

# Think-Aloud Protocol on Dictionary Use by Advanced Learners of Japanese

Yoshiko Okuyama

Hiroko Igarashi

The University of Hawai'i at Hilo

*In what media (e.g., paper or online) and how do advanced learners of Japanese use bilingual (L1-Japanese/Japanese-L1) and monolingual (Japanese-Japanese) dictionaries? This qualitative study reports on how university students of advanced Japanese classes used different dictionaries to meet their homework needs. The main methodology of the study is a think-aloud protocol (TAP), supplemented with a questionnaire and an L2 proficiency test. Results showed that these students had similar purposes for consulting dictionaries yet used a different combination of media (paper, electronic and online types) and highly individualized search strategies. Moreover, some connections were noted between L2 sub-proficiency levels and efficiency in selecting a dictionary and a search strategy appropriate for a specific purpose.*

**I**n first language acquisition, children with strong reading skills are faster and more accurate in looking up words in a dictionary (Beech, 2004). In second language acquisition, effective dictionary use appears to help language learners, too, particularly to meet with the demand of daily class preparation. Yet, "little is known about how learners make use of a (bilingual) dictionary to help understand text" (Liou, 2000, p. 467), and only a few studies (e.g., Loucky, 2005) have investigated word search strategies with the use of dictionaries by L2 learners. One reason for little research on this topic might be relative difficulty in gathering reliable data on how they actually use their dictionaries. **Adapting the Think-Aloud Protocol methodology, this study documented advanced Japanese learners' mental processes of consulting their dictionaries for different search purposes and analyzed the data at a level deeper than a survey or an interview per se would allow.**

### **Think-Aloud Protocol**

The methodology of think-aloud protocol (TAP) was first validated by Ericsson and Simon in the 1980s. Based on their theory of short-term and long-term memory, they hypothesized that all human learning is information processing and that “a cognitive process can be seen as a sequence of internal states successively transformed by a series of information processes” (1984, p. 11). The TAP method has been applied to research in cognitive psychology as well as usability tests of newly developed electronic products, such as calculators and computer software. Quite recently, the method has crossed the boundary to the other fields such as second language acquisition, particularly in the area of computer-assisted language learning (e.g., Sun, 2003; Hill & Laufer, 2003; Vinther, 2005). The main feature of this introspective technique is “asking participants to delve into their own states of consciousness and verbally report on cognitive, affective, or social aspects of that consciousness” (Brown & Rodgers, 2004, p. 54). The TAP differs from interviewing in that its objective is to get subjects to vocalize their own mental processes while they are engaged on a task. Thus, the researcher’s role is to give directions, to encourage or remind them to keep talking (not to the researcher, but to themselves), to record their verbalized processing (e.g., audio-tapes and observational notes), and later to look for common patterns and specific strategies used by them in the gathered data (Brown & Rodgers, 2004). Careful considerations must be taken to ensure reliable data (Abolrous, 2001). Enough time needs to be given in an orientation phase for the subject to become familiar with the procedures. It is also important for the researcher not to distract the verbalizing subjects from their current thought with questions about the proceeded actions or anything that should be saved for a follow-up interview (Branch, 2000). The present study adhered to these recommendations for reliability.

### **Types of Existing Dictionaries and Related Works**

Roughly speaking, dictionaries for L2 learners come in three types of media: traditional *paper* dictionaries, portable digital dictionaries (hereafter *PDD*), and web-based, so-called online dictionaries (hereafter *online*). The main difference between the two is that PDD, such as *Cannon Wordtank IDF-2000E*, is a palm-sized, light-weight, portable machine with a large database of lexical entries from several dictionaries, whereas online dictionaries are accessed at designated websites, are usually free of charge (and maintenance responsibility), and are built with useful hyperlinks and speedy navigation.

Evaluating PDD products designed for Japanese ESL learners, Hatanaka (2006) claims that the key advantage of PDD over paper dictionaries is its function called *jump*, which allows the user to switch between dictionaries without losing the search item. For example, if a definition of “atmosphere” by *Oxford Dictionary of English* is not satisfactory, the user can bring up from the database a definition provided by another monolingual dictionary or a bilingual dictionary. Another key feature of PDD is its ‘multiple-search’ ability, enabling the user to look up an item through several dictionaries and get search results instantaneously. Loucky (2005) reported another useful feature for L2 learners, albeit it is available only in certain PDD products: “some handheld electronic dictionaries... can recognize a user’s handwriting or voice” (p.401). We learned that *Casio XD-470* is designed to recognize a hand-drawn *kanji* character with the use of a small computerized pen. Lan (2005) describes how recent online dictionaries improved its quality (e.g., search speed) and unique features

(e.g., provision of pronunciations via synthesized test-to-speech technology).

Both PDD and online types are collectively called 'digital' dictionaries and getting more popular among college students. Lan (2005) reports that over 70% of the interviewed students at Hong Kong Polytechnic University were web-dictionary users. Regardless of the media, Tono (2001) argues, dictionaries are not always created with a good understanding of L2 learners' needs and abilities. For example, he found that idioms were not presented in a systematic way in the selected dictionaries. Thus, not all features of a dictionary (of any medium) are created to the best interests of the user. Moreover, some important features may be way above the average user's capability. This is when the learner's dictionary-using skills become critical.

Some studies discuss the importance of effective word search skills in foreign/second language learning (Liou, 2000; Hill & Laufer, 2003). What search strategies are related to the efficiency in dictionary use, then? A few studies (e.g., Loucky, 2005) investigated lexical processing strategies that Japanese college learners of ESL use with digital dictionaries. However, to the best of our knowledge, no studies have documented the efficiency in dictionary use by advanced learners of Japanese. It is also important for language teachers to know what dictionaries are used, how they are used, and what problems are experienced by individual L2 learners with different backgrounds.

## Methodology

### Research Questions

The study's main purpose was to document individual differences in dictionary use among advanced Japanese learners with different backgrounds. In order to uncover their cognitive processes in looking up words and kanji-characters, we recorded their verbalized thoughts with the think-aloud-protocol (TAP) method. **The following specific questions were addressed prior to our data collection:**

- Q.1 What dictionaries do advanced Japanese learners use for what purposes?
- Q.2 What problems do they have with their dictionaries?
- Q.3 What search strategies do they use in looking up words and *kanji* characters, and how does their strategy choice relate to their L2 proficiency level?

### Participants

Eight 'highly committed' L2 learners (so defined due to their near-perfect attendance and perceived preparedness for the daily lesson) were recruited from two advanced-Japanese language courses at a four-year liberal arts college. However, only six participants were able to complete all the procedures required for full participation. Four of the six participants were enrolled in JPNS 302 (Third-year-second-semester Japanese language course) and two were in JPST 425 (translation workshop for third-and fourth-year Japanese learners). Of the four 302 students, two were concurrently taking JPST 425. **Both classes had enrollment of around 15 students, met three days a week, and used Japanese-only materials:** JPNS 302 used a college-level advanced Japanese textbook, *Aozora*, while JPST 425, a series of excerpts from the contemporary Japanese novels selected by the instructor. It is important to note that one participant was a native speaker of Korean and the rest of them were

all native speakers of English. No extra credits or monetary compensation were given to ensure that their participation was voluntary and that those who withdrew from the study would not be disadvantaged academically.

### **Data Collection Instruments**

The instruments developed to gather data are: a two-page questionnaire, a two-page Japanese language proficiency test, and a set of TAP tasks that simulated the subjects' daily assignments (typically translation tasks for 425 and reading and listening exercises for 302 students). The instruments used with the six participants were identical in the formats and contents.

The proficiency test was first administered in order to measure the six learners' sub-proficiency levels in Japanese. The test was developed with items from mock tests for Level 2 of *Nihongo Nooryoku Shiken* and a reading material taken from a 6<sup>th</sup>-grade textbook used in Japanese public schools. Five tasks were used to gather introspective TAP data on the learner's cognitive processes in dictionary use. Task 1, 2, and 3 were adapted from the exercises of un-instructed chapters of the third-year Japanese textbook, and Task 3 and 5 were taken from un-used texts of the translation course. In other words, the materials were new to the participants, yet the types of the tasks (e.g., translation of a passage, matching vocabulary items) resembled what was typically assigned in their Japanese classes so that the TAP performance would offer natural data of homework-related behaviors. The tasks were written in Japanese. (See the Appendix for the actual task sheets used in this study.) The questionnaire was written with 11 items to survey on two related topics: advanced Japanese learners' homework/class preparation behaviors and their use of dictionaries. The items were written for multiple-choice and short-answer responses. The survey was incorporated as a method of 'triangulation' (Brown & Rodgers, 2004) for the TAP data.

### **Procedures**

Each participant first filled in the questionnaire and took the proficiency test. Then, the participants met with the primary investigator individually to perform the TAP tasks for about an hour. The second investigator was also present to assist the meeting. At the beginning of the meeting, the primary investigator read a short statement of the purpose and objectives of the TAP to familiarize the participant with the procedures. To facilitate their verbalizing behavior, the primary investigator occasionally provided "prompts" (e.g., echoing, signaling that she is listening, using continuers such as "Oh, really?"). Each participant's verbal statements about dictionary use and search strategies (e.g., what they are trying to do with which dictionary, what aspect of the dictionary is helpful or frustrating) were audio-recorded. If the participants continued to remain unvocal for 20 or 30 seconds, they were asked to "keep talking" so that the significant loss of the introspective data was spared.

The specific procedures the participants took in looking up words and kanji characters were also observed and kept as field notes by the second investigator sitting behind the participant. The notes were to be used to generate questions for a post-TAP interview and to later assist our interpretation of the TAP data or solve problems with dictating the audio-recordings. In addition, the posthumous interview was used to collect 'retrospective' data, that is, the participant's self-reflections on certain search processes after completing

the tasks. It was conducted during the one-hour meeting, when the needed information was still fresh in their short-term memory. In the interview, the questions that had been avoided before (so as not to disturb the flow of their task performance) were addressed. Their responses were also used for the TAP data analysis.

### **Data Analysis Methods**

The Japanese proficiency tests were graded against the total of 52 points. The questionnaire responses were tallied by categories to discern the common tendencies and differences in dictionary use by the advanced Japanese learners. The participants' TAP recordings varied from about 30 minutes to one hour in length. With about eight hours per tape on the average, approximately 48 hours of transcription work were consumed for the six participants' recordings. Their names were changed to pseudo-names, Ed, Jane, Kim, Pat, Tim and Woody, for anonymity during data coding. Because the primary investigator was the instructor of JPNS 302, we made sure that the students' grades would not be influenced by postponing our data analysis until after grade submission.

### **Findings**

#### ***Advanced Japanese Learners' Dictionary Choice***

Two to five dictionaries were reported by each of the six participants in the questionnaire; yet the types were always in two media (PDD and Paper, PDD and Online, or Paper and Online.) Four participants answered that they used the dictionaries "more than once per day" while Woody chose "about once a day" and Kim, "not daily but more than once a week." Another characteristic is the perceived importance of the digital dictionaries, which were listed as their primary dictionaries' by five participants. Although a monolingual kanji dictionary and two Japanese-based web-dictionaries were also reported, the majority were bilingual dictionaries.

Although the participants had been asked to bring to their TAP meeting all the dictionaries they usually used, Jane brought only her PDD. Both Tim and Woody requested access to their online dictionary sites through our office computer. In addition, most of successful kanji searches by Tim and Woody were conducted with their preferred web-dictionary via Jim Breen's website. Woody said, "I discovered this website a while ago... while I was just trying to be lazy and find dictionaries for Japanese on the Internet." He also expressed his strong desire for owning a PDD but added that its affordability was beyond his small college budget. Ed, Kim, and Pat used their PDD more frequently than their other dictionaries. (Pat did so, contrary to his questionnaire response.) Referring to his PDD, Pat repeatedly said, "See you can feel this is totally invaluable. I would die without this thing... If this thing broke, I would die." Tim, on the other hand, did not use his PDD at all in the TAP session, even though he listed one in the questionnaire; he said that he would use it only where he had no Internet access such as his Japanese classroom.

In addition to Jim Breen's site, Tim was comfortably using two Japan-based websites built for Japanese viewers: *Sanseido's Goo Jisho* and *Yahoo! Jisho*. Tim appeared to be un-intimidated by the language of the web-dictionaries, swiftly navigating through the Japanese-labeled hyperlinks. Ed made almost all kanji searches with his monolingual, paper kanji dictionary,

*Kadokawa-Saishin Kanwa Jiten*, which he said he had bought when he was studying in Japan. However, the general tendency of these participants was to resort to their bilingual/learner dictionaries particularly for the search of meanings; they almost always looked for English rather than Japanese definitions of the unknown word. This tendency persisted even if a monolingual dictionary is available in the PDD user's database. When Ed stumbled on to a Japanese definition of 困憊 ('kompai' *fatigue*) in his PDD, he uttered, "One of the problems when looking up in this dictionary, it won't tell the reading. [...] It only gives explanation, 'kurushii'.. yeah 'kurushii'..'kurushii' means (reading the screen) 'tukare kiru koto.' I don't know 'tukare kiru.' Sounds like 'cut-tiredness'? I don't know..." Then, he switched to a bilingual dictionary in the PDD to resolve the semantic problem.

### **Purposes of Consulting a Dictionary**

The questionnaire's responses pointed to three purposes unanimously selected in the questionnaire: 1) to look up a Japanese word's meanings in their native tongue, 2) to translate a word in their native tongue into Japanese, and 3) to select the right entry/meaning of the word that best fits the passage's context. Except one respondent, they also chose "to look up a kanji's pronunciations (via manual input or stroke order)." Jane, Pat, and Tim reported to use the dictionary to find a synonym or antonym of a Japanese word (i.e., thesaurus use). This response may be related to the fact that one or two thesauruses are installed in most high-quality PDD products. Only Tim and Kim claimed to 'find all the possible entries/meanings of a Japanese word in different dictionaries (i.e., cross-reference in an electronic dictionary).

However, compared to the questionnaire results, more uniformed patterns of lexical search were observed during the TAP sessions. Every participant used a dictionary for the following five purposes: 1) to learn the (on-/kun-) reading of a kanji character, 2) to search the English meaning of a kanji-word (when its reading is known), 3) to find the English meaning of a kana-word from its reading (an item of semantic unfamiliarity) 4) to confirm the guessed meaning of a kanji or kana word, and 5) to find the English meaning of an idiom (e.g., 頭にくる 'atama ni kuru' *to get mad at*). These purposes reflect the nature of homework assigned in their regular classes, which the TAP tasks were made to simulate: The textbook exercises and vocabulary confirmation were occasionally done with the use of English in the third-year Japanese class, and the fourth-year students were only required to translate Japanese texts into English in class. In addition to those five common purposes, Ed and Tim verbalized two more purposes: to find an alternative meaning of a previously consulted word (when the first meaning did not fit the context), and to discover a new usage of a known word (e.g., ごと 'goto' *the whole* instead of *the matter* or *issue*, or 嫌いがある 'kirai ga aru.' *be apt* to instead of *hate/dislike*). Ed solved the usage problem with his PDD while Tim used one of the web-dictionaries. The other four students failed to adequately handle the usage problems, even though they could have found some help from their dictionaries.

Some search patterns recorded in the TAP sessions were rather contradictory to the participants' questionnaire responses. For example, no parts of the transcripts showed Jane or Pat's search for "a synonym or antonym of a Japanese word". We only observed Ed using a thesaurus (*Eigo-Ruigo Jiten*) in his PDD to look for another English definition of the Japanese word, "omoikaesu" (*to reflect*). He said, "It's a good one for looking for verbs... *remember.. recall something* [...] I have to change the structure of the sentence." He then re-wrote

his translation of a Japanese sentence. Another discrepancy is that five participants almost always chose the very first meaning listed in the Japanese-English dictionary whether or not it best fit the passage's context. For example, Jane, Woody, Pat, and Kim all erroneously selected the primary meaning, *to make a mistake*, for the Japanese word ぬかる'nukaru' when the secondary meaning, *to be muddy*, was correct. By contrast, Tim always wrote down all the given meanings of the searched word. When he was not satisfied with any of the meanings offered by the first web-dictionary, he quickly switched to the other web-dictionary trying to retrieve more fitting translations of the item. Similarly, Ed often looked for more meanings whenever his first choice did not work well under the given context. These two students produced the most accurate translations of the passage in Task 3.

### **Problems with Consulting a Dictionary**

These advanced Japanese learners' most common problem was their inability to use a kanji-dictionary properly. Kim often used her PDD's *jukugo* (kanji compounds) dictionary and took a long time to skim through the numerous other compounds to find what she was looking for. For example, she diligently looked through more than 50 compound words made with the character, 流('ryuu') shown on the tiny screen and finally spotted 流行('ryuukou' *trend, fashion*) after ten or fifteen minutes. Her *jukugo* search with the PDD was not always successful, either. After much frustration, she gave up on several items, such as 表現('hyou-gen,' *expressions*) due to her overlooking the compound in the huge list of words made of the kanji, 表('hyou').

Failed searches and user frustration also occurred due to the lack of resources or functions of their dictionaries. For example, Task 1, 3, 4 and 5 required the translation of Japanese words into English. Yet, Jane's PDD did not have English-Japanese and Japanese-English dictionaries installed. She compensated for the disadvantage with a round-about strategy: She typed the Japanese reading of the word in romaji in her Japanese-Korean dictionary to learn its Korean meaning, selected a Korean-English dictionary, and typed the Korean meaning to find the matching English meaning. Kim could navigate only between a kanji dictionary and a Japanese-Japanese dictionary, *Koojien* in her PDD. Thus, when she used the kanji radical-reference and found the target character, she had to memorize its reading first, brought up a Japanese-English dictionary, typed the reading in romaji, and finally found the English translation of the Japanese word. Pat's PDD did not always accept his kanji input, and he occasionally had to re-write the character. That PDD also lacked a Japanese-English dictionary with a sufficient number of entries needed for advanced-level materials. To look up a Japanese idiom, for example, he used his paper bilingual dictionary instead but did not necessarily find the needed information in it, either.

Although there were no questions specifically asked about dictionary problems, a related question was addressed in the questionnaire: What do you think would improve the quality of your class preparation? Jane responded, "I want to buy a Japanese-English dictionary," Pat wrote, "Purchasing an electronic dictionary with a larger vocabulary," and Woody stated, "A better dictionary." Their questionnaire answers indicate that these three participants were aware of the problems they had with their current dictionaries to some extent.

## **Word and Kanji Search Strategies**

What strategies did the advanced learners use to meet the purposes described above? To find the reading or meaning of a kanji character, the most common strategy would be to look up the character either by the radical<sup>2</sup>-based or stroke number-based classification using a paper kanji dictionary. Because over 2,000 characters are presented in a kanji dictionary either by the radical-based classification or by the total number of strokes, one's ability to spot the character among about 250 different radical types or to count the strokes<sup>3</sup> correctly is an indispensable skill in using the kanji dictionary. However, the participants of this study demonstrated highly individualized strategies for kanji search. Tim and Woody went to Jim Breen's web-dictionary, clicked on a hyperlink called 'Multi-radical Kanji' and checked the box of the relevant radical on the radical table that displayed the radicals in the order of stroke numbers, 1 through 17. Although Woody previously failed to find several characters in his paper kanji dictionary, his search was quick and successful with this web-dictionary. Kim's PDD had the radical-based reference for kanji search, but she had a hard time using it well. For the same kanji, Tim and Woody spent much shorter time using the web-based multi-radical table than did Kim with her digitalized kanji dictionary. Jane was familiar with the most kanji characters used in the tasks due to her LI (Korean) background. Pat relied on the PDD which read his hand-drawn kanji characters. He described that using it for kanji is "the fastest way I have. I can't go any faster. So.. it's a shame. I'd love just to say a word and have it pop up on the screen." Interestingly, Pat's digital search resulted in a similar time-on-task (38 minutes) to that of Ed, who used a paper kanji dictionary (39 minutes) to look up almost the same number of items (Pat's total searches were 19 items, and Ed's, 20).

When the reading of a kanji-word was already known, the participants did not need to count the strokes for the radical classification. Thus, they looked for its meaning either by typing its pronunciation in romaji in a digital dictionary (PDD or Online) or by checking the phonetically-arranged list of kanji characters in a paper dictionary. Woody used his paper English-Japanese dictionary to verify that the English word he had guessed was the equivalent of the Japanese word. He said, "Usually it takes longer to look up a kanji in the dictionary, so I'm just going to look up the English meaning in my English-Japanese dictionary." Pat also used his bilingual paper dictionary, which listed all the commonly used kanji-words under the character entry if he knew how to read the character.

## **Connections between L2 Proficiency and Search Strategies**

We suspected that the high-achieving learners are also efficient users of their dictionaries. Thus, we decided to contrast the participants' overall Japanese knowledge and their efficiency with search strategies. Here, the term 'efficiency' is defined based on the four factors: T-O-T ("time-on-task" or the time they spent in completing the five tasks), the number of SI ("searched items"), the number of FS ("failed searches") and the number of the correct answers in Tasks 1, 2, 4 and 5 (T1, T2, T4, T5) and the completion and accuracy of translation in Task 3 (T3). As a measure of L2 knowledge, we used the scores of JPA, or the Japanese proficiency assessment, taken by all the participants. Table 1 below presents the efficiency-related factors in the order of highest-to-lowest JPA scores (given in the first column in the table). The numbers in the parentheses in SI refer to the time of search per item (the time-on-task divided by the number of searched items).

Table 1. Comparison of Japanese Proficiency Assessment (JPA) and TAP Performances

Subjects	JPA	T-O-T	SI	FS	T1	T2	T3	T4	T5
N=6	(52)	(min: sec)	# of items	# of items	(out of 3)	(out of 2)	(degree)	(out of 4)	(out of 3)
Tim	49	23:32	10 (2.3)	0.5	3	2	100%	4	3
Jane	33	29:40	15 (2.0)	2	3	1	70-80%	4	1
Ed	32	39:41	20 (1.9)	0	3	2	100%	4	2
Kim	30	55:00 (OT)	14 (3.9)	5	3	2	> 50%	4	1
Woody	19	55:38 (OT)	20 (2.8)	6	3	2	> 50%	4	0
Pat	10	38:10	19 (2.0)	3	3	2	> 50%	4	0

The top three scores of JPA were Tim, Jane, and Ed. They also produced more accurate and complete answers, making their homework "better prepared" than those of the other participants. Another possible interpretation is that the higher their JPA scores, the more successful their search was, based on the lower number of failed items. Except for Pat, these three participants also completed the tasks in much shorter time. Therefore, the learner's Japanese proficiency may be related to the success rate of using strategies to accomplish the search purposes, contributing to overall efficiency in dictionary use.

Interestingly, the lowest scorer, Pat, appears to use the dictionaries as efficiently as the high-scoring did. First, his time per item is 2.0, which is the same as Jane's. Second, he made only three failed searches. Third, he was able to look up almost the same number of items in a similar time frame as Ed. However, if the quality of his homework is judged in terms of accuracy and completion, his performance lags far behind from the top three scorers. It is important to recall that Pat's kanji search was well mediated with his PDD that read hand-drawn characters. By contrast, Ed was using the more complicated one, *Kadokawa-Saishin Kanwa Jiten*, a paper kanji dictionary designed for the native speakers of Japanese. Their difference in attitudes toward homework preparation was also evident in their questionnaire responses: Pat marked '1 hour' for his average time preparing for the next lesson while Ed chose '3-4 hours,' although both claimed that they were well-prepared "almost always (9 or 8 out of 10 times)."

### Pedagogical Implications

Based on the TAP performance data, the most critical time-waster was the dictionary user's inefficiency in looking up a kanji character. There were many instances in which the participants spent many minutes just to locate one character in a dictionary. The main cause of this inefficiency appeared to be the learner's lack of knowledge about the nature of the kanji script. For instance, accuracy in stroke-counting is critical, because if the learner miscounts the stroke number of a kanji, the word search either fails or leads to an incorrect meaning even after much time is wasted. The higher the number of strokes, the degree of kanji's complexity increases. And counting complex characters is still a daunting task even at the advanced level. Kanji search also becomes troublesome when the learner is not adept at distinguishing similar-looking, phonetically identical characters (e.g., 欲'yoku' *desire* vs. 浴

'yoku' *bathing*). The learner should also know that some compounds have more than one meaning depending on its reading (e.g., 大勢 'oozei' *many*, and 'tai-sei' *general tendency*). Moreover, the learner should be aware that many basic characters, such as 上 ('ue/jyou' *up/above*), are very productive compound generators, creating a long list of compounds made with that character. Thus, it would be easier for the learner to search for 上司 ('jyou-shi' *superior*) by the entry 司 than 上, for example.

The study demonstrated that inefficiency in dictionary use was partially attributed to a dictionary that did not meet the learner needs. It was often noticed that much time was wasted when the participants were trying unwittingly to make their electronic dictionaries work for their search purposes. For instance, Hatanaka (2006) claims that two features which make PDD more powerful than paper dictionaries are *jump* and *multiple-search*. Unfortunately, these features were either under-used by our participants or were absent in the PDD versions they had purchased. Pat's *Casio XD-470* was designed to recognize any kanji characters he manually copied from the TAP task sheet. Yet, because that PDD was built in a format so different from a paper dictionary he was more familiar with (and carried a larger database of lexical items from several dictionaries) that it was not easily for the novice user like Pat to use it efficiently. Lan (2005) praises *quick search* as the top strength of recent online dictionaries; "Information retrieval by means of the computer's search engine takes much less time than thumbing through the pages of an alphabetic (paper-type) dictionary" (p.21). Our two participants indeed took advantage of this fast search. Yet, regardless of the media, dictionaries have not been created for advanced learners' critical search needs and different abilities. Thus, they should be aware of the inherent imperfection of any dictionary (of any medium) they chose to purchase. This is where much guidance from experienced users and instructors should be provided.

The last pedagogical concern is the participants' heavy dependence on bilingual dictionaries even after three or four years of learning Japanese in the classroom. Tono (2001) observed that "only a handful of university students" make use of monolingual dictionaries for L2 learning in Japan (p.82). Hsien-jen (2001) conducted an experimental study with intermediate learners of Spanish in an American university and found that the college students in the bilingual dictionary group looked up L2 words more frequently than the monolingual dictionary group. It was found that these intermediate learners "could not entirely understand the definition given" in the monolingual dictionary while the bilingual dictionary was put into more use since it had "an instant translation for each vocabulary item" (p.21-22). Similarly, our study indicated that the advanced learners had not switched to monolingual dictionaries entirely and that they tended to look up words with a bilingual dictionary even if the task did not require English translation. This is another area where advanced learners need some training.

### Limitations of the Study

First, this study's TAP task setting was somewhat artificial. Normally, the learner would be alone when doing reading or translation homework. Thus, the presence of the researchers unnecessarily made the participants more self-conscious. Similarly, taken from the participants' actual course work (areas that were to be covered later in the semester), the TAP items might have been slightly more advanced than their current assignments (e.g., more unfamiliar words and expressions), and we could not simulate all the possible 'homework' types these

advanced Japanese learners had in real life using only a limited number of TAP tasks.

Second, the materials used in this study were biased towards native speakers of English. The questionnaire was written and TAP procedures were read in English, and three out of the five tasks required Japanese-to-English translation. Moreover, English was the main language of communication during the TAP session. Because the Korean participant did not speak English fluently yet, Japanese was used in her TAP session; it must have been challenging for this particular subject to vocalize her mental processes in the target language.

Third, there are other possible factors, such as prior experience in L2 reading and English translation and the length of use with a particular dictionary, which might interact strongly with the efficiency of dictionary use. This study did not examine these variables.

Finally, the findings of this study lack generalizability **due to the small number of participants**. However, as explained in the methodology section, the triangulation technique was incorporated to improve the 'credibility, dependability and confirmability' (Brown & Rogers, 2004) of the introspective data.

## Conclusion

This study provided qualitative data on university-level, third- and fourth-year Japanese learners' personalized dictionary use. Results showed some discrepancies between the subjects' questionnaire responses and what they actually did with the dictionaries during their TAP sessions. Beside the similarities of purposes and highly individualized search strategies in consulting dictionaries, the study shed light on dictionary-related problems commonly experienced by Japanese learners at this level. Moreover, the findings about the efficiency in dictionary use provided implications for why some students are more overwhelmed by the same homework. Although the study has some limitations, the protocol data from the six participants shed some light on problems with currently available dictionaries for Japanese learning. We hope that future research will overcome the study's shortcomings and provide more insight on L2 learners' dictionary use.

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## Footnotes

1. The questionnaire asked the participants to list their dictionaries in the order of perceived usefulness with Dictionary I being their 'primary' (most frequently used, most valued) dictionary.
2. A radical (or classifier) is the main part of a kanji character, usually the one that provides canonical semantic information (e.g., the "mouth" radical is used in the characters such as 'haku' to vomit, 'norou' to curse, and 'shikaru' to yell at/scold).
3. The radicals are also arranged in the order of the numbers of strokes.

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## Appendix

### Think-Aloud-Protocol (TAP) Tasks

TASK 1. Please perform this task as if you were doing homework on your own.

次の言葉はどういう意味でしょうか。右から選んで線で結びましょう。

- |         |                         |
|---------|-------------------------|
| a. 吐く   | ア. to vomit             |
| b. 流行する | イ. to rest              |
| c. 休む   | ウ. to become widespread |

TASK 2. Please perform this task as if you were doing homework on your own.

次のような場面では、どのような気持ちになりますか。Aから Cの表現の中から選びましょう。

(1) 自分のミスではないのに、上司に注意された。 \_\_\_\_\_

(2) 大勢のクラスメートの前で、先生にほめられた。 \_\_\_\_\_

- |        |        |         |
|--------|--------|---------|
| A. 悲しい | B. 嬉しい | C. 頭にくる |
|--------|--------|---------|

TASK 3. Please perform this task as if you were doing homework on your own.

次の日本語を翻訳してください。

自分は何をしていたのだろう、と彼は時折、ぬかるんだ土に靴を踏み入れ

ながら、思い返していた。自分のことで、分かっていることは一つだけある。そ

れは、現在、自分が疲労困憊していることだ。

TASK 4. Please perform this task as if you were doing homework on your own.

次の漢字が読めますか。意味は何ですか。

- |        | 読み  |     | 意味  |
|--------|-----|-----|-----|
| 1. 危ない | ( ) | ( ) | ( ) |
| 2. 欲しい | ( ) | ( ) | ( ) |
| 3. 危険  | ( ) | ( ) | ( ) |
| 4. 食欲  | ( ) | ( ) | ( ) |

TASK 5. Please perform this task as if you were doing homework on your own.

次の日本語を<sup>ほんやく</sup>翻訳してください。

それは笑いごとではない。

りんごを皮ごと食べた。

私はいつも心配<sup>しんぱい</sup>し過ぎる<sup>す</sup>きらいがある。