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Research Article

The mediating role of academic self-regulation in the relationship between autocorrect use and vocabulary size

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ABSTRACT

Mobile learning has extensively influenced students' learning gains and motivation due to the hardware and software development of mobile devices and applications in recent decades. On-the-go learning increases the capacity for flexible and joyful learning and guarantees access to the instructional content anywhere, anytime. Despite their potential benefits, the presence of mobile applications in students' every educational activity can be detrimental to their cognitive abilities as misuse or overuse of specific applications may influence students' concentration and critical thinking. One such downside is reported for overusing automatic spelling correction software, known as AutoCorrect (AC), in language learning. Uncertainty regarding the educational values of AC has increased as students' spelling skills and vocabulary knowledge have declined. The main problem this study addressed is examining the relationship between EFL learners' AC use and their vocabulary size; and if their academic self-regulation mediates this association. Data were gathered from 101 foreign language learners who completed the measures of AC use, academic self-regulation, and vocabulary size. The results showed significant positive correlations between AC use, vocabulary size, and self-regulation. Further, testing the model supported a mediating role for self-regulation in the relationship between AC use and vocabulary size, suggesting that AC use can lead to more knowledge of English words in the condition of deploying self-regulatory strategies. The study signifies how academic self-regulation can assist learners in exploiting mobile learning (m-learning) to their advantage and attaining their educational goals more efficiently.

Keywords: AutoCorrect, vocabulary, size, self-regulation, mediating

INTRODUCTION

The development of mobile hardware infrastructure and the growth of the software industry have led to the ubiquitous presence and prevalent use of mobile devices among people of the 21st century. Undoubtedly, mobile technology has profoundly influenced all spheres of human endeavor, from social communication to professional practices. The smartphone dependency is reflected in 6 billion smartphone subscribers in 2021, with a forecast of 7.5 billion in 2027 worldwide (www.statista.com).

Within the educational arena, m-learning has enormous potential for fulfilling the needs of today's generation that depend heavily on their mobile devices. Many educational applications are available for assisting students in managing their academic work and attaining better learning outcomes. Mobile applications let students organize their curricular activities, learn from the instructional contents, collaborate and share information, and accommodate projects or homework. Research shows that m-learning affects students' personal and academic interests and learning gains (Squire & Dikkers, 2012) by creating an engaging learning environment. The benefits of mobile applications for language learning have been particularly

examined in the last decades, illustrating that mobile-assisted language learning (MALL) has positive effects on the development of communicative competence (Cooney & Keogh, 2007) and language skills (Chang & Hsu, 2011); motivation and achievement (Wen et al., 2019); and interaction and collaboration (Joseph & Uther, 2009).

However, one fundamental flaw in MALL's rich literature is that research within this scheme has focused mainly on the benefits of MALL in a teacher-fronted context, and individualistic uses of the educational applications have been sparingly examined (Rahimi & Miri, 2014). Learners' differences and their learning needs are often neglected or shadowed by pedagogical and technical themes. More specifically, the downside of mobile dependency and how the overuse of specific mobile tools can harm students who lack study skills demand further attention.

One application tool that students widely use and are becoming increasingly dependent on is AC, as it is available almost on all smartphones, works efficiently with touchpads, and does not need any extra charge or fee to function. Language learners' use of mobile applications is often associated with their "availability, convenience and low cost" (Steel, 2012, p. 1); therefore, AC seems to be an attractive and helpful tool for many language learners. The users are not required to know the spelling of every English word while entering the text during browsing, texting, playing games, or writing emails as AC quickly checks each word they type, predicts what is being typed, and suggests the word it assumes is being typed.

Despite the widespread use of AC for general and educational purposes, language pedagogues have raised serious concerns about users' deterioration of literacy and writing skills as a result of overreliance on AC (Baron, 2009; Sorrentino, 2008). Empirical works on the benefits or harms of AC use for native language learners have yielded inconclusive results. Some studies report positive effects of writing assistive tools such as spellcheckers and AC on vocabulary learning and spelling skills (Arif et al., 2016), as well as writing quality and quantity (Lewis, 1998). Others show that using these tools would lead to the decay of cognitive abilities and literacy (Clark, 2013; Sheehan, 2009) and the development of language skills at a surface level (Mudassir et al., 2020). Notably, the scarcity of research on the role of AC use in foreign language learning demands further research to shed light on the educational value of AC for those who use AC in the English as a foreign language (EFL) context.

AC Software

Successful and beneficial interaction with virtual environments requires specific skills and strategies. One essential skill for working efficiently with technological devices is keyboarding, i.e., "the ability of learners to key in information into the memory of the computer with the minimum effort and energy use" (Lubbe et al., 2006, p. 281). Keyboarding skill entails three facets of perceptual-motor, sensory-motor, and conceptual-motor skills (Russon & Wanous, 1973). The mastery of working with keyboards increases the thinking and processing power of the brain while interacting with computers and assists users in viewing the keyboard as a part of their thinking process rather than as an external tool for typing (Hayles, 2012). In the same vein, disappointing interaction with digital devices may lead to frustration and withdrawal from working with some system functions (Klein et al., 2002).

To optimize computer-human interaction, spellcheckers and editing tools appeared in the word processors of personal computers in the 80s. These tools help with typing and producing error-free documents (Walfish et al., 2000) by detecting spelling errors and suggesting the correct form of the word (Liang, 2008). The software programs developed for smartphones are equipped with automatic word correction (Wood, 2014) that can check the word being typed with its built-in dictionary and insert its suggested word. If the typed word does not match the dictionary lookup, the software automatically replaces the word, even before the word is completed.

There are several empirical studies in favor of using AC. It is suggested that the function of AC and word suggestion can improve the deficiency of low input entry speed of soft keyboards and their high rates of typos (Palin et al., 2019). Further, the appropriate use of AC can lead to a lower mental burden and emotional drain while users are interacting with technological devices (Alharbi & Stuerzlinger, 2021). Using AC saves plenty of time in producing and editing written documents (Buckwalter, 2016), reduces writing anxiety, and thus increases the volume of written communication significantly (Shahryari, 2019). Despite these advantages,

some demerits to irrational reliance on AC have been documented. Most of the time, the users are in a hurry or unaware of the changes made; thus automatic correction may lead to misunderstanding and communication breaks. It may also hinder the users from becoming aware of their mistakes and learning from them (Arif et al., 2016), leading to ignorance of words spelling and low levels of literacy (Sorrentino, 2008).

The Role of Spelling Correction Software in Language Learning

With the overspread use of social networking, motivation to compose written materials, such as tweets, comments, and text messages, has wildly escalated. This has attracted the attention of language educationists to examine the challenges and opportunities the use of mobile devices provides for promoting the young generations' linguistic competence and the development of literacy skills (Rahimi & Shahryari, 2019).

As for writing, it is evident that incorporating word processors in the writing process makes the writing task less tedious because the program checks and corrects the misspelled words. Assistive editing helps the writers write with fewer mistakes and more confidence (Warschauer, 1998) and thus saves their time and energy (Phinney & Khouri, 1993), which ultimately leads to higher writing motivation and quality of the written text (Lewis, 1998; Nichols, 1996). As spelling and punctuation marks are among students' most common mistakes while writing (Lunsford & Lunsford, 2008), the impact of spellcheckers and spelling correctors on reducing these errors is of great interest. Using autocorrecting software can even reduce the demand on working memory and increase understanding and recall of the content by making word writing more automatic (Hiscox et al., 2014). In addition to the writing process, some studies have specifically focused on the role of AC in improving or deteriorating students' mechanics of writing. Mechanics of writing includes a wide array of skills and abilities such as letter and word recognition and rules of spelling and punctuation (Olshtain, 2016). Arif et al. (2016), for instance, showed the significant effect of a color-coded autocorrect method on children's learning of new words and spelling. In another study, Lin et al. (2017) examined the effects of spelling aids on detecting and correcting misspelled words among English as a second language students' performances in detecting and correcting the misspelled word considering learning transferability and durability. Results indicated that all spelling aids induced error-detection learning even when the errors were presented in a different context (transferability) or a delayed post-test (durability). For error-correction learning, results showed that both the spellchecker (drop-down list) and the dictionary helped the students to learn the spelling incidentally.

Despite these promising findings, serious reservations exist about the destructive effects of overuse or heavy reliance on these assistive tools in language learning. Sheehan (2009) examined AC use among university students and concluded that AC dependence undermines students' cognitive abilities and spelling skills as it boosts their false self-confidence. Clark (2013) examined the ability of adults to spell English words and found an association between the participants' age and spelling skills, indicating that overuse of AC by younger generations has had a direct impact on their learning behavior and the development of literacy. Bronowicki (2014) reported that students' use of spelling and grammar-checking programs saves time and energy in preparing homework; however, it still can reduce their mental energy and perseverance in completing their tasks. The reason is that students evade the challenges of the writing process (planning, drafting, editing) to develop the topic deeply, and instead, they conceive writing as just generating texts based on syntactic forms instead of discoursal and rhetorical organizations. Similarly, Alhusban (2016) showed that excessive use of technology in writing instruction, particularly spellcheckers and ACs, may ruin students' editing skills as they disregard their mistakes while typing fast during online communication.

In this framework, a few studies have probed into the deeper effects of AC use on spelling and typing mistakes. Rimbar (2017) examined if students internalize the error correction provided by the spellchecker tool in word processors. The result showed that while the spellchecker helped the learners revise their spelling on one dictation exercise, they still made the same spelling errors after using spellcheckers. Therefore, it is argued that while spellcheckers help to eliminate surface errors, they have very little influence on correcting the mistakes on deeper cognitive levels. In the same vein, Mudassir et al. (2020) examined the impact of spellcheckers on language learners' writing performance. They found that spellcheckers only help students at the surface level rather than helping them generate productive results at a cognitive level. In other words, a spellchecker does not allow students to generate repairs themselves. Hicham and Bachir (2020) found that

using AC and spellcheckers as assistive writing tools significantly improved writing skills because they helped students use more passive vocabulary in their writing and raised their confidence and creativity. Yet automatic substitution of spelling and grammatical errors increased students' stylistic errors.

As noted by this brief review, most studies on spellcheckers and AC have focused on the impact of these assistive tools on the development of language skills without considering the individual differences among the users. Self-regulation as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (Zimmerman, 2000, p. 14) is assumed to be a critical factor in using technology in general and AC in particular for educational purposes.

Academic Self-Regulation and Vocabulary Learning

Self-regulated learning is a multi-faceted construct interrelated with cognition, metacognition, motivation, strategies, beliefs, and social aspects of learning (Ping et al., 2015; Sperling et al., 2004). Successful learners benefit from self-regulatory skills as they help them to set goals and invest strategically to reach those goals (Zimmerman, 2000). Self-regulated learners are aware of their weaknesses and strengths and how to regulate their learning process. They know how and when they are required to utilize learning strategies (Finkbeiner et al., 2012) and often gain better results in performing academic tasks (Thompson, 2012).

Self-regulation within the context of foreign language learning has received thoughtful attention supporting the importance of self-regulatory strategies and skills for the development of language literacy (Graham et al., 2018; Thiede & de Bruin, 2018) and oracy (Al-Hawamleh et al., 2022). Considering vocabulary as "an internal link among all language skills and knowledge" (Ping et al., 2015, p. 137) and its vital role in language acquisition and communication, many studies have tried to examine the ways self-regulation can assist vocabulary learning.

The rationale for promoting language learners' self-regulation for vocabulary learning is interpretable within the schemes of vocabulary knowledge and underlying learning mechanisms. Vocabulary knowledge is a collection of words that language learners acquire incrementally through incidental and intentional vocabulary learning. Both intentional vocabulary learning through formal instruction and incidental vocabulary through language use contribute to expanding language learners' word knowledge. The former is more helpful in understanding the meaning and register of the words, and the latter is beneficial for picking up form, collocation, and word classes (Nation, 2000). To help learners gradually develop their vocabulary knowledge over time, even without intentional learning, they should be armed with self-regulatory skills and vocabulary learning strategies. This helps learners become more self-directed, autonomous, and independent (Ping et al., 2015) and increases the size and depth of their knowledge of words (Schmitt, 2000).

Such context for learning vocabulary is supported by technology-enhanced environments where the conditions of both vocabulary knowledge development and self-regulatory learning are fulfilled. Technology is supportive of self-regulatory and autonomous learning as it promotes learner-centered and self-directed learning, gives learners access to authentic materials, and encourages interactive use of the target language (Benson, 2011). More specifically, integrating technology into instruction can increase learners' deployment of vocabulary learning strategies (Rahimi & Allahyari, 2019), the use of authentic language out of the classroom conducive to lifelong learning (Hao et al., 2021), and motivation regulation that guarantees learning outcomes (An et al., 2021).

For a technology to be supportive of self-regulation learning, three criteria should be met: learners should be encouraged to plan their learning activities, learners should receive appropriate feedback so they can monitor their learning, and learners should be given criteria so they can evaluate their learning outcomes (Bartolome & Steffens, 2011). AC may meet these conditions as it provides students with time management and strategic planning functions, gives prompt feedback based on vocabulary choice and spelling mistakes, and improves evaluation judgment based on the outcome of using the software for communication through the sent messages. Despite such rationale, there is a lacuna in the literature on the role of AC in assisting vocabulary learning by taking language learners' self-regulatory skills into account. Thus, the current study was carried out based on the hypothesis that academic self-regulation can mediate the relationship between AC use and vocabulary knowledge, meaning that those language learners who use AC more frequently have a larger vocabulary size because they are more self-regulated.

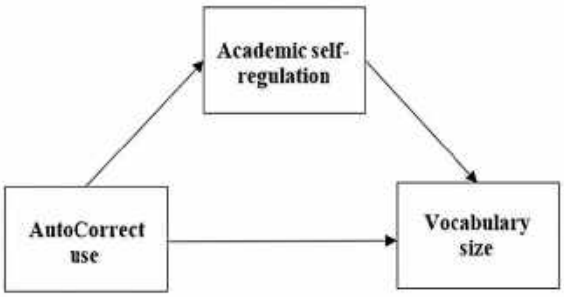


Figure 1. The conceptual model of the study (Source: Authors)

The Mediation Model

In the current study, it is hypothesized that the predictive power (facilitative or debilitative) of AC use (as the IV) on vocabulary knowledge (as the DV) is mediated by students' deployment of self-regulatory strategies (the mediator). The main purpose of the study is to examine if self-regulation is a mediator that explains the underlying mechanism of the relationship between AC use and vocabulary knowledge. The study thus seeks to answer the following research questions:

1. Is EFL learners' AC use related to their vocabulary knowledge?
2. Does EFL learners' academic self-regulation mediate the relationship between AC use and vocabulary knowledge?

The study utilizes a cross-sectional non-experimental design. This is a common approach in mediation analysis (David & Sava, 2015) based on which the data are collected at one point in time and no manipulation of the variables occurs. The conceptual model of the study is displayed in **Figure 1**.

METHOD

Participants

One hundred and one EFL learners participated in this study. They were all Iranian and their first language was Persian. The participants were selected based on convenience sampling from male students in grade 11 of a public high school in Tehran.

Iranian students study English for six years, from grade seven to grade 12. The English curriculum has been designed based on Nation's (2007) four strands proposition, where all four language skills (listening, speaking, reading, and writing) are important to be mastered. The main pedagogical approach is "an adapted version of the communicative approach labeled 'the self-esteemed and active approach'" (Rahimi & Alavi, 2017, p. 486). At the end of the EFL program, the students are expected to be at the level of B1 (intermediate) based on the common European framework of reference (CEFR). At this level, the students can use English competently for different communicative purposes.

Instruments

AC use scale

A revised version of the autocorrect software use scale (ASUS) (Rahimi & Shahryari, 2019) was used to assess the sample's perceptions of AC use in learning English as a foreign language. AC use scale was examined for its factor structure, and the result approved a four-factor model that explained 71.03% of the variance of the construct.

AC use scale has 13 items anchored on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree) and grouped into four factors, including awareness of how the software functions, the educational value of the software, learner's dependency on the software and frequency of use, and usefulness of AC in improving English spelling. The reliability of the scale and its factors are reported in **Table 1**.

Table 1. Reliability Indices of AC use scale

Variable	Number of items	Cronbach's alpha (α)
AC use scale	13	.80
Function	4	.82
Educational values	4	.83
Dependency and use	3	.75
Improvement of spelling	2	.82

Table 2. Reliability indices of ASRQ

Variable	Number of items	Cronbach's alpha (α)
ASRQ	55	.94
Memory strategy	14	.75
Goal setting	5	.80
Self-evaluation	12	.87
Seeking assistance	8	.70
Environmental structuring	5	.74
Learning responsibility	5	.72
Organizing	6	.70

Academic self-regulation questionnaire

Academic self-regulation questionnaire (ASRQ) was used (Magno, 2010) to assess participants' academic self-regulation. ASRQ contains 55 items and seven factors: memory strategy, goal setting, self-evaluation, seeking assistance, environmental structuring, learning responsibility, and organizing.

Each item is anchored on a 4-point Likert scale from 1 (strongly disagree) to 4 (strongly agree). The ASRQ has been used with the Iranian sample, and its reliability and validity have been verified (Cheraghi, 2020). The reliability of the scale and its factors are reported in **Table 2**.

Vocabulary size test

To estimate the participants' vocabulary size, Nation and Beglar's (2007) vocabulary size test was used. This test has been developed to "provide a reliable, accurate, and comprehensive measure of a learner's vocabulary size from the 1st 1,000 to the 14th 1,000 word families of English" (p. 9). Since the frequency of words decreases per 10 questions and considering the sample's level of English proficiency, the first 20 questions were used to assess the participants' vocabulary knowledge of English words. The reliability of the test was found to be .89 in this study.

Procedure

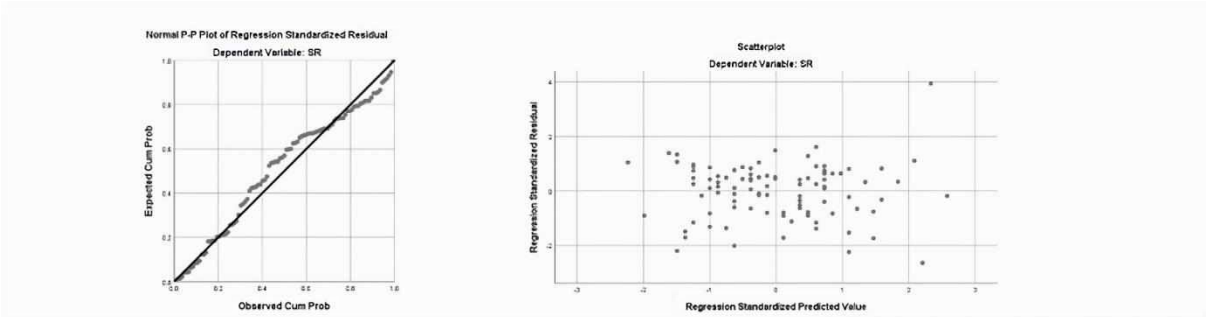
Upon obtaining approval from the educational office and the principal of the school, 101 K-11 students of a public high school were selected as the participants of the study.

At the beginning of the academic year, the teacher explained the educational value of m-learning in general and the AC software in particular to the students. The students' mobile device accessibility was assessed, and all students' asserted that they owned or had access to a mobile device (a tablet or a smartphone). Also, their awareness of how AC software functions was examined and found to be at a satisfactory level (n=88, %87).

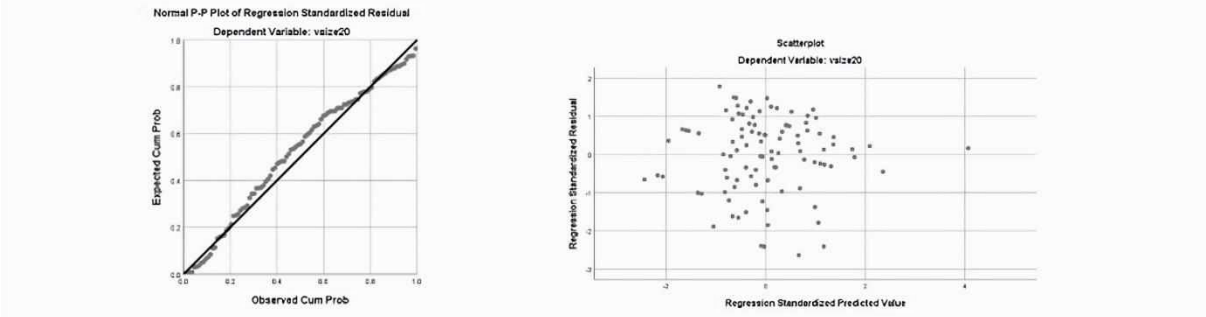
Based on school policy, no mobile device was allowed to be used during school time. Therefore, the students were advised on using their AC software during out-of-the-class times whenever they were communicating in English such as texting, writing messages/comments on social media, or playing games.

The participants completed the AC use scale, ASRQ, and the vocabulary knowledge test at the end of semester one of the academic year, which normally lasts five months. More than 83% of the students (n=84) asserted that they used their AC software most of the time for communicating in English. More than 77% of the students (n=78) felt dependent on their AC software while they were using their mobile devices.

After checking the completed scales, the data were inserted into IBM SPSS Statistics 24 and were analyzed utilizing a simple mediation approach to examine the fitness of the suggested model.



(a) Normal p-p plot regression standardized residual & regression standardized residual scatterplot for path *a* (AC use-SR)



(b) Normal p-p plot regression standardized residual & regression standardized residual scatterplot for paths *b* and *c'* (AC use/SR-vocabulary size)

Figure 2. Normal p-p plot regression standardized residual & regression standardized residual scatterplot for analyses (Source: Authors)

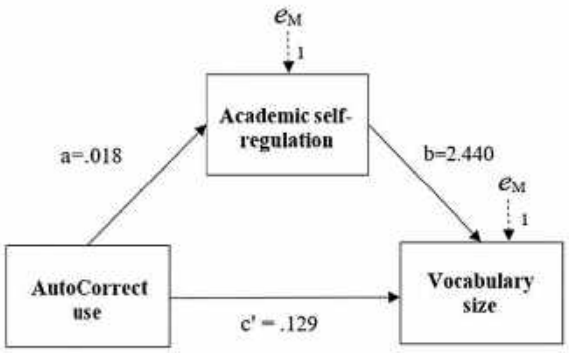


Figure 3. The statistical diagram of the mediation model (Source: Authors)

RESULTS AND FINDINGS

To assess the suggested model of the study, a simple mediation analysis was conducted using PROCESS v3.5 (Hayes, 2018). For this analysis, the mediator, academic self-regulation, is regressed on AC use (X) to produce *a*, and vocabulary size (Y) is regressed on both academic self-regulation (M) and AC use (X), which yields *b* and *c'*, respectively. Normal p-p plot regression standardized residual and Regression standardized residual scatterplot for paths *a, b,* and *c'* are shown in **Figure 2**. As shown in the figures, no serious departure from normality is observed and the fitness of the predicted model is verified.

The statistical diagram of the model is shown in **Figure 3** and the model coefficients for data are reported in **Table 3**.

As can be seen in **Table 3**, *a*=0. 018, *b*=2.44, and *c'*=.129, respectively. In the form of two ordinary least squares (OLS) regression models: $\hat{M}$=1.486+.018X and $\hat{Y}$=3.016+.129X+2.44M.

Table 3. Model coefficients for the model of the study

Antecedent		Consequent						
		M (academic self-regulation)				Y (vocabulary size)		
		Coefficient	SE	*p*		Coefficient	SE	*p*
X (AC use)	a	.018	.004	.000	c′	.129	.068	.061
M (ASR)		---	---	---	b	2.440	1.427	.090
Constant	i_M	1.486	.151	.000	iy	3.016	3.020	.320
		R^2=.147				R^2=.097		
		F(1, 99)=17.154 , *p*=.000				F(2, 98)=5.264, *p*=.006		

Table 4. Effects of AC use on vocabulary size

Effect	SE	t	*p*	LLCI	ULCI
Total effect of X on Y					
.174	.063	2.731	.007	.047	.300
Direct effect of X on Y					
.1291	.068	1.889	.061	-.006	.264
Indirect effect of X on Y					
Effect	BootSE	BootLLCI	BootULCI		
.044	.029	.000	.114		

Also, the results of the total, direct, and indirect effects of the model are summarized in **Table 4**. Multiplying *a* and *b* yields the indirect effect, *ab*=.018(2.44)=.044. Therefore, it is concluded that two language learners who differ by one unit in their AC use are estimated to differ by .044 units in their vocabulary size as a result of more positive AC use of those who use more self-regulatory skills (because *a* is positive), which in turn translates into larger vocabulary size (because *b* is positive). This indirect effect is statistically different from zero, as revealed by a 95% bootstrap confidence interval that is entirely above zero (.000 to .114) inserted under the headings "BootLLCI" and "BootULCI", respectively in **Table 4**.

The direct effect of AC use, *C'*=.129, is the estimated difference in vocabulary size between two language learners having the same level of self-regulation but who differ by one unit in their AC use. As the coefficient is positive, it indicates that the language learner who uses AC more but who is equally self-regulated is estimated to have .129 units larger vocabulary size. However, as can be seen in **Table 4**, this direct effect is not different from zero [t(98)=1.889, *p*=.061>.05] with a 95% confidence interval from -.006 to .264.

The total effect of AC use on vocabulary size is derived by summing the direct and indirect effects, *C*=*C'*+*ab*=.129+.044=.174. It shows that two people who differ by one unit in AC use are estimated to differ by .174 units in their vocabulary size. The positive sign means that the person with higher AC use owns a larger vocabulary size. This effect is significantly different from zero [t(99)=2.731, *p*=.007] with a 95% confidence interval from .047 to .300.

DISCUSSION

Overuse of technological devices and applications has raised serious concerns about their detrimental effects on the development of cognitive and linguistic abilities. Within the language education arena, research has cast doubts on the educational values of automatic spell correction software programs that language learners widely use on their smartphones. To shed light on this issue, the current study examined the relationship between EFL learners' AC use and vocabulary size and whether their academic self-regulation mediates the relationship between these two variables.

The result of the study showed that academic self-regulation is a significant mediator between AC use and vocabulary size. In other words, those language learners who use AC more frequently and are more reliant on it have larger vocabulary size because they are more self-regulated. This finding, first and foremost, gives credence to Tseng and Schmitt's (2008) model of motivated vocabulary learning, which represents a broader view of the interrelationship between motivation to learn words, the self-regulating capacity of vocabulary learning, strategy involvement, and vocabulary knowledge, emphasizing that vocabulary learning is a cyclic and systematic process. Based on this model, the learners should develop their self-regulatory skills, techniques, and tactics to get control of their vocabulary learning.

By mastering the required expertise in each phase of learning, the learners gradually become "self-motivated experts in vocabulary learning" and "establish a large, well-structured mental lexicon by improving both their vocabulary size and depth of knowledge about individual lexical items" (p. 389). Accordingly, vocabulary knowledge is operationalized in terms of vocabulary size and depth of knowledge (Tseng & Schmitt, 2008). Vocabulary size is generally determined by the number of frequent words a language learner knows (Nation & Macalister, 2010), and the depth of vocabulary knowledge is a combination of the knowledge of the meanings of a word, its collocation, and spelling.

The procedural nature of vocabulary learning demands certain conditions be met including spaced retrieval of the learned words, focusing on both meaning and form, engaging students in different types of tasks, and giving the students chances to use the words in interactions and negotiation of meaning (Zimmerman, 2016). Therefore, increasing the size and depth of vocabulary knowledge needs individual effort and perseverance as learners are required to find their own ways "to learn, acquire, comprehend, retain, recall, use and expand their vocabulary" (Siriwan, 2007, p. 43). This is much related to language learners' self-regulatory strategy investment, how they plan their learning tasks, and how they implement those plans to reach their goals. As documented in CALL research, learners who have access to technology-assisted learning perform better on measures of L2 vocabulary in comparison to learners with no access to technology as vocabulary learning becomes more efficient and enjoyable (Hao et al., 2021). The optimization of vocabulary learning with technology can be related to the reciprocal or even causal relationship between technology and self-regulatory skills. On one side, technology supports autonomous and self-directed language learning during which learners take charge of their learning, where "the objectives, progress, and evaluation of learning are determined by the learners themselves" (Benson, 2011, p. 10). On another side, as reflected in the findings of the study, those learners who have higher self-regulation can exploit technology best for their own advantage and regulate their learning process because they are assisted in monitoring, integrating, and evaluating their learning (Mooji et al., 2014).

The findings of the study corroborate previous research that although AC is perceived to be a helpful feature by users, they believe that it should be used sensibly with care and attention (Alharbi & Stuerzlinger, 2021). It also underscores the fact that efficient incorporation of technologies into language learning requires developing self-regulation skills and strategic awareness of motivation regulation (An et al., 2021). Self-regulatory skills provide users with real images of their weaknesses and strength and assist them in attaining their learning goals by managing the learning process through systematic and sustained effort (Zimmerman & Schunk, 2011). The combination of cognitive, metacognitive, social and motivational strategies helps learners regulate information processing, learning resources, contextual variables, and interest and engagement in doing tasks (An et al., 2021). This implies that self-regulated users of AC are more aware of the benefits of this function, and they decide when and how they want to use it for the goal they have set in advance, that is, vocabulary learning.

The presence of self-regulatory skills in the process of vocabulary learning with AC supports previous research that, in addition to spelling (Lin et al., 2017), AC is beneficial for influencing two other components of vocabulary knowledge, that is meaning and collocation. AC use can contribute to comprehension (Hiscox et al., 2014), learning new words (Arif et al., 2016), and retention of words in the context (Rahimi & Shahryari, 2019). Moreover, AC use can impact the knowledge of collocation as word suggestion function, and text prediction tends to encourage predictable writing (Arif, 2013) and remind the writer of what words can be combined in a given context. This is because AC, like any other technology, makes vocabulary learning more meaningful, and enhances word recognition ability and deployment of learning strategies (Rahimi & Allahyari, 2019). Yet, the finding adds to our understanding that technology-enhanced learning environments cannot lead to learning unconditionally, and users should be armed with special skills and competencies to use these resources to their advantage.

CONCLUSIONS

The contentious issue of AC use and its impact on learning outcomes motivated the researchers to examine the interrelationship between AC use, academic self-regulation, and vocabulary size among language learners in an EFL setting. The result of the study was indicative of a mediating role for self-regulation in the

relationship between AC use and vocabulary knowledge, meaning that more frequent use of AC use would lead to larger vocabulary size in the presence of self-regulatory skills and strategies.

What is inferred from the findings of the study is that the use of technology for educational purposes needs each user's awareness of how to exploit that technology and its affordances for their own benefit. The finding guides researchers in identifying the roots of the controversies around AC use and its adverse impacts on AC users' cognitive and linguistic development. In other words, more attention to the individualistic use of technology, the learning needs and preferences of different users, and their context and goals of using the technology should be given in technology-enhanced education. The outcomes suggest the necessity for flourishing MALL facilities in schools, as without the presence of the needed tools and resources it is unrealistic to have high expectations that mobile technology would be suitably utilized for teaching and learning purposes.

The findings of the study should be interpreted within the limitations the researchers faced in the process of carrying out the study. The results are drawn based on a descriptive and correlational study and the participants' development of vocabulary size in a given period was not assessed. Follow-up studies utilizing experimental designs are recommended where students' use of AC can be more carefully monitored and examined. Also, the data of the study is quantitative, and due to the unavailability of the participants after the study, no qualitative data could be gathered. Assessing students' perceptions of and attitudes towards AC and its educational benefits and/or negative impacts on users' learning outcomes is suggested. Incorporating individual differences such as age, gender, and language proficiency as well as psychological characteristics such as awareness of language learning strategies, motivation, and anxiety into the design of further studies is also recommended.

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