical tools and applications was reported to be moderately high. This could be explained by the fact that all the participants have a mobile phone and/or a computer and seem to be familiar with technology and its use in their education. Many university students tend to look for information related to their studies on Google and other online resources, and they watch YouTube and use social media sites for communication with others in their free time. It should be noted that their use of corpora websites and e-flashcards was very limited. The reason for this finding might be that even teachers in Myanmar seem to have a limited knowledge of corpora websites and students might therefore not be familiar with these websites. Similarly, the use of e-flashcards is not popular among the participants either. To my knowledge, no empirical studies have been conducted in relation to EFL learners' use of technology-medicated lexical tools and applications based on Ma's (2017a) framework. The framework seems to be quite recent, and it is hoped that future vocabulary research studies will use the framework which covers a wide range of technology-mediated tools and applications in vocabulary learning. It would be interesting if the results of the present study can be compared with findings from other EFL contexts.

With regards to VLS use, the overall use of strategies according to the descriptive statistics was moderately high, which might be a result of the high mean value of dictionary use, as using dictionaries was found to be the most used strategy among the participants, which is not surprising. This is in alignment with the previous empirical findings of many VLS studies in which dictionary use was reported to be the most frequently employed strategy by learners. However, participants in the current study seem to lack other vocabulary learning strategies, and the way they deal with the difficult words or new words is to look up the meaning in a dictionary. However, it is interesting to see that students' activation and use of the newly learned words were also high. This implies that students tend to make attempts to use the words they have learned in speech and writing. This might be because they need those words again when they speak and write in English in academic settings or in real situations. Moreover, their vocabulary learning beliefs were not found to be very strong, demonstrating that students' perception towards

vocabulary learning are mostly oriented towards memorizing words from dictionaries and repeating words to remember them. This might be due to the fact that students became used to learning vocabulary by heart instead of using more communication-oriented vocabulary learning strategies. This issue could be solved by teachers modelling the use of strategies in teaching vocabulary and encouraging students to use those strategies when they encounter new words in class. All in all, having a thorough knowledge of vocabulary learning strategies and having an opportunity to use them in the classrooms can lead to an increase in the students' use of vocabulary learning strategies and their vocabulary learning beliefs.

There was a strong correlation between the use of technology-mediated lexical applications and encoding, activation and rehearsal, which could be explained by the vocabulary learning process described in Ma's (2014) memory-based strategic model which Ma's (2017) framework was based on. The memory-based strategic model by Ma (2014) accounted for two four-stage parallel vocabulary learning processes, in which the cognitive processes (perceiving word form, accessing word meaning, building the word entry, and retrieving the word from memory) taking place in the internal memory system correspond to the stages of external strategic behaviours and internal thoughts (discovering the new word, obtaining the word meaning, mapping the word meaning with form, and consolidating the word). Findings of this study seem to be in accordance with Ma's (2014) framework in that the process of utilising technology-mediated lexical applications is strongly linked with the vocabulary learning strategies such as encoding, activation, and rehearsal, which are more related to cognitive processes.

In terms of the problematic aspects of vocabulary knowledge, the results show that students had difficulty in achieving receptive vocabulary knowledge compared to productive knowledge. This finding is contradicted by many previous findings from other studies on receptive and productive vocabulary knowledge which reported that ESL/ EFL learners found productive vocabulary knowledge more problematic compared to its counterpart. Some possible reasons for students encountering problems in achieving receptive vocabulary knowledge are bad practices in the development of receptive skills, a lack of effective reading habits, few opportunities to listen to English materials, and less exposure to English in the context of the selected participants. This finding also contradicts the studies mentioned in the review of the literature. For example, Nation (2020) argued that receptive knowledge is easier to gain compared to productive knowledge. Likewise, productive knowledge is more difficult to achieve and retain compared to its counterpart due to the fact that it requires a learner to possess other features of knowledge in order to use a word while it is sufficient to know the meaning of a word in order to understand a message (Laufer, 1998, as cited in Laufer, 2020). The suggestion would be to provide students with more opportunities for reading and listening in English and to encourage them to focus on vocabulary while reading and listening. It is also worth mentioning here that while students encounter problems learning vocabulary receptively, it does not necessarily mean that their productive knowledge is high since it is possible that they only use English in simplistic ways.

6 Conclusion

This pilot study attempted to test the reliability of a questionnaire designed to measure the use of technology-mediated lexical applications, VLS and problematic aspects of the vocabulary knowledge in order to investigate what kind of technology-mediated lexical applications and vocabulary learning strategies are used by BA university students in Myanmar and what aspects of vocabulary knowledge the students find challenging. The piloting of the instrument demonstrated that it is possible to study these three constructs together in one questionnaire; however, the instrument needs further piloting and item analysis to improve the internal reliability of the instrument. The findings of the study may contribute to a better understanding of the vocabulary learning of Myanmar EFL university students.

Regarding the research questions, out of the technology-mediated lexical applications, open-online resources, e-dictionaries and watching online videos were the most often used by the participants of the study. Despite the high use of technology-mediated lexical applications, the participants did not seem to use certain applications such as corpora websites and e-flashcards. Their use of VLS was also moderate, with dictionaries and activation strategies standing at the top of the list while encoding, note-taking, and rehearsal were not practiced by the students. Receptive vocabulary knowledge was found to be more challenging for the students in several aspects. This finding raises a question in light of the previously mentioned literature and the previous findings of the related studies. It should be noted, however, that the present study is based on the questionnaire data as opposed to measurements of the participants' vocabulary ability. This could be further investigated in the future studies by running receptive and productive vocabulary tests and comparing their test scores with the results of the questionnaire. Responding to the last research question, the participants' use of technology-mediated applications and VLS seem to be related to each other. The findings of the study are expected to propose some pedagogical implications. Teachers should learn to use online corpora and introduce them to students to demonstrate how to use them for vocabulary learning, VLS should be incorporated in teaching (reading lessons in particular), and students should be provided with more opportunities for reading and listening in and outside the classrooms to develop their receptive knowledge. In addition, teachers should focus on the 'use' aspect of vocabulary knowledge in their vocabulary teaching.

Naturally, there are some limitations of the study in terms of the research design. First of all, the global pandemic and political situation of the country of the target participants limited the researcher's ability to reach out to more participants for the study, which resulted in an insufficient number of participants for a questionnaire survey and a limited group of participants from one specialization. Secondly, all the items in the questionnaire were written in English, and it may be the case that some of the participants did not understand the items correctly. Thirdly, Cronbach's Alpha values were not high for every scale and some items in the questionnaire had to be taken out to improve the reliability. This might be due to the inclusion of three different topics combined in one questionnaire. Finally, it would be better to ask students what other lexical applications or strategies (not mentioned in the questionnaire) are used and what other aspects of vocabulary knowledge they find difficult. Based on these limitations, several steps could be taken to increase the validity and reliability of future research on the topic by sampling more participants and a diverse group of students, writing questionnaire items in the participants'

L1 to avoid misunderstanding, creating three different questionnaires based on the main topics and analyzing the data respectively, and using open-ended questions to gather any information which would add to a more complete understanding of the participants' vocabulary learning habits. For future research, other components could be integrated into the current study, such as an investigation into students' attitudes towards the use of technology-mediated lexical applications and/ or VLS, how teachers use the applications in their teaching, how they teach vocabulary, and what aspects of vocabulary they focus on in their teaching. Further studies could also be carried out that use a mixed-methods design for data triangulation to gather more information about each of the topics included in the questionnaire.

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APPENDIX

Questionnaire on English vocabulary learning
The aim of the following questionnaire is to examine your vocabulary learning in English. This questionnaire consists of four parts.
It should take about 20-30 minutes to complete the questionnaire.
This is not a test so there are no "right" or "wrong" answers. The results of this questionnaire will be used only for research purpose so please give your answers sincerely. Your answers will be kept confidential.
The investigation is anonymous and voluntary. You have the right to withdraw at any time.
Thank you very much for your help. If you have any questions, email me thetoo@student.elte.hu.

<u>**Part 1**</u>
In this part, I would like to know how true each statement is to you about the use of technology-mediated lexical tools and applications in your vocabulary learning.
1= Not at all true 2= Not really true   3= Partly true/untrue   4= Mostly true   5= Absolutely true

Use of technology-mediated Lexical applications	1	2	3	4	5
1. I use e-dictionaries to look up the new words.					
2. I use Google Translate to learn the meanings of new words.					
3. I use open-online resources to search for unknown vocabulary.					
4. I use the corpora websites to discover how words are used in text.					
5. I play mobile vocabulary games.					
6. I use Duolingo to learn English.					
7. I read online texts.					
8. I listen to online podcasts.					
9. I watch online videos.					
10. I use social media apps to communicate with people in English.					

11. I use web-based flashcard learning systems to make e-vocabulary lists.					
12. I use vocabulary learning software which combines tutor functions with tool functions.					

Part 2

In this part, I would like to ask you how much you agree or disagree with the following statements by giving marks from 1-5. Please do not leave out any items.
1= Strongly Disagree   2= Disagree   3= Neither Agree nor Disagree   4= Agree   5= Strongly Agree

Beliefs about vocabulary learning	1	2	3	4	5
1. I think learning English is remembering the English words of all my native language meanings.					
2. The best way for me to remember words is to memorize words from dictionaries.					
3. I think the purpose of learning a word is to remember it rather than to use it.					
4. A good memory is all you need to learn a foreign language well.					
5. I think repetition is the best way to remember words.					
6. I think I learn words after I use them.					
7. I think guessing words in context is one of the best ways to learn vocabulary.					
8. I think when I come across a word several times in different contexts, I will learn what it means.					
Metacognitive strategies	1	2	3	4	5
1. When I meet a new word or phrase, I think I know whether I need to remember it.					
2. I learn what my English teacher tells me to learn.					

3. I care much about vocabulary items that my teacher explains in class.					
4. I have a sense of which word I can guess and which word I can't.					
5. I use various means to understand vocabulary items that I am not quite clear of.					
6. I know what cues I should use in guessing the meaning of a particular word.					
Inferencing	**1**	**2**	**3**	**4**	**5**
1. I use common sense when guessing the meaning of a word.					
2. I check my guessed meaning in the paragraph to see if it fits in.					
3. When I don't know a new word in reading, I use my background knowledge of the topic to guess the meaning of the new word.					
4. I make use of the part of speech of a new word when guessing its meaning.					
5. I use alternative cues and try again if I fail to guess the meaning of a new word.					
6. I look for any examples provided in the context when guessing the meaning of a new word.					
7. I analyse the word structure when guessing the meaning of a word.					
Using dictionaries	**1**	**2**	**3**	**4**	**5**
1. When I see an unfamiliar word again and again, I look it up.					

2. When not knowing a word prevents me from understanding a whole sentence, I look it up.					
3. I look up words that are important to the understanding of the sentence or paragraph in which they appear.					
4. I pay attention to the examples when I look up a word in a dictionary.					
5. When I want to know more about the usage of a word that I know, I look it up.					
6. I check the dictionary when I want to find out the similarities and differences between the meanings of related words.					
7. When I get interested in another new word in the definitions of the word I look up, I look up this word as well.					
8. I look for set expressions that go with the word I look up.					
Taking notes	**1**	**2**	**3**	**4**	**5**
1. I make a note when I think the word I'm looking up is commonly used.					
2. I make a note when I think the word I'm looking up is related to my personal interest.					
3. I make a note when I see a useful expression or phrase.					
4. I write down the English explanations of the word I look up.					
5. I write down the English explanation of the word I look up and its translation in my native language.					
6. I note down examples showing the usages of the word I look up.					

Rehearsal	1	2	3	4	5
1. I go through my vocabulary list several times until I remember all the words on the list.					
2. I review the words from the vocabulary cards that I make.					
3. I make regular reviews of new words I have memorized.					
4. When I try to remember a word, I say it aloud to myself.					
5. When I try to remember a word, I repeat its pronunciation in my mind.					
6. Repeating the sound of a new word to myself is enough for me to remember the word.					
7. When I try to remember a word, I write it again and again.					
8. I memorize the spelling of a word letter by letter.					
9. I write both the new words and their translation in my native language again and again in order to remember them.					
Encoding	**1**	**2**	**3**	**4**	**5**
1. I act out some words in order to remember them better.					
2. I create a picture in my mind to help me remember a new word.					
3. To help me remember a word, I try to see the spelling of the word in my mind.					
4. I put words that sound similar together in order to remember them.					

	1	2	3	4	5
5. When words are spelled similarly, I remember them together.					
6. When I try to remember a new word, I link it to a sound-alike word that I know.					
7. When I learn new words, I pay attention to prefixes, roots, and suffixes.					
8. I intentionally study how English words are formed in order to remember more words.					
9. I memorize the commonly used roots and prefixes.					
10. When I try to remember a word, I also try to remember the sentence in which the word is used.					
11. I put words in set expressions in order to remember them.					
12. I put words in sentences in order to remember them.					
13. I remember a new word together with the context where the new word appears.					
Activation	**1**	**2**	**3**	**4**	**5**
1. I make up my own sentences using the words I just learned.					
2. I try to use the newly learned words as much as possible in speech.					
3. I try to use the newly learned words as much as possible in writing.					
4. I try to use newly learned words in real situations.					
5. I try to use newly learned words in imaginary situations in my mind.					

Part 3

In this part, I would like to ask you how much you find problematic in the following aspects of vocabulary knowledge by giving marks from 1-5. Please do not leave out any items.

1= Not at all   2= Not really   3= So-so   4= Quite a lot   5= Very much

Problems achieving receptive vocabulary knowledge	1	2	3	4	5
1. How difficult is it for you to learn what a word sounds like?					
2. How hard is it for you to learn what a word looks like?					
3. How problematic do you find recognizing the parts of a word?					
4. How hard is it for you to know the word meaning from its form?					
5. How hard is it for you to know what is included in the concept of a word?					
6. How hard is it for you to think of the other words associated with a word?					
7. How problematic do you find knowing the patterns in which a word occurs?					
8. How problematic is knowing collocations of a word for you?					
9. How hard is it for you to know the constraints on the use of a word?					
Problems achieving productive vocabulary knowledge	**1**	**2**	**3**	**4**	**5**
10. How problematic is pronouncing a word for you?					
11. How hard is it for you to write and spell a word?					
12. How difficult is it for you to use the word parts needed to express the meaning?					

13. How hard is it for you to use the word form in order to express the meaning?					
14. How problematic is it for you to know what items the concept of a word can refer to?					
15. How hard is it for you to use other words instead of a particular word?					
16. How problematic do you find in the patterns you must use a particular word?					
17. How hard is it for you to use the collocations of a particular word?					
18. How problematic is it for you to use a word in an appropriate context?					

<u>Part 4</u>

In this part, I would like to ask you about your background information. Please provide the following information in the given space.
Gender:
Major:
Year of study:

Thank you for your participation!