**Japanese Written Language Learning Techniques Applied to an Interactive Web Application**

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ウェブアプリケーションに適用された漢字を学ぶ手法

要旨

相互につながる世界では日々外国語を学ぶ必要性が増す。文化的問題がある可能性があるから一つの言語のみを使用して全部の国とコミュニケーションをとることは困難かもしれなくて言語翻訳ソフトウェアを使うのはまだ実用的なことではない。政府や企業は複数の言語を話すことができる従業員を求めている。日本は経済的、政治的に世界をリードしているが、日本語は非常に難しい。日本語が難しい理由の1つは漢字を勉強することである。日本で生活するのに必要な漢字は2000と言われているが、日本人は小学校一年から高校三年までかけて漢字を勉強するのである。しかし、外国人は2～4年という短い時間でその漢字を学ばなけらばならない。学生が漢字を学ぶほど難しくなるからしばしば学習ツールを使いる。

目標は、漢字の学習に役立つ効果的な学習ツールを構築することである。ピッツバーグ大学の学生の漢字の勉強したものを手助けするために色々の漢字を学ぶ戦略を調べた。以前研究を調べることによって二モニックという戦略とモチベーション戦略を考察した。学生の勉強する理由とどうやってその事を影響を与えるかについて議論した。二モニックという事とモチベーション有効性に関する複数の研究を検討してモチベーション戦略を使うことによって漢字を勉強するためのサイトが構築することができた。またJavaScriptとPythonというプログラミング言語を用いて「KanjiMaster.com」というサイトを開発することができた。

**Introduction**

As the world becomes more interconnected by the day, the need to learn multiple languages increases exponentially. Using one universal language presents various cultural issues that can be too hard to overcome, and current language translation software is not accurate enough to make its use outside of simple vocabulary viable. National governments stress the necessity to learn multiple languages to facilitate communications with other nations. Businesses and corporations desperately seek out suitable employees who can communicate with clients from a wide variety of backgrounds.

Among the major global political and economic powers is Japan, whose language is notoriously difficult for native English speakers to learn as a second language. One of the most challenging factors associated with learning Japanese is its written language, which consists of multiple sets of characters known as hiragana, katakana, and kanji. By the time the average Japanese citizen graduates high school they are expected to know at least 2,000 different characters in order to interact with the world around them. It is far easier for native speakers to pick up on kanji than foreigners in another cultural setting that is not constantly immersed in it. Non-native speakers are often expected to recognize hundreds of different characters after only a few months to a few years of study. This expectation raises the question of how this can be done effectively. The task of learning kanji through various methods such as relational story-telling and motivational manipulation will be explored and used to develop a web-based application in an attempt to further develop Japanese language learners’ abilities with the written language.

**A Brief Description of Kanji**

Kanji are morphological characters that originated in China and represent the language through a mix of meaning-based and sound-based units, as opposed to mostly sound-based units that most Indo-European language learners are accustomed to. It can be argued that English itself is not entirely phonological, having numerous exceptions on how to read certain words. However, the sheer number of kanji and kanji radicals (kanji components) that one must learn in order to make pattern recognition and radical analysis a practical option to learn quickly makes the task more complex.

The background of the learner plays an influential role when trying to teach them a new written language. Those with an English background tend to use phonological information to learn a written language. This means of learning also extends to kanji (Kubota 1). Kanji can often be broken up into radicals or subunits which can give information on how it should be read (Saito 237). Analysis is made easier in that phonological radicals have been shown to be mostly used for their phonological function (Saito 234). Thus, if a user can recognize these radicals they should be able to at least guess the reading and use other information to conclude its meaning. However, the large number of radicals that must be learned in order to do this efficiently is itself a difficult task to do quickly. Those who come from a Chinese background may have less difficulty with this task but it does not necessarily improve their results. Kanji have both native Chinese (*on*) and Japanese (*kun*) readings, and this extra requirement on learning readings is a large task for all learners to overcome (Saito 237). Various other factors can lead to different rates of literary acquisition. For example, for Japanese children phonological awareness, naming speed, and letter knowledge can predict reading attainment concurrently and longitudinally (Inomata, 2). Studies have shown that all of the above are important for literary acquisition in Japanese, especially for young children (Inomata 9).

Employing a single learning strategy that can be applied to all language students has been shown to not be an effective means of teaching. According to James Heisig, there are certain factors to consider when teaching kanji to students that could help them retain knowledge long term. First is all or nothing, in that one should either commit to learning the language in its entirety or not do it at all. Next is the order in which they learn the kanji. In order to effectively learn the kanji, one must master the simple kanji before they can move on the complicated ones (Heisig). In this context Heisig refers to simple kanji as those with a low stroke count and number of radicals. Whether this also refers to its commonality is not clear. Third is that learning different aspects of the language such as reading, writing, and speaking should be kept separate from each other (Heisig). Since each will present differing degrees and types of difficulties to the student, it is important to keep them separate in order to keep the problems associated with them separate. Finally, each student learns at a different pace. Knowing this, it becomes apparent that lessons in teaching kanji should be tailored to the student in order to maximize their ability to learn it affectively (Heisig). First, mnemonic and pictorial strategies will be discussed on how this process can be developed. Next different kinds of motivational strategies will be examined. With the information gathered from these areas of study, a web application will be developed in order to customize the educational experience to the learner.

**Mnemonic and Pictorial Strategies**

One strategy to increase the rate of kanji acquisition for non-native speakers to is to use mnemonic strategies. The tactic of creating audio or visual means by which the student can better grasp the meaning of kanji is a popular way to help them not only learn its shape but also its meaning. The use of mnemonics among second language learners varies significantly. Use of mnemonics ranges from a constantly used tactic to refusal to do so (Rose). Some students believe it is an invaluable tactic to learning while others believe it is too childish to be considered a viable means of study. Others theorize it has the potential to actually hinder the acquisition of the reading or meaning of the kanji, depending on how the mnemonic device is derived. It has been found that mnemonic devices can be of some use early on in one’s language studies. However, it is a tactic that has its limitations and one that should not be overly relied upon (Rose).

Another common strategy to learn kanji, in particular a subset of mnemonic strategies, is to use visual stimuli to form pictorial relations that the student can understand. The strategy involves breaking down the kanji into parts, usually radicals, and from their meaning or shape forming a story that somehow relates to the overall meaning of the kanji. Many studies have been done on its effectiveness. One study undertaken by Norman Lin, Shoji Kajita, and Kenji Mase at Nagoya University investigated it through the use of a tabletop computer system. In the study, participants were required to combine valid kanji components into valid kanji compounds. The kanji components were written on cards that the participants had to rearrange. Then they had to form a mnemonic device to memorize them in the form of a story (Lin 28). The results of the system suggested that the more creative the participants were with their stories the better they were able to memorize the kanji (Lin 41). The results of this study seem to suggest that letting the learner adapt the system to themselves and be creative about how they choose to learn in regards to kanji analyzation increases their learning ability.

Another study on this topic was conducted by Mariko Kubota and Etsuko Toyoda at the University of Melbourne. The study was done with the assumption that kanji were more difficult for those who came from an English speaking background. Kanji were selected by the number of kana that they could be represented by. They were also selected so they would represent commonly used words, had radicals that were recognizable to those in the study, were nouns, had no double consonants, and were completely new to those who participated in the study. All who participated were native English speakers. Participants received a list of kanji, a pencil, and paper in order to memorize the list and were encouraged to think aloud. They were given 20 minutes to study and then chatted with researchers on something unrelated for 10 minutes to rule out short-term memory for the test. They were then quizzed on the list. The study showed that the current level of Japanese proficiency in the learner does not correlate to rate of kanji acquisition. Three main techniques were used by the participants: analysis, writing repeatedly, and analysis combined with tests. According to the results of the tests, writing repeatedly was shown to have the worst results. Radical recognition and analyzation of the kanji produced the best overall results. This studies results suggests that meaningless memorization without analyzation yields poor overall results when trying to learn kanji. It also suggests that understanding the meaning behind radicals can assist with future kanji acquisition.

Another kanji study tactic to examine is the idea of air writing. *Kusho*, or the manual tracing of kanji on the hand, on a desktop or in the air is a common means for native speakers to learn while in school. It is also used as a means to avoid miscommunication when speaking about the written language. *Kusho* is a means of studying that gives the learner kinesthetic and visual feedback on the kanji under examination. It has been proven to show better results on memorization than iterative writing. However, it seems to have its limits when the kanji reaches a certain threshold of difficulty for the individual learner (Thomas). This study suggests one of the keys to helping learners memorize kanji is to provide connections with other types of stimulation in order to more permanently plant its meaning or reading in the mind of the student.

**Motivational Strategies**

Motivation is one of the greatest influences on language study patterns. Different studies have explored the effects of motivation on the ability to learn languages such as Japanese. An example of these studies that examined its effects was investigated a mobile-phone email based application. The user would send a text message to the system to request a kanji quiz. After filling in the results of the quiz the user would send it back, the system would automatically grade it, and it would send back the results to the user (Li 521). Although this is a fairly outdated approach to kanji applications that was developed before the prevalence of smart phones, some of the features and results of its effects on users are still applicable. To try to keep users interested in the application, it would dynamically change the vocabulary being tested and the difficulty of said vocabulary (Li 523). In addition to this, it would periodically send the user an email if they hadn’t used the application after a certain period of time (Li 524). Although the application does not place its focus on keeping the user interested in learning kanji, it does try to make use of motivational strategies to engage the user in vocabulary that he/she wanted to learn and found that some of their effects to be beneficial.

A study carried out by Akie Hirata motivational effects on kanji studies. Hirata described three types of motivational orientations: intrinsic orientation, instrumental mastery, and performance orientation. Four different sources of motivation were also listed. They included self-efficacy, self-concept, intrinsic value, and extrinsic value. Hirata also described cognitive, metacognitive, behavioral, and environmental self-regulation factors (Hirata 87). In this study he explored motivational patterns of Japanese language students and analyzed what strategies and motivational patterns led to the most success in kanji studies. Those in his study were more likely drawn to instrumental mastery of kanji followed by intrinsic value. In terms of the actual learning of kanji, they placed some extrinsic value on the practice (Hirata 87).

The results of Hirata’s studies led to some conclusions on how motivation can be used to enhance kanji studies. According to his results, practice outside of the classroom may foster motivation and self-regulation in the learner (Hirata 90). In order to improve results in the learner it is suggested that the teacher be aware of the cultural interest of the learner when teaching and use appropriate teaching methods to do so (Hirata 91). The study also produced results on how other students can negatively affect each other and how the teacher can negatively facilitate this. Hirata notes that the teacher should not threaten self-concept of students by forcing learners to compete with each other (Hirata 91). Some studies have shown effects on how it can enhance performance in the work place, but those results may not be applicable to a classroom setting. Instead, they should be rewarded for their efforts in order to build upon their self-worth as a student. To protect self-efficacy, the teacher should develop conditions so the student can experience mastery of the subject. This would include fostering familiarity for the task at hand to bolster the student’s sense of capability with kanji. It also becomes important to encourage the student to use the language outside of the classroom to foster their own interests (Hirata 91). All of the stated results are worth noting for the focus on the individuality of teaching methods for the student. It suggests that kanji studies should be more tailored to the individual rather than to a group task. This method could facilitate the learner’s own interests and reasons for learning the language as well as to isolate them from those who learn at different paces.

In order to better understand the motivational problems of studying kanji the different levels of commitment required must be considered. According to Heath Rose and Lesley Harbon, there are multiple levels to take into account. First is commitment control and preserving the learner’s goals in kanji studies. Learners at higher levels of literacy tend to have more difficulty with commitment strategies than those at lower levels. This stems from the sheer work load and commitment required to learn high numbers of kanji at a time. Due to this they tend to set higher goals that grow increasingly impossible to achieve. On the other hand, lower level learners tend to be less serious in their studies of the language. They set goals that aren’t as serious and set more short term goals than those who were more literate (Rose and Harbon). These results vary due to the importance of considering the level of the learner when focusing on motivational strategies. It is something that should be further customized to the learner and will be far different for different levels of literacy. To increase improvement for high level learners, it was recommended for them to set specific, short term goals for their studies and to break up long term goals into smaller ones. These suggestions have be shown to increase learning rates by 50 percent (Rose and Harbon). To tailor the learning program for a learner, one should assign larger goals to first time students and over time create smaller, more specific goals for kanji studies.

The second motivational roadblock to overcome is emotional control. Due to the difficulty of learning kanji students tend to become more frustrated with their progress the longer they study the language. It creates a sense of defeatism and lack of self-confidence that becomes increasingly a hindrance to future progress. Early in the kanji learning process this is not as much of an issue. Learners will see more immediate progress early on so they feed off of it and want to learn more from it (Rose and Harbon). The idea of emotional control provides a difficult challenge to consider. To curtail its possible negative effects, the teacher must remind the user to be realistic in their goals to learn kanji and that kanji becomes increasingly more difficult as more progress is made. Positive reinforcement of current progress could also be used in order to boost the learner’s confidence.

Another motivational aspect to consider is satiation control. As time progresses with one’s kanji studies it becomes easy to lose motivation to continue due to boredom. Lower level learners see kanji as something new, foreign, and fascinating. They are able to focus on it more easily as a result. However, as their studies continue it becomes so familiar to them that it becomes boring, routine, and mundane (Rose and Harbon). This is an issue that is not quite as difficult to solve since it can be reduced by a change in the way one studies. It is recommended to break up study sessions with something unrelated to keep the learner focused. Another way to increase interest is to use a reward based system of study, a system of self-gift giving to ensure that goals can be met more easily (Rose and Harbon). Other factors can improve this as well. One can develop techniques to change the way they study, such as implementing a study game or trying to apply their knowledge of kanji to cultural aspects. Relating the learned material to something that interests the learner can also improve satiation control. Encouragement to change study locations may help as well.

The topic of quizzes as related to kanji motivation is controversial. In can have both positive and negative short term effects in that it can easily show progress to the learner (Rose and Harbon). However, it can also lead to competition with other students to achieve high grades. This could either positively or negatively affect motivation, depending on the student. It is important to demonstrate to students how the quizzes can relate the achievement of short term goals of learning kanji to the learner in order for them to not see them as a hindrance. Some studies have shown other ways in which a user can become more motivated to learn kanji. One study showed that students tend to learn kanji more effectively if they learn the vocabulary and corresponding kanji that they want to learn. In order to make their accomplishments with this into a malleable achievement, the researcher had the students create their own dictionary of kanji. This helped them relate some of the different aspects of kanji, including shape, *on*-reading, *kun*-reading, and meaning/reading in context of a given compound. Other ideas in the study were different activities that enabled the learner to become more engaged with the kanji learning process than what a quiz could attain (楊敏4).

**Web Application Development**

To narrow the focus of the application it has been decided to put emphasis on motivational enhancement techniques in order to keep the user interested both in using the website but also learning kanji in general. The only aspect of the Japanese language that this site tries to teach is literacy. It does not in any way teach grammar, speaking, writing, or any other language skills in order to narrow its scope and make the task of learning kanji more focused. It is assumed that the user has a fair grasp on some of the basics of Japanese grammar before using this site.

Simple quizzes were chosen to provide a way to develop a sense of accomplishment and progression for the user. Although allowing the user to choose which kanji they shall be tested upon is a good way to keep the user engaged in the process, the desire to keep the site simple enough to use and to abstract away the process of entering in vocabulary onto the user’s profile led to the decision to give the user a predetermined set of kanji to study from. To try to minimize any negative effects that could be brought about by the use of quizzes users’ results are kept isolated from another. A public leaderboard of the top users could inspire a user to achieve more, but it was chosen not to implement due to any demoralizing effects it could have. To compensate for this other motivational strategies were implemented instead.

One of the first tasks of developing the website was determining what kanji to incorporate into its database. Because the order of kanji is not necessarily the topic under consideration in the development of this site an approach that corresponds with an established textbook was chosen. Only a sample of its kanji and vocabulary were selected. The approach undertaken in *Japanese: The Written Language Field Test Edition Part 1* by Eleanor Harz Jorden and Mari Noda was chosen due its association with the University of Pittsburgh’s Japanese language curriculum. It also has a corresponding spoken language textbook whose vocabulary aligns with it, giving it another advantage. The order in which kanji are presented corresponds with commonality of usage. Kanji that are used more often in practical settings are chosen over those whose meanings can assist with radical analysis or even number of strokes required to write it.

Upon visiting the site the user is required to sign up for an account via the sign up page. From there they can log into their account and visit their personalized home page, consisting of multiple tabs from which the user can do various tasks. The default tab loaded upon login is a page briefly explaining the functions of the website and the research that was gathered to create it. There is also a quiz tab, where the user can take quizzes on various sets of kanji from the aforementioned set. Each quiz will consist of 30 questions where the user must match the kanji or kanji compound to the correct reading in hiragana out of 4 choices. The reports tab consists of all of the grade reports from the users completed kanji quizzes. Upon completion of a quiz a report will be sent to the website and overall statistics taken from all of the quizzes shall be presented the user along with a history of all reports. The kanji sets tab holds all of the kanji that the site offers for study. The default option is to display all kanji at once, but users may filter out kanji for a specific lesson that they desire to learn. Lessons shall consist of 30-40 kanji and kanji compounds. Their hiragana readings and English meanings are also displayed. The mnemonics tab displays all mnemonic devices created by the user. If the user selects a wrong answer in the kanji quizzes, they have the option of creating a mnemonic device to help them remember said kanji/kanji compound. However, this is optional due to the controversial nature of mnemonics. The user has the option to turn off mnemonics entirely if they choose. Finally is the user settings tab, where the user can check their user information, change email addresses, change passwords, and anything related to their goals for the site.

Next is the issue of how the site should tackle motivational sustainment. A way to control and keep the commitment of the user is to set goals and remind the user why they are learning the language. When the user signs up, they must fill out a short text box with the main reason they are studying Japanese. This statement will be posted on the homepage every time the user logs in to remind them of this, and it can easily be changed if the user so desires via user settings. This will act as their long term goal at which they will work over time. Users will also be required to create weekly short term goals for their studies. The system reminds the user to try to keep their kanji acquisition low, around the order of 10 per week. This is to ensure that their short term goals are achievable. The recommended range for the goals will be 5 to 15 kanji per week. New goals are to be set every week. The use of outside resources to further gain knowledge and promote cultural interest in learning kanji will also be implemented. This will consist of links to outside language resources such as *The Asahi Shinbun* and other free literature sources. Increasing visual appeal of the site will come in the form of theming the site around anime, a common interest among those learning Japanese at the university level. Animated characters will act as visual accessories and will become animated upon when the user selects the correct answer in the quiz to promote a small sense of satisfaction, reward, and progress towards their goals. The color scheme can also be changed at will by the user. The original intent was to have color schemes change automatically as the user completed more lessons of study on the site in order to provide a greater sense of progress. However, due to the short-term use of this site they were made directly available for the user to implement at their desire as a means of increasing visual appeal. To distance the site from that of a dry educational setting to that a user fill find more interesting the site uses different vocabulary on how the user should learn kanji. For example, the site refers to quizzes as adventures and color changes of the site as gemstones.

Lastly, the technical details of KanjiMaster.com shall be discussed. The backend is programmed primarily in Flask, a micro-framework written in Python. It acts as the code to run the server, handle user traffic to visit the site, and request any information available from it. Because Flask is a micro-framework, it does not have a built-in database to store and manage data about kanji, user information, and quiz reports. To solve this, an object relational model known as SQLAlchemy was used to implement a database. It includes four main tables to store its data. First is used to store user related data such as name, username, and email address. All passwords are securely encrypted, salted, and hashed using the bcrypt hashing algorithm to ensure user accounts are as secure as possible. The second table stores information regarding user quiz reports. This includes the date, lesson quizzed upon, and percentage of the questions answered correctly. Another table stores all kanji that the website can teach the user. The last table stores information about any mnemonic devices that the user has created.

The front end of the website was done primarily with JavaScript, HTML, and CSS. In order to reduce the amount of code for the site written in HTML, a templating tool known as Jinja2 was used to write a base template for the rest of the pages. This was mainly used to write the main framework of the web page visible to the user, with the details of the specific pages being filled in with more specific code. In order to handle requests from the server and make the site more interactive, JavaScript was used to manipulate page actions. Some of these would include sending quiz results to the server, changing which tab was open to the user on the home page, and password requirement checks on the signup page. The link to the website can be found here: http://jcc117.pythonanywhere.com/.

**Conclusion**

With all of the techniques stated above an interactive website that tutors the user in kanji was developed. Its focus primarily lies with motivational tactics used at keeping the user engaged throughout the rigorous process of becoming literate in Japanese. Mnemonic devices were also implemented but were made optional due to its polarizing reaction among language learners. The presented research gives it some basis for its effectiveness, but its results have yet to be analyzed. This site provides a different approach to language studies that will hopefully lead to further research and development into an application that can help even more people study a variety of different languages.

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