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How do CALL Programs Affect the Literacy Skills of English Language Learners?

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Over the past decade, many English language education programs have incorporated computer-assisted language learning (CALL) programs in their classrooms. For example, institutions have adopted specially designed computer software programs for language learners or have utilized the Internet in reading classes to expose students to authentic English texts. Other institutions have set up Local Area Networks (LANs) or developed computerized bulletin boards to facilitate student-to-student feedback on writing. Although CALL programs are being used in language classes throughout the world, there is not yet a solid understanding of their effect on the literacy skills and behaviors of English language learners. As more institutions make use of computer-mediated instruction, it becomes increasingly important for educators to understand how computer technology affects language learning and be knowledgeable about which technologies have proven to be effective.

This paper will examine five recently published research studies that address the impact computer technology has on ESL/EFL students' reading comprehension skills, strategy use, vocabulary retention, writing skills, and learning preferences. The analysis of these research studies will include a brief description of the methods used in each study, a discussion of the important findings, and an evaluation of the conclusions drawn by the authors followed by suggestions for future research. The implications the current research findings have for instructional practices will also be presented.

Web-based Reading vs. Traditional Print Reading

One research study investigated whether web-based reading is more effective for improving comprehension levels than reading traditional print texts. In this study,



Stakhnevich (2002) designed a research project that allowed her to compare the posttest scores of ESL students assigned to self-directed reading tasks that utilized both mediums of instruction. For her study, Stakhnevich created an original text on the history and culture of the state of Mississippi. The text was developed into a web-based resource that included multimedia features such as graphics, animations, hyperlinks to vocabulary definitions and an online dictionary. A traditional print version was also developed that included the same information as the web resource, but utilized typical print features such as static illustrations, traditional glosses, and a bound copy of the dictionary. Stakhnevich tried to determine which medium would be more effective for teaching content and whether students with higher proficiency levels benefited more from the activity than students with lower proficiency levels.

Thirty adult students (16 females and 14 males) from 10 different countries participated in Stakhnevich's study. All of the students had recently moved to the United States to attend programs at the University of Mississippi. None of the students had ever lived in an English-speaking country nor had they ever visited the U.S. prior to their enrollment. On the basis of the students' TOEFL scores, which ranged from 400 to 647, they were divided into two subgroups: those who scored at or above the median score of 597 and those who scored below. Participants in each subgroup were then randomly assigned to three different groups: a control group, a group that read the web-based text, and a group that read the traditional print version.

During the two-hour experimentation session, all participants completed a demographic study and a computerized pretest. The two treatment groups were told to learn as much as possible about Mississippi culture and history through independent reading in their respective mediums while the control group watched a video and engaged in a teacher-led discussion on a completely unrelated topic. At the end of the session, all participants completed a posttest.

In her analysis of the posttest scores of the students in the various groups, Skakhnevich found that the ESL students in both treatment groups achieved significantly higher scores than the students in the control group. For example, the pretest means of the students in the web group, traditional print group, and the control group were 10.6364, 11.4, and 10.5 respectively while their posttest means were 18.3636, 16.9, and 11.6 respectively. She also found that the ESL students who utilized the web-based resource achieved a significantly higher level of reading comprehension than those students in the traditional print group. Thirdly, she found that there was no significant



difference (at the .05 level of significance) between the students with higher TOEFL scores and the students with lower TOEFL scores. Skakhnevich concluded that the medium of instruction can have an impact on reading comprehension levels and that the mode of web-based instruction results in better performance than using traditional print texts. She also concluded that students at varied levels of proficiency, at least as measured by TOEFL scores, benefit equally by learning through the kind of content-rich, self-directed reading activity used in her study.

The results of Stakhnevich's study suggest that there might be a discernable advantage to adopting the type of CALL technology she utilized in her study. However, generalizations cannot be made with certainty because her study was conducted over a short period of time and included only a small sample size. Also, there are other factors that were not explored in the study that may have contributed to the findings. For example, individual differences such as age, country of origin, native language, gender, and previous English experience or psychosocial factors such as motivation and learning style preferences might have influenced the participants' performance. In order to produce more generalizable outcomes, similar research projects in the future may want to take these factors into consideration and be conducted over a longer period of time with a larger number of participants.

Further research is also needed to investigate precisely which multimedia features aid the comprehension process and how those features interact with students' preferences or influence their behavior. For example, in her study, Stakhnevich only briefly mentioned that the web group, which had significantly higher scores, spent slightly more time on the assignment than the other groups. Perhaps the many options and easily accessible reading supports of the web text raised student interest and motivation to read more, or perhaps these features were considered distractions that caused students to lose concentration and thus take more time. Future research that examines whether various features of web resources are beneficial or distracting to learners would be useful to ESL educators.

Hypertext-specific Reading Strategies

A second research study examined the types of strategies students use when reading hypertext. Konishi (2003) utilized a think-aloud activity to look into the behaviors and strategies ESL students use when reading authentic texts on the Internet. Konishi videotaped students as they completed reading tasks online and traced their navigation



of websites through a tracking system loaded onto the computer. The students in Konishi's study met with her individually for a 1½ -hour session and completed a questionnaire concerning their familiarity with hypertext, cognitive preferences, and English proficiency. The students also received instruction on how to engage in the think-aloud protocol and were interviewed after the session to give their reflections on the activity. Konishi's research tried to determine whether students use strategies to read hypertext similar to those used to read print text, what strategies might be unique to hypertext, and how familiarity with hypertext and proficiency in English might influence strategy use.

Six international students from Japan who were studying at a university in Melbourne, Australia, participated in Konishi's study. The four females and two males in the study had different majors, and their TOEFL scores ranged from 525 to 627. Their lengths of stay in Australia varied from six months to four years and their experience with using the Internet varied from three and a half to seven years. The students' reported weekly Internet use ranged from five to ten hours, and only two students reported that they enjoyed reading web pages. Only one participant reported that she read footnotes often and was also the only student who reported that she did not like to read text with pictures, tables, or graphs. During the think-aloud session, all participants, except one, opted to complete the protocol in Japanese.

Each participant was asked to complete two tasks and think-aloud as the tasks were completed. The first task required students to utilize strategies for an open-ended task that involved free browsing, skimming, and careful reading. Participants were asked to browse through the site of a popular Melbourne newspaper, choose an article of interest to them, read through the article, and then report to the researcher about its content after the session. The second task required students to use searching and scanning strategies. For this task, participants were asked to use a popular search engine to locate specific information about Australian Aboriginal languages and report their findings to the researcher after the session.

From the think-aloud data, Konishi found that every student used cognitive and meta-cognitive strategies similar to those typically used to read traditional print text. For example, students commented on word meanings or pronunciations, utilized their background knowledge, made inferences, set goals for reading, monitored their understanding, and revised their strategy use. However, because of the nature of the Internet, with its multiple layers of text, students utilized cognitive strategies that are



not commonly used in ESL classes. These strategies included checking the consistency between two sources or evaluating the importance or the validity of texts. Students also used meta-cognitive strategies specific to reading hypertext such as deciding what key words to enter, which menus to search, or what Web pages to open. Additionally, Konishi recorded numerous examples of hypertext-specific navigational strategies employed by her subjects. For example, students scrolled through text, clicked links, and used multiple windows. She noted that students also encountered difficulties when navigating through web pages, such as clicking on links but not finding pages or not being able to download pictures. Konishi also found that several of her subjects went off task during the protocol because they were tempted to search through pages of personal interest, but which were of no relevance to the assigned tasks. The most significant finding from Konishi's study was that hypertext reading requires a great deal of cognitive flexibility because readers must constantly integrate new information and monitor their understanding. Students needed to continuously make decisions about what content to access and what sequences to take, including when and where to start and finish reading.

This research study provides ESL educators with an insightful look at the actual behaviors of students and the strategies they utilize when reading on the Internet. However, it does not allow for reliable generalizations because the data was collected from a small sample size of Japanese ESL learners who all had a high degree of computer skills. Further research is needed to see if ESL learners from different countries and language backgrounds with varying levels of hypertext familiarity utilize the same strategies or perhaps others that were not found in this study. Moreover, Konishi never thoroughly analyzed how the learner variables of familiarity with hypertext and English language proficiency may have influenced the data she collected. She also never reported whether the students were able to successfully locate the information they needed, so it is unclear whether the strategies the students used helped them complete their assigned tasks. Future follow-up studies may want to include a broader population of students and evaluate how learner variables, such as computer experience, reading rates, or second language proficiency levels affect the types of strategies students use. Research that investigates what strategies help students navigate through difficulties online, or studies to determine what types of authentic hypertext reading tasks are most interesting and/or beneficial to students would also be useful to ESL educators.



Electronic Dictionaries and Vocabulary Retention

A third research study investigated how students utilize dictionaries built into CALL software programs and whether there is a relationship between students' dictionary preferences and vocabulary retention levels. Laufer and Hill (2000) designed a study to investigate ESL and EFL learners' ability to remember vocabulary definitions after having the opportunity to access various kinds of dictionary information while completing a reading comprehension exercise. Their study utilized a computer program called *Words in Your Ear* that consisted of four parts: a pretest of the words targeted for investigation, a text in which those words appeared highlighted, information about each target word in the form of five dictionary options (definition in English, translation into Hebrew or Chinese, word pronunciation, root, and "extra" information), and a tracking system that kept a log file of every option selected. The 12 words the researchers targeted in their study were confirmed in a pilot study to be the most unfamiliar. Laufer and Hill sought to determine what percentage of words were remembered, whether different lookup preferences were associated with different retention levels, and whether there was a relationship between the number of lookups and retention of word meanings.

The participants in the study were 32 EFL students from the University of Haifa in Israel and 40 ESL students from the University of Hong Kong. Both the Israeli and Chinese students were taking English for Academic Purposes and had at least seven years of English education prior to their university studies. The Chinese students' mean proficiency score on the TOEFL was 570 and the Israeli students had all scored 1-1.5 standard deviations above the mean on the reading comprehension section of the TOEFL.

Both groups of students followed the same 3-stage experimental procedure. First, the students completed the pretest of the *Words in Your Ear* computer program. Second, they were given 10 minutes to complete the computerized tutorial that displayed the text with the highlighted words. Third, students were given a surprise vocabulary test that asked them to write the meanings of the target words in either their native language or in English, after which they were given a comprehension exercise. Students were told that there would be a reading comprehension exercise after the tutorial and encouraged to use the dictionary information options to look up information about the highlighted words in the text. Students were not informed that there would be a vocabulary posttest so that the researchers could analyze the amount of incidental vocabulary learning that occurred through the reading task.

Laufer and Hill found that every participant looked up all the target words, but



the groups showed very different retention levels and lookup behavior patterns. For example, the Chinese students gave correct definitions for 62% of the words, whereas the Israeli students correctly identified 33% of the words. Most Israeli students (72%) preferred to look up unknown words in their native language of Hebrew. In comparison, only 12.5% of the Chinese students selected translations in their native language. Most Chinese students (38%) selected word meanings in Chinese and/or English along with “extra” information, such as other forms of the word, phonemic transcriptions, or related meanings. The Israeli students’ highest retention score (45%) was obtained by those learners who looked up words in English and Hebrew in equal proportions, whereas the highest retention score for the Chinese group (79%) was obtained by students who preferred to look up word meanings in English. Laufer and Hill also found that there was no significant relationship between the number of lookups and correct retention.

This research study demonstrates that multiplicity of lexical information tends to be associated with better retention. In spite of the differences between the two groups, the use of native language translations together with English definitions lead to good vocabulary retention. The findings also suggest that there is no one particular lookup strategy that results in better retention for all students. One limitation of Laufer and Hill’s study is that it could not explain why the Hong Kong learners outperformed the Israeli learners. The researchers mentioned that the Chinese students spent more time on the tutorial (full 10 minutes) than the Israeli students (5-6 minutes). This difference in time spent on the reading task might be a reflection of the students’ motivation or task diligence. Also, because the stated goal of the task was reading comprehension, not vocabulary learning, the Israeli students might have paid greater attention to the text as a whole rather than focusing on the meaning of each word.

Future studies that examine why lookup strategies work differently for different groups of learners would be useful for English teachers using electronic dictionaries in their classrooms. Factors such as the specific features of students’ native language or prior dictionary training may need to be considered. Longitudinal studies could also help determine how CALL programs aid ESL/EFL students’ long-term retention of vocabulary.

LAN Classes vs. Traditional Writing Classes

The fourth research study looked at whether LAN computers improve the writing skills of ESL and EFL students. Braine and Yorozu (1998) examined the effectiveness of LANs through a review of studies by several researchers that measured the quantity and



quality of students' essay writing and peer feedback. These studies reported the number of words written by students in LAN classes as well as the number of messages students contributed to LAN class discussions. These studies also compared the first and final drafts of essays written by students in LAN classes to those written by students in traditional writing classes and compared the student discourse patterns and behaviors during the peer review process in both classroom environments.

Braine and Yorozu found that LAN technology elicited a high volume of writing from students and a high percentage of participation. For example, in one study involving 14 students in Hong Kong, all 14 students participated in the LAN discussion and generated 99 messages during a 105-minute class. In two other studies measuring student output during peer feedback sessions, the researchers found every student participated in the small group LAN discussions and that at least 71% of the interactions were between students. The researchers found this to be very different from the 60-80% of classroom speech that is attributed to teachers in traditional language classes.

Although LANs proved to elicit a high quantity of writing and active class participation, Braine and Yorozu could not find conclusive evidence that LANs enhance writing quality more than traditional writing classes. They compared four different research studies that measured the changes in scores between first and final drafts of students in both LAN and traditional writing classes. In only half of the studies were the final drafts of students in LAN classes of higher quality than those in traditional classes. Also, in three of the studies, essays written by students in traditional classes showed more improvement between the first and final drafts than those written by students in LAN classes.

In regards to the peer review process in the two environments, Braine and Yorozu found that traditional classes produced more feedback than LAN classes as determined by word count. For example, in a study of 100-minute peer review sessions, students provided an average of 694 words of verbal feedback in traditional classes, whereas students in LAN classes wrote an average of 334 words. Braine and Yorozu also found that students in the two classroom settings exhibited very different behaviors and discourse patterns. For example, students in traditional classes gave holistic feedback, took turns speaking in an orderly fashion, provided feedback in narrative form, and responded immediately to their peers' comments. Feedback in LAN classes was found to be more sporadic and unorganized. Students in LAN classes selected which essays to



review arbitrarily and many students did not react to feedback made by their peers.

Braine and Yorozu's analysis of current research on the effectiveness of LANs is useful for understanding both the advantages and disadvantages of using computer networks. One limitation of their work is that there was no discussion about the content of the students' essays. It is unclear which aspects of the students' writing differed or improved between drafts. Also, the quality or amount of teacher instruction and interaction was not taken into consideration. Future research may want to investigate what types of students or class sizes can benefit most from the use of LAN technology, or what aspects may negatively influence student motivation or ability to follow the flow of ideas generated in LAN discussions.

Computer Anxiety and Learners Preferences in Writing Classes

A fifth research study examined how computer anxiety affects students' learning preferences and performance in EFL/ESL writing classes. Matsumura and Hann (2004) designed a study to measure student comfort levels with computers and the amount of improvement in their essay writing after the opportunity to receive different forms of feedback. Matsumura and Hann's study attempted to determine whether students' levels of computer anxiety were related to their preferred methods of feedback on their writing and whether the degree of improvement in their writing was related to their chosen feedback methods.

The participants in Matsumura and Hann's study were 218 college-age students in four beginning-level and four intermediate-level EFL writing classes at two private universities in Japan. The students had roughly the same level of computer experience, and the majority had taken a semester-long introductory computer course.

At the start of the study, students completed a questionnaire on computer anxiety and then, as part of their graded regular coursework, wrote a formal essay on the topic "Should English education begin in Japanese elementary schools?" using a standard five-paragraph format. Students were required to submit a rough draft at the end of the first week, make appropriate improvements as suggested by the teacher's feedback, and submit a final draft at the end of the third week. Students were not given time to develop their essays in class, but they did receive instruction regarding essay structure and mechanics. The essays were evaluated by two instructors on five criteria, for a possible total of 20 points. Students had several feedback options: receive direct feedback from teachers and peers by posting drafts to the online bulletin board, receive



indirect feedback by viewing drafts written by peers along with the teacher's suggestions, or receive face-to-face feedback by visiting the teacher to discuss improvements. Students had the freedom to use any or all of the options as well as none of them.

Matsumura and Hann found that the students with higher levels of computer anxiety chose feedback methods that involved no computer use, whereas the students with lower anxiety levels chose feedback methods that involved computer use. The researchers also found that the students who received all the available forms of feedback (posting drafts online and receiving online and face-to-face feedback) showed the most improvement in their essay writing. Matsumura and Hann's results also showed that receiving any two forms of feedback in the revision process benefited students more (about a 2 point gain) than receiving only one form of feedback (about a 1 point gain) or none at all ($\frac{1}{2}$ point loss). The researchers found no significant difference in the degree of improvement between the essays of students who opted for online indirect feedback only and the essays of students who opted for face-to-face feedback only.

The results of this study suggest that providing multiple feedback options is effective for improving students' writing and that classroom feedback methods should match the preferred feedback styles of individual students so that computer-anxious students are not put at a disadvantage. One limitation of this study is that it did not collect data that measured anxiety over face-to-face interactions, which might have influenced learners' feedback preferences. Also, the disproportionately small number of students who chose to post their essays online (only 13) made it impossible for the researchers to perform statistical tests to compare that group of students with others. To encourage more students to post their drafts in future studies, researchers may want to assign un-graded writing tasks or guarantee the anonymity of authors. Future researchers may also want to examine the effectiveness of various forms of feedback on student essay writing over the course of a semester or year, explore changing levels of computer anxiety, or investigate the feedback preferences of learners from different age groups or nationalities.

Implications for Educational Practices and Conclusions

The five research studies reviewed in this paper suggest that computer technology can be utilized to enhance the literacy skills of English language learners. However, the implications these findings have for educational practices vary depending on the type of technology. In the first three studies, which incorporated reading comprehension



exercises, the findings imply that teachers should utilize web-based texts in the classroom, teach hypertext-specific strategies to help students navigate through web pages, and provide students with a variety of dictionary options when assigning tasks that involve the understanding of unfamiliar words. In the last two studies, which analyzed how computer technology can improve students' writing skills, the main teaching implication is that educators should not rely solely on computer-mediated instruction in writing classes. While LANs were shown to encourage high productivity and participation, traditional forms of instruction may work better for improving the quality of students' writing. Teachers should also provide classroom feedback that is matched to students' preferences, which may mean not utilizing computers if it causes high levels of anxiety in the learner.

In conclusion, future research is still needed to obtain a clearer picture of how computer technology affects the literacy skills of English language learners. It is the responsibility of educators to incorporate the CALL programs that best meet the language needs and learning styles of their students. Although CALL programs can offer students and teachers many learning options, caution needs to be taken before educators assume that computer-mediated instruction is suitable or beneficial to every student.



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