**Flashcard-based design and spaced repetition in Computer Aided Language Learning (CALL): a literature review**

**Abstract**

**Purpose** – This literature review’s purpose is to address the following questions: How does the design of a flashcard-based Computer Aided Language Learning (CALL) application affect a user’s ability to acquire and retain language? What effect does spaced repetition have on the acquisition and retention of language in CALL applications? What other learning techniques can be used with such CALL applications to increase the efficiency of language acquisition and retention?

**Methodology**

*Search and selection strategy*

Google Scholar and the University of Portsmouth’s library Discovery and catalogue search to find papers and books to get a rough feel and overview of the topic areas, journals and research.

Scimago Journal and Country Rank was then used to find narrow down findings to journals that are reliable and peer reviewed. Papers related to computer assisted learning will be limited to papers from the past 11 years (2007 and onwards) to ensure relevancy.

*Refining the search criteria*

* *English only*
* *Papers on Japanese language favoured over others*

Journals of interest and relevance are:

* Computers and Education
* Journal of Computer Assisted Learning
* Language Learning
* The Modern Language Journal
* Studies in Second Language Acquisition
* Computer Assisted Language Learning
* Language Learning and Technology
* Journal of Experimental Psychology: Learning Memory and Cognition
* Brain and Language
* Journal of Memory and Language
* Language & Communication

The papers found in language and linguistics journals will be limited to second language acquisition and selected upon relevance to language acquisition.

The papers found in psychology journals will be selected upon relevance to language acquisition and its relationship with technology.

**Findings**

**Research limitations**

**Practical implications**

Introduction

This literature review uses a combination of academic papers, books, internet webpages and existing systems to answer some important questions that will have a large impact on the design of the application. These questions include: How does the design of a flashcard-based Computer Aided Language Learning (CALL) application affect a user’s ability to acquire and retain language? What effect does spaced repetition have on the acquisition and retention of language in CALL applications? What other learning techniques can be used with such CALL applications to increase the efficiency of language acquisition and retention?

Knowledge obtained because of doing this literature review will be turned into requirements for the application.

**Advantages and dis-advantages of flashcard-based interfaces**

**Flashcard design**

* *Note specifications for certain devices and operating systems*
* *Discuss any other design elements*

**Spaced repetition and the Leitner system**

* *Forgetting curve, Leitner algorithm*

**Spaced repetition algorithms**

* *Discuss the many different implementations of the SM2 algorithm and its flaws*
* *Discuss other algorithms*

**Conclusions**

***Notes on research papers written up as paragraphs***

Language learning has dramatically increased in accessibility to the public in recent years due to the advancement in technology and software development. Before the huge step in functionality with the Apple iPhone in 2007, many language learning projects where constrained by poor audio quality, limited storage capacity, poor internet connectivity, difficult text entry and low-resolution screens on older handheld devices, Godwin-Jones (2011).

As a result of the boom in mobile technology, we currently have an abundance of language learning software, a lot of which are just simple apps with no real research on language acquisition to back up their teaching and learning methods.

Second Language Learning and Acquisition

There are a variety of different approaches currently being used to learn second languages and while often these are intertwined together in a variety of ways, there are two main approaches that people tend to choose.

The first is where one learns the “building blocks” of a language with a bottom-up approach, starting from the basics of the language’s grammar and vocabulary, learning how to string sentences together and how the language’s alphabet is pronounced. A good example of this would be standard language classes that use a textbook as the main material and where a teacher takes you step by step through different structures. According to Krashen (1982) this is language *learning* and refers to conscious knowledge of a second language, i.e. knowing the rules and being able to talk about them and that this is independent from language *acquisition.*

The second is to use a top-down approach where one spends as much time exposed to the foreign language as possible and the idea is that the longer and more time you spend with the language, the more you will become able to understand and output. This type of approach is common in immersion or bilingual programs used in schools in countries where there are one or more official languages, for example in Canada where both English and French are official languages (Central Intelligence Agency, n.d.). Immersion-based strategies work better than standard classes and going abroad to a country which speaks the target language according to research by Freed, B. F., Segalowitz, N., & Dewey, D. P. (2004). Krashen (1982) suggests that these two approaches are in fact two distinct and independent ways of developing second language competence. He states language *acquisition* to be “a process similar, if not identical, to the way children develop ability in their first language.”

The Input Hypothesis, Krashen (1982), states that “We acquire by understanding language that contains a structure that’s just beyond our current level of competence *(i + 1)*. This is done with the help of context or extra-linguistic information.” This is something that immersion learners will experience due to the massive exposure they get to the language. The more exposure one gets to the foreign language, the more chances there are of being exposed to *(i + 1)* comprehensible input. The concept of comprehensible input is now widely accepted by most applied linguists to be necessary for language acquisition, Cummins (2000).

Krashen (1982) says that conscious language *learning* helps us only as a “Monitor”, which can change the output, speaking/writing, of the language *acquisition* system before or after output. He then states that it is the acquired system which initiates normal, fluent speech which implies that conscious learning plays a limited role in second language performance. As language acquisition is the more important aspect in gaining language ability, focusing more on comprehensible input, and lots of it, will yield better results than focusing entirely on grammar and studying about the target language.In other words, if a learner of Japanese wished to reach a level where they could comprehend a native speaker, and converse with them, they would be better off spending their time reading and listening to native Japanese than by learning about its sentence structure, verb conjugations, how Kanji components combine to create meaning etc. This would imply that language learning software should focus less on trying to teach the language and instead simply providing language learners with comprehensible language aimed towards their current level so that they can acquire language through understanding the message of the content.

Learning vocabulary

There are a variety of different approaches that people use when trying to learn vocabulary in Japanese.

Analysing existing software

The quick dictionary look-up Google Chrome extension Rikaichan, is incredibly popular with the Japanese learning community.

Rahimi (2014) took thirty-four lower-intermediate language learners and divided them into two groups (17 in each group) based on their choice to work with a mobile dictionary or a printed one for their language course. The experimental group used a dictionary installed on their mobile phones while the control group worked with the printed version of the same dictionary. The result of the study showed that the experimental group outperformed the control group in the final test. This study suggests that having easy access to a dictionary straight from your phone plays a vital role in a language learners success. *This suggests to me that having a built-in dictionary look up feature would be very useful for learners.*

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