

ARTICLE



Self-regulated and collaborative personalised vocabulary learning approach in MALL

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Abstract

Students often have difficulties in self-regulating their vocabulary learning in mobile-assisted language learning (MALL). Building on past studies of vocabulary learning, MALL, self-regulation, and personalised learning (PL), we propose a self-regulated, collaborative, personalised vocabulary (SCPV) learning approach in MALL. In this exploratory mixed-methods study, 35 university students learned second language (L2) vocabulary via the SCPV or a self-regulation-only (S) approach. Data were collected through pre- and post-surveys, personalised vocabulary tests, and interviews. The results indicated that the new approach may hold more potential to help learners achieve better productive vocabulary knowledge. Thematic analyses of interviews indicated that the SCPV students enhanced their vocabulary learning; specifically, these students demonstrated a systematic understanding of vocabulary learning processes. Furthermore, specific PL roles (e.g., community sharing of self-regulated vocabulary learning) showed how collaborative PL could aid participants' development of self-regulated learning. Implications include how to conduct self-regulated training in MALL and designing both individual and collaborative tasks that involve PL.

Keywords: *Second Language (L2) Vocabulary Learning, Self-regulation, Personalisation, Mobile-Assisted Language Learning (MALL)*

Language(s) Learned in This Study: *English*

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Introduction

Vocabulary is one of the most popular areas for studying mobile-assisted language learning (MALL) (e.g., Chen et al., 2019; Lin & Lin, 2019; Stockwell, 2007). Using personal portable devices, MALL enables new ways of learning across contexts (Kukulska-Hulme & Shield, 2008). MALL mostly occurs in two contexts: (a) learning a language through mobile devices (Kukulska-Hulme & Shield, 2008) and (b) students' move (Ma, 2016). Such mobile students often use available mobile devices with laptop/desktop technologies moving between MALL and CALL environments (Burston, 2014; Ma, 2017; Tafazoli et al., 2019). For example, a student could check a new word in a dictionary app during a lecture at school and then tidy the vocabulary notes on a laptop/desktop at home.

Effective vocabulary learning via MALL depends on student autonomy—especially their self-regulation, as they can be easily distracted. However, past studies showed that many students lack sufficient self-regulation training to learn vocabulary independently (Ping et al., 2015). As customised learning tasks for individual students (*personalisation*) can aid self-regulation (Basham et al., 2016; McHugh et al., 2020), we suggest including both self-regulation and personalisation in vocabulary learning in MALL. Specifically, we explore how personalisation with community sharing (a type of student collaboration) might aid self-regulated vocabulary learning in MALL.

Based on Zimmerman's (2000) self-regulation model, we (a) propose a new framework for a self-regulated and collaborative personalised vocabulary (SCPV) learning approach in MALL and (b) conduct an exploratory intervention study of Chinese university students' vocabulary under two conditions: SCPV and self-regulation-only. We explore whether MALL environments incorporating self-regulation, collaboration and personalisation can enhance student motivation, self-regulation, and vocabulary learning across time.

Literature

Self-regulation in MALL

Self-regulation is defined as “self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals” (Zimmerman, 2000, p. 14; cf. *learner autonomy*, Godwin-Jones, 2019; Reinders & White, 2016). Self-regulated learning can improve learning outcomes, learning behaviour/satisfaction, motivation, strategy use, and metacognitive learning. According to Zimmerman's (2000, 2011) three-phase self-regulation model, motivation drives self-regulation in Phase I (forethought), which comprises setting learning goals and conducting strategic planning. In Phase II (performance), students execute their learning processes (interest enhancement, task strategies) while monitoring and controlling them. In Phase III (self-reflection), students evaluate their performance and cognitive strategies and then propose adaptive actions for future tasks.

Self-regulation can enhance learner autonomy in MALL or CALL (Ranalli et al., 2019; van Lieshout & Cardoso, 2022) and it features in several MALL studies (e.g., Çakmak & Erçetin, 2018, García Botero et al., 2019; Kondo et al., 2012; Viberg et al., 2020). However, there are issues and limitations that require further exploration. First, current self-regulation training may not sustain student learning interest or learning outcomes (García Botero et al., 2019), especially when teacher support fades away (Kondo et al., 2012). Second, guided self-regulatory instructions did not necessarily improve students' language skills (Çakmak & Erçetin, 2018).

Notably, although technological advances can aid student learning, they can also distract them and hinder their self-regulated learning in MALL (Altbach et al., 2019; Zimmerman, 2002; García Botero et al., 2019). Specifically, students show shorter attention spans and are more easily distracted in mobile contexts than face-to-face contexts (Mokhtari et al., 2015). When exploring online resources (e.g., YouTube), students mainly searched for attractions and entertainment; they rarely used self-regulation strategies such as setting goals and taking notes for autonomous learning (Wang & Chen, 2020).

Personalised Learning in MALL

As these empirical findings suggest that self-regulation alone may not be as effective as expected, increasing their motivation and learning interests might enhance their self-regulation and learning outcomes (Hooshyar et al., 2019). Specifically, we aim to boost student interest by integrating student voice and choice (*personalised learning*, PL; Bray & McClaskey, 2014) via personal choice and personalised assessment into self-regulation training (Alamri et al., 2020). PL can provide students with more satisfactory learning experiences by allowing them to address their needs and pursue their interests to increase their intrinsic motivation and yield better learning outcomes (Niemic & Ryan, 2009; Watson et al., 2012).

PL is essential to many theoretical models of MALL (e.g., Arispe & Burston, 2017; Godwin-Jones, 2021). In reality, PL is often associated with intelligent or context-aware design (e.g., Lin & Lin, 2019; Stockwell, 2007). Such intelligent-design apps analyse student behaviour, recommend context-sensitive vocabulary items (e.g., based on location or season), and/or suggest suitable vocabulary exercises. However, students using such apps might passively follow a machine-designed learning path rather than exercising their second language (L2) agency and choice to design their own PL path, which contradicts with the literature finding that students making more choices are often more motivated to learn (Patall et al., 2010).

Effective PL must address student differences and allow student choice (Choi & Ma, 2015). As students' learning interests, levels of readiness, and other characteristics vary, PL that capitalises or addresses these differences can improve their learning (Smith & Throne, 2009). Furthermore, student choice (e.g., which apps to use; when, where, or how to use them) fosters their autonomy to empower PL (Ma & Yan, 2022; Schlemmer & Schlemmer, 2008).

Although practical concerns and experience drive most PL designs (Walkington & Bernacki, 2020), explicit learning theories can guide practitioners implementing PL (Bernacki et al., 2021). The PL process suggested by McCarthy et al. (2020) includes several important subprocesses in Zimmerman's self-regulation model. Through self-regulation, students can exert their agency, set their own goals, and reflect on PL learning environments (Basham et al., 2016; McHugh et al., 2020). For example, after students received self-regulation training mediated by PL, their help-seeking behaviour improved (Baker, 2016). These findings suggest that integrating PL into self-regulation can aid learning.

Collaborative Learning in MALL

In MALL, there is increasing attention to incorporating collaborative learning tasks among learners (Cong-Lem, 2018; Kukulska-Hulme & Viberg, 2018; Troussas et al., 2014). However, very little MALL research involving collaborative learning investigated PL features. An exception is Underwood et al. (2014), who encouraged students to co-design vocabulary learning activities based on their learning experience using a mobile application. However, Underwood (2016) pointed out that students need to sustain their engagement with more types of learning other than incorporating peer-to-peer collaboration. Most of the MALL studies tend to explore the affordances of collaborative learning alone but not the combined effects of the PL and collaborative learning, as Kukulska-Hulme and Viberg (2018) commented that “these ‘linkings’ [between the personal and the social learning experience] are not frequently considered” (p. 215).

L2 Vocabulary Pedagogy for Self-regulation and Personalisation

As self-regulation is a subject-specific and context-specific process (Zheng et al., 2018), suitable task strategies and metacognition for students' L2 vocabulary learning should reflect its best practices. However, many MALL designs lacked innovative instruction and relied on rote learning within a behaviourism paradigm (see meta-analysis by Burston, 2015; for a review, see Song & Hwang, 2020). Hence, we grounded this MALL study in a theory-based and pedagogy-oriented design as recommended by Elaish et al. (2019).

Based on Nation's (2011) work, our vocabulary pedagogy uses Ma's (2014, 2015) four-stage, memory-based vocabulary learning framework: (1) discovering a new word, (2) getting its meaning, (3) mapping to its form, and (4) consolidation. First, a student's brain perceives a new word while reading or listening (visual or auditory input). Second, the student constructs or accesses the meaning of the new word using their L1 or L2 lexicon. Third, the student connects this meaning (L1 translation or L2 meaning) with its form via repetition, imagery, rhyming, etc., facilitating more neural connections to help entrench it in the mental lexicon and aid successful, faster access later. Fourth, repeated retrievals of this word via more subsequent uses of it further strengthens its neural connections within the brain's cerebral cortex (long-term memory) to facilitate faster access subsequently (Barcroft, 2004; Ma, 2009).

To operationalise personalised vocabulary learning in our study, we accommodate students' different vocabulary abilities, personal interests, and individual preferences by letting them choose their target vocabulary and learning strategies, following Choi and Ma (2015).

A New Framework for Self-regulated and Personalised Vocabulary Learning in MALL

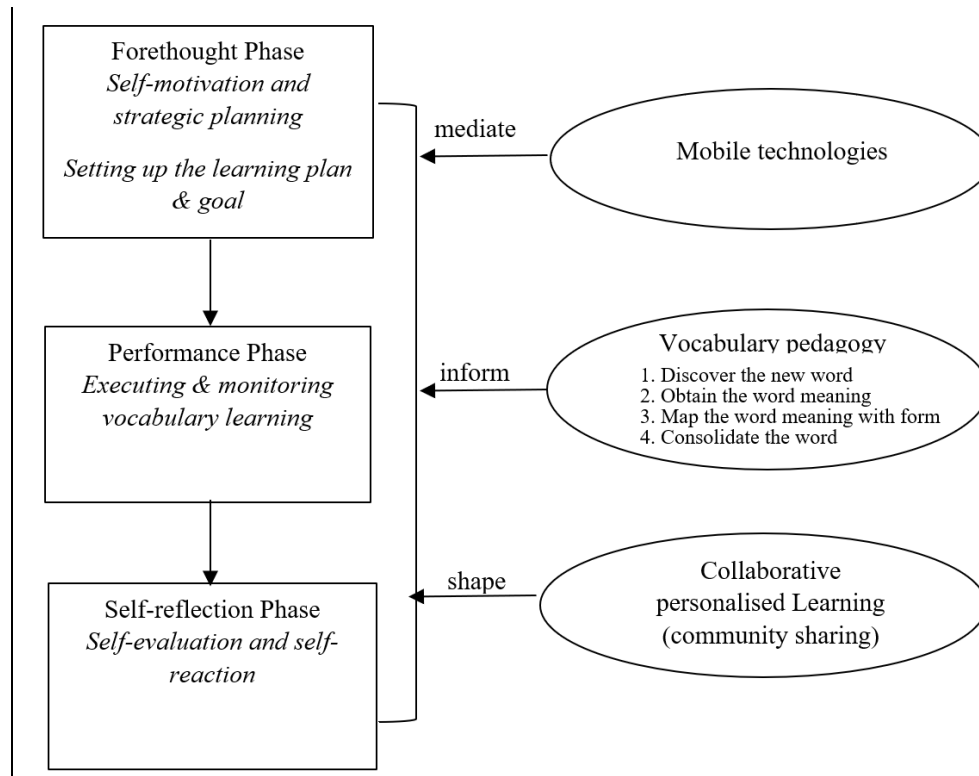
We integrate self-regulation, PL, and collaborative learning with vocabulary learning in MALL. First, self-regulated learning enhances MALL (Kondo et al., 2012; Lai & Gu, 2011). Second, PL addresses student differences and gives them choices to boost their motivation (Lin & Lin, 2019). Third, collaborative learning can help PL boost motivation with shared ideas and sharing metacognitive demands to aid student learning (Chiu & Kuo, 2009). Fourth, Ma's (2014) four-stage memory-based vocabulary learning

framework undergirds the vocabulary learning in MALL.

Hence, our study incorporates three types of training into self-regulated, collaborative personalised vocabulary learning approach (SCPV) in MALL: (a) self-regulation strategies (like Romeo & Hubbard's (2010) strategic training), (b) vocabulary instruction (similar to Romeo & Hubbard's (2010) pedagogical training), and (c) collaborative PL (community sharing). Through SCPV, students select their own vocabulary items, design their own learning paths to personalise their self-regulated training at their own pace, and share ideas with their community. In this SCPV approach, mobile technologies mediate, vocabulary instruction informs, and collaborative PL shapes the student's self-regulated L2 vocabulary learning (Figure 1). With two added components (vocabulary pedagogy and collaborative PL), we expect that the SCPV approach will help students learn vocabulary more efficiently and effectively than the self-regulation-only approach in MALL. We are also interested in knowing how each group will change their perceived ability for self-regulation after the intervention. In addition, this study will explore students' perspectives regarding how this SCPV approach can facilitate their vocabulary learning.

Figure 1

Self-regulated, Collaborative, Personalised Vocabulary (SCPV) Learning Approach



The study is guided by three research questions:

RQ1. Will the SCPV (self-regulated, collaborative, personalised vocabulary) approach help students learn more L2 vocabulary (receptively or productively) than the S (self-regulation only) approach?

RQ2. How do the SCPV and S approaches change both groups' perceived ability of self-regulation after the intervention?

RQ3. How do the students perceive the role of SCPV in vocabulary learning?

Methodology

Participants

This study compared students' vocabulary in MALL across two conditions: SCPV versus S. By placing a notice on an electronic bulletin in a university in Hong Kong, we recruited 71 students (60 females, 11 males) across five years of study (1–5) and across disciplines (Chinese, education, science, mathematics, history, and visual arts). They were randomly assigned into SCPV ($n = 37$) or S ($n = 34$). Unfortunately, the voluntary participation (independent of any university course), the 9-week duration, and the post-test overlapping with their examination periods caused high attrition: only 35 students (17 SCPV; 18 S) completed the post-tests. The data showed that these two groups did not differ across age, gender, years of study, or vocabulary size (number of words whose meaning a student recognizes; Qian, 2002; see descriptive statistics in [Table 1](#)).

Table 1

Participant Information

| | SCPV | S |
|-----------------------|--|--|
| Number | 17 | 18 |
| Age | 18–23 | 18–23 |
| Gender | F = 16 M = 1 | F = 15 M = 3 |
| Year of study | Y1 = 9 Y2 = 4 Y3 = 2 Y4 = 0 Y5 = 1 | Y1 = 10 Y2 = 2 Y3 = 2 Y4 = 2 Y5 = 1 |
| Mean vocabulary size* | K2 = 89%; SD = 9% K3 = 88%; SD = 9% K5 = 63%; SD = 24% UWL = 63%; SD = 24% K10 = 28%; SD = 20% | K2 = 91%; SD = 10% K3 = 89%; SD = 14% K5 = 69%; SD = 26% UWL = 67%; SD = 28% K10 = 25%; SD = 22% |

* K2 = 2nd 1000 frequency; K3 = 3rd 1000 frequency; K5 = 5th 1000 frequency; UWL = university word list; K10 = 10th 1000 frequency.

Note: On admission to university in Hong Kong, all students must demonstrate independent English use (e.g., International English Language Testing System [IELTS] language proficiency score ≥ 6 ; at least B2 in the Common European Framework of Reference).

Mixed-method Design and Research Procedure

Our mixed-method study included surveys, personalised tests, and interviews (see [Table 2](#)). After participants were randomly divided into two groups (SCPV, S), the first author separately briefed each group on their respective vocabulary learning programs (SCPV vs. S) via online 6-week self-learning packages (through [Schoolology](#), an online learning management system similar to Moodle). Then, the participants completed a self-regulation survey (based on Zimmerman, 2011) and a vocabulary size test (Nation, 1990) before starting the programme.

Table 2*Research Procedure*

| | SCPV group | S group |
|------------------------------|---|--|
| Step I (1 week) | <ul style="list-style-type: none"> ● Pre-vocabulary size assessment ● Pre-self-regulation survey | <ul style="list-style-type: none"> ● Pre-vocabulary size assessment ● Pre-self-regulation survey |
| Step II (6 weeks) | <ul style="list-style-type: none"> ● Implementing the SCPV vocabulary learning approach ● 2-week self-study of online self-training materials ● 4-week vocabulary learning using the SCPV approach | <ul style="list-style-type: none"> ● Implementing the self-regulation-only approach ● 2-week self-study of online self-training materials ● 4-week vocabulary learning using the S approach |
| Step III (2 weeks) | <ul style="list-style-type: none"> ● Personalised vocabulary knowledge assessment (receptive + productive) ● Post-self-regulation survey ● Interviews | <ul style="list-style-type: none"> ● Personalised vocabulary knowledge assessment (receptive + productive) ● Post-self-regulation survey |

Following, all participants registered on their Schoology learning platforms: the S group received self-training in self-regulation while the SCPV group received self-training in self-regulation, vocabulary pedagogy, and collaborative PL (see [Appendix A](#) for sample training materials).

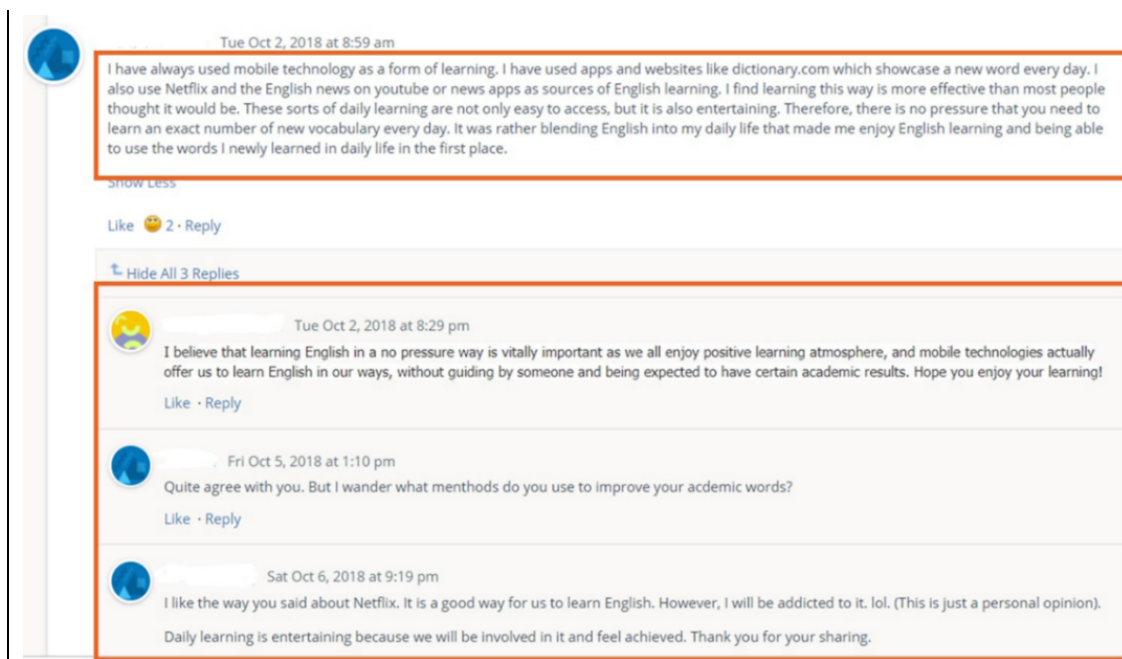
All participants chose and uploaded at least 25 new vocabulary items (from their lecture slides, textbooks, online reading, online videos/songs, etc.) per week to Schoology, resulting in at least 100 words in four weeks. The S group provided three types of information to vocabulary learning recording (VLR) sheets in Excel: (1) item, (2) ways to access the word meaning, and (3) lexical information (meaning, word class, collocation, or example sentences). SCPV participants also added: (4) source, (5) personalised strategies for memorising the word, and (6) strategies for using the word. This six-category VLR reflected the key stages of vocabulary learning embedded in SCPV. All participants could use any mobile device (e.g., mobile phone, iPad) and their laptops to learn vocabulary or access Schoology.

Then, we analysed each participant's 100 (or more) submitted vocabulary items to create a personalised vocabulary post-test with both receptive and productive test formats, along with the same self-regulation survey (to measure any changes in self-regulation from the pre-survey). To document students' perspectives on how SCPV affected their learning, 12 SCPV students were interviewed.

We encouraged the SCPV students to share and comment on one another's personalised vocabulary learning stories in the discussion forum of Schoology. They posted 40 messages, each one typically followed by one to three comments. In a representative example, a student posted about using various mobile technologies to learn vocabulary, attracting three comments endorsing the PL strategies or raising questions (e.g., "But I wonder what methods will you use to improve your academic words?"). Such personalised sharing (such as exchanging learning strategies and resources) can facilitate social connections, produce new ideas, or boost learning motivation.

Figure 2

Example of Community Sharing of Personalized Learning Stories



Research Instruments

Survey

Based on Zimmerman's (2011) three-phase self-regulation model, we developed a self-regulated mobile language learning survey with 55 items (e.g., goal setting, strategic planning, motivation, self-efficacy, task strategies, etc.). Two experts in psychometrics and self-regulation evaluated these items and judged them to capture the key aspects of Zimmerman's model and to show high content validity.

The survey was administered to a different set of 142 students (similar to those in this study). The survey explored nine constructs: metacognitive planning, self-efficacy for mobile learning, intrinsic motivation, extrinsic motivation, task strategies, self-observation, self-encouragement and rewarding, self-evaluation, and future planning. As 11 items had low factor loadings below 0.4, they were removed. The remaining factor loadings ranged from .406 to .99, with no cross loadings exceeding 0.4 (see details of factor loadings [here](#)); see sample survey questions in [Appendix B](#)). These sub-scales of the large sample ($N = 142$) and the actual sample for the current study ($N = 35$) showed high reliability (Cronbach's $\alpha = .897$ to $.971$; see [Table 3](#)). The Kayser-Meyer-Olkin value was .929, and Bartlett's test of sphericity was significant ($\chi^2[1431] = 8608.95$, $p < .000$). The Kayser-Meyer-Olkin (KMO) value of .929 indicates a very high degree of sampling adequacy, which suggests that the data set is well-suited for factor analysis. Additionally, the significance of Bartlett's test of sphericity confirms that the variables are sufficiently correlated and therefore appropriate for factor analysis, reinforcing the reliability of the factor analysis results. However, the high explained variance of 52% and high eigenvalue of 28.27 for the first factor may indicate that these items perhaps reflect one large factor, not nine factors.

Table 3*Factor Structure and Reliability Results for the Subscales*

| Phase | Subscale | Cronbach's α (<i>N</i> = 142) | Cronbach's α (<i>N</i> = 35) | Number of items |
|-----------------|---|--|---|----------------------------------|
| Forethought | Metacognitive planning | .946 | .971 | 9 |
| | Self-efficacy beliefs for Mobile learning | .914 | .977 | 4 |
| | Intrinsic motivation | .956 | .950 | 4 |
| | Extrinsic motivation | .929 | .977 | 4 |
| Performance | Task strategies | .903 | .942 | 4 |
| | Self-observation | .908 | .940 | 3 |
| | Self-encouragement & rewarding | .904 | .932 | 5 |
| Self-reflection | Self-evaluation | .932 | .955 | 7 |
| | Future planning | .897 | .919 | 4 |

Personalised Assessment

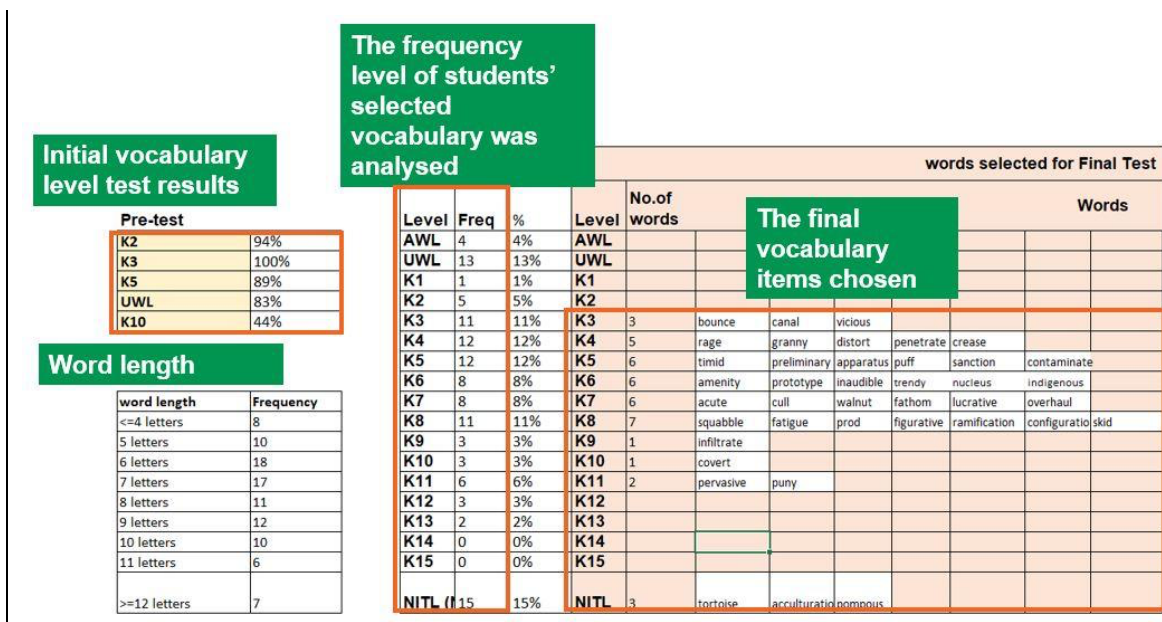
A successful personalised assessment requires both (a) selecting appropriate words for each participant to accommodate their differences, and (b) ensuring fairness across all participants. We used the [Range programme](#) (Heatley et al., 2002) to analyse the frequencies (ranging from 1,000 to 15,000) of each word in each of the participants' selected vocabulary words.

We applied the following procedure to ensure that each participants' test of vocabulary included 40 words with suitable difficulties, lengths, and equal proportions of word classes (nouns, verbs, and adjectives). Using the results of each participant's vocabulary size test, we created individual vocabulary profiles. For example, one participant showed fairly good knowledge up to level K5 (see [Figure 3](#)). Therefore, most items (80%) included in the personalised test were selected from K5 or above. As the 100 words submitted by this participant were mostly 4–12 letters long (mean = 7.6 letters), 20–40% of the words were selected from each length category, and the average word length of the 40 words was approximately 7.5 letters (close to 7.6 of the 100 words). In addition, the words selected for the post-test had a similar proportion of nouns (35%), adjectives (32.5%), and verbs (32.5%). Hence, this procedure addresses participant differences, choices, and fairness to select 40 vocabulary test items based on each participant's vocabulary level.

Aiming for an informative vocabulary assessment (Schmitt, 2019), we randomly divided each set of 40 items into two subsets to create receptive and productive vocabulary tests (see sample test questions in [Appendix C](#) and sample vocabulary test lists for students at different proficiency levels [here](#)). In the receptive vocabulary test of meaning recall, a participant is given a word and required for the corresponding L1 translation or L2 definition. In the productive vocabulary test, a participant is required to fill in the blank word within a given sentence, with the first letter(s) of the word as cues (Laufer & Nation, 1999). For each correctly answered question, a participant received one score.

Figure 3

Selection of 40 Items for Personalised Assessment for a Participant



Interview Guidelines

The SCPV participant interviews gathered their perceptions and reflections about their self-guided SCPV training. Interview questions focused on key SCPV components: vocabulary pedagogy, personalisation, and self-regulation (see sample interview questions in Appendix D). A research assistant was trained to conduct all the interviews (see Appendix E for interview responses).

Data Analysis

Given the small sample size involved ($N = 17$ for SCVP; $N = 18$ for S), we treated this study as exploratory in nature and only used descriptive statistics together with Cohen's d , without using any significance test, for answering $RQ1$ and $RQ2$.

To capture participants' perceptions of SCPV's effects on their vocabulary learning ($RQ3$), the first author and a well-trained research assistant applied a thematic analysis (Braun & Clarke, 2006) to create codes, group them, and combine them into themes regarding each key construct (vocabulary pedagogy, personalisation, or self-regulation). Inter-coder reliability was high (Cohen's $\kappa = 0.86$). We resolved disagreements through discussions and negotiations.

Results

RQ1. Will the SCPV Approach Help Students Learn More L2 Vocabulary (Receptively or Productively) than the S Approach?

Table 4 shows the results of the descriptive statistics on personalised receptive and productive vocabulary scores. Compared to the S students, the SCPV students had slightly higher mean receptive vocabulary scores ($M_{SCPV} = 15.73$; $M_S = 14.73$) and 40% higher mean productive vocabulary scores ($M_{SCPV} = 13.33$; $M_S = 9.53$). With reference to the recommendation by Plonsky and Oswald (2014) regarding effect

size for L2 research, the Cohen's d values obtained suggested a very small effect (Cohen's $d = 0.18$) for receptive vocabulary and a medium effect (Cohen's $d = 0.67$) for productive vocabulary. This may suggest that the SCPV approach may hold more potential in helping students learn vocabulary productively than the S approach.

Table 4

Descriptive statistics for personalised vocabulary test scores

| | Group | Mean | SD | Cohen's d |
|------------------------------|-------|-------|------|---------------|
| Receptive vocabulary scores | S | 14.73 | 6.12 | 0.18 (Small) |
| | SCPV | 15.73 | 4.68 | |
| Productive vocabulary scores | S | 9.53 | 6.63 | 0.67 (Medium) |
| | SCPV | 13.33 | 4.70 | |

The result that the SCPV condition showed very little superiority regarding receptive vocabulary learning can be possibly explained by the nature of the receptive test, which only required test-takers to recognise the meaning of the vocabulary items. As Ma (2009, p. 40) stated, “knowing a vocabulary item receptively is likely to require only shallow knowledge [...]; to know a word productively is to involve deep knowledge...”. Since research has shown that receptive knowledge grows at a higher rate than productive knowledge (González Fernández, & Schmitt, 2020; Melka, 1997), it is relatively easy for students to gain receptive knowledge, even with shallow mental processing.

RQ2. How do the SCPV and Self-regulation-only Approaches Change Both Groups' Perceived Ability of Self-regulation after the Intervention?

Table 5 displays the descriptive statistics for self-regulation measures, showing generally higher scores on the post-survey than the pre-survey for both groups. In the forethought phase, the metacognitive planning of both groups was improved after the post-test. With reference to Plonsky and Oswald (2014), the S group achieved a slightly higher effect size than the SCPV group (0.61 vs. 0.53). While the SCPV group improved their intrinsic motivation (mean difference = 0.43) with a small effect (0.41), the S group showed little improvement (mean difference = 0.09). In the performance phase, both groups demonstrated improvements in all sub-sections with small to medium effects: task strategies, self-observation, and self-encouragement and rewarding. While the effect size for self-encouragement and rewarding of the SCPV group was higher than that of the S group (0.60 vs. 0.41), the reverse was observed for self-observation (0.56 vs. 0.87). This suggests that after experiencing the S or SCPV approach, each group improved their performance phase of self-regulation by using more cognitive, monitoring and emotional strategies. In the self-reflection phase, both groups exhibited improvements in self-evaluation, with the S group achieving a higher effect size than the SCPV group (0.76 vs. 0.59), whereas the SCPV group achieved higher gains in future planning (mean difference = 0.69, medium effect) than the S group (mean difference = 0.49, small effect).

Table 5*Descriptive Statistics of Pre- and Post-self-regulation Surveys*

| Phases and Processes | Group | Mean (SD) | | Mean Diff. (post-pre) | Cohen's <i>d</i> |
|-----------------------------------|-------|---------------------|----------------------|-----------------------|-------------------|
| | | Pre-self-regulation | Post-self-regulation | | |
| Forethought Phase (I) | | | | | |
| Metacognitive planning | S | 4.03 (0.88) | 4.59 (0.97) | 0.56 | 0.61 (Medium) |
| | SCPV | 4.07 (0.99) | 4.59 (1.11) | 0.52 | 0.53 (Small) |
| Self-efficacy for Mobile learning | S | 4.25 (0.83) | 4.68 (1.43) | 0.43 | 0.38 (Small) |
| | SCPV | 4.47 (1.16) | 4.82 (0.98) | 0.35 | 0.32 (Small) |
| Intrinsic motivation | S | 4.48 (1.13) | 4.57 (1.10) | 0.09 | 0.08 (Very small) |
| | SCPV | 4.31 (1.10) | 4.75 (1.09) | 0.43 | 0.42 (Small) |
| Extrinsic motivation | S | 5.02 (0.68) | 4.83 (1.16) | -0.19 | Null |
| | SCPV | 5.04 (0.85) | 5.22 (1.11) | 0.18 | 0.18 (Small) |
| Performance Phase (II) | | | | | |
| Task strategies | S | 3.80 (0.91) | 4.57 (0.94) | 0.75 | 0.81 (Medium) |
| | SCPV | 4.03 (1.13) | 4.87 (1.07) | 0.84 | 0.86 (Medium) |
| Self-observation | S | 3.50 (1.10) | 4.44 (1.06) | 0.94 | 0.87 (Medium) |
| | SCPV | 3.84 (1.07) | 4.45 (1.12) | 0.61 | 0.56 (Small) |
| Self-encouragement & rewarding | S | 3.93 (1.05) | 4.40 (1.23) | 0.47 | 0.41 (Small) |
| | SCPV | 3.92 (0.84) | 4.46 (1.04) | 0.54 | 0.60 (Medium) |
| Self-Reflection Phase (III) | | | | | |
| Self-evaluation | S | 3.98 (0.85) | 4.62 (0.83) | 0.63 | 0.76 (Medium) |
| | SCPV | 4.06 (1.00) | 4.61 (0.93) | 0.55 | 0.59 (Small) |
| Future planning | S | 4.08 (0.91) | 4.54 (0.94) | 0.46 | 0.49 (Small) |
| | SCPV | 4.19 (1.08) | 4.88 (1.05) | 0.69 | 0.68 (Medium) |

RQ3. How do the Students Perceive the Role of SCPV in Vocabulary Learning?

Our thematic analysis of the interview data from the 12 SCPV students yielded five major themes: (a) benefits of mobile devices, (b) understanding stages of vocabulary learning, (c) benefits of vocabulary learning recording (VLR), (d) greater intrinsic motivation, and (e) benefits of community sharing.

Benefits of Mobile Devices

The majority of interviewees reported that their mobile devices aided their vocabulary learning. They used dictionary apps on their mobile devices to find the meaning of a new word or to check their understanding of words: "I will use this app to look up unknown words" (Judy) (all participant names are pseudonyms). They also used vocabulary learning apps on their mobile devices to record and manage unfamiliar vocabulary words: "I will record new vocabulary in my mobile apps" (Luna).

Systematic Understanding of the Four Key Stages of Vocabulary Learning

Before participating in this study, many interviewees stated that they only identified new words (stage I) and found their meanings (stage II) but did not map the word meaning to the form (stage III) or consolidate their understanding of the word (stage IV). For example, Katie said, "...previously, I would only look up the new word in the dictionary. After knowing the meaning, I would stop learning the word."

After receiving the SCPV training, many interviewees developed a systematic understanding of all the essential stages involved in vocabulary learning, as Katie expressed: "Now, I record the new word using the recording function of the dictionary app (of her mobile phone) [...] I also tried to reinforce the 'mapping' and 'consolidating' stages." With their greater awareness of stages three and four, interviewees reported developing a habit of using newly learned vocabulary items in their subsequent speaking or writing. Luna said, "I started to use the four memory-based stages to inform my vocabulary learning. For example, I would consciously use the word when writing my academic papers or when chatting with others."

Recording Items on the VLR Sheet Aiding Vocabulary Memorisation

Most students appreciated the six-category VLR. For example, Mary said, "I used to use a notebook to record vocabulary. But now I can use the VLR sheet with many different functions, and I find it very useful." Similarly, Judy stated, "I can review the words anytime and anywhere. This can turn the words from short-term memory to long-term memory." These SCPV students reported using newly learned words in speaking and writing and a preference for the VLR sheet, which might help explain their large productive vocabulary gains (cf. S students).

The SCPV Approach Enhances Students' Intrinsic Motivation in the Forethought Phase

The interview data showed evidence documenting how SCPV can help students increase their intrinsic motivation. For example, Katie said, "I am getting more passionate about using the approach to support my vocabulary learning. I will use the approach from now on and recommend it to my friends."

Community Sharing of PL Stories Facilitates Self-regulation. An analysis of the interview data concerning the community PL story sharing revealed five salient themes regarding the important roles of collaborative PL in students' self-regulation of vocabulary learning in all phases (see Table 6): (a) set up new learning plan, (b) try out new learning resources or task strategies, (c) self-regulate emotions, (d) self-reflect on learning, and (e) improve future planning.

Table 6

Six Specific Roles of the SCPV Approach on Self-regulation

| Specific Roles | Phase | Counts | % |
|------------------------------------|-----------------------|--------|-----|
| 1. increasing intrinsic motivation | Phase I: Forethought | 13 | 10 |
| 2. setting up new learning plans | | 6 | 5 |
| 3. trying out new task strategies | Phase II: Performance | 46 | 35 |
| 4. self-regulating emotions | | 19 | 14 |
| 5. self-reflecting on learning | Phase III: Reflection | 37 | 28 |
| 6. better future planning | | 10 | 8 |
| | Total | 131 | 100 |

First, after interviewees read others' PL stories on the forum, they reported being inspired to *set up a new learning plan* (forethought, phase I). For example, Luna said, "I read their personalised learning stories and got inspired... So, I included a new vocabulary learning plan in my calendar: watch an episode of American TV series every Sunday." (Luna, Interview)

Second, after learning about other students' personalised pathways to vocabulary learning, some

interviewees reported *trying out new learning resources or task strategies* (performance phase II) that they had rarely used. For instance, Hana said, “some students recommended us to look for new words from listening to music or reading news. She also mentioned a mobile app for reviewing English vocabulary, which I find particularly helpful.” (Hana, Interview)

Third, some participants reported that personalised sharing also helped to self-regulate their emotions by connecting to other students who adopted similar strategies and reconfirmed their own choice of the strategies. Mary said:

One student learned vocabulary from watching TV series. But my previous English teachers do not think this strategy is effective ... Well, now I know other students also use this strategy, and I am not the only one who adopts the strategy perceived “inappropriate” by my teachers... (Mary, Interview)

Fourth, knowing others' PL stories can help students *self-reflect on their learning* (self-reflection phase III). For example, Jane said, “I think learning about others' learning stories helps with my self-reflection, that is, reflecting on the areas where I did not do well. Then, I can follow and learn from others about how to improve my way of learning.”

Fifth, such personalised sharing within a community can help students *improve their future planning* (self-reflection phase III). For instance, Tina said:

In one story shared by a student, he made a concrete plan to prepare for the IELTS test. He also set a clear goal. After reading his story, I got inspired and decided to follow what he did to prepare for my IELTS test next year. (Tina, Interview)

Discussion

As students often have difficulties self-regulating their vocabulary MALL, we proposed and examined a self-regulated, collaborative, personalised, vocabulary (SCPV) against self-regulation only (S) in MALL. This exploratory, small-sample study showed that SCPV participants had higher productive vocabulary gains than S participants. Furthermore, both SCPV and S participants showed greater outcomes on the post-survey than on the pre-survey for all nine self-regulation measures. However, the factor analyses indicate that these nine self-regulation measures may form a single broad factor. Future studies with larger samples and superior analyses can test these differences more rigorously.

Encouraging a Deep Learning Approach by Reinforcing Meaning-form Mapping (RQ1: Vocabulary Knowledge)

While the receptive vocabulary post-test scores across groups showed small differences, the SCPV mean exceeded the S mean on the productive vocabulary post-test by 40%.

The SCPV group recorded six types of information: L2 word, source of the item, ways to access the word meaning, word information (meaning, word class, collocations, and example sentences), personalised strategies for memorising the word, and strategies for using it. Such additional lexical information provided by the SCPV group can be considered mapping elaborations expounded by Deconinck et al. (2017), which undoubtedly created a deeper level of mental processing of the target words for the SCPV group than the S group. The more elaborations one has for a word, the faster and more successful recall of the word is expected. As reported by the SCPV students, the vocabulary pedagogy encompassing the four stages experienced by them especially helped them reinforce the meaning-form mapping, which is an essential condition for learning new vocabulary (Barcroft, 2004; Ma, 2009).

Given that the SCPV group completed additional tasks on vocabulary pedagogy and collaborative PL, the SCPV group may have spent more time than the S group in vocabulary learning. However, research has shown that the time-on-task effect assumes a much less important role than the quality of meaning-form mapping (Deconinck et al., 2014; 2017). This means that the mental operations that participants perform in vocabulary learning are more crucial than time-on-task.

Together, these results encourage further studies with larger samples to determine whether SCPV aid neural connections for deeper mental processing and improve students' productive vocabulary.

Integrating Specific Language Learning Pedagogy in Enhancing Student Self-regulation for MALL (RQ2: Self-regulation)

Both SCPV and S participants improved self-regulation outcomes for all the three phrases: forethought, performance and self-reflection. These results suggest that both approaches enhanced students' self-regulation, despite the fact that the SCPV group had to perform additional tasks on vocabulary pedagogy and collaborative PL. Although Wicken's (2007) research shows that allocation of attention to different tasks may interfere with the learner's task performance when they need to attend to different tasks, this is not the case in our study. We believe some added values arising from the SCPV approach may have helped the students compensate the dispersed attention during their self-regulated learning process, as inferred by the interview data.

First, it is important to provide students with pedagogical training to help them become efficient self-regulators for academic studies (Zimmerman, 1998). Hubbard (2013) also emphasised that students should receive some pedagogical training in terms of language learning theories. Providing this teacher knowledge to students can help them take responsibility for their own self-regulated behaviour to achieve better learning outcomes. The interview data indicated that SCPV students developed a systematic understanding of the essential stages involved in vocabulary learning and attached great importance to consolidating the vocabulary items through use. Such enhanced task-specific pedagogical knowledge and self-regulation may be mutually beneficial and further strengthen student vocabulary learning in MALL.

Second, the interview data shows that SCPV approach can enhance participants' motivation in self-regulation. By better understanding vocabulary learning processes, this can boost their confidence to learn vocabulary in the future, which enhanced their motivation. These results suggest further studies with larger samples to determine whether SCPV increases motivation more than S does.

Third, SCPV interviewees especially appreciated the benefits of the six-category vocabulary learning recording (VLR: item, source, ways to obtain its meaning, lexical information [meaning, word class, etc.], personal memorisation strategies, personal word use strategies). Participants reported that they used the VLR sheet as an effective scaffolding tool for vocabulary MALL. They especially appreciated the VLR's support for vocabulary learning via its ease of use, comprehensiveness, and organisation. The VLR Excel sheet helped them record new vocabulary items whenever and wherever they were in a MALL environment. Also, VLR's comprehensive capture of the vocabulary learning processes helped them remember all of the lexical content recorded. Moreover, the VLR sheet helped them organise new words to aid later access and review. Hence, SCPV interviewees committed to using VLR sheet to self-regulate their future L2 vocabulary learning.

Personalised Learning and Community Sharing (RQ3: Learner Perceptions)

The results suggest a close relationship between PL and self-regulation outcomes, providing the first empirical evidence for scholars' theoretical arguments of their links in past studies (e.g., Basham et al., 2016; McHugh et al., 2020). Our interview data unveiled specific PL roles involving student community sharing on self-regulation, thereby elucidating how collaborative PL can aid student development of self-regulation. Specifically, community PL sharing aided SCPV participants' learning of three phases of self-regulation of vocabulary learning: (I) forethought, (II) performance, and (III) self-reflection. For the forethought phase (I), community sharing of PL provided examples/models of others' learning plans which inspired and informed interviewees' creation of their own learning plans.

For the performance phase (II), community PL sharing broadened the students' strategy repertoire by modelling use of new task strategies and encouraging others to try using them. Moreover, learning about peers' use of PL strategies validated their own inclination to use them despite discouragement from teachers or other authority figures who decry such strategies as ineffective.

For the self-reflection phase (III), community PL sharing provided many examples of others' vocabulary learning experiences that served as grist for reflection. By comparing one's vocabulary learning processes with those of others, SCPV interviewees reflected on and better understood their weaknesses, and showed willingness to explore possible ways to improve. Reading others' future plans helped motivate individuals to create their own.

Traditionally, PL often emphasises individual choices, interests, goals, and differences (Alamri et al., 2020). Recently, some researchers (Alamri et al., 2020; McHugh et al., 2020) have suggested that PL is rooted in socially constructed theories such as Vygotsky's (1978) sociocultural theory, self-determination theory, and socially shared regulation (e.g., Järvelä et al., 2016). In addition, some researchers have suggested that socially shared regulation can facilitate PL by regulating their collective activity, including time management (McHugh et al., 2020), motivation, competency in task perceptions and planning during self-regulation processes (Järvelä et al., 2016). Our results lend empirical evidence to support these theoretical propositions.

Together, our results indicate that adding learner community sharing could considerably enhance students' self-regulated vocabulary learning in MALL by aiding learning plans, encouraging use of different vocabulary learning strategies, deepening self-reflection, and improving future planning. Thus, it is recommended that both individual and collaborative learning (especially learner community sharing) be included when designing PL implementations for MALL or CALL contexts.

Limitations and Future Research

There are several limitations that may have affected the generalisability of this exploratory study. First, this study had a small sample size, which made it difficult to adopt significance tests. Future studies can collect larger samples to conduct significance tests. The small sample size also precluded suitable statistical analyses, such as structural equation modelling—especially as the factor analyses indicate that the items formed a single self-regulation factor.

Second, due to practical constraints, we had to include students with different proficiency levels. To reduce the influence of this extraneous variable, we placed students in both groups with similar age, gender composition, year of study, and vocabulary size at different frequency levels. Future studies with larger samples can determine the effect of proficiency.

Third, the SCPV group took more time and completed two more steps (vocabulary instruction and collaborative PL) than the S group. Although past studies suggest that the effect of mental operations performed in learning new vocabulary far exceeds the time-on-task effect (Deconinck et al., 2014; 2017), this time effect should be thoroughly investigated in future research.

Fourth, we only interviewed the SCPV participants, not the S participants, neglecting a potentially rich data source. Hence, future studies should interview participants from both interventions.

Fifth, this study only collected data from a single location. Future studies can collect data from multiple locations in multiple countries.

Conclusions

In this exploratory study, we proposed and tested a self-regulated, collaborative, personalised vocabulary (SCPV) learning approach against the self-regulation only (S) approach in mobile-assisted language learning (MALL). The SCPV students went through a deep mental processing of the target items and demonstrated more potential in improving their productive vocabulary. Regarding self-regulation, both groups improved their self-regulation in all three phases. The interview data reviewed additional evidence to support the SCPV group's perceived enhancement in all three phases of self-regulation. Our findings also highlighted the importance of integrating a specific pedagogy for a given language skill into self-regulated

training in MALL environments, and we revealed the importance of collaborative personalised learning (PL) in enhancing self-regulated learning for MALL.

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Appendix A. Development of E-learning Materials

Self-regulation training. Using Zimmerman’s (2011) three-phase self-regulation model, we designed some e-learning materials to help students self-regulate their language learning (see Figure A1). Concrete examples supported the strategies in the three self-regulation phases. All participants could read the information, complete embedded online quizzes to self-monitor their learning progress, and win academic points (sustaining their self-learning; also used in training for PL and vocabulary instruction).

Figure A1

Exemplar Self-regulation Training Material

The graphic illustrates three self-regulation strategies:

- 4 Self-rewarding**: Will you promise yourself some kind of a reward if you get the English assignment done?
 - I promise myself something I want when I complete an important English assignment, e.g., going to a movie, getting together with friends, a favorite CD.
 Visual: A person holding a trophy.
- 5 Maintain interest**: When you feel bored, how do you maintain your interest to keep studying?
 - I make studying more enjoyable by turning it into a game
 - I do something I enjoy before going back to study again
 Visual: A person looking bored, a thumbs up, and a person studying.
- 6 Control emotions**: When you feel distressed, i.e., you did not make expected progress, what strategies do you use to get rid of the distress and continue to study?
 - I take a break
 - I listen to music to calm down
 - I take deep breath to get relaxed
 - Eat snacks
 - I think about the goals I have set for myself (how what I do now may affect my future).
 Visual: A row of yellow smiley faces showing various emotions.


Check Yourself and Earn Academic Point (AP) here


Personalisation training. Similar e-learning materials were developed for personalisation training, including textual reading, video watching, and community sharing tasks for the SCPV students. The students were also provided with concrete examples and stories about how to personalise their vocabulary learning. Figure 5 provides a video example in which students could read an authentic PL story from a previous student who was a “YouTube lover” and constantly searched YouTube videos for identification of target words to learn. Selecting YouTube as the main learning resource also matched the academic background and character of the student. She studied visual arts, and watching videos brought visual enjoyment and provided a source for learning new English words that could help her studies.

Figure A2

Example of Personalised Training Material

Youtube Lover





Alice is a First Year local student majoring in Visual Arts. She has a habit of searching for music videos on **YouTube**, which not only gives her visual enjoyment but also helps her learn English by listening to English songs. She constantly searches for lyrics of the songs to understand better their meaning as well as to learn some new words.

In particular, she loves to watch a **YouTube** channel called "**loveglambert**" (反斗英語) produced by a local TV channel, where English is taught to people in a series of funny short stories.

Vocabulary pedagogy training. The e-learning materials for vocabulary pedagogy training were similar in design to those for self-regulation and personalisation. Concrete strategies were introduced for each of the four essential mental stages of vocabulary learning in which the students could gain academic points by completing designated tasks. **Figure A3** provides an example of specific strategies that students could use to obtain the word meaning in Stage 2 of Ma (2014, 2015) vocabulary learning framework.

Figure A3

Example of Vocabulary Instruction Materials

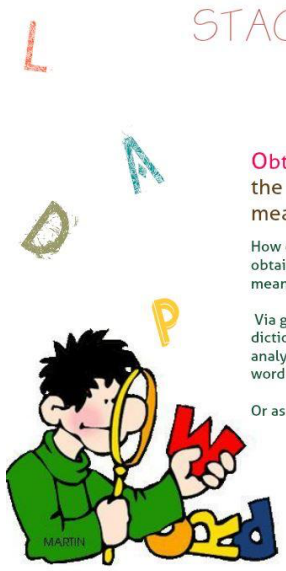
STAGE 2

Obtaining the word meaning

How do you obtain the word meaning?

Via guessing/
dictionary/
analysing the
word structure?

Or asking others?





I usually guess the word meaning from the context or ignore some unknown words at first. But when out, I would check the electronic dictionary app to find the word meaning.

I would google it.

I analyse the meaningful parts that make up the word to guess its meaning (e.g. un-true).

Check Yourself and Earn Academic Point (AP) here

Appendix B. Sample Survey Items

| Forethought Phase (I) | Sample items |
|------------------------------------|---|
| Metacognitive planning | <i>I set up weekly/monthly tasks for my language learning</i> |
| Self-efficacy for mobile learning | <i>I am a skilful user of mobile apps</i> |
| Intrinsic motivation | <i>I think it is very interesting to learn the language</i> |
| Extrinsic motivation | <i>I learn the language because it is required for my course study</i> |
| Performance Phase (II) | |
| Task strategies | <i>I know what techniques/strategies I should use to facilitate my language learning tasks</i> |
| Self-observation | <i>I record my learning process and progress regularly</i> |
| Self-encouragement & rewarding | <i>When I feel stressed about language learning, I encourage myself to continue by setting a reward</i> |
| Self-Reflection Phase (III) | |
| Self-evaluation | <i>I will check regularly whether my language learning goal has been achieved or not</i> |
| Future planning | <i>I will produce a better study plan in the future</i> |

Appendix C. Sample Test Items

Section A

Instruction: Write down the definition in English or Chinese for each word

| | | |
|---|------------------|-----------------------|
| Example: | | |
| express: <u>to show a feeling, opinion, or fact</u> | or | express: <u>陈述；表达</u> |
| 1. | representational | _____ |
| 2. | profitable | _____ |
| 3. | marginally | _____ |
| 4. | substantial | _____ |

...

Section B

Instruction: Fill in the missing English word with its correct form. The meaning of the missing word appears in brackets. Use the first letter/s provided for you. The word class of each missing word is also provided.

Example:

What's the **pr**ocedure for applying for a visa? (n.)

(Meaning: a way of doing something, especially the usual way)

1. We must **add**_____ the problem of traffic pollution. (v.)
(Meaning: deal with the problem of traffic pollution)
2. The police have found no **ev**_____ of a terrorist link with the murder. (n.)
(Meaning: facts or signs that show clearly that something exists)
3. He won't be able to draw his **pe**_____ until he is 65. (n.)
(Meaning: a regular payment to a person that is intended to allow them to subsist without working)
4. The President is clearly in a dilemma about how to **t**_____ the crisis. (v.)
(Meaning: to deal with a difficult problem)

Appendix D. Sample Interview Questions

To what extent do you think knowing about these four essential stages can help you learn vocabulary?

Do you like the vocabulary recording sheet? How do you think it has helped you learn vocabulary in this scheme?

Personalisation is also emphasised in this scheme. Do you like the personalised stories shared by other students on Schoology?

To what extent do you think the personalised stories shared by other students on Schoology have helped you learn English vocabulary? Provide a concrete example.

Self-regulation is key to successful vocabulary learning, in which there are three steps. Do you remember these steps?

Now, reflecting on your vocabulary learning in the past few weeks, are you satisfied with your vocabulary learning now compared with previously or compared with your classmates/friends?

Appendix E. Student Quotes from Interviews

Evidence for specific roles of collaborative PL in self-regulation

Set up a new learning plan

Someone suggested listening to songs. I previously thought there would not be much to learn in lyrics, but they commented that it depends on the choice of your songs. From then on, I planned to pay more attention to choosing appropriate songs to look for new vocabulary.

Joan, interview

Trying out new task strategies

I read a few students' personalised learning stories, which inspired my own learning. For example, one student mentioned that she learned vocabulary via a WeChat group. Before I read their stories, I did not have the motivation to learn vocabulary. Reading their stories pushed me to learn vocabulary via WeChat groups.

Rain, interview

Self-regulating emotions

The advantage of reading others' learning stories is that you know how others tackle their vocabulary learning. I remember one student said that she learned vocabulary primarily through watching English movies, which was exactly what I did previously. I was glad and felt I had found a like-minded person.

Wendy, interview

Self-reflecting on learning

[Through reading other's personalised stories] I can compare my learning method with others'. I could find out the differences for my reference and reflect on my own way of learning.

Jack, interview

Better future planning

I think reading other people's stories has helped me make more attempts. I should not focus merely on reading and listening to learn new vocabulary because I see someone try to write blogs. I think this has inspired me to plan better and take the first step.

Katie, interview

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