Methodology for Constructing a Prototype Site for Finding Employment SPI Measures Using Mobile Phones

Shinsuke Wakita, Michiko Anse, and Tsutomu Tabe

Graduate School of Science and Engineering, Aoyama Gakuin University.
5-10-1, Fuchinobe, Sagamihara, Kanagawa, 229-0006, Japan
c5606138@cc.aoyama.ac.jp,anse@ise.aoyama.ac.jp,
tabe@ise.aoyama.ac.jp

Abstract. The written examination for job hunters in Japan is an important examination that cannot be skirted as the first step in the hunt for employment. However, there is no environment that can be studied using easy methods (mobile phones, etc.). In this research we clarify a methodology for constructing a prototype system for finding employment SPI measures. After constructing a prototype, we examine the effectiveness of the methodology. We use answer formats to achieve two purposes. (1) We clarified an answer format that can be efficiently studied through an experiment in 'no space' in order to produce a measure site that can be efficiently studied in little time. (2) We constructed a prototype for selecting answer formats in order to examine whether the prototype can be used to select the following two formats on a mobile phone: first, "the word, the meaning of the word, and an example of the word in use"; second, "the word, an explanation of the word, an example of the word in use, and the meaning of the word." (3) The test-takers studied the constructed prototype on mobile phones, then our group examined the effectiveness of the prototype based on the questionnaire results. The results indicate that the form can be efficiently studied. Thus, we can conclude that the prototype constructed can be used to select the following two answer formats: "the word, the meaning of the word, and an example of the word in use" and "the word, an explanation of the word, an example of the word in use, and the meaning of the word".

Keywords: e-learning, mobile phone, answer presentation form, problem display form.

1   Research Purposes

To construct an SPI (Synthetic Personality Inventory) examination support system for use on mobile phones; to clarify the methods for developing and progressing with the study and study content, to construct a prototype, to have test-takers use the prototype, and to examine the and effectiveness.

2   Research Background

2.1   About the SPI Examination Support Using the Mobile Phone

After the written examination, many often reflect: "I would probably have solved it if I had reviewed a little more." The many company introductions during the job hunt leave little time to spare in a student's schedule]. At the end of the day, the job hunters return home exhausted. Even if they want to study, their fatigue prevents them. The SPI is a written examination no more difficult than the written portions of the high school entrance examination. Test takers can easily score well with little review. However, job seekers cannot proceed directly to the interview, by skipping this written examination (job recruitment process: applicant screening, the written examination, the interview, and the job offer). The written examination is often full of numbers, but it still can be easily passed by cramming in advance and listening to current events. Various books on employment SPI measures are now published, but most are too heavy for the students to lug around during their busy days. Our group therefore has speculated that the students could be more easily studied if students had a tool study tool suitable for use during the less busy hours of a student's life. In this research we propose methodology for constructing a prototype support system for mobile phones to help students prepare for the written examination. We focus on the answer format in this research, as the problem formats of SPI are almost uniformly multiple-choice (test takers choose from two or more answers). Specifically, we examine whether the amount of information placed in the answer format influences the efficiency of the student's study. This research is carried out in the following steps: (1) Give students a questionnaire to investigate the current status and needs of the written examination and the students' mobile phones. (2) Clarify the method for constructing the prototype support system for the written examination. (3) Construct the prototype based on the abovementioned result. (4) The effectiveness is examined.

2.2   About the SPI Examination

SPI stands for "Synthetic Personality Index," a measure of personality developed in 1974. When companies screen job applicants, many give aptitude tests. Typically this involves assessment of the SPI. The content of the written examination during the stages of applicant selection employment tests (applicant screening, written examination, interview) is shown in fig 1. SPI, the index referred to in (2), is the most widely used measure of aptitude.

   One of the major stumbling blocks for students is the assessment of ability propriety during the aptitude test inspection. This assessment is divided into inspection I and inspection II. The former, Inspection I, is a set of 40 questions to be completed in 30 minutes for the examination of linguistic competence. Inspection II is a set 30 questions to be answered in 40 minutes for the examination of logical thinking and calculation abilities. The test takers must answer a relatively large number of problems within a relatively limited period. The problems themselves are not difficult: anyone with the scholastic attainments of a standard level junior high school education can solve them. A combination of the following factors does lead to mistakes, however: examine tension + short time allotted + many problems. Among

the problems testing linguistic competence, test takers focus first on those they know. The most common questions are on idioms and proverbs made up of four Chinese characters. The test takers pay close attention to the answer format, usually a multiple-choice style format with four possible answers.

Written examination	(1)Common sense, Liberal learning ・Language study ability ・Expertise
	(2)Proper inspection (1)Potentiality examination (2)Character aptitude test

Fig. 1. Content of written examination

2.3 About Study by the Mobile Phone (Advantages and Disadvantages)

Two factors greatly influence study using mobile phones. The first is an environmental factor: the learner's place and situation. The other is a technical factor: the size of the screen and the transmission rate of the user's phone [D. Becking, 2005]. One advantage of mobile phones is freedom from operational problems: students are adept at using the devices, as almost all of the students use them in daily life[ANDO, 2006]. In our research we sent out a student questionnaire with questions on the use of the mobile phone for study. Students mentioned the following advantages: "It can be easily and readily used," "It's portable and convenient," "It doesn't become a burden to carry around (like luggage), and "I can use it on my free time." In a word, mobile phones can be used flexibly for study without constraints from the learner's location. The phone is "no place." Use is promoted in various places such as in coffee shops, restaurants, or during tedious waiting times, such as time spent at rendezvous spots or on bus journeys [T. Kopomaa, 2004]. One disadvantage of the mobile phone that detracts from its value in education is its reputation as a kind of toy for play [D. Morris, 1977]. Other disadvantages mentioned include the following: "The screen is small," "Books seem cheaper," "Only limited information is available," "The communication charge rises minute by minute," "It doesn't seem easy to use," "The charges make me anxious," "There is resistance to study with mobile phones," "Mobile phones make me tired." Regarding the communication charges, some questionnaire respondents indicated "The charges don't make me nervous, as the purpose is to study" and "My communication charges were covered by my charge plan" [ANDO, 2003]. These answers suggest that the mobile phone can be easily used, ideally via some kind of charge plan that exempts the user from paying.

3 Methodology of SPI Examination Support by Cellular Phone

We developed an effective format for presenting the answers, based on the results of our questionnaire and experiments.

3.1 Questionnaire Results

The questionnaire results dictated the following basic policy. (1) Learners use their mobile phones (i application program), a device at their disposal whenever they have free time. Mobile phones are often highly portable and are never a burden to carry (they can be carried more easily than a book). Our reason for choosing DoCoMo is presented in Table 1 below (there are many NTT DoCoMo users). (2) JAVA is used for the i application program. (3) It makes the tests for students searching for employment. This research focuses on "proverbs and four-character idioms" in problems from the SPI assessment for job seekers. For problems with synonyms and antonyms, etc., the only method for the test taker is to settle down and solve them. In this case, however, it makes a big difference if the test taker knows the correct answers or not. (4) The questions are arranged at random and the history function is activated to help the test takers can manage or correct their mistakes. Our experiment also clarified that test takers can efficiently memorize the answer format.

Table 1. Sep, 2006 Share comparison according to mobile

	pure increases	all users	share
DoCoMo	126,300	52,102,900	55.54%
KDDI	160,800	26,402,500	28.14%
SoftBank	23,400	15,307,000	16.32%
Sum	310,500	93,812,400	100.00%

3.2 About the Memory and the Forgetting Curve

What is problem format can be most efficiently memorized with a short time? The "forgetting curve" of Ebbinghaus illustrates the relation between time and a memory (Fig 2).
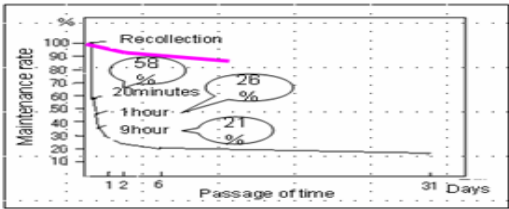

Fig. 2. Forgetting curve of Ebbinghaus (curve) and four character idiom (heavy line)

Ebbinghaus gave objective evidence of where the memory existed. At this time, a list of meaningless three-character strings is remembered from "Consonant, vowel, and consonant." As a test-taker, he measured how much information the test takers could recall after a fixed amount of time. The amount of maintenance (saving rate) is known to show a so-called negative acceleration curve: the memory will decrease rapidly just minutes after the information is studied, but thereafter the decline is not so

sudden. (58% in 20 minutes, 26% in a day, 21% in 31 days) [John Henderson, 1999]. To this, 15 four-character idioms were divided into five titles and presented in three answer formats: "The word and the meaning of the word," "the word, the meaning of the word, and an example of the word in use," and "the word, an explanation of the word, an example of the word in use, and the meaning of the word." In a similar experiment in which the meaning, the explanation, and the example are prepared for seven test-takers for complete memorization, the amount of maintenance fell by about 90% after a day and about 80% after one week average (Fig. 2). Nonetheless, the decrease was not as rapid as that observed by Ebbinghaus. This was because the four-character idiom has meaning and leaves a significant impression. Therefore, an unfamiliar word can be more effectively memorized if the material creates a significant (meaningful) impression using the meaning of the word, and explanation of the word, and an example of the word in use.

3.3   Experiment That Leads Effective Answer Form

The purpose of the experiment is to clarify whether to effect an alteration of the memory according to the answer form.

(1) Preliminary experiment 1 "Solving the problem in space."
We conducted an experiment by having ten test-takers remember 15 four-character idioms. In this experiment, we presented "a four-character idiom and the meaning" in 1 to 5 titles, "a four-character idiom, its meaning, and an exercise" in 6 to 10 titles, and "a four-character idiom, its meaning, an explanation, and an exercise" in 11 to 15 titles. Test takers study them only once, and the number of words they remember immediately afterwards is tested. As a result, the correct answer rates were 28% for answer format 1, 53% for answer format 2, and 80% for answer format 3. Answer format 3, the format with the most detailed explanation provided, apparently left the strongest impression.

(2) Preliminary experiment 2 "Solving the problem on a PC."
The mobile phone was displayed on a personal computer. We constructed a prototype for solving problems with 5 four-character idiom titles and 5 proverb titles (10 titles in total). Thirty test-takers were divided into three groups. All problem formats were multiple-choice with four options. The first group solved the problem using answer format 1, the second group solved the problem using answer format 2, and the third group solved the problem using answer format 3. The problems were to be solved in 2 or 3 days, one week, or two weeks in space. The acquisition levels will be shown later. (In the format shown here, the problem presents a set of ten words at the outset, then a list of 30 choices from which to choose the answers. The purpose is to determine the acquisition level for ten questions presented only once (for the first time.) The result is shown in Table 2 below: the answer rates were 56% for answer format 1, 72% for answer format 2, and 74% for answer format 3. No difference was seen between answer formats 2 and 3.

Table 2. Experiment 2

	1	2	3
At experiment	5.6	5.8	6.1
2days later	6	6.3	7.2
One week after	6.3	7.2	7.4

(3) Preliminary experiment 3 "Solving the problem with a mobile phone."
 The content and problems studied were the same as those used in preliminary experiment 2. Three answer formats were downloaded to the mobile phone and studied by five test-takers, as shown in Table 3 below. The correct answer rates were 65% for format 1, 72% for answer format 2, and 73% for answer format 3. The answer rate did not change appreciably using either the PCs or mobile phones. However, some rest-takers indicated that the mobile phone is more convenient than the mobile phone in two ways: "It can be carried" and "I can use it anytime." From these three preliminary experiments, we can conclude that answer formats 2 and 3 are effective. Therefore, we adopt them.

Table 3. Experiment 3

	①	②	③
At experiment	5.8	5.7	6.2
2 days later	5.9	6.9	7
One week after	6.5	7.2	7.3

4   Construction of the Mobile Learning System

The purpose of constructing the prototype is to help learners study the SPI efficiently within little time. The content consists of (1) problem formats that can used effectively within little time; (2) the random ordering of the problems presented; (3) built-in answer formats that can be efficiently memorized (as clarified by the experiment); and (4) a history management function to manage problems handled erroneously by the test-taker.

4.1   The Development Environment

The i application program is the application service for the "i-mode" mobile standard introduced by NTT DoCoMo in January 2001. The execution environment runs on an installed version of Java (Java virtual machine), and the Java applications (scaled down version of the language) can be downloaded and executed. The system supports application of up to 30 Kbytes in size. For screen processing, the data-saving area for the local application "Scratchpad" stores up to 10 Kbytes of information.

4.2 Operation

(1) The system is designed for smooth cooperative function with the upper and lower buttons, as no scroll function is provided. (2) The prototype counts the number of characters in the displayed sentences and changes the line based on the appropriate number of characters, as no line-change function is provided. (3) On screens with two or more choices, the lines displayed on the screen move up and down with pushes of the upper and lower buttons, and the selected line is either highlighted or made to correspond to the figure key.

4.3 System Functions

Three system functions are built in: "solve the problem," "see history," and "see explanation." The user selects the desired function from the main menu screen. Once the function is selected, the user moves to the next screen by pushing the enter button on the cellular phone. The "solve the problem" function consists of three sub-functions: "select the style for answer presentation," "display the problem," and "check the answer and explain the correction." When the user chooses "Select the style for answer presentation," the system selects the currently highlighted items as the correct or incorrect answers are displayed. It does so by two methods: "display only the example" and "display the example and explanation" (Fig. 4). If the user chooses "Display the problem," the system displays the problem after the method for answer presentation is selected. The form for setting the questions is selected from two options: "Meaning" in the upper row and the "four answer candidates" displayed in the lower row. The answer is input from 1 to 4 with the figure key. The problem displayed is selected at random from the problems registered in the database. The "four-character idiom" offered as an answer candidate is also selected at random. When the user selects "check the answer and explain the correction," the system collates the input answer with the database and displays it according to "another correction" and "the method for presenting the selected answer." When the answer is corrected, the problem is removed from the problem list, and it displayed the answer. When the answer is incorrect, the problem is registered in the history management list as a "meaning" (Fig. 5). Through this method, the user can later study the problems that have incorrectly answered or left unanswered. Moreover, the system calculates the number of problems answered and the number of problems correctly answered. The "see history" function displays a list of incorrectly answered problems from earlier sessions ("Meaning") (Fig. 6). The "see explanation" function explains the function and the operation method to a person who uses the system for the first time. The flow chart below shows the entire flow of the system.

When the user pushes the enter button on the main menu screen, the system brings up the answer format selection screen. Initially it displays the message "the problem is solved" underlined in blue, and the blue underlining can be moved with by pressing the upper and lower buttons. If the user pushes enter button when "the history is seen" is underlined, the system brings up the history management screen. If the user pushes the enter button when "the explanation is displayed" is underlined, the system brings up the explanation screen.
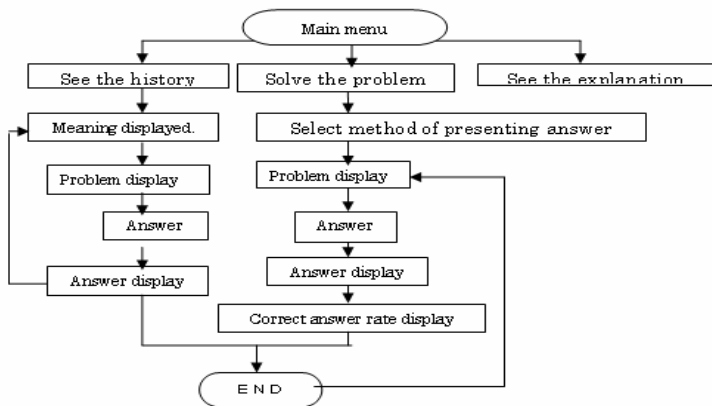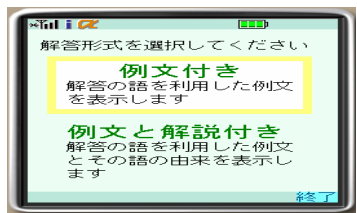
Fig. 3. Flow of system

Fig. 4. Selection of method of presenting

The square on the answer format selection screen moves up and down with presses of the upper and lower buttons. The problem screen is displayed with a push of the enter button.

The flow up to the appearance of the problem screen generates random numbers first and then judges whether the problem is correctly answered. If the problem is correctly answered, random numbers are generated again. In the case of other problems (problem incorrectly answered or left unanswered), the array is called and the problem is displayed. Next, random numbers are generated in the answer group. If the same random numbers are generated, random numbers are generated again. If the same random numbers are not generated, choices are displayed. Moreover, as an answer format, choices of the answer correspond to the figure key. (The user goes to figure key 1 by selecting (1)

The flow chart for the answer screen (Figure 5) distinguishes whether or not the answer is correct. In the case of a correct answer, the system removed the problem from the problem list and displays the answer. In the case of an incorrect answer, the system registers the mistake in history management and displays the correct answer.

The line scrolls within the range when the user pushes the upper and lower buttons on this screen. 'Following' displayed in the lower right of the screen (corresponding to the 'Menu button' on the mobile phone). The system advances to the following
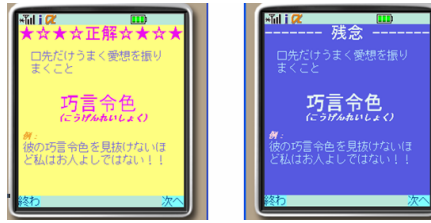
Fig. 5. Answer display

problem when the user pushes the 'Menu.' The 'Finish' message displayed at the bottom left of the screen corresponds to the 'i' button. The system advances to the correct answer rate display when the user pushes the 'i' button.

The meaning will scroll up and down the history management screen (Figure 6) when the user pushes the upper and lower buttons. If the user pushes the enter button, the system sets the problem with the meaning enclosed in the blue line. If the user pushes the 'i' button, the system returns to the main menu.

This is principally a screen for first-time users. The screen explains the method of operating the system and meaning of the system.
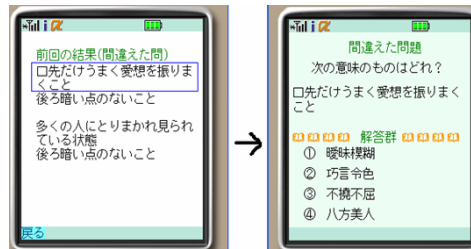

Fig. 6. History management screen

5   Experimental Results and Examination of the Effectiveness

Our purpose here was to examine whether the two answer formats obtained from the experiment were effective. The experiment was executed after a prototype registered on a website was downloaded to a cellular phone. In an experiment conducted over a 10-minute period, 10 test takers were asked to present two answers. After the study phase, the experiment proceeded in the following steps: "answer format," "problem format," "history management," and "operability of the keys." The results and considerations are described as follows.

5.1   About Operability

Over 90% of the test takers answered that the operability of present key arrangement was good, regardless of the method used to present the answer. With respect to the arrangement of the answer key, 20% of the test takers who studied using the

"Example" method for answer presentation chose the "2, 5, 8, 0" arrangement not used by the experiment.

5.2   About the Correct Answer Presentation Form

Over 30% people overall answered that they had been able to select the "necessity" about the method of answer presentation. The test takers who chose "only example" explained that "I want to answer many problems" and "I don't want to read the explanation sentences." The test takers who chose "example and explanation" explained that "It was interesting to learn about the origin of the word" and "I expected it to help remember the etymology more easily." There are clearly individual variations in the way people consider the methods used.

   With respect to the impressions after study, test takers who chose "example" answered "four-character idiom shown in problem sentences with explanations of meaning," while test takers who chose "example and explanation" answered "four-character idioms." The reading of the explanation sentences apparently deepened the learners' impressions of the words.

Table 4. Questionnaire of correct answer presentation form

Answer form		Unit(%)	
		With explanation	Only the example
The answer form about being able to choose	Necessity	70	60
	Unnecessary	30	40
It remained in the impression.	Word of answer	80	50
	Meaning	30	60
	Explanation	40	×
	Example	10	10

5.3   Problem Display Form

With respect to the form of the problem-setting questions, all test takers answered that it was okay to newly set a problem that had been previously answered incorrectly. Moreover, the lowest number questions that answered in ten minutes were 20, and the highest number was 88. Individual variation was caused even when the same method was used for the answer presentation. 80% of test takers answered, "Good" about the number of problems being not set. This also suggests that it is effective not to set the number of problems.

5.4   About the History Management

History management is an effective option, as many people indicated that history management was "necessary." Equal numbers of questionnaire respondents selected "answer the problem" and "display only the answer" in the history management. But the test takers who chose the "example" method of answer presentation tended to answer "display only the answer," while the test takers who chose "example and explanation" tended to choose "answer the problem."

6   Conclusion

Our examination of the effectiveness of the answer formats revealed that two effective types can be selected: "the word, the meaning of the word, and an example of the word in use" and "the word, the meaning of the word, an explanation of the word, and an example of the word in use." This clarifies the methodology for constructing the prototype site for supporting study of employment SPI measures using mobile phones.

Three tasks lie ahead. (1)The test takers suggested "if the answer is corrected, displayed the only example in the answer form and if the answer is incorrect, displayed the example and explanation in the answer form", so there is a need to consider whether the answer format can be studied efficiently. (2) It will be useful to develop mechanisms to enable a beginner's class, intermediate class, and higher class to select problems appropriate for their abilities. (3) For managing the history, it will be good provide the capability to display the current score, the number of problems answered correctly before, the highest score, etc.

Acknowledgement

References

1. Akinobu, A.: Introduction of Cellular Networking for Revitalization in University Classes. In: Human interface symposium thesis collection, pp77–80 (2003)
2. Akinobu, A.: Trends and Prospects of Utilizing Mobile Phones in Educational Fields, control and information, vol. 50(6), pp. 226–231, 20, 20060615(ISSN 09161600)
3. Becking, D.: How to match mobile learning resources with learners current needs: The didactic profiling? In: Proc. HCII2005 144 (2005)
4. Henderson, J.: Memory and Forgetting published, Routledge (1999) (ISBN 041518651x)
5. Morris, D., et al.: Man watching translated by Raija Mattila (1977). translated by Fujiita man watching, Shougakukan (1981)
6. Kopomaa, T.: The city in your pocket (2000), translated by Kawaura: The mobile phone changes the world, Kitaoji Bookstore, p. 52 (2004)