How Do Mobile Technologies Affect Learning Environments?: Smartphone Dictionary Apps vs. Pocket E-Dictionaries*

Toshiko Koyama

1. Introduction

1.1. Dictionary Use and L2 Learning

It has been argued by many researchers whether foreign/second (hereafter L2) language learners could derive benefit from dictionary use or not. There has been a growing body of research that has had its focus over the last several decades. To give some examples, Luppescu and Day attempted to confirm the effectiveness of bilingual dictionary use in L2 learning. As a result, the dictionary group got a higher score on the vocabulary test than the no-dictionary group did. The study also indicated that a dictionary might be helpful to disambiguate word meanings when learners could not infer them completely from the context. They concluded that the use of a bilingual dictionary while reading could facilitate L2 learners' vocabulary learning, and that it seemed to help L2 learners who could not infer word meanings from the context. Knight's study revealed that students who used a dictionary not only learned more words but also attained higher reading comprehension scores than those who guessed from context, conversely, that low verbal ability students were at a disadvantage when they were told to guess from the context. She also reported that high verbal ability students referred to the dictionary, even though they had already correctly guessed the meaning. In summarizing these findings, Knight put emphasis on the effects of dictionary use on comprehension and vocabulary acquisition for L2 learners. Tono conducted a wide variety of studies to clarify the relationship between dictionary

use and L2 acquisition. He aimed to show how research into dictionary use could contribute to the improvement of dictionary design and the clarification of issues in language learning. Although Béjoint did not completely accept such an optimistic view, Laufer claimed that, "The conclusion that seems to have emerged is that people who use a dictionary almost always acquire more words than people who read without a dictionary."(849) Other studies likewise reported that dictionaries can offer learners the obvious possibilities of effective L2 learning.

With the development of digital technology, the types of available learners' dictionaries have become widely diversified since the end of the twentieth century. Lynda Mugglestone, in "Dictionaries: A Very Short Introduction," described how types of dictionaries have diversified from ancient times up to the present:

> What is abundantly clear in terms of the ongoing history of dictionaries and dictionary-making is the way in which a form that began, as we have seen, on clay tablets over 3,000 years ago is triumphantly continuing to adapt and to evolve capitalizing on new environments (mobile phones, iPads, iPods), as well as on the capacity to interact with users (and for uses to interact with dictionaries) in ways which clearly extend what had earlier been possible. (132)

Today, a wide range of dictionaries not only on paper but also on the Web or digital devices are available for L2 learning. Aust *el al.* argued that an online electronic dictionary (hyper-reference) can offer many advantages to learners because it provides immediate access to the target information, compared with paper dictionaries which require learners to tackle an arduous task. They found that learners consulted hyper-references much more frequently than paper dictionaries, however, no significant difference in comprehension was found between hyper-references and paper dictionaries. Laufer investigated incidental vocabulary acquisition under two reading conditions, and reported that the electronic text group using an electronic dictionary performed better.

1.2. Dictionaries with Mobile Technology

The advent of pocket E-dictionaries has changed the pedagogical learning environment. During the latter half of the 1990s, the number of L2 learners using this type of dictionary has expanded, and to everyone's surprise, pocket E-dictionaries have rapidly replaced the paper dictionary especially in East Asian countries. And they continue to be popular among Japanese high school and college students even now.

Koyama and Takeuchi, which was one of the first attempts to compare paper dictionaries and pocket E-dictionaries, reported that the number of look-ups for pocket E-dictionary users was not necessarily proportional to the retention of looked-up words, and claimed that the interface design of paper dictionaries might lead to higher word retention. They also found that some relations existed between the dictionary's interface design and the learners' impression of each dictionary. Shizuka claimed that the pocket E-dictionaries were more efficient. One of his findings was that pocket E-dictionaries were superior to paper dictionaries in accessing words and identifying their meanings quickly. Additionally, he insisted that L2 learners tended to look up words more frequently in using pocket E-dictionaries, as they were less reluctant to use them. His assertion is supported by Aust *et al.*

On the other hand, new gadgets such as smart phones and tablets have rapidly made their way into universal favor in recent years. According to the report made by Pew Research Center in 2015, smartphones increasingly play an important role in helping Americans access, share, and create information and communicate with others. It stated that nearly two-thirds of Americans now own a smartphone. It is said that mobile devices as teaching tools are actually becoming more common part of the American classrooms, from preschool through college level. That the situation in Japan is the same goes without saying. In fact, the IICP Annual Report for 2014 announced that 62.3% of Japanese aged 13–69 use a smartphone. It also revealed that 94.1% of Japanese between the age of 20 and 29, and 68.6% of Japanese teenagers use a smartphone respectively.

Recent learners in their teens and twenties can be called "Digital Natives" who have spent their entire lives surrounded by and using all sorts of different digital tools. Prensky (2001: 1), an advocate of this notion, mentioned that "Today's students have not just changed *incrementally* from those of the past, nor simply changed their slang, clothes, body adornments, or styles, as has happened between generations previously. A really big *discontinuity* has taken place."

As has Mugglestone pointed out, the situation quickly changing around dictionaries can not be neglected. Here let us direct our attention to the argument concerning the smartphone as a dictionary for L2 learning. What will happen when our digital natives have a smartphone dictionary whose contents are the same as a pocket E-dictionary? Will they migrate to the smartphone? Will they use it frequently? How effective would it be as a tool for language pedagogy? These are issues that require examination from the pedagogical aspects of dictionary use and L2 learning. The paucity of reports on these issues has prompted this investigation.

2. Research Objectives

The primary objective of the study was to explore the potential to enhance language learning through the use of mobile devices. To this end, the present study was carried out examining the following four hypotheses:

Hypothesis 1: *The number of lookups in using pocket E-dictionary will be more than that of smartphone dictionary apps.*

Hypothesis 2: *The time to complete the assigned task in using smartphone dictionary apps will be shorter than that of pocket E-dictionaries.*

Hypothesis 3: *The retention of the lookups in using smartphone dictionary apps will be the same as that of pocket E-dictionaries.*

Hypothesis 4: *Participants prefer smartphone dictionary apps to pocket E-dictionaries.*

As might be suspected, the participants were considered to be heavy users of smartphones. It could be assumed that, therefore, they might manage dictionary apps on their phones skillfully as well as, or better than their pocket E-dictionaries. Additionally, as Hulstijn advocated "*the depth of processing*" hypothesis, an elaborate process for acquiring new lexical information leads to higher retention. It appears that neither mobile device under study requires participants to go through an elaborate look-up process.

On the other, there exist marked differences in data display and physical keyboard input functions of smartphone dictionaries and pocket E-dictionaries. In Koyama and Takeuchi, owing to its interface design, learners tended to consider that pocket E-dictionaries did not provide sufficient information, as did printed ones, although both of them contained the same amount of information. Thus, the difference in its interface design of both dictionaries might have some influence on learners' lookup behavior. To examine these issues empirically, the four hypotheses above were made.

3. Methodology

3.1. Participants

Participants in the experiment were 15 undergraduate students in their 3rd and 4th years (10 females and 5 males) at several universities in the western part of Japan. Their majors ranged widely over English, Cultural Heritage Sciences, Engineering, Politics, Social Sciences, Education, and Veterinary Science. Given both the result of a 45-item cloze test (M=22.47, SD=2.72) conducted in advance and their scores obtained in TOEIC[1] or EIKEN[2], they were considered to be at an intermediate level of English proficiency as Japanese college students.

Interview data revealed that they have been E-dictionary users at least since they were high school students. Also, all of them have owned smartphones which they used social media or texting with others for several years.

3.2. Dictionaries used

The smartphone dictionary apps and pocket E-dictionaries the participants already possessed were used in the present study. Both dictionaries included *Taishukan's Genius English-Japanese Dictionary (4th edition)* by which the participants were instructed to perform their assigned task in the experiment. Since they were unfamiliar with the smartphone dictionary apps at that time, all the participants were given sufficient time to practice with them beforehand. Although that application was a pay version, the participants were refunded the cost after the experiment.

3.3. Task assignments

Two types of tasks, ten vocabulary quizzes and three reading comprehension quizzes were used in the experiment (See one of the tasks in the Appendix). They were chosen from a written examination of the Pre-1 Grade STEP Test (The Society for Testing English Proficiency, Inc.) which was held in June and October 2006. These quizzes contained several words and phrases that were judged to be unfamiliar to the participants. The readability of each text was approximately the same level (See Table 1).

Table 1. Readability of Reading texts

Text	Flesch Reading Ease	Flesch-Kincaid Grade Level	Number of Words
A	47.9	12.7	322
B	46.1	11.0	319

3.4. Procedure

A triangulated approach was adopted to collect data by means of multiple instruments—tasks assigned with two conditions, questionnaires, and participants' feedback.

To compare the differences in both interface design and effects on learning, the procedure in Koyama and Takeuchi (2004), which investigated the differences in look-up behavior and learning effect between

printed dictionaries and pocket E-dictionaries, was mainly applied to the current study. To reduce possible risks of order and task effects, the study employed a counter-balanced design, thus, the participants were divided into two groups (See Table 2).

The experiment consisted of two sessions. The participants of each group performed two tasks in the first session: answering vocabulary quizzes and reading comprehension quizzes with dictionaries. Group 1 answered Text A with a smartphone dictionary, and then, did Text B with a pocket E-dictionary. In the case of Group 2, devices used were reversed. The participants of both groups filled out a 20 item-questionnaire afterwards.

In the second session, which was held about a week later, two different tasks were also assigned to both groups: a recognition test without advanced notice and a request for comments while reviewing the answers of the 20-item questionnaire and the tasks performed a week before. The recognition test was conducted to assess word retention from in the first session. The test was a list consisting of the words in both Texts A and B. Participants were requested to circle the words they thought they actually looked up in the both dictionaries in the

Table 2 Procedure of the Experiment

Group 1 (N=9)	*Group 2 (N=6)*
Cloze test	Cloze test
<1st session>	**<1st session>**
1. Vocabulary Quiz and Reading comprehension task (Text A) with **a smartphone dictionary Apps**	1. Vocabulary Quiz and Reading comprehension task (Text A) with **a pocket E-dictionary**
2. Vocabulary Quiz and Reading comprehension task (Text B) with **a pocket E-dictionary**	1. Vocabulary Quiz and Reading comprehension task (Text B) with **a smartphone dictionary Apps**
3. Answering a 20-item questionnaire	1. Answering a 20-item questionnaire
One week later	**One week later**
<2nd session>	**<2nd session>**
1. Recognition Test	1. Recognition Test
2. Interview (making some comments on the task in the 1st session)	2. Interview (making some comments on the task in the 1st session)

first session.

The entire session, including instructions, lasted close to three hours. The participants were tested individually, so that they worked at their own pace.

4. Results

4.1. Time needed and quiz scores obtained

Table 3 compares the time and the number of looked up words in the first session. The result of the mean scores and the *SD*s for vocabulary and reading comprehension quizzes in the first session was shown in Table 4. One point was given to each correct answer, and with full marks being ten and three respectively.

Given the small number of the participants in the experiment, the non-parametric *Wilcoxon signed-rank test* was adopted for statistical analysis (Siegel and Castellan, Jr.). The values revealed no significant differences in the time they required and the number of the words looked up in each condition. In addition, no significant differences were found in both vocabulary and reading comprehension quiz scores between smartphone apps and pocket E-dictionaries conditions at the .05 level.

Table 3. Results of Look-up Behavior

	Smartphone Apps		Pocket E-dictionary	
	M	*SD*	*M*	*SD*
Time to perform tasks (min.)	32.73	8.22	30.87	8.61
The number of lookups	28.47	11.78	29.53	13.47

All values are n.s.

Table 4. Results of the Quiz Scores

Quizzes	Smartphone Apps		Pocket E-dictionary	
	M	*SD*	*M*	*SD*
Vocabulary	7.67	1.72	8.07	1.53
Reading Comprehension	1.93	.88	1.87	.74

All values are n.s.

4.2. Retention

The result of the recognition test scores of each participant in the second session was shown in Table 5. The test was administered to measure retention after one week in each dictionary condition. In grading the recognition task, one point was given if participants circled the words they thought they had actually looked up in a dictionary in the first session. These were calculated by dividing the number of words they consulted in the first session by the number of words recognized in the second session. Each score in Table 5 was thus shown in percentages.

Comparing the mean values in Table 5, no great differences were found in either condition. This was statistically supported by the result of *Wilcoxon signed-rank test*.

Table 5. Descriptive Statistics: Retention of Looked ups

Participants #	Group	Smartphone Apps	Pocket E-dictionary
1	1	25.0	24.0
2	1	69.8	76.2
3	1	11.1	0.0
4	1	5.0	14.9
5	1	13.3	15.0
6	1	55.6	47.4
7	1	10.3	18.8
8	1	29.4	30.0
9	1	50.0	56.3
10	2	34.6	19.0
11	2	13.6	23.3
12	2	73.5	69.4
13	2	26.8	25.0
14	2	20.7	20.0
15	2	61.0	73.6
M		33.3	34.2

(Unit: %)

All values are n.s.

4.3. Participants' feedback on the dictionaries used

In order to assess the differences in the students' attitudes, a 20-item questionnaire was administered immediately after answering the vocabulary and reading comprehension quizzes with dictionaries. A five-point Lickert scale was used, with 5 indicating complete agreement with the statement.

Table 6 displays some excerpts from the questionnaire that showed a considerable difference between the two dictionaries. Item (19) "*I have to get the knack for using this dictionary*." has its polarity reversed, a favorable attitude being rated as "1".

The participants evaluated smartphone apps highly only on item (9) "*This dictionary was handy*." On the other hand, they rated smartphone apps low on item (12) "*I feel I can use this dictionary for a long time*." It seemed that their opinions of each item were inconsistent.

On the whole, they had a preference to pocket E-dictionaries on other items, on which large differences between the two dictionaries were observed in the questionnaire. It should be noted that although

Table 6. Responses to the Questionnaire (Excerpts)

Item #	Questionnaire Items	Smartphone Apps	Pocket E-dictionary
1	This dictionary provided me with much information at first sight.	2.9	4.2
9	This dictionary is handy.	4.6	3.5
11	This dictionary was convenient for comparing the meanings of more than two words.	2.7	3.7
12	I feel I can use this dictionary for a long time.	2.3	4.1
14	I would like to use this dictionary again when participating in this sort of experiments.	3.0	4.1
17	This dictionary is appropriate for beginners in learning English at a primary or lower secondary school.	2.2	3.0
19	I had to get the knack for using this dictionary.	4.1	2.6

The questions were originally given in Japanese.

the participants were seemed to manage their smartphone dictionary apps skillfully, their response to item (19) "*I had to get the knack for using this dictionary*." was negative. And furthermore, their assessments of item (17) "*This dictionary is appropriate for beginners in learning English at a primary or lower secondary school*." were relatively low on both dictionaries.

Table 7. Participants' Feedback on Item (17)

Participant #	Feedback
1, 11	School kids should use a paper dictionary at the beginning. Because it displays a lot of information at first sight, and they can become familiar with dictionary contents.
3	Dictionaries that learners first encounter are very important. They can follow information about target words in dictionaries, if it is a printed version.
4	I suppose that school kids easily consult digital version of dictionaries without any trouble.
5	Either will do, but I believe that language information should be put in order by oneself using stickers on the page. So paper version of dictionaries will be the best.
6	Paper dictionaries can be customized to fit one's need, but pocket E-dictionaries are equipped with a phonetic sound function, which is useful for English study.
7	It is inappropriate for elementary school pupils to use smartphone dictionary apps as an educational device. Pocket E-dictionaries will be OK if teachers teach them how to use them.
9, 14	I think pupils should start using paper version of dictionaries. They had better have a hard time looking up words with them at the beginning, then, they can notice how convenient pocket E-dictionaries are.
10	I think that it is valuable for learners of English to look up words in paper dictionaries. So the best is paper version, but a pocket E-dictionary is also acceptable. It makes me turn on my "study" switch.
12	I think that a function of telecommunications of smartphones may interfere with their studying.
13	It depends on how teachers in elementary schools give their pupils guidance when using dictionaries.
15	I think that smartphones are not for school kids. They cannot concentrate on studying when looking up words, because other apps such as *LINE* or *YouTube* are available on it at the same time.

The comments were originally given in Japanese.

After recognition test in the second session, participants commented on each dictionary while reviewing the tasks they performed a week before. Their comments on items (17) "*This dictionary is appropriate for beginners in learning English at a primary or lower secondary school*," which has low evaluation in either dictionary, were shown in Table 7. Examining their feedback in the table, it is obvious that most of the participants regarded smartphone dictionaries as inappropriate for beginners of L2 learning, and some of them recommended them to use paper version of dictionaries.

The questionnaire item, on which a decided difference was observed between two dictionaries, was (19) "*I had to get the knack for using this dictionary*." Table 8 displays some excerpts from the participants' comments, which indicate that they were not satisfied with data input into smartphone as compared to the pocket E-dictionaries. They observed that making efficient use of smartphone dictionaries required greater skill.

Table 8. Participants' Feedback on Item (19)

Participant #	Feedback
5	Smartphones are not equipped with a physical keyboard.
3, 4	Smartphones are not equipped with necessary function keys like usage examples or idioms.
7, 12, 14	I think it takes some time to get used to smartphone dictionary apps, but a pocket E-dictionary was easy for me to use from the beginning.
9	Letters displayed on the smartphone are really small. Also, I had to scroll text one line at a time to find necessary information.
10	I can "type" target words with a keyboard of a pocket E-dictionary like a computer. I think a recognition rate is a little different in both dictionaries.
13	I think that we soon get the knack of using new digital devices.
15	I like a sensation of the touch of my pocket E-dictionary's keyboard.

The comments were originally given in Japanese.

5. Discussion

Based on the above findings, we can state the following. First, from

the results in 4.1, no differences were observed in both the time they needed and the number of the words looked up in either condition. Furthermore, the participants' scores in vocabulary and reading comprehension quizzes with smartphone dictionary apps did not differ from those with pocket E-dictionaries. These were ascertained statistically as the results of the *Wilcoxon signed-ranks test* at the .05 level. It means that the interface design of each dictionary device did not directly affect learners' lookup behavior related to L2 study.

The results imply that the potential to enhance language learning exists in both dictionaries. Therefore, *Hypothesis 1: The number of lookups in using pocket E-dictionaries will be more than that of smartphone dictionary apps* and *Hypothesis 2: The time to complete the assigned task in using smartphone dictionary apps will be shorter than that of pocket E-dictionaries* were not supported.

Second, as indicated in 4.2, no significant difference in the recognition task scores was found in either condition even though the retention rates of their looked-ups varied as was shown in Table 5. The assumption that neither mobile device requires an elaborate look-up process seems to be close to the mark. Both devices seem to result in similar learning, thus, *Hypothesis 3: The retention of the lookups in using smartphone dictionary apps will be the same as that of pocket E-dictionaries* was supported.

Third, as was shown in 4.3, the participants evaluated smartphone apps highly in item (9) "*This dictionary was handy.*" Since they always have their smartphone with them, this response was considered to be taken as a matter of course. Nevertheless, as displayed in Table 6, they overwhelmingly had a preference to pocket E-dictionaries in other responses, where large differences between the dictionaries were observed.

It is a notable that these responses were closely connected with dictionary's interface design. Note that information concerning the target words was the same and shown on a display in either case. The size and the design of each device, however, differed in respect of "a physical keyboard." Furthermore, the participants' response to item (19) "*I*

had to get the knack for using this dictionary." was negative, although the participants were considered to manage dictionary apps on their phones skillfully. Their feedback to the item in Table 8 indicates that they might consider the use of smartphone dictionaries required some skills in handling. In other words, they appeared to value pocket E-dictionaries more as an educational device.

Another remarkable opinion from the participants was the response to item (17) "*This dictionary is appropriate for beginners in learning English at a primary or lower secondary school.*" which was relatively low for both dictionaries. This can be interpreted to mean that the participants regarded dictionaries on mobile devices as convenient, but that they considered paper dictionaries to be still reliable for L2 study. One interpretation could be that they thought that there is relationship between the complexity of the lookup process and L2 acquisition, as Hulstijn advocated in "*the depth of processing*" hypothesis. Thus, they recommended paper version of dictionaries to beginners in L2 learning. From these findings, we confirmed that *Hypothesis 4: Participants prefer smartphone dictionary apps to pocket E-dictionaries* was not supported.

6. Concluding Remarks

The results derived from the experiment described above reveals the following. First, it appears that the interface design of smartphone dictionary apps does not directly have an influence upon L2 learners' lookup behavior and the effect on their learning. There were no significant differences in the number of lookups, retention rate of looked up words, and the time needed to complete tasks between two dictionaries.

Second, the interface design of dictionaries might be an incentive to L2 learning. Although today's digital natives are considered to be good users of mobile devices, they showed some preference for pocket E-dictionaries. The size of screen display and the design of each device affected the L2 learners' impression. In fact, they regard a physical keyboard of a pocket E-dictionary as useful for L2 learning.

Third, some digital natives still emphasize the importance of using paper version of dictionaries at the beginning of L2 learning even though they never use them in daily study themselves. This issue has not been sufficiently investigated yet.

We should continue investigating the applicability of the findings on the present study. These findings, the author hopes, will shed some light on further research to consider the potential to promote L2 learning with dictionaries with mobile technology.

*This article is a revised and combined version of the papers presented by the author at the 54th Annual Conference of the Japan Association for Language Education and Technology (LET) in Fukuoka and the 6th Foreign Language Education and Technology Conference (FLEAT VI) at Harvard University in Cambridge, Massachusetts.

NOTES

1. The TOEIC (Test of English for International Communication) test was conceived in Japan and created by the Educational Testing Service (ETS), a U.S. nonprofit test development institution, as a common global yardstick for measuring English skills. The test is administered in some 150 countries around the world.
2. EIKEN is Japan's most popular and widely administered English qualification for nearly fifty years backing of the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT). EIKEN-administered tests are taken by more than 2 million examinees annually and at over 18,000 locations.

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APPENDIX

Text A

1. To complete each item, choose the best word or phrase form among the four choices.

1) We may encounter strong ( ) during the flight, so please keep your seat belt fastened when you are seated.
   1. affection 2. inspection 3. turbulence 4. interference
2) Bob dislikes eating out with his sister because she is so ( ). Sometimes it takes her 10 minutes just to place her order.
   1. nonsensical 2. indecisive 3. unconditional 4. defensive
3) Although John could speak Japanese fluently, his inability to read or write it was major ( ) when he was looking for a job in a Japanese company.
   1. obstacle 2. standstill 3. deficit 4. incentive
4) The visiting circus featured, among other things, a chimpanzee that had been trained to ( ) the movements of a ballerina.

1. mimic 2. falsify 3. favor 4. defer

5) After years of competing against one another, the two golfers have developed a deep feeling of ( ) respect. Neither of them underestimates the ability of the other.
1. majestic 2. variable 3. neutral 4. mutual

6) Clara's father scolded her so ( ) for not doing her homework that she burst into tears and ran from the living room.
1. fitfully 2. humbly 3. harshly 4. lamely

7) The police officers were forced to give up their ( ) of the thief when they lost sight of him in the crowded town square.
1. vocation 2. pursuit 3. venture 4. mission

8) Although the company bought the new electronic dictionary for everyone to use, Junko tended to ( ) it, claiming that she needed it more than everyone else.
1. conventionalize 2. paralyze 3. monopolize 4. mobilize

9) The town mayor did everything he could to make sure the queen was treated with the ( ) respect during her visit.
1. utmost 2. furthermost 3. innermost 4. outermost

10) Customer records are highly ( ). Please keep them in a secure place at all times.
1. consecutive 2. confidential 3. concise 4. considerate

2. Read the passage below and choose the best answer from among the four choices for each question.

The Greenbrier Hotel

The Cold War has been over for more than decade, but across the United States there remain many reminders of a period when the shadow of nuclear conflict fell over the whole world. One of the most fascinating of these is the Greenbrier Hotel in West Virginia. For over two centuries, the Greenbrier has been known as a playground for the wealthy, but in 1992 *Washington Post* reporter Ted Gup revealed that the hotel had also served another, secret purpose. A mammoth underground bunker, or complex, intended as an emergency center of government for the U.S. Congress in the event of a nuclear war with the Soviet Union, had been built under a hill adjacent to the hotel.

Construction of the bunker—condemned Project Greek Island—began in 1959 and was finished in 1962, just as the Cuban missile crisis occurred. To disguise the bunker's construction, the government paid for a new wing to be built onto the hotel. The project's scale was remarkable, including two-foot-thick concrete walls and 28,000-pound steel doors, all buried under 700 feet of earth—clearly not just another hotel ballroom. Nevertheless, the most impressive achievement was still to come. Although thousands of workers were involved, and hotel staff suspected something odd was going on, patriotism made sure the secret was kept.

In the end, though, the bunker proved to be impractical. Tracking down all members of Congress and transporting them to the Greenbrier would have taken much longer than the time required for a nuclear missile to reach the Capitol form the other side of the world. In addition, a mass departure of politicians from Washington would have been sure to alert the Soviets that an American first strike was about to occur. Still, as the debate over national security versus the public's right to know continues today,

many of us are bound to wonder how many more such projects are waiting to come to light.

1) In 1992, a reporter from the Washington Post revealed
   1. a scandal concerning top politician's use of a luxury resort.
   2. construction plans for an emergency bunker for the general public.
   3. that the government was planning to build a secret missile base.
   4. the existence of an underground shelter intended to hold Congress.

2) According to the writer of the passage, what was one remarkable feature of the Greenbrier Hotel project?
   1. The U.S. government believed the hotel could withstand a nuclear attack.
   2. The bunker was used only for a short time despite the huge cost of building it.
   3. All the people involved in the bunker's construction kept it a secret for decades.
   4. The complex was complete long after the danger of nuclear war had disappeared.

3) What does the writer's conclusion suggest?
   1. The Greenbrier Hotel is something that U.S. citizens had no right to know about.
   2. The Greenbrier Hotel would likely have been a major target of a Soviet attack.
   3. Project Greek Island was probably not the only big secret of the Cold War.
   4. Project Greek Island was the most successfully kept secret of the Cold War.

From the pre-1st Grade test of EIKEN, 2006–1