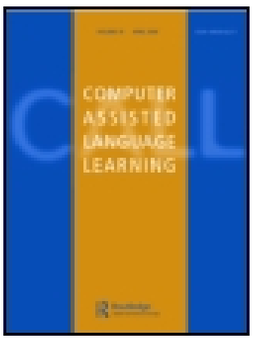

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Assessing self-regulated learning: The case of vocabulary learning through information and communication technologies

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ABSTRACT

Focusing on Self-Regulated Learning, this study aims to contribute a gap in current research by developing a learning environment and domain-specific measure (i.e. vocabulary learning in Information and Communication based environments) that could be used for research and pedagogical purposes in language learning. The development and validation of the instrument underwent an extended test design process. The first phase was the development of an item pool which made use of relevant literature and focus group interviews with EFL learners (n = 15). The second phase was the field-testing of the measure through its administration to 77 EFL learners. The last phase involved an evaluation of the psychometric properties of the revised instrument given to a total of 250 EFL learners. The findings from Confirmatory Factor Analysis with acceptable values of goodness of fit indices (NFI = .89; CFI = .93; TLI = .92, RMSEA = 0.06 and SRMR = 0.04) supported a 23-item, five-factor scale. The Cronbach alpha internal consistency coefficient of the overall scale was calculated to be .85, leading to the conclusion that the scale proposed here is a valid and reliable measure for systematic inquiry into EFL learners' self-regulated vocabulary learning through technology.

KEYWORDS

English as a foreign language (EFL) learners; self-regulated learning (SRL); vocabulary; information and communication technologies (ICT)

1. Introduction

For second language learners, mastering an L2 lexicon is a significant learning challenge because of the vast number of words involved (Schmitt, 2014), and learners are required not only to know the form and meaning of a word, but also connect the two (Nation, 2013). Things get harder with learning vocabulary within the context of English as a Foreign Language (EFL) where opportunities for language learning are mostly restricted to the formal educational setting. Although EFL contexts are characterized by a huge range of attributes, one feature frequently used to describe traditional EFL contexts is that the amount and

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type of target language contact which are thought to facilitate language learning are relatively limited (Lightbown & Spada, 2006; Longcope, 2009; Tsuda & Nakata, 2013).

One remedy to overcome the inherent constraints of traditional EFL contexts where learners are mostly isolated from the target language, albeit at varying degrees in diverse contexts, could be the use of Information and Communication Technologies (ICT) in language learning (Nakata, 2014; Pim, 2013; Stockwell, 2007b). The positive impacts of ICT tools on vocabulary learning have been well evidenced by a myriad of studies, although most have been experimental in nature and focused on situations where learners have used ICT tools mostly under the guidance of the instructor within the school setting (Kaur & Hegelheimer, 2005; Kurt & Bensen, 2017; Mashadi, Hayati, & Jalilifar, 2016; Peters, 2007; Wang, Teng, & Chen, 2015; Wu, 2015). However, it is also well-known that current generation of learners has an inclination to extend the use of ICT tools to their out-of-school language learning practices (Inozu, Sahinkarakas, & Yumru, 2010; Lai & Gu, 2011). Therefore, it is necessary to investigate language learners' engagement with ICT tools beyond the school setting to provide insights into the utilization of ICT tools. This is especially critical for vocabulary learning, which has remained little understood (Li, 2009; Liu, Lan, & Jenkins, 2014; Segler, Pain, & Sorace, 2002).

One viable theoretical framework that describes significant aspects of successful learning is self-regulated learning (SRL), which also underpins the present study. Broadly defined as controlling and directing the learning actions by the learners' themselves, the concept of self-regulation has its roots in the field of educational psychology, embracing cognitive, affective and behavioural aspects of learning (Bown & White, 2010; Perry, Hutchinson, & Thauberger, 2008; Tseng, Dörnyei, & Schmitt, 2006; Zimmerman, 2008). Despite a plethora of studies on autonomy and independent learning (Ellis & Folley, 2011), SRL, in its own right, is a newly emerging topic of study in the field of language learning (Kim, Wang, Ahn, & Bong, 2015), which implies the need for designing studies to explore the internal complexities of language learners within the framework of SRL (Tseng et al., 2006; Tsuda & Nakata, 2013). What is more, relevant literature indicates a gap regarding the development of instruments for the assessment of SRL and its components in EFL settings (Teng & Zhang, 2016). As the form and nature of SRL can vary according to learning domains (e.g. vocabulary learning) and learning environments (i.e. technology enhanced environments) (Schunk, 2001), devising context and domain specific instruments for understanding SRL would greatly contribute to the relevant literature (Barnard-Brak, Lan, & Paton, 2011; Tseng et al., 2006).

With the purpose of addressing these gaps, this paper reports on a study on developing an instrument for assessing self-regulatory capacity of language learners. What distinguishes the current instrument from existent measures is that it is situated in one specific language learning domain (i.e. vocabulary

learning) and one specific learning environment (i.e. ICT based environment). Following section presents the literature on SRL with a focus on extant measures for assessing SRL.

2. Background

2.1. Self-regulated learning (SRL)

Since its emergence in the 1970s in the field of educational psychology, Self-Regulated Learning (SRL) has been increasingly recognized as having a pivotal role in numerous learning contexts. SRL as a construct involves individuals' active participation in their own learning, which is fundamental to success in learning. As such, developing SRL capacity in students by guiding them to manage their learning actively and efficiently is considered to be among the primary goals of education (Zimmerman, 2008).

With the increasing interest in SRL, a number of models emphasizing different conceptualizations of SRL have been proposed in the relevant literature. Based on close scrutiny, Wolters, Pintrich, and Karabenick (2005) identify four main assumptions underlying the extant models of SRL. Accordingly, *active, constructive assumption* denotes that 'learners are assumed to actively construct their own meanings, goals, and strategies from the information available in the *external* environment' (Wolters et al., 2005, p. 3). *Potential for control assumption* presumes learners potentially monitoring and regulating both their metacognition, affect and the certain aspects of their learning environment. *Goal, criterion assumption* pertains to individuals' setting learning goals, monitoring their progress in connection with these goals and regulating their cognition and resources in order to reach these goals. The last assumption common to all SRL models is that 'self-regulatory activities are mediators between personal and contextual characteristics'(Wolters et al., 2005, p. 5), which refers to individuals self-regularity capacity in adjusting the available learning resources to their learning needs.

One definition of SRL incorporating the aforementioned assumptions is 'an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behaviour, guided and constrained by their goals and the contextual features in the environment' (Wolters et al., 2005, p. 256). SRL encompasses 'cognitive, affective, motivational and behavioural components that provide the individual with the capacity to adjust his or her actions and goals to achieve desired results in the light of changing environment conditions' (Dörnyei, 2005, p. 191).

Although there is a widespread agreement as to the significance of investigating and fostering SRL capacity in the learners, ways of measuring SRL properly remains a topic of contention (Endedijk, Brekelmans, Sleegers, & Vermunt, 2016; Tseng et al., 2006). The relevant literature proposes a number of instruments for measuring SRL; however, most of them pose problems when

generalized across settings (Endedijk et al., 2016). EFL settings where learning is characterized as a complex and multifaceted process in particular require special attention regarding SRL measurement (Teng & Zhang, 2016).

2.2. Existing measures for SRL

In relevant literature on language learning and SRL, three measures stand out: the Strategy Inventory of Language Learning (SILL) by Oxford (1990), the Learning and Study Strategies Inventory (LASSI) by Weinstein, Schulte, and Palmer (1987) and the Motivated Strategies for Learning Questionnaire (MSLQ) by Pintrich, Smith, Garcia, and McKeachie (1991).

The SILL includes six types of strategies (e.g. memory, cognitive, metacognitive, social strategies, etc.) worded through 50 items on a 5-point Likert scale ranging from 1 (never use it) to 5 (often use it). Each item on the scale represents a different language learning strategy. Despite its widespread use in various language learning environments, its treatment the strategic learning and its psychometric properties have been much debated. The scale descriptors in the SILL imply that the items are frequency-based behavioural items, making an assumption of a linear relationship between the individual items and the total scale score impossible (Teng & Zhang, 2016; Tseng et al., 2006). It has also been argued that 'the scales in the SILL are not cumulative and computing mean scale scores is not justifiable psychometrically' (Tseng et al., 2006, p. 83).

Another instrument, the LASSI, aims to measure both students' awareness and their use of learning strategies through a total of 80 items placed on a Likert scale ranging from 1 (not at all typical of me) to 5 (very much typical of me). The LASSI includes a scale on SRL comprising time management, test strategies and study aids. The popularity of the LASSI, which has been applied in a wide range of educational contexts, (e.g. sports, music, L1 reading, etc.) suggests that SRL is a crucial construct worthy of further research. However, the LASSI has been criticized for its approach to learning strategies as all-embracing for all contexts and knowledge domains and for its generalized use in substantially different educational contexts without sufficient empirical data (Endedijk et al., 2016; Teng & Zhang, 2016). Therefore, developing measures specific to knowledge-domains (e.g. L2 vocabulary learning) or contexts (e.g. technology enhanced language learning) has been repeatedly suggested in the relevant literature (Roth, Ogrin, & Schmitz, 2016; Tseng et al., 2006).

The last instrument with an extensive coverage within SRL literature is MSLQ which represents an instance of domain or course specificity (Roth et al., 2016). MSLQ consists of a total of 81 items, 50 of which focus on the cognitive, metacognitive and resource management strategies in classroom environments. The items are placed on a 7-point Likert scale from 1 (or not at all true of me) to 7 (very true of me). One of the reported strengths of the MSLQ is that its subscales in both individual and more generalized contexts, providing detailed

information regarding the learners' SRL capacity. However, the fact that psychometric testing regarding the goodness-of-fit indices have provided values lower than the suggested benchmarks remains a concern in terms of reliability of the measure, particularly when applied to other learning contexts (Teng & Zhang, 2016).

In conclusion, the existing measures of SRL have doubtlessly contributed to the literature on measuring self-regulation; however, findings from these instruments reveal that there are several gaps involving the emergent shift of focus on SRL as a capacity rather than actual techniques employed (Roth et al., 2016; Tseng et al., 2006). Another gap revealed is the need for developing domain and context specific measures for SRL (Roth et al., 2016; Teng & Zhang, 2016) Finally, developing instruments with strong psychometric properties remains a shortcoming in existing instruments (Teng & Zhang, 2016; Tseng et al., 2006).

2.3. Vocabulary learning strategies and SRL

The progress in SRL research over the past two decades has initiated a paradigm shift bringing the domain-specific and context-specific SRL measures to the foreground (Boekaerts & Corno, 2005; Roth et al., 2016). It is proven that SRL is valid for all domains, and vocabulary learning is the domain focus of this study.

Vocabulary is doubtlessly indispensable for language learning whether it is in the context of second language (SL) or foreign language (FL). Vocabulary is the building block of communication as recognized years ago by Wilkins (1972) who notes that '…while without grammar very little can be conveyed, without vocabulary nothing can be conveyed' (p. 111). Echoing similar points for language learning, Schmitt (2000) underlines that 'lexical knowledge is central to communicative competence and to the acquisition of a second language' (p. 55). Inadequate lexical knowledge will not only cause EFL learners to have communication breakdowns but also pose an impediment in learning the other language skills (Liu, Lan, & Ho, 2014).

SRL capacity reflected in volitional control has been acknowledged as a significant factor in facilitating L2 vocabulary learning (Mizumoto & Takeuchi, 2012). Emphasizing the importance of using strategies in vocabulary learning, Tseng and Schmitt (2008) note that involvement in strategic vocabulary learning is directly influenced by SRL capacity of the L2 learners. However, developing instruments that focus on the vocabulary learning strategies (VLS) within an SRL framework has received scant attention from the relevant literature (Tseng & Schmitt, 2008; Tseng et al., 2006).

One of the earliest attempts to do so was led by Gu and Johnson (1996) who compiled a total of 91 items in their Vocabulary Learning Questionnaire (VLQ). These items were grouped into categories such as metacognitive regulation, guessing strategies, dictionary strategies. Treating VLS as the main predictor of vocabulary knowledge and general language proficiency, VLQ is considered to

be one of the most comprehensive instruments of VLS in the EFL context (Li, 2009). Nonetheless, its greater focus on specific vocabulary learning behaviours pose limitations on the use of VLQ to measure one's overall SRL capacity (Tseng et al., 2006). Another noteworthy measure of VLS was developed by Schmitt (1997) using Oxford's (1990) taxonomy and classifying VLS under such strategies as social, cognitive, metacognitive, memory and compensatory strategies. Although Schmitt's (1997) inventory of VLS significantly contributed to the relevant literature, it has been criticized for its behaviour-oriented approach to VLS and the difficulty it poses in distinguishing the designated categories from each other (Tseng et al., 2006). More recently, Tseng et al. (2006) proposed an integrative model of SRL measuring both self-regulation capacity and vocabulary strategy use. Their instrument, self-regulated capacity in vocabulary learning (SRCvoc), included 23 items under five main categories: commitment control, metacognition control, satiation control, environmental control and emotional control. Distinguishing itself from other measurements, SRCvoc emphasizes learners' innate SRL capacity rather than the micro level specific learning behaviours.

Despite the prominent contributions of these scales to the literature on SRL and VLS, there is still substantial room for further studies on self-regulated vocabulary learning especially in ICT based environments. Being a broader term, ICT is defined as a range of technological tools and resources employed to communicate, create, store, retrieve, transmit and manage information (Kenning, 2007). Learning through ICT refers to all the uses of digital technology for learning purposes. With all the affordances for information managing, ICTs are thought to be advantageous in vocabulary learning due to the opportunities for self-paced, anytime- anywhere learning, multi-glossed and multi-modal presentation of vocabulary (Wong & Looi, 2010). As reported in the relevant literature, major vocabulary learning activities through ICT include, but not limited to, looking up words through online dictionaries, thesauruses; meaning focused studies through corpus-based online concordances; deliberate vocabulary learning through vocabulary-captioned videos, hyperlinks, lexical glosses, computerized vocabulary lists/ flashcards/exercises and mobile based applications (e.g. SMS, whatsapp, etc.) (Ma, 2013; Stockwell, 2007a; Wong & Looi, 2010).

Given the widespread use of ICT tools among the current generation of learners, it seems highly relevant to understand how they are engaged with technology in their vocabulary learning activities. It is now well-established that engagement with technology for learning purposes requires some SRL capacity (Barnard-Brak et al., 2011; Lai, 2013); therefore, assessing learners' self-regulated vocabulary learning in ICT based environments would be beneficial in profiling the students and in the development of pertinent teaching strategies. The aforementioned SRL and VLS instruments may not be appropriate to assess SRL in connection with VLS in ICT based environments (Barnard-Brak et al., 2011). It is this specific view that guides the present study which sets to develop and

validate an instrument to assess self-regulated vocabulary learning through ICT tools by EFL learners. The following section provides a detailed guideline for the development and validation of such an instrument.

3. Method

Aiming to develop and test an instrument on self-regulated vocabulary learning through ICT, this study had three basic specifications in devising the instrument. First, based on the discussions surrounding the existent measures of self-regulation, the content of the present measure focuses on the self-regulatory capacity of the learner instead of specific behavioural habits. Second, the structure of the instrument is informed by relevant theories. This study draws on the component-oriented SRL models (Dörnyei, 2001; Pintrich, 2004; Pintrich & Garcia, 1994) in which components such as cognitive strategies, resource management or metacognitive control are conceptualized as learners' traits of SRL capacity. Furthermore, as this study seeks to measure SRL within the context of technology enhanced environments, the body of literature on self-regulated use of technology (Ducate & Arnold, 2006; Lai, 2013; Lai & Gu, 2011) was also referenced in the process of selecting relevant constructs. As such, the following are the five dimensions of SRL within an ICT context selected for this study:

(1) Commitment control which concerns with the preservation or increase of learners' original goal commitment
(2) Metacognitive control which involves the SRL skills for managing concentration, procrastination, monitoring and controlling of the students' learning
(3) Affective control which refers to the use of SRL skills for coping with impediment feelings (e.g. boredom, stress, etc.) and replacing them with facilitating emotions (e.g. maintaining interest)
(4) Resource control which relates to seeking, managing and expanding learning resources to increase learning opportunities.
(5) Social control which involves building constructive environments by seeking social support.

Finally, the content of the instrument items targets the domain of vocabulary learning through ICT, an under-researched area within the context of SRL (Lai, 2013; Tseng et al., 2006). Considered among the major hurdle encountered by EFL learners (Nation, 2013; Oxford, 1990; Tseng et al., 2006), vocabulary learning could be facilitated through the use of ICT tools (Pim, 2013; Stockwell, 2007b) and 'clearly good self-regulation would be an important asset in this major task' (Tseng et al., 2006, p. 86). Thus, this study aims to devise a self-report instrument targeting SRL capacity in English vocabulary learning through ICT with the assumption that, should the instrument be successful in

determining SRL capacity for vocabulary learning in ICT based environments, it could, in turn, serve as a basis for language practitioners desiring to provide scaffoldings for learners in developing their SRL capacity in technology enhanced environments. It is also assumed that this instrument (henceforth SRLvocICT), if successful, could be a model for other areas of language learning as well.

3.1. Development of the item pool

In view of these objectives, an extended test design process the first step of which is to develop an item pool (Dörnyei, 2010) was initiated. Two main sources identified by Dörnyei (2010) were used to develop the item pool. The first was the use of relevant literature to adapt items from existent measures, targeting the above-mentioned five dimensions of the instrument. The second source nourishing the item pool was focus-group interviews involving the learners themselves, as implicating the intended population of the instrument in the item-developing process helps improve the content representation of the items (Dörnyei, 2010). Following the established practice in the field of education (where involving four to six respondents is considered to be typical; Creswell, 2010), three focus group interviews, each with five university level EFL students, were conducted. The interviews were carried out using pre-defined prompts by the second author functioning as a facilitator. The language of the interviews was the respondents' L1 (i.e. Turkish).

Themes that emerged in the focus group interviews were translated into questionnaire items, taking the guidelines elaborated in Dörnyei (2010) into consideration. Additional items based on the review of relevant literature (Lai, 2013; Lai & Gu, 2011; Tseng et al., 2006) were added to the instrument, resulting in a total of 44 items on five dimensions of the construct as follows:

- Commitment regulation through ICT: 8 items
- Metacognitive regulation through ICT: 10 items
- Affective regulation through ICT: 13 items
- Social regulation through ICT: 6 items
- Resource regulation through ICT: 7 items

All items were set on a 6-point Likert Scale where 1 represents 'not at all true of me' and 6 represents 'very true of me.' The scale excluded the 'middle' option (e.g. 'neither agree nor disagree,' 'not sure,' or 'neutral') as the relevant literature emphasizes that middle options prevent obtaining salient evaluative reactions (Dörnyei, 2010; Mizumoto, Chujo, & Yokota, 2016).

3.2. Field-testing the questionnaire

Before pilot testing the questionnaire, Turkish and English versions of the instrument were prepared by the authors. Both versions were then reviewed for

coherence by a specialist holding a PhD in Interlingual Translation Studies. After finalizing the items, the instrument was pilot tested with 77 university EFL learners. Given the fact that a reasonable minimum recommendation for the pilot studies of scale development is 30 participants (Johanson & Brooks, 2010), the sample size of the study could be considered appropriate. Drawn in accordance with the convenience sampling procedures (Creswell, 2010), 58 of the participants were male and 19 were female with a mean age of 20.3 ranging from 18 to 28. The participants comprised of education and engineering majors and all were learning English as a foreign language at the time of the study. The English proficiency level of the participants was identified as B1 by the School of Foreign Languages, where the study was conducted.

During pilot testing, the researchers were present in the research site to explain the purpose of the study and to inform the participants on the issues of anonymity and confidentiality. Before administering the instrument, a few minutes were spent to elaborate on what *vocabulary learning through ICT* means and what type of activities (e.g. mobile applications for vocabulary learning, vocab-captioned videos, etc.) it entails. The Turkish version of the questionnaire was administered without any time limit, and the respondents were encouraged to share their ideas on the items if worded inappropriately.

Having attained the responses, following analyses were performed: a) Item-total correlations to ascertain the power of correlation between the item and its subscale. An item was regarded weak if its correlation with the subscale is under 0.40 (Dörnyei, 2010; Urdan, 2011); b) Extreme Group t-test analysis on each item to move beyond the correlations and further explore the scale items in terms of the differences existing between participants at the extreme ends of the scale. According to this analysis method, items enabling discrimination well between the total test scores of the upper 33 and lower 33 percent of participants were considered acceptable (Thompson, 2013; Tseng et al., 2006); c) Reliability analysis referring to Cronbach's α to determine the internal consistency of each subscale (Cohen, Manion, & Morrison, 2000).

Analysis of item-total correlations showed that two items in the commitment regulation subscale, two in the metacognitive regulation subscale and three items in the affective regulation subscale did not perform well, and as such, they were excluded from the instrument. Extreme group analysis on the remaining 37 items demonstrated that they were appropriate in discriminating learners with SRL capacity in ICT based vocabulary learning from those without such capacity. For the reliability analysis, Cronbach's α coefficients for each subscale were computed to identify the most coherent items. After the analysis, the items with inter-item correlations lower than 0.30 (Larson-Hall, 2010) and those changing Cronbach's considerably were eliminated from the scale. Table 1 displays the results of reliability analysis and the number of remaining items for each subscale.

As seen in Table 1, each dimension in the scale has a Cronbach's α value above 0.70. This is an acceptable level (Larson-Hall, 2010) to conclude that the

Table 1. Pilot test results of internal consistency for each subscale.

Subscale	Number of items	α
Commitment regulation in ICT based vocabulary learning	4	0.79
Metacognitive regulation in ICT based vocabulary learning	7	0.88
Affective regulation in ICT based vocabulary learning	6	0.91
Social regulation in ICT based vocabulary learning	3	0.78
Resource regulation in ICT based vocabulary learning	5	0.87

SRLVocICT is a reliable measure to investigate the learners' SRL capacity for vocabulary learning in ICT based environments.

3.3. Validation of the final instrument

In order to evaluate the construct validity of the instrument and to check how well the final version performs with a different group, the instrument was administered to another group of university level EFL learners (n = 250) who had not participated in the pilot testing of the measure. 153 of the participants were in the preparatory year and 97 of them were first-year students whose medium of instruction was English. 186 of the participants were males and the rest were females, with a mean age 21.6 ranging from 18 to 30 years old.

The questionnaires were completed in the presence of the researchers having discussed the term *vocabulary learning through ICT tools* and elaborated on the activities that could be regarded as such. The researchers also explained the privacy and confidentiality issues of the study. The language of the instrument was the participants L1 and no time limit was set in completing the questionnaires. The participants were offered no reward in monies or in kind.

The results obtained from the administration of the final version of SRLVocICT were subjected to two sets of statistical analysis: a) Confirmatory factor analysis to test the construct validity of the final instrument; and b) Reliability analysis to understand if the final form of the instrument was a reliable measure.

To provide information on how well the proposed factor model fits the actual data, Confirmatory Factor Analysis (CFA) with maximum likelihood estimation method was computed for each subscale through IBM SPSS AMOS V22 (Arbuckle, 2013). The five factors proposed in the present study (Commitment Regulation of Vocabulary learning through ICT; Metacognitive Regulation of Vocabulary learning through ICT; Affective Regulation of Vocabulary learning through ICT; Environmental Regulation of Vocabulary learning through ICT; and Resource Regulation of Vocabulary learning through ICT) were assumed to be correlated. Items with loading estimates higher than 0.5 were accepted as strongly loaded on their respective factors (Hair, Black, Babin, & Anderson, 2010). The analysis at this step based on the loading estimates showed that two items in the metacognitive subscale remained below the acceptable value; therefore, these two items were excluded from the further analysis. As CFA tests if the proposed model is consistent with the observed data, the overall model fit

was assessed through five major indices reflecting different facets of the model: the standardized root mean square residual (SRMR) for which acceptable criterion was <0.06, the root mean square error of approximation (RMSEA) for which acceptable value was <0.08, the comparative fit index (CFI) with a recommended value of ≥ .90 and Tucker-Lewis index (TLI) with an acceptable value of ≥ .90, the normed fit index (NFI) with an acceptable value of ≥ .90 and goodness of fit index (GFI) with a value of ≥ .90 indicating an acceptable model (Hair et al., 2010). In view of the arguments in relevant literature on chi-square value's being too sensitive to sample size (Mizumoto et al., 2016; Urdan, 2011), goodness-of-fit with chi-square was not reported, although it forms the basis of the aforementioned indices in this study. Table 2 presents model fit indices for each subscale.

As presented in Table 2, values for incremental fit indices (i.e. NFI, CFI and TLI) of the current scale were beyond the recommended threshold, which lends support for the appropriateness of the proposed model. All indices were also computed for the overall measure with the five factors and the results indicated that the hypothesized model performed well within the acceptable ranges (NFI = .89; CFI = .93; TLI = .92, RMSEA = 0.06 and SRMR = 0.04) with a total of 23 items loading on five factors as intended. Standardized results for the five-factor model are presented in Figure 1.

As illustrated in Figure 1, factor loadings (standardized estimates loadings) of the observed variables are above the recommended value of .50 (Hair et al., 2010), thus signifying an satisfactory effect size. However, a word of caution is necessary here, as the factor loading of item 21 (concerning ICT tools for self-paced learning environments) remained just below the accepted value. One common practice in such cases is the deletion of the target item. Nevertheless, we did not opt to drop the item from the scale as we believe that the reason of this low loading is related to the wording of the item in the Turkish version. Rewording of the item and testing its validity could be a basis for further research.

Apart from construct validity through CFA, the scale reliability analysis was performed for each of the five subscales. Table 3 shows the internal consistency reliability coefficients of the subscales in the final instrument.

As seen in Table 3, reliability indices were higher than the pilot test results in all dimensions of the construct with an exception for social regulation subscale.

Table 2. Model fit indices for the subscales of SRLVocICT.

Subscale	GFI	NFI	CFI	TLI	RMSEA	SRMR
Commitment regulation in ICT based vocabulary learning	.99	.99	.99	.98	0.06	.01
Metacognitive regulation in ICT based vocabulary learning	.97	.95	.97	.95	0.08	.03[a]
Affective regulation in ICT based vocabulary learning	.98	.98	.99	.98	0.06	.04[b]
Social regulation in ICT based vocabulary learning	.99	.99	.99	.98	0.07	.02
Resource regulation in ICT based vocabulary learning	.97	.97	.98	.96	0.08	.02

[a] In metacognitive subscale, Meta 6 and Meta 11 were covariates through modification indices.
[b] In the affective subscale, Affect 14 and Affect 15 were covariates through modification indices.

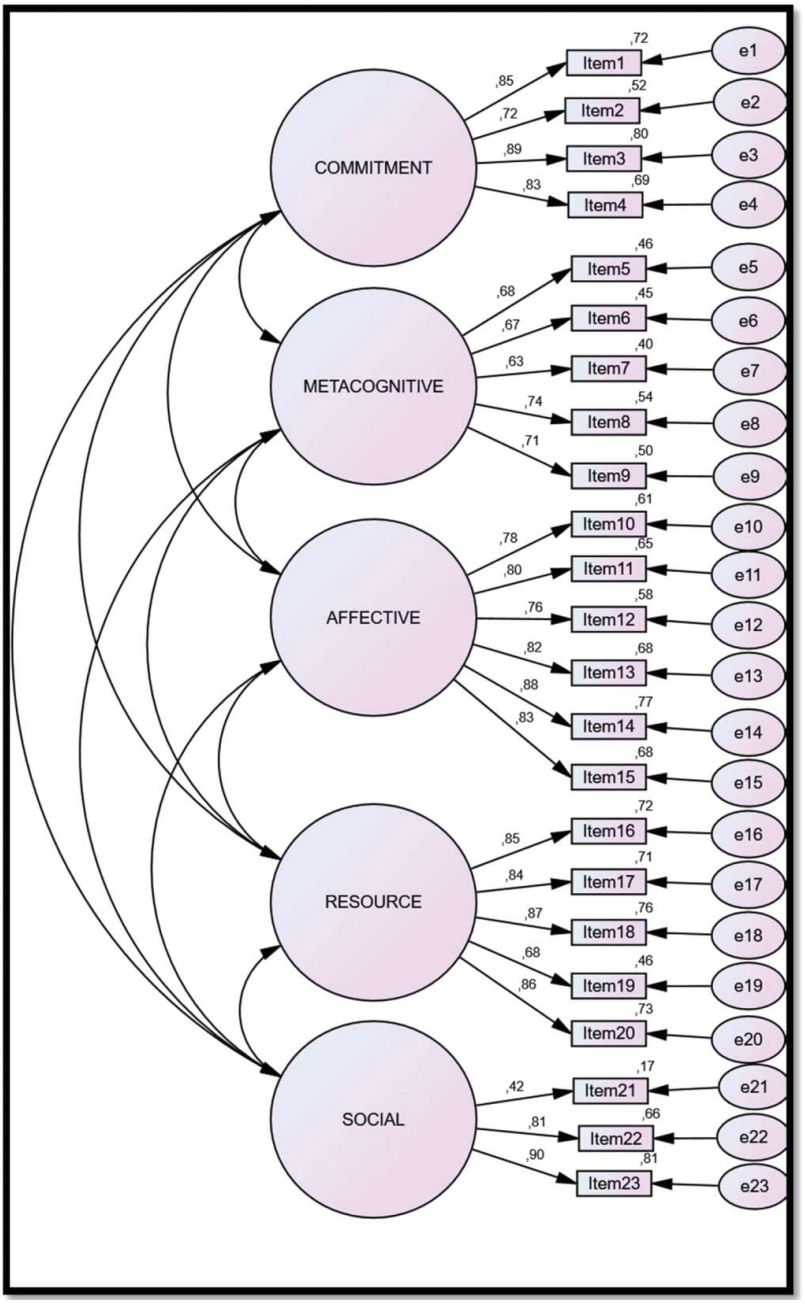

Figure 1. Five-factor correlated model of SRL for ICT based vocabulary learning with standardized regression weight. Numbering of the items is in parallel with the numbering in Appendix.

The mean scale coefficient was found to be 0.85, which is much higher than the benchmark value 0.70. This could lead to the conclusion that the final version of SRLvocICT is a reliable measure to investigate self-regulated vocabulary learning through ICT.

Table 3. Reliability coefficients of the final instrument.

Subscale	α
Commitment regulation in ICT based vocabulary learning	0.89
Metacognitive regulation in ICT based vocabulary learning	0.81
Affective regulation in ICT based vocabulary learning	0.92
Resource regulation in ICT based vocabulary learning	0.91
Social regulation in ICT based vocabulary learning	0.73

4. Conclusion

Based on the analyses presented above, it could be asserted that SRLvocICT as a whole could serve as a valid and reliable measure of learners' SRL capacity in learning vocabulary in ICT based environments. This study is significant in that it provides a domain-specific (i.e. vocabulary learning) instrument for technology enhanced learning that could be used both for research and pedagogical purposes by the practitioners in the field. The strength of this study lies in its attempts to take a consolidative approach in combining vocabulary-learning strategies into ICT based environments within a SRL framework. As the current generation of EFL learners have a strong tendency to incorporate ICT tools into their learning activities, albeit using limited type of technologies (Lai, 2013; Şahin Kızıl, 2017), understanding their self-regulated use of technology is of great importance. As such, the scale proposed in this study would be useful for systematic inquiry into EFL learners' self-regulated vocabulary learning through technology.

Such an inquiry, in turn, would enable language teachers to take informed steps in helping their learners develop relevant skills for technology-enhanced language learning, empowering them to be more efficient language learners. Tseng et al. (2006) note that the essential aspect of empowering learners is to guide them to develop a self-regulatory capacity. With its potential to function as a diagnostic measure to assess learners strengths and weaknesses in relation to their use of technology for SRL in the domain of vocabulary learning, this scale could serve as a basis for developing appropriate solutions for any SRL shortfalls.

As a result, this study setting out to develop a psychometrically sound measure of SRL capacity for learning vocabulary through ICT tools achieved its primary research goal as the statistical analyses point out SRLvocICT being a valid and reliable scale. However, this study is not without limitations. First, all the respondents in this study were the tertiary level EFL learners and the study was carried out in one university in Turkey. Depending on the assumption that socio-cultural and educational context of learners might be influential in the SRL capacity for vocabulary learning in ICT environments, future studies could focus on learners at different institutions and educational levels. Second, the self-report nature of the scale and focus-group interviews used in item development may pose some limitations as participants may have misunderstood the items in the questionnaire. Similarly, items obtained through focus group

interviews may not reflect the absolute SRL capacity. Hence, future studies might expand on the data collection methods in developing and validating the scale items. Finally, it should be acknowledged here that SRLvocICT is not an all-in-one solution for current measurement shortfalls, as it cannot determine any causes of weaknesses in SRL capacity but it creates a starting point for developing relevant insights. Therefore, it is recommended that results attained through SRLvocICT be supported with more qualitative methodologies to have a more complete understanding.

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No potential conflict of interest was reported by the authors.

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Appendix
Self-regulated vocabulary learning through information and communication technologies (SRLvocICT) Scale)

	Scale Items	Not at all true of me	Somewhat not true of me	Not true of me	Somewhat true of me	True of me	Very True of me
Commitment	1. When learning vocabulary, I believe ICTs can help me achieve my goals more quickly than expected	☐	☐	☐	☐	☐	☐
	2. When learning vocabulary, I believe ICTs can help me persist until I reach the goals that I make for myself	☐	☐	☐	☐	☐	☐
	3. ICTs are important sources and tools to maintain my interest in achieving my vocabulary learning goals	☐	☐	☐	☐	☐	☐
	4. I believe ICT applications are effective in boosting willpower for learning vocabulary	☐	☐	☐	☐	☐	☐
Metacognitive	5. I know how to use ICTs to effectively monitor myself to achieve my vocabulary learning goals	☐	☐	☐	☐	☐	☐
	6. I plan tasks and relevant materials to learn vocabulary outside of school that involve the use of ICTs	☐	☐	☐	☐	☐	☐
	7. I adjust my vocabulary learning goals in response to the information resources and communication venues I have access to via ICTs	☐	☐	☐	☐	☐	☐
	8. I believe ICT tools help me monitor my progress in learning vocabulary	☐	☐	☐	☐	☐	☐
	9. I know how to adjust ICT tools according to my learning styles	☐	☐	☐	☐	☐	☐
Affective	10. During the process of learning vocabulary, I believe that ICTs can help me overcome any sense of boredom	☐	☐	☐	☐	☐	☐
	11. When feeling bored with learning vocabulary, I use ICTs to regulate my mood in order to regain the interest and enthusiasm in learning.	☐	☐	☐	☐	☐	☐
	12. When I feel stressed about vocabulary learning, I feel ICTs help to reduce this stress.	☐	☐	☐	☐	☐	☐
	13. I feel satisfied with the way I use ICTs to reduce the stress of vocabulary learning.	☐	☐	☐	☐	☐	☐
	14. I feel ICTs can make the task of vocabulary learning more attractive to me	☐	☐	☐	☐	☐	☐
	15. I feel ICTs effectively maintain my interest and enthusiasm in learning vocabulary.	☐	☐	☐	☐	☐	☐
Resource	16. When I feel I need more learning resources in vocabulary learning, I use ICTs to expand my learning resources.	☐	☐	☐	☐	☐	☐
	17. I use ICTs to create and increase opportunities to learn and use vocabulary.	☐	☐	☐	☐	☐	☐
	18. I use ICTs to seek learning resources and opportunities to help achieve my vocabulary learning goals.	☐	☐	☐	☐	☐	☐
	19. I seek engaging vocabulary learning materials and experience delivered via ICTs.	☐	☐	☐	☐	☐	☐
	20. I believe ICT tools are effective in expanding my resources for vocabulary learning.	☐	☐	☐	☐	☐	☐
Social	21. When learning vocabulary, I think ICT tools can help me create a self-paced learning environment.	☐	☐	☐	☐	☐	☐
	22. When learning vocabulary, I use ICTs to connect with native speakers of the language	☐	☐	☐	☐	☐	☐
	23. When learning vocabulary, I use ICTs to connect with peer learners all over the world	☐	☐	☐	☐	☐	☐