Integrating CALL to Develop Metacognitive and English Proficiency Skills in EAP Classrooms

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Abstract

The immersion of technology in the 21st century has changed the pedagogical foundation of the English for Academic Purposes (EAP) field. Computer-Assisted Language Learning (CALL) materials, when integrated into content-based EAP classrooms, have great potential to enhance the learning experiences of second language (L2) learners. This paper explores the significance of integrating CALL tools in two EAP classrooms to develop the metacognitive skills of L2 learners. Analysis of pre and post CALL instruction surveys and pre and post writing scores of 26 advanced EAP students indicated that the use of CALL tools had a significant effect on helping them develop their metacognitive skills.

Keywords: Metacognitive Skills, Computer Assisted Language Learning, English for Academic Purpose, Content-based

Introduction

In this research paper, we report the results of a study investigating the use of computer-assisted language learning (CALL) materials to support knowledge acquisition, language skills, academic English proficiency, and metacognition of English-for-Academic Purposes (EAP) students. Additionally, we discuss a number of CALL designs, developments, research perspectives, practices, and materials, and how they enrich the learning experiences of EAP students. We further discuss metacognitive diversity which pertains to the different learning standards and processes across cultures and socioeconomic statuses (Proust & Fortier, 2018).

For the purposes of this paper, we adopt Chaka's (2009) definition of CALL, which pertains to the use of computers and computer-related technology, including hardware and software applications that facilitate the learning of language. Chun (2011) posits that CALL is a field (as opposed to a methodology) that has been explored in the past decade to study how technological tools are utilized for language learning. The CALL field consists of a range of technological tools with the potential for use in language teaching and learning contexts. The employment of computer technology has increased in the past decade as the use of the Internet has become ubiquitous, providing nearly universal access to social media, teaching and learning materials, and online instruction and assessment (Chapelle & Sauro, 2017). Technologies in CALL may include generic tools and devices such as Microsoft Office for writing or presentation, online dictionaries for vocabulary work, or MP3 players for listening activities (Levy & Stockwell, 2008). In addition to directly helping students learn, CALL applications may also help language educators and learners understand how languages are learned (Levy & Stockwell, 2008). That is, CALL tools can afford language educators and learners opportunities to develop metacognitive

skills for understanding how languages are anchored in a systematic and pedagogical way (Hyte, 2002). However, to date there is little empirical evidence to support the claim that CALL tools increase metacognitive strategies that promote English proficiency.

We aim to contribute to the field of CALL by investigating the use of CALL materials in teaching EAP students to understand how they can use CALL materials in the learning process, and by exploring the efficacy of CALL materials to improve metacognitive strategies that promote English proficiency skills. To investigate the effectiveness of CALL tools in enhancing EAP students' language learning experiences, we developed the following three research questions:

1. Does the use of computer-assisted language learning (CALL) tools correlate with significant changes in the metacognitive skills of EAP students in advanced Writing/Editing and Advanced Business courses?
2. Do EAP students from East Asia, the Middle East, and European regions perform differently on assessments of metacognitive awareness?
3. To what extent does the use of CALL tools correlate with increases in the self-reported metacognitive skills of EAP students?

Literature Review

CALL Design and Materials

Technology can greatly assist in language teaching and learning and enhance the quality of the experiences of language learners (Chapelle, 2007). Technology has become an integral part of academic life in the twenty-first century. The use of CALL tools can help equip EAP students with proficiency in multiliteracies that they will need in their future professional and academic endeavors (Cope & Kalantzis, 2000). Furthermore, the evolution in technological innovation has changed the second language acquisition (SLA) field, and further technological changes are inevitable. Therefore, English language educators should be informed about which CALL tools are available and effective for different EAP contexts and students and maintain a balance between traditional classroom environments and the integration of technology in EAP classrooms.

According to Chapelle and Jamieson (2008), in order to enhance language learning experiences, technological tools should be integrated into EAP classrooms in an effective manner with appropriate pedagogical foundations. They also add that computerized language learning environments enhance second language teaching in a variety of ways. This is particularly the case when CALL tools are used as a medium to enrich educational programs and learning opportunities of EAP students with guidance from educators.

Januszewsky and Molenda (2008) emphasize that "Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (p. 209). Considering this definition, however, there are no technological tools in language learning that are universally effective for every learner. As Chun (2011) indicates, these tools are only effective when applied accordingly for particular learners for particular aspects of language learning within particular teaching methodologies. Warschauer (2001) also holds the view that with changes in literacy instruction practices, the computer has become an essential tool in language instruction. However, as course designers, language instructors also play an important role as Levy and Stockwell (2008) posit:

> Not only do many language teachers design or adapt materials and develop tasks and courses to match the needs and goals of the students (online and offline), they are also the

> designers in the way they organize and manage their classes, programs, times, and resources. (p. 10)

CALL design plays an important role in the integration of CALL in the classroom. Levy and Stockwell (2008) observe that the integration of in-class activities and out-of-class activities has to be thoughtfully designed based on the available resources and particular needs and goals of the learners. For instance, EAP students often share goals such as: (a) achieving the required GRE scores and IELTS/TOEFL scores for college admission, (b) acquiring advanced English proficiency in reading, writing, speaking and listening comprehension, and (c) receiving admission to an undergraduate or graduate program in the United States. Bruckman (2002) adds that CALL design is a living document; it evolves as the designers understand the pedagogical motives and constraints provided by the technological resources. For instance, course designers may have designed and planned a lesson where technology is involved, but when they are faced with challenges (e.g., students need further training on how to use the technology or the students are cognitively overloaded because of the technology) they have to be flexible and understand that they need to redesign their lesson. More importantly, from an interactionist perspective that capitalizes on engaging second or foreign language (L2) learners via meaning-oriented activities, Chapelle (1998) suggests that CALL developers promote a beneficial L2 learning environment via multimedia CALL that provides L2 learners constant interaction with peers and allows them to engage in negotiation of both form and meaning. Specifically, Chapelle proposes the following seven hypotheses as guides for CALL developers in their development of multimedia CALL:

1. The linguistic characteristics of target language input need to be made salient.
2. Learners should receive help in comprehending semantic and syntactic aspects of linguistic input.
3. Learners need to have opportunities to produce target language output.
4. Learners need to notice errors in their own output.
5. Learners need to correct their linguistic output.
6. Learners need to engage in target language interaction whose structure can be modified for negotiation of meaning.
7. Learners should engage in L2 tasks designed to maximize opportunities for good interaction. (pp. 23–25)

Thus, it is paramount to accentuate comprehensible input, interaction, and output in language acquisition and learning. Plass and Jones (2005) confirm that "[s]econd-language acquisition with multimedia is the use of words and pictures designed to support the comprehensible input that the learner is exposed to and interacts with, and to elicit and negotiate comprehensible output" (p. 469). Therefore, in order to help L2 learners untangle incoming information effectively and generate comprehensible output ultimately, CALL researchers and designers need to capitalize on various forms of L2 learners' meaningful interaction empowered by means such as multimedia glosses and external links. Through means such as these there is potential to reduce L2 learners' cognitive loads. Discussion of the application of technology-assisted language learning in EAP classrooms requires understanding which types of technologies are useful in EAP classrooms, including specific examples of those technologies.

Computer-Mediated Communication

Computer-mediated communication (CMC) in language teaching is defined by Herring (1996) as "communication that takes place between human beings via the instrumentality of computers" (p.1). Levy and Stockwell (2008) categorize CMC into synchronous computer-mediated communication (SCMC) and asynchronous computer-mediated communication (ACMC). They further explain that *synchronous* CMC allows real-time virtual communication to happen and that responses among communicators are given immediately. Alternatively, in *asynchronous* CMC,

participants can communicate online when it is convenient, allowing more freedom to respond to each other.

Previously, synchronous and asynchronous CMC involved only text-based and audio-visual based communication mediums; recently, however, video-based mediums have increased the variety of CMC types (Chun, 2008; Thorne & Payne, 2005). Chun (2008) and Thorne and Payne (2005), who further discussed recent trends with ACMC and ASMC, stated that Web/CMC 2.0 consists of either ACMC 2.0 (e.g., blogs, podcasts, vodcasts, Twitter, Flickr, YouTube, social networking sites) or SCMC 2.0 (e.g., Intelligent CALL, chatbots, virtual worlds, internet phone, audio conferencing, video conferencing, multiplayer games). Yanguas (2009) and Chang, Pearman, and Farha (2012) investigated technological tools, such as multimedia glosses, Web 2.0, and the potential of Web 3.0 in enhancing language teaching to adult ESL students at institutions of higher education.

Levy and Stockwell (2008) and Chang et al. (2012) describe Web 2.0 as a web-based browser where presenters and users are contributors (i.e. one-to-many and many-to-many). Any Web 2.0 user can share their ideas and thoughts with online communities by utilizing web-based software services and authoring tools (Wolcott, 2007). As a technological tool, Web 2.0 technologies consists of blogs, wikis, podcasts, social networking, and virtual worlds. Educators have used Web 2.0 tools in language education. Chang et al. (2012) believe that on the horizon are Web 3.0 technologies, technological tools that use web-services such as Application Programming Interface (API) to search for images, teach content, and, where the applications have the ability, speak to each other directly for broader searches of information with simpler interfaces (Getting, 2007). The authors elaborate that some functions associated with Web 3.0 are web-services with 3D capabilities to find media (graphics and sound) using other media or to view a true three-dimensional object or location (e.g., Google Earth, virtual reality, real estate properties), and provide access to websites by devices other than PCs, smartphones, or tablets. An example of using Web 3.0 technologies would be EAP teachers who employ Google Earth as a CALL tool and assign students to look for the country of origin of immigrants to the United States. The students would then present a report using images they obtained from Google Earth.

Theoretical Frameworks as Applied to CALL

Psycholinguistic Theories and Cognitive Theory of Multimedia Learning

Chun (2011) notes that psycholinguistic theories as applied to CALL focus on cognitive processes and how the brain processes language. She adds that, in the learning process, the cognition of the learners involves memory, attention, noticing, as well as how each learner processes multimodal information. It is important to note that many of the psycholinguistic CALL approaches are based on the cognitive theory of multimedia learning. Mayer (2005) posits that multimedia learning plays a critical role in the process of decoding L2 reading materials because multimedia resources such as visuals, audios, videos, animations, and simulations may expand L2 learners' working memory. For example, multimedia glosses make the use of dictionaries unnecessary because they provide easily accessible computerized definitions of vocabulary items in textual, pictorial, or textual and pictorial formats (Yanguas, 2009). This enables learners to avoid interrupting their reading comprehension process and vocabulary acquisition (Yanguas, 2009).

Mayer (2001), based on his cognitive theory of multimedia learning, asserts that "people learn more deeply from words and pictures than from words alone" (p. 31). That is, for example, while decomposing an abstract term or concept, L2 learners may process the term or concept couched within copious multimodal resources more effectively because the working memory of L2

learners is maximized because their two subsystems (i.e., "[a] phonological loop for verbal information and a visuospatial sketchpad for visual information" can work synchronously (Baddeley as cited in Butcher, 2014, p. 198). Nevertheless, Sweller (2005) argues that due to working memory limitations, problems could arise when multiple modes are used to present information. For instance, based on psycholinguistic theories, computer-based dictionaries and multimedia glosses may use multiple modes of information such as textual, visual, and audio information, which could help with vocabulary acquisition as long as the multimedia glosses do not exceed the working memory capacity of L2 learners (Chun, 2011; Mayer, 2005; Sweller, 2005).

Plass, Chun, Mayer, and Leutner (2003) conclude that the most effective CALL materials cannot be indicated because learners use technological-assisted language learning tools differently. They further explain that visual learners find graphic information more helpful in acquiring vocabulary, but learners with verbal learning preferences may not find graphic information as helpful. They also assert that although, in general, multiple glosses are effective for most learners, struggling learners may find a combination of verbal and visual glosses produce cognitive overload. Hence, when selecting CALL materials, apart from considering linguistic concerns associated with theories in second language acquisition, CALL researchers and practitioners should also be mindful of L2 learners' metacognitive competence that enables them to actively select, organize, and integrate multimedia resources to comprehend the target content.

Social Constructivism and CALL

The use of technological tools in second language teaching is further supported by social constructivism theory (Fosnot, 2005). Vygotsky (1978) believed that learning is achieved through social interaction. According to Lantolf (1994), the fundamental theory of Vygotsky is "higher forms of human mental activity are always and everywhere mediated by symbolic means" (p. 418). Thus, Vygotsky develops the concepts of cognitive development and mediation in the learning process. He views that, through interaction, both the environment and humans are transformed, which has implications for socio-cultural interaction, scaffolding and dialogic scaffolding, and teaching. For instance, when a student uses an e-dictionary or asks a teacher or a classmate about the definition of a difficult word, she/he is interacting with a technological tool to help her/him understand the meaning of a word. Haas (1996) argues, "Vygotsky's theory of mediation helps us see tools, signs, and technologies as. . . systems that function to augment human psychological processing" (p. 17). That is, technological tools, falling within the social constructivism theory, are supposed to, on the one hand, help L2 learners process and understand target knowledge more effectively. On the other hand, technological tools should create ample opportunities for L2 learners to collaborate with their peers.

Metacognitive Skills Development in CALL and Metacognitive Diversity

While multiple research studies have indicated the use of CALL can result in positive learner outcomes in EAP education contexts (e.g., Frankenberg-Garcia, 2018; Marcus, 2019; Morales, 2014), care needs to be taken that CALL materials do not overburden EAP students as they process new information (Mayer 2005, Sweller, 2005). The cognitive-affective theory of learning from media (CATLM), which is a framework in multimedia learning derived from the cognitive theory of multimedia learning (Mayer, 2009; Moreno, 2005), argues that learners process incoming information using visual and verbal information. It explains that learners first select information from low-level sensory representations and then organize the information in the form of visual and verbal information. Learners also integrate prior knowledge from long-term memory resulting in a cross-modal mental model represented in working memory. Employing

CATLM, Kalyuga (2011) suggests that educators avoid cognitively overloading language learners in order to keep them motivated to acquire language skills.

According to Huang and Nisbet (2012), L2 learners can become overwhelmed when conversing in L2; however, they have the advantage of being able to draw upon background knowledge from their first language (L1). Huang and Nesbit also argue that L2 learners can be taught to employ various strategies in decoding the meaning of unfamiliar vocabulary, text structures, cohesive devices, and cultural references. For example students can be taught to (a) connect the sound of a new English word and an image or picture of the word to help remember the word; (b) remember a new English word by making a mental picture of a situation in which the word might be used; and (c) look for words in L1 that are similar to new words in English, or to search for people (via e-mails, video chat, and chat room) they can talk to in English. Metacognition is also critical in acquiring language skills, particularly reading skill, therefore L2 educators should provide explicit instruction on how learners can use their metacognitive skills (Anderson, 2005). Research by Anderson (2005) indicates this teaching approach has resulted in significant gains in L2 English proficiency skills.

Flavell (1976) defines metacognitive knowledge as "the knowledge concerning one's own cognitive processes and products, or anything related to them" and metacognitive skills as "the active monitoring and consequent regulation and orchestration of these processes" (p. 232). Several studies (e.g., Hauck, 2005; Malcolm, 2009; McGrath, Berggren, & Mezek, 2016; Nergis, 2013) have investigated whether metacognitive growth is fostered in online distance language learners by awareness-raising activities for metacognitive knowledge acquisition. Flavell's study showed that there was interdependence between the degree to which online language learners were aware of their metacognitive skills, on the one side, and their abilities to demonstrate control and flexibility in the use of those skills (e.g., self-management, autonomy), on the other. The researchers argued that metacognition, which CALL can facilitate, is a very important part of learning in EAP contexts. Through the use of tools such as Google Docs, EAP students reflected on and regulated their learning. Google Docs provided a multimodal, asynchronous and synchronous medium that facilitated instructor-student and student-student interaction and the sharing of metacognition-related knowledge and skills. This technology also provided a context in which students could reflect on and develop metacognitive skills and strategies that could improve learner outcomes. For example, it provided with them with opportunities to think about how they organize their writing. As stated by White (1995), "successful learner self-management is a strong indicator of a high level of metacognitive awareness of the circumstances in which they, as individuals, learn best and possess the skills necessary to create those conditions" (p. 207).

In teaching metacognitive awareness to L2 learners, educators must be aware of the metacognitive diversity of the learners, which pertains to the role of metacognition to represent learning practices and standards across culture (Proust & Fortier, 2018). People from various socioeconomic statuses and cultural groups have different ways of organizing their thoughts (Neisser, 1982). For instance, research indicates that many Eastern cultures adopt a teacher-centered teaching philosophy with less emphasis on critical thinking skills; however, Western cultures are more familiar with student-centered teaching philosophies that emphasize critical thinking skills (Proust & Fortier, 2018). Research also shows that linguistic and cultural differences, such as being raised in a collectivist or individualist society or being educated in a school system where being able to excel in evaluation is more highly valued than being able to think critically, may influence cognitive and metacognitive processes (Proust & Fortier, 2018; Ünal & Papafragou, 2018).

Notwithstanding the wealth of literature on CALL technologies for EAP instruction and suggested affordances emanating from those CALL technologies that promote L2 learners'

linguistic competence, little is known about the impact of CALL technologies on L2 learners' metacognitive skills in an EAP context. Therefore, the purpose of this study is to determine the extent to which CALL technologies correlate with EAP students' metacognitive skills as well as to investigate the extent to which different cultural and linguistic backgrounds of EAP students may impact their self-reported metacognitive skills. We approach this task via three sets of statistical analyses as described in the next section.

Methods

Participants and Context

This study's participants were 26 undergraduate and graduate international students enrolled in two advanced English EAP courses, Writing/Editing and Advanced Business, in an English language program embedded in a large, public research university located in the southeastern United States. A major component of the courses was the integration of computer-assisted language learning materials focused on increasing the metacognitive skills needed to acquire English proficiency skills.

Instruments

After receiving 14 weeks of instruction in advanced academic English courses, the 26 students completed the adapted five-point Likert scale survey questions in the *Metacognitive Awareness Inventory* developed by Schraw and Dennison (1994). The survey given to the students was written so that their responses fell along a scale indicating their opinions of their respective metacognitive skills. The researchers used a Likert-type scale to measure the survey, assigning a value of 1 to low metacognitive skills and 5 to high metacognitive skills. Their pre- and post-writing scores were also analyzed to identify improvement in their English proficiency skills.

Research Design and Analytical Procedure

Language instruction incorporating technological tools with emphasis on developing metacognitive skills and knowledge was given to the 26 EAP students for one semester. One of this study's authors performed the role of instructor of the advanced academic English courses and integrated CALL materials in her daily lesson plans. In organizing and summarizing the data, we first used descriptive statistics to analyze the mean value. Considering the small sample size, several nonparametric analyses (Kruskal-Wallis tests) were conducted to test the significant difference of the self-reported metacognitive skills of the EAP students between Writing/Editing and Advanced Business courses (Coladarci & Cobb, 2014) as well as the total value of metacognitive skill between the students from Writing/Editing and Advanced Business courses. The Kruskal-Wallis is a nonparametric statistical test that assesses the differences among three or more independently sampled groups on a single, non-normally distributed continuous variable (Kruskal & Wallis, 1952). Second, we conducted pairwise comparisons (Wilcoxon rank sum tests) to investigate the differences in metacognitive skills of students who came from different cultural and linguistic backgrounds. Finally, we conducted a dependent *t*-test to analyze the pre- and post-writing scores of the EAP students to determine whether the integration of CALL had a significant effect on their metacognitive skills. The purpose was to investigate whether the increases of the mean values in both classes might result from the metacognitive skills taught and reinforced by the instructor during the writing revision process.

Results

Descriptive statistics of each metacognitive skill within each class were examined including number of participants, standard deviation, skewness and kurtosis. By investigating skewness and

kurtosis, we can conclude that the data of each class were normally distributed (skewness ranged from -1.14 to 0.72, and kurtosis ranged from -1.57 to 2.31). Mean and standard deviation of each metacognitive skill within each class is presented in the Table 1.

Overall, we found that there was no statistically significant difference between the Advanced Business and Writing/Editing classes for any of the metacognitive skills. However, all the means of the Advanced Business class were slightly higher than the means of the Writing/Editing class, except the compensation strategy mean of the Advanced Business class (M = 21.25, SD = 7.59) was a little bit lower than the mean of the Writing/Editing class (M = 21.86, SD = 5.26).

Table 1. *Descriptive Statistics of Metacognitive Skills of Each Class*

Metacognitive skill	*n*	*M*	*SD*	Skewness	Kurtosis
bus_memory	12	33.25	9.03	-0.58	0.10
wrt_memory	14	28.14	7.52	0.56	1.48
bus_cognitive	12	51.67	13.83	-1.14	2.43
wrt_cognitive	14	51.29	8.23	0.72	0.44
bus_compensation	12	21.25	7.59	-0.67	-0.62
wrt_compensation	14	21.86	5.26	-0.09	-0.97
bus_computer	12	35.58	8.50	-1.15	1.28
wrt_computer	14	31.64	5.64	0.62	1.40
bus_affective	12	20.50	7.38	-0.13	-1.57
wrt_affective	14	18.00	4.77	0.92	2.31
bus_social	12	24.17	5.57	-1.09	0.59
wrt_social	14	22.93	4.41	-0.31	-0.04

Note. bus = business; wrt = writing; *SD* = standard deviation. Results procured via SPSS quantitative analysis on descriptive statistics for strategies subscales.

The total value of metacognitive skill report of the Advanced Business class was M = 186.41, SD = 45.74 and the total value of metacognitive skill report of Writing/Editing class was M = 173.86, SD = 30.12. Through calculating the mean and standard deviation for each subscale, we found that there was no statistically significant difference in both the Advanced Business class and the Writing/Editing class. However, notably, we did find that students in the Advanced Business class (M = 33.25) outperformed the writing class (M = 28.14) on the memory subscale. These mean differences on the memory subscale might be related to the goals of each course. On the one hand, the goals of the Writing/Editing course focus on helping EAP students develop their English language abilities in writing and editing for academic studies. They focus on improving argumentative writing skills while editing for grammatical accuracy. On the other hand, the goals in the Advanced Business course focus on exploring selected business topics through readings, discussions, and written responses. The students learn business-related vocabulary and development of critical thinking skills by engaging in tasks and projects related to real-world business issues and practices. Since the students in the Advanced Business course had to mainly learn business-related vocabulary, they were given more opportunities and were taught to use more of their memory strategies in relation to their metacognition skills. Additionally, in the CALL subscale, we noticed that the mean (35.58) for the Advanced Business class was comparably higher than the mean (31.64) for the Writing/Editing class. We expect this mean difference on the CALL subscale is partly related to the student learning outcomes and the type of CALL tools being integrated in the instruction and learning process. While both courses were exposed to various CALL tools, the Advanced Business course students had more exposure to a

wider array of technological tools. In the Writing/Editing course, the students primarily integrated the use of a CALL tool (i.e., Google Docs) for writing assignments, peer review, and teacher feedback. However, in the Advanced Business course, the EAP students used various CALL tools, such as Google Docs for writing/editing activities, e-dictionaries for business-related vocabulary, Google Slides for presentations, *Kahoot!* and *Quizzes* as platforms for e-games, Google search for research, *Zoom* for online meetings with the instructor and group members, Windows Movie Maker for a promotional video, and Microsoft Office (e.g., Excel, Word) to create their budget and flyers for the fundraiser business start-up final project.

With an aim to investigate the differences in metacognitive skills of students who come from different cultural and linguistic backgrounds, we combined all the students (N = 26) from the two classes into three groups. Specifically, students from Thailand (n = 1), Japan (n = 1), and China (including both mainland China and Taiwan; n = 8) compromise the East Asia Group (Group 1), given the fact that these students share some cultural and linguistic similarities. Furthermore, since 12 students reported that they speak Arabic as their first language and come from Saudi Arabia, we created the Middle East Group (Group 2) based on their first language and home country. By the same token, students of European language domain (n = 4) comprise the European Language Group (Group 3), with one student from Sweden speaking Swedish, one from Italy speaking Italian, and two from Venezuela speaking Spanish.

Differences in metacognitive skills were found to exist among individuals from various cultural and linguistic backgrounds (see Table 2). Conducting a descriptive analysis (shown in Table 2), we found that students from East Asia and the Middle East regions have similar means (East Asian = 189.6, SD = 49.41 and Middle East = 181.92, SD = 26.74). However, students from European-language domains have a comparatively low mean score (M = 179.65 SD = 17.64). Comparatively speaking, these results indicate that students from East Asia and the Middle East have analogous metacognitive skills, which were self-reported in the questionnaire embedded in the online survey.

Table 2. *Descriptive Statistics for Metacognitive Skill Differences among Individuals from Different Cultural and Linguistic Backgrounds*

Cultural background	*n*	*M*	*SD*	*Min*	*Max*
1	10	189.60	49.41	84.00	250.00
2	12	181.92	26.74	149.00	248.00
3	4	179.65	17.64	123.00	164.00

Note. 1 = East Asia Group; 2 = Middle East Group; 3 = European Language Group.

Nonetheless, looking at the pairwise comparison of the mean scores among the three groups in Figure 1 and detailed statistical analysis demonstrated in Table 3, the students of the European language domain were not as aware of their metacognitive skills as the students from the East Asia and the Middle East regions. We believe this significant mean difference might be influenced by the cultural and linguistic differences in metacognitive processing between instructor and students as well as among the students themselves. On the one hand, in the East Asian and Middle East regions, the teaching philosophy is more teacher-centered with less emphasis on critical thinking skills. On the other hand, the students from the European group are familiar with student-centered teaching philosophy with emphasis on critical thinking skills (Proust & Fortier, 2018). Research also indicates that linguistic and cultural differences, such as being raised in a collectivist or individualist society or being educated in a school system where being able to excel in evaluation is better than being able to think critically, may have an influence on cognitive and metacognitive processes (Proust & Fortier, 2018; Ünal & Papafragou, 2018).

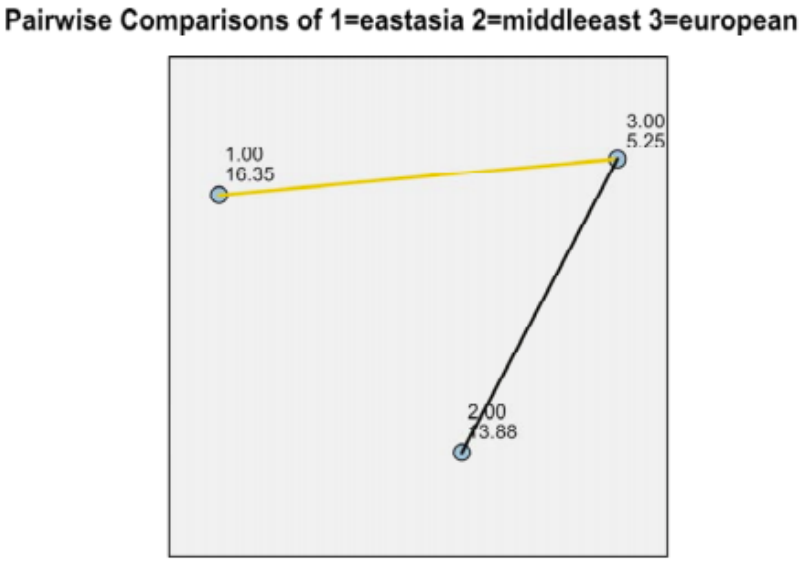

Figure 1. Pairwise comparisons of different groups.

Table 3. *Pairwise Comparison of Different Groups*

Comparison	*t*-value	*SD*	Sig.	Adj. Sig.
3-2	8.63	4.41	.051	.152
3-1	11.10	4.52	.014*	.042*
2-1	2.48	3.27	.450	1.000

Note. 1= East Asia Group; 2 = Middle East Group; 3 = European Language Group.
*$p < .05$.

Using the Kruskal-Wallis test, with respect to students' metacognitive skills, we found that students from European speaking domains scored lower than the students from the Middle East and East Asia regions. As appraised and shown in Table 3, there is a statistically significant difference when the European Language Group is compared to the East Asia Group ($t = 11.10$, $p < .05$). What is more noticeable from the Kruskal-Wallis test results is that the standard deviations of the East Asia Group and European Language Group are large, which implies that students' self-reported metacognitive skills range unevenly. These results support research indicating that factors such as linguistic and cultural backgrounds may influence metacognition (Proust & Fourtier, 2018; Ünal & Papafragou, 2018). However, even considering all three groups together, we found that the self-reported metacognitive skills of individual students also vary significantly, regardless of the language group. These results indicate that while metacognitive skills may vary across cultures, individual learners within a particular culture can also differ significantly in their abilities to use metacognition.

Via the analysis of a dependent *t*-test for each class, we noticed that there were statistically significant differences ($p < .05$) between students' pre- and post-test scores on writing performance in both the Advanced Business and Writing/Editing classes. As seen in Table 4, the mean in the Advanced Business class grew significantly from a pre-test score of 89.99 to a post-test score of 95.96.

Akin to the Advanced Business class, the mean for the Writing/Editing class, having a pre-test score of 85.18, rises to 92.86 (see detail in Table 5). These mean increases in both classes might have resulted from the metacognitive skills taught and emphasized by the instructor during the

writing revision process. She provided the students with prompts to proofread their writing in terms of grammar, sentence structure, spelling, and the strength of their introduction or conclusion by comparing them with similar papers. More importantly, it is worth noting that the pre-test mean (89.99) of students' writing performance in the Advanced Business class is higher than the mean (85.18) for the Writing/Editing class.

Table 4. *Comparison of Business Class Students' Pre- and Post-Test Scores*

	n	*M*	*SD*	*t*-value	df	Sig. (2-tailed)	Mean Difference
bus_pre	12	89.99	10.85	28.74	11	.00*	5.97
bus_post	12	95.96	4.66	71.27	11		

Note. bus = business. *$p < .05$.

Table 5. *Comparison of Writing Class Students' Pre- and Post-Test Scores*

	n	*M*	*SD*	*t*-value	df	Sig. (2-tailed)	Mean Difference
wrt_pre	14	85.18	6.39	49.88	13	.00*	7.68
wrt_post	14	92.86	4.69	74.11	13		

Note. wrt = writing. *$p < .05$.

The significant differences between the pre-test and post-test scores for both courses indicated that metacognitive awareness may be pertinent to the successful learning of the EAP students since metacognition enables them to manage their cognitive skills and evaluate their weaknesses. By teaching students metacognitive skills through the use of CALL tools, they become more metacognitively aware. Consequently, these results suggest they performed better when they were provided with opportunities to plan, sequence, and monitor their learning in a way that indirectly improved their writing skills. The proliferation of their metacognitive skills corresponds to the specific strategies and strategy-related conditions that are more useful in their learning. The regulation of their metacognition also corresponds to the knowledge of how they plan, implement strategies, observe, correct comprehension mistakes, and evaluate their learning.

Limitations

One of the limitations of this study is the relatively small sample size. Given the fact that the instructor was only able to recruit 26 students from two classes to participate in this study, the conclusions may not be robust. As such, one caveat to note is that the results of this study cannot be generalized to other EAP contexts. However, the results of this study do confirm Carrell and Carson's (1997) argument that Task-Based Language Teaching tends to promote EAP students' metacognitive skills, which in this study, were reflected in the Advanced Business course where students had more opportunities to utilize CALL tools to complete multitudinous tasks.

This study only includes four students from the European language domain; therefore, the results manifested by the pairwise comparisons cannot establish a correlational relationship asserting that European-language-speaking students tend to have lower metacognitive skills than the students from East Asia and the Middle East. According to Raoofi, Chan, Mukundan, and Rashid (2014), other factors may affect L2 learners' metacognition, including language proficiency, educational level, bilingualism, learning styles, and L1 metacognitive knowledge/strategy use. A more realistic hypothesis is that the aforementioned variables may have indirect effects on these students' L2 metacognitive development. Perhaps a future experimental study should investigate how variables such as learning styles and L1 metacognitive knowledge/strategy use might be influential on EAP students' L2 metacognitive development supported by CALL tools. To this end, a multiple regression analysis may aid researchers in understanding whether or not such

variables will contribute to L2 learners' metacognitive skills.

Another limitation is the length of the study as students' metacognitive skills in English learning may not be fully acquired within a single semester. If possible, when a new semester starts, the instructor may collaborate with her colleagues at the language institute to further investigate students' metacognitive development in English and utilize the same instrument to gather output for another round of analysis. In this light, we believe these attained metacognitive skills may be reflected in students' academic writing with a study that is more longitudinal in nature. With research conducted over a longer time period, the researchers may be able to draw more definitive conclusions.

Conclusion

The findings of this study of students' pre and post writing scores and adapted survey of strategy inventory toward academic English learning (see Appendix A), confirmed the psycholinguistics theories' claim that the use of CALL tools (e.g., Google Docs, Google Slides, e-dictionaries *Kahoot!* and *Quizzes* as platforms for e-games, Google search, Windows Movie Maker, and Microsoft Office) should increase the metacognitive skills of the learners (Mayer, 2001, 2005; Plass et al. 1998, 2003). They also confirmed Vygotsky's (1978) concept of cognitive development in the learning process that through interactions, involving the mediation of more knowledgeable others or culture (e.g., collaborative CALL such as Google Docs), students and their environments are transformed.

Statistical analysis of the self-reported metacognitive strategies in the Writing/Editing and Advanced Business courses showed that the learning objectives and the CALL tools being employed in the classroom affected the proliferation of each metacognitive strategy (memory, cognitive, compensation, CALL, affective, and social). Our findings also suggested that student factors, such as cultural and educational backgrounds, may influence the use of metacognitive strategies. Individual differences, including learning preferences (Plass et al., 1998), may also play an important role in metacognitive strategy choice. The findings further pointed to the valuable role metacognitive skills can play in L2 acquisition. Anderson (2005) strongly asserts their role thus: "[u]nderstanding and controlling cognitive processes may be one of the most essential skills that classroom teachers can develop in themselves and the students with whom they work" (p. 767). Given that the findings of this study further suggest that CALL tools can play a valuable role in developing and supporting EAP students' metacognitive strategies, there is a need for further research on the positive impact educational technology may play in helping L2 learners regulate their own language acquisition and thus become more independent and motivated learners.

Pedagogical Implications

The results of this research indicate that reasoned and theory-based applications of CALL technologies in EAP contexts may help improve the metacognitive skills of students. Teachers and teacher educators should consider ways of improving the use of CALL technology to help students develop metacognitive skills and strategies. To facilitate this, teacher education and professional development should include a focus on helping practitioners employ CALL in their classrooms. Integration of CALL use should prime EAP students to better comprehend the target materials with their metacognitive skills as well as afford them opportunities to work collaboratively with increased motivation and help them develop into lifelong learners.

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Appendix A

Adapted Survey Questions on *Metacognitive Awareness Inventory* (Schraw & Dennison, 1994)

Write the response (l, 2, 3, 4 or 5) that tells HOW TRUE OF YOU THE STATEMENT IS.

l. Never or almost never true of me

2. Usually not true of me

3. Somewhat true of me

4. Usually true of me

5. Always or almost always true of me

NEVER OR ALMOST NEVER TRUE OF ME means that the statement is very rarely true of you.

USUALLY NOT TRUE OF ME means that the statement is true less than half the time.

SOMEWHAT TRUE OF ME means that the statement is true of you about half the time.

USUALLY TRUE OF ME means that the statement is true more than half the time.

ALWAYS OR ALMOST ALWAYS TRUE OF ME means that the statement is true of you almost always.

Answer in terms of how well the statement describes YOU. Do not answer how you think you should be, or what other people do. There are no right or wrong answers to these statements. Work as quickly as you can without being careless. This usually takes about 20-30 minutes to complete. If you have any questions, let the teacher know immediately.

A. Memory Strategy

1. I think of relationships between what I already know and new things I learn in English.
2. I use new English words in a sentence, so I can remember them.
3. I connect the sound of a new English word and an image or picture of the word to help remember the word.

4. I remember a new English word by making a mental picture of a situation in which the word might be used.
5. I use rhymes to remember new English words.
6. I use flashcards to remember new English words.
7. I physically act out new English words.
8. I review English lessons often.
9. I remember new English words or phrases by remembering their location on the page, on the board, or on a street sign.

B. Cognitive Strategy

10. I say or write new English words several times.
11. I try to talk like native English speakers.
12. I practice the sounds of English.
13. I use the English words I know in different ways.
14. I start conversations in English.
15. I watch English language TV shows spoken in English or go to movies spoken in English.
16. I read for pleasure in English.
17. I write notes, messages, letters, or reports in English.
18. I first skim an English passage (read over the passage quickly) then go back and read carefully.
19. I look for words in my own language that are similar to new words in English.
20. I try to find patterns in English.
21. I find the meaning of an English word by dividing it into parts that I understand.
22. I try not to translate word-for-word.
23. I make summaries of information that I hear or read in English.

C. Compensation Strategy

24. To understand unfamiliar English words, I make guesses.
25. When I cannot think of a word during a conversation in English, I use gestures.
26. I make up new words if I do not know the right ones in English.
27. I read English without looking up every new word.
28. I try to guess what the other person will say next in English.
29. If I cannot think of an English word, I use a word or phrase that means the same thing.

D. CALL Strategy

30. I try to find as many ways, online and offline resources, as I can to use my English.
31. I notice my English mistakes and use that information to help me do better.
32. I pay attention when someone is speaking English.
33. I try to find out how to be a better learner of English.
34. I plan my schedule, so I will have enough time to study English online and offline.
35. I look for people (e-mails, video chat, and chat room) I can talk to in English.
36. I look for opportunities (web sites, applications, web-based software) to read as much as possible in English.
37. I have clear goals for improving my English skills.
38. I think about my progress in learning English.

E. Affective Strategy

39. I try to relax whenever I feel afraid of using English.
40. I encourage myself to speak English even when I am afraid of making a mistake.
41. I give myself a reward or treat when I do well in English.
42. I notice if I am tense or nervous when I am studying or using English.
43. I write down my feelings in a language learning diary.
44. I talk to someone else about how I feel when I am learning English.

F. Social Strategy

45. If I do not understand something in English, I ask the other person to slow down or say it again.
46. I ask English speakers to correct me when I talk.
47. I practice English with other students.
48. I ask for help from English speakers.
49. I ask questions in English.
50. I try to learn about the culture of English speakers.