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Characteristics of Mobile Phone E-learning Systems in Japan

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The present study developed a checklist concerning the characteristics of mobile phone e-learning systems in Japan, which includes items for site contents (learning materials and study guidance), technology (operability, design, and system), and management. We employed a content analysis method to evaluate 14 learning sites based on this checklist. The results showed high scores for items in technology overall, however, scores for items in study guidance and management were low. The findings suggest that mobile phone e-learning systems in Japan are superior in their technological aspects; however, it seems there is some room for improvement in contents and management aspects in the future.

Keywords: mobile phones, e-learning systems, characteristics, checklists, evaluation

Introduction

In recent years, e-learning has become popular as a new form of learning in an advanced information society. E-learning on mobile phones has gained increased attention due to its superior ubiquity.

Research on mobile phone e-learning has been conducted in countries all over the world (Wood, Atkinson, Johnson, & Phippen, 2007; Bettelheim, Tal, & Mermelstein, 2006; MacCallum, Jeffrey, & Kinshuk, 2007), and is often conducted in Japan as well (Kunori, 2005; Kimura, 2007; Quang & Sasaki, 2006; Honma, 2002; Hamaoka & Nakagawa, 2006). The Ubiquitous Learning Consortium was established in Japan, March 2005, which engages in activities to popularize mobile phone e-learning (Ubiquitous Learning Consortium, 2008). A web survey by Mitsubishi Research Institute (2004) shows that out of 1,741 mobile phone users between the ages of 15 and 59, 46.5% were considering using mobile phone e-learning.

However, another survey reports completely different results. Among 300 Internet users

between the ages of 15 and 59, who were able to access the Internet through their mobile phones, over 30% answered, “I don’t want to use it,” and over 20% answered, “I don’t really want to use it,” which suggests that over half of the responders have a negative attitude towards mobile phone e-learning (ITmedia, 2005). This survey also reports that only 2 out of the 300 survey responders have had experience in mobile phone e-learning.

A related aspect is that some researchers hold the opinion that mobile phone e-learning is unpopular in Japan, a reason for this might be the lack of good quality electronic learning materials (Sugiura, 2005). However, up until now, little research has been conducted to evaluate and analyze the characteristics and issues of mobile phone e-learning.

The purpose of this study, therefore, is to evaluate and analyze the characteristics of mobile phone e-learning systems in Japan. We investigated the systems points of excellence, what kind of issues they have in general, and sought to obtain suggestions concerning aspects for future improvement.

We employed a content analysis method often used in mass communications research. This method includes procedures to encourage multiple coders to rate the same targets and to validate the objectivity of analysis and evaluation from the agreement rate.

Method

Targets and Period of Implementation

The targets for this study were the learning sites available on NTT DoCoMo and au (by KDDI) mobile phones, which were the two most famous mobile phone brands and had many subscribers in Japan. According to the Telecommunications Carriers Association (2005), the three most popular brands in Japan were NTT DoCoMo, au, and Vodafone (currently SoftBank); their subscribers in October 2005 amounted to approximately 50 million, 21 million, and 15 million, respectively. As the combined total of mobile phone subscribers for the 2 brands, i.e. NTT DoCoMo and au were nearly 80% of all subscribers in October 2005, we assumed that if we used only the learning sites of these 2 brands it would not, in any way, detracted from what they represent.

We chose learning sites that were classified as “study/qualification” and “home study” from the sites that were registered on the i-mode and the EZweb menu of the two brands’ Internet services (i-mode and EZweb are the names of NTT DoCoMo and au’s Internet services). Among these, (1) sites deemed to have a high degree of social merit, such as “Shortcut! Pass the English Proficiency Test,” which won the Japan e-Learning Awards, and (2) sites believed to have a high number and a wide range of users, such as those introduced in magazines related to mobile phones and computers were selected, for a total of seven sites from i-mode and seven sites from EZweb. Although the learning fields in 10 of the 14 sites mainly focused on English learning, as English learning was the main purpose of a majority of the existing sites, we believed that this distribution was appropriate. Further, both i-mode and EZweb provided “Shortcut! Pass the English Proficiency Test,” and as different brands often provided the same

service, this site was included as a target for both brands.

Table 1 indicates the learning sites that were rated and analyzed, names of the companies that provided these sites, eligible people, contents and characteristics in this study.

This study was conducted in November 2005.

Table 1. *Profile of Sites Evaluated*

	Persons Eligible	Contents	Characteristics
NTT DoCoMo			
Shortcut! Pass the English Proficiency Test (Toppan Printing)	People who have difficulty with English	Memory and confirmation tests using memory sheets	Specialized vocabulary learning for the English Proficiency Test
NOVA Keitai Ryugaku (NOVA Corporation)	People who want to learn English	English in latest news, industry and specialized fields	Question delivery format, small step format, divided by learning contents
Keitai Doranet (NEC Corporation)	Elementary school students	Japanese, arithmetic, science, social studies	Quiz / puzzle format
Eigotsuke (Dwango)	Adults who have difficulty with English	Basic vocabulary and easy-to-understand sentences	Training in sentence building
The World of Kanji (Zappallas)	No particular restrictions	Kanji that is difficult to read	From mocks for Kanji Kentei to puzzle format quizzes
TOEIC Test Keitai Master (Bizcom-Japan)	TOEIC candidates	No fine divisions in study contents	Question delivery format, listening and reading are divided
ECC Keitai Lessons (Kiss-FM Entertainment)	People who want to learn English	Useful expressions, vocabulary and phrases, strengthening grammar, etc.	Emphasizes vocabulary and grammar power
Au			
Shortcut! Pass the English Proficiency Test (Toppan Printing)	People who have difficulty with English	Memory and confirmation tests using memory sheets	Specialized vocabulary learning for the English Proficiency Test
Toshin Keitai Prep School (Nagase Brothers)	Entrance exam students	Classic / modern literature, Classic Chinese, Physics, Chemistry, etc.	Contents can be freely selected, and "Entrance Exam Treasure Box" also available
Cinema English Conversation EX (Tsutaya Online)	People who want to learn English	English, subtitle translation	English lessons with audio and visual functions
English Vocab with Mobile (Techno Search)	Entrance exams students	Entrance exams for high school, university and TOEIC measures	Segmented levels and random display of English vocabulary
Mainichi Kotsu Kotsu eTango! (Communication Compass)	People who want to learn English	English vocabulary, phrases test question edition, etc.	Quiz format
Study Course "Rakkuben" (Idea Corporation)	Elementary and junior high students	Japanese, arithmetic, English, etc.	Improve listening with vocab book and audio contents
Eigo no Tatsujin (AltaVista)	New TOEIC, English conversation, university entrance exams students	English vocabulary, phrases, newspapers, etc.	English learning with manga

Procedures

In order to evaluate the characteristics of mobile phone e-learning systems, we first developed a checklist and conducted a preliminary survey to cultivate it. We then conducted a main survey using this cultivated checklist to evaluate and analyze the 14 sites mentioned above. All detailed procedures were as follows.

Development of the Checklist

As only a few e-learning evaluation checklists have been developed thus far, there were almost

no existing checklists available to evaluate mobile phone sites. Therefore, we collected appropriate items from checklists for educational web pages (Omi, Yatsuzuka, & Sakamoto, 2005) and educational TV games (Hirakawa, Ihori, & Sakamoto, 2005). Furthermore, as most sites in this study were intended for English learning, we also referred to the checklist for English learning multimedia by Tanaka (1997). We also referred to checklists such as Guidelines for Evaluating Web Sites (Abdullah, 1998) and The Quality Information Checklist (Health Development Agency and Center for Health Information Quality, 2000), which were intended for general websites. Necessary changes were made based on the items in these previous checklists, and a few new items to develop a draft checklist for evaluating mobile phone e-learning systems were added. This checklist included 78 items and notes concerning the rating process.

Further, we developed five grades for each item, modeled on the previous checklists to which we referred. The coders rated the item by selecting a grade. Table 2 shows representative examples of items and grades. The number that is selected becomes the rating score of each item; the higher the score, the higher the evaluation of each item of the site.

We conducted a preliminary survey in order to make improvements to this checklist.

Table 2. *Checklist Items and Examples of the Five Grades*

Item	Category	Check Contents	Choices
1	I	It is easy to work out the information fields handled by the site.	5. It is possible to work out immediately from the title; 4. It is possible to work out from the top page; 3. It is possible to work out from the sub-heading and when looking through specific contents; 2. It is possible to work out vaguely but it is no
35	II	Some kind of reward is given for exercises.	5. Reward rank changes in detail depending on number of correct answers (3 ranks or more); 4. Reward rank changes generally depending on number of correct answers (2 ranks or more); 3.The same reward is given and progress is made even if only 1 correct
31	III	When using the site, excess inputting is not necessary.	5. Excess inputting is not required at all; 4. Excess inputting is almost not required at all; 3. Excess inputting is not really required at all; 2. Excess inputting is required to a certain extent; 1. Required inputting is excessive.
23	IV	Text is unified in colours that are easy to see.	5. Text colour is unified on each page; 4. There are some parts that are different but it is basically unified; 3. Cannot say either way; 2. There are some parts that are unified but it is basically different to read; 1. Test colour is different on ea
38	V	Page download time is not too long.	5. Loads within 10 seconds; 4. Loads within the stated time; 3. Cannot say either way; 2. It is slow but it is not so long that I cannot wait; 1. It's considerably slow.
6	VI	Site is updated with appropriate regularity.	5. Almost all site contents are updated daily; 4. Some site contents are updated daily but there are many that are not; 3. Almost all site contents are updated weekly; 2. Almost all site contents are updated fortnightly; 1. Almost all site contents are updated fortnightly; 1. almost all site contents are updated monthly or less / site contents are basically not updated.

Preliminary Survey

The preliminary survey was conducted with four sites (two sites from each, NTT DoCoMo and au), randomly selected from the 14 target sites, and were evaluated by six coders. We chose, as the coders, graduate and undergraduate students studying psychology/social survey, or who were well versed in the use of mobile phones. Among these six coders, three were assigned to rate the two NTT DoCoMo sites, and the other three were assigned to rate the two au sites. In addition, NTT DoCoMo coders used FOMA, and au coders used WIN mobile phones, because these represented typical models of the two brands.

On the coding sheet there were spaces for the coders to write down why they chose a particular rating and points that were difficult to understand. Additionally, the sheet had spaces to record basic information such as the date of the rating; the name of the learning site being rated; the name, affiliation, and age of the coder; and the model of the mobile phone the coder used.

Based on these results, items that did not have a high reliability, i.e., those whose agreement rates were low (e.g., "Based on records of individual results and progress in tasks on the site, such as support in order to decide the direction of learning at home is provided," "There are sufficient examples and similarities believed to be easily understood by learners") were excluded. Moreover, we found some problems based on the coders' indications and comments, thus we deleted the items whose definitions could not be understood well enough, or those for which the coders' interpretation differed from that of the checklist (e.g., "The learning goals of the websites are defined clearly, comprehensibly, and concretely," "Pedagogical philosophy: is it instruction principle or constructivism"), or the items that were difficult to judge objectively (e.g., "There is educational value in the themes that the site is trying to teach," "All presented information is accurate"). Finally, bearing in mind our role in evaluating the entire mobile phone e-learning system, we removed items applicable only to sites with specialized purposes or content (e.g., "The site promotes cooperation between learners," "The site effectively motivates the creativity of learners," "Learners' cooperation is requested in order to accomplish the study"). Eventually, 52 items remained that were considered in the main survey.

We employed the classification framework of previous checklists as a reference and divided the items into six categories: I. Items for learning materials, II. Items for study guidance, III. Items for operability, IV. Items for design, V. Items for system, and VI. Items for management. I and II

Table 3. *Structure of Checklist and Average Scores for Each Category*

Items	Number of Items	Category No.	Scores
Items concerning Contents			
1. Items for Learning Materials	10	I	4.11
2. Items for Study Guidance	14	II	3.75
Items concerning Technology			
1. Items for Operability	7	III	4.35
2. Items for Design	8	IV	4.71
3. Items for System	7	V	4.78
Items concerning Management	6	VI	2.71

are related to contents and III-V are related to technology. Table 3 shows the classification structure. The six representative examples in Table 2 were selected from the categories I to VI.

Main Survey

Fourteen college students rated the 14 target sites in this survey. There were three reasons for our choosing college students as the coders here. First, as the checklist we developed was objective, we believed that the results would not differ too much even if we used students instead of experts as coders. What is more, the coders chosen in this study were majoring in psychology/social survey and education, which meant that they were accustomed to evaluating and had the skills to rate correctly and appropriately. Finally, their rating skills would be further improved, because we trained them how to rate, as follows below. For these reasons, we chose college students as the coders in the preliminary and the main survey.

Seven coders rated seven NTT DoCoMo sites, and the other seven coders rated seven au sites. Every coder was randomly assigned to rate three sites; each site eventually being rated by three different coders. The combination of coders was different between sites. After the ratings were performed, agreement rates were obtained from the three coders.

The average age of the coders was 19.4 years, the average period during which the coders had used Internet-enabled mobile phones was 47.9 months, and the average time the coders spent using a mobile phone was 1.9 hours per day. All but one coder had no experience using a mobile phone learning site. Around 90% of all the coders owned a computer, and the average time they spent using it was 1.8 hours per day. All but one coders had no experience of e-learning on a computer. The average rating time for the coders was 2.3 hours.

Prior to commencement, the coders received instruction and training about the checklist and how go about rating. After handing out the checklist, we showed the coders what these items were. We explained each item, using specific examples from sites that would not be rated by coders in the actual survey. After we had resolved all of the coders' questions, we made sure that they understood the nature of their job, and they began.

First, we explained to each coder how to access the mobile phone learning sites that they were going to rate and requested them to register themselves on their respective sites. The coders learned or played games on the actual sites. If appropriate, they used mailing lists and websites, etc. offered by the provider to fill in the checklist. In order to confirm which characteristics of a site generated the coders' ratings and whether these judgments were appropriate or not, we asked them to fill the spaces below the check boxes with specific reasons. We provided a "free comment" space on the last page of the checklist. The coders filled this in with their notes and merits/demerits of the sites.

We instructed orally when we conducted the above explanation, in addition to, identical instructions mentioned on the cover of the checklist as "Notes". Specifically, the coders were instructed how to conduct the ratings thoroughly by themselves, to read all the contents of the items properly, to browse through the entire site, to fill the given spaces for reason with as much detail as possible, to check with the authors if any questions came up, and not to start working again until all their questions had been resolved. Further, as some items included a requirement

to use the provider's company website as a reference, we distributed a form with the sites URLs and asked the coders to access the appropriate website when rating such items. Finally, we instructed the coders how to register and how to refer to any mailing lists or links to information sites.

The median of the three scores for each item on each site became the level of achievement for that site, and the average score for all 14 websites were calculated.

Results and Discussion

In this study, all but one coders had no experience in e-learning. Since we excluded items that were difficult to judge objectively, and as the agreement rates between the coder with learning experience and the other coders were high, we analyzed their data together as follows.

Agreement Rates

There were 14 sites in this study, which meant that one item could receive 42 pairs of coder rating [if one site is rated by three coders A, B, and C, three pairs of ratings occur (A & B, B & C, C & A), hence, there are 42 pairs for 14 sites]. The agreement rate between the coders for each item in this study was thus calculated as the "number of agreed ratings among 42 pairs divided by 42." However, as the agreement rate in the 5-point scale was low (the median of the agreement rate of all 52 items was .38, and the range was .17- .81), analysis was conducted using the 3-point scale. For the 5-point scale from 1-5, 1 and 2 were calculated as 1, 3 stayed as it was, while 4 and 5 were calculated as 5.

As a result, the median of the agreement rate for the 52 items was .60, and the range was .21- .95. However, as there were eight items whose agreement rate was less than .40, we excluded them from the analysis. The median of the agreement rate for the remaining 44 items was .68, and the range was .43- .95. Since each site was rated by three coders and since this could heighten the level of reliability, the value of .68 is considered to be acceptable.

Overall Average of Each Item

A median value of the rating score for each item was obtained from the three coders, and was used for the 14 sites. We used the averaged score from all 14 sites as the item's index. Based on these average scores, each item was divided into one of four groups, and Fig. 1 shows the frequency totals for each group. From Fig.1, we can see that 70.45% of the items had scores that ranged between 4.00 and 5.00. It can be said that the achievements levels for the sites eligible in this study were high as a whole.

Next, when we see the average scores for each category (Table 3), the highest category was items for system, followed by the items for design and operability. The categories with the lowest scores were those for management and study guidance.

Table 4 shows the average value for each item. Out of 44 items, one-third (15) items with the

highest scores can be regarded as the top items, and one-third (15) items with the lowest scores can be regarded as the bottom items. In other words, the top items are the 1st item "Background and characters are easy to view" (Item 22) up to the 15th item "Screen display is clear and is well-formatted" (Item 27), are the top items. While "It is easy to understand the target of the site" (Item 3), which is the 30th item, up to "There are hints for the correct answers" (Item 16) are the bottom items.

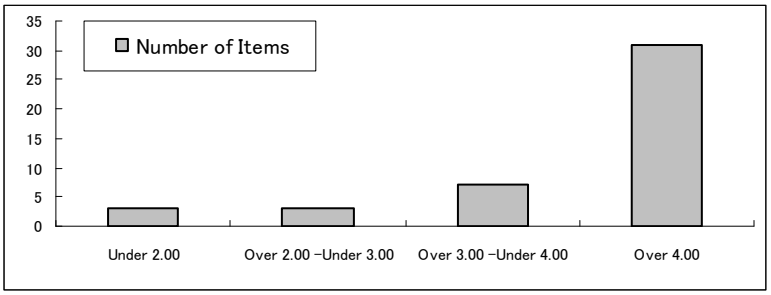

Figure 1. *Distribution of number of items for each group*

Top Items

As shown in Table 4, scores for the top items were 4.86-5.00. A majority of the top items were for technology; its breakdown was three items for operability (all seven items), five items for design (all eight items), and five items for system (all seven items). These top items included ease-of-use buttons, easy to view backgrounds and characters, appropriate fonts and white space, screen clarity, length of loading time, how easy the program is to open, length of time to reach the desired contents, etc.

Based on the results above, we can see that e-learning systems on mobile phones have the following positive aspects.

The system's easy to view layout was the first. There were many items with the highest scores that related to good design, such as appropriate font sizes (Item 24), unified text (Item 23), enough white space (Item 25), the balance of background and characters (Item 22), and clear and well formatted screen display (Item 27). We can say that almost all the sites fulfilled this characteristic of design satisfactorily. As the display pixel counts of mobile phones are far less than those of computer screens, though they are not particularly good for graphs, it can be said that the sites had appropriate, simple, and easy to view designs for mobile phones overall.

Second is the system's convenient operability. There are fewer operation buttons as mobile phones are smaller tools than computers. For this reason, almost all sites' operations were composed of operation cursor and decision buttons. It is possible that this simplicity led to the coders' following answers: no excess inputting is required (Item 31) and all the buttons are easily understood (Item 20). Furthermore, most coders answered that the sites did not stop responding even when they pressed the wrong buttons (Item 28). This response also implies excellent operability.

The third is the system's ease of use. Almost all the coders replied that the pages loaded and programs opened within 10 seconds (Items 38 and 39; see Table 2 for details about Item 38. The choices of Item 39 are similar to those of Item 38), and they could move from the top page to the required contents in a short time (Item 40). In addition, almost all the coders answered that they could use the sites easily because the sites did not stop operating even when they made small mistakes (Item 34) and the processes hardly took away any time that could be spent on learning (Item 37). These responses may be a reflection of the fact that the processing capacity of mobile phones, nowadays, is such that they can process high volumes of data faster than ISDN, etc.

As these results indicate, nearly 87% of the top items were those for technology, and it can be said that mobile phone e-learning systems in Japan excel in technological aspects. The fact that the evaluation for technology was high, is similar to the results for other cases of e-learning (Connolly & Stansfield, 2006; Naismith, Lonsdale, Vavoula, & Sharples, 2004; Shimizu & Miyazawa, 2005; Hirakawa, Ihori, & Sakamoto, 2005).

Bottom Items

When looking at Table 4, we observe that the bottom items' scores were 1.43-4.00. At the same time, we find that the differences between these scores were larger than those for the differences between the top items. Category VI, related to management, was particularly remarkable since five items (all 6 items) were found; a few items for study guidance and learning materials were included in the bottom items as well.

From the results for the bottom items, it is possible to consider points of issue and improvement for mobile phone e-learning systems in the following manner.

First, one-third of the bottom items were those for management. There was no information that showed provider companies were conducting surveys in order to certify site validity in the sites (Items 43). Even when there were items concerning the means of provider companies to discuss customers' complaints, although there were displays for enquiries, no descriptions of customers' complaints could be found on the sites (Item 44). Moreover, neither interesting supplementary information nor projects were proposed on the sites (Item 9). Although there were some descriptions of information/communication fees on some sites, not all the sites offered sufficient information (Item 42). In the future, we would expect providers to improve such issues. In addition, though the sites are updated regularly (Item 6), this criterion belonged to the bottom items here.

Second, in the category of study guidance, the feedback and hint items had particularly low levels of achievement overall. We can see that there were not many sites that provided feedback or gave additional practice when learners answered incorrectly (Item 17). Very few sites gave learners hints or opportunities to answer again or to correct their answers when they responded incorrectly (Item 16). Further, we can see from the results of Item 35 that many contents gave the same rewards to learners whether they got only one answer or all the answers correct. In this respect, it seems that there is a weakness in learning support feedback functions. Such poor individual feedback further suggests that the learner core approach, which is a feature of

Table 4. *Items and Average Scores for the Checklist in This Study*

Rank	Category No.	Scores	Item No.	Item Description
1	IV	5.00	22	Background amd characters are easy to view.
1	IV	5.00	23	Text is unified in colours that are easy to see.
1	IV	5.00	24	Appropriate fonts are used.
1	IV	5.00	25	There is enough white space.
1	III	5.00	28	The site does not stop responding if the wrong button is pressed or the wrong command is given.
1	III	5.00	31	Excess inputting is not required when using the site.
1	V	5.00	34	It is not designed to entail serious results if a small mistake is made.
1	V	5.00	37	Hardly any time at all is required to learn.
1	V	5.00	38	Page download time is not too long.
1	V	5.00	39	Programs (images, videos, etc.)are easy to open.
1	V	5.00	40	It does not take long to get from the top page to the required contents.
12	II	4.86	4	Guidance contents and methods are not so unprecedented and not something that is unconnected to the experience of learners up until now but they are often familiar situations.
12	I	4.86	13	There are many opportunities for learners to select and decide and many exercises, etc. are provided.
12	III	4.86	20	Operation buttons are easy to understand. (e.g., If the i-mode (Ezweb) button is pressed, the operation of "Back" is possible.)
12	IV	4.86	27	Screen display is clear and is well-formatted.
16	I	4.71	1	It is easy to work out the information fields handled by the site.
16	I	4.71	10	It is possible to progress with learning the contents without using a textbook or other reference books.
16	I	4.71	14	Grammar, spelling (okurigana, kanji, English spelling, etc.) and punctuation are correct.
16	IV	4.71	21	Text layout is easy to read.
20	I	4.57	12	The site continuously works based on a uniform (standardized) set of
20	III	4.57	30	It is possible to skip if the student already knows the contents of the le
20	V	4.57	41	The site can be used with any model.
23	II	4.43	8	Metacognitive support (possibility of comprehending level of understanding) is available.
23	III	4.43	29	The site is easy for learners to use due to the menu or other functions.
23	II	4.43	36	If a mistake has been made the learner is informed promptly.
26	I	4.29	2	The themes handled by the side cover a wide range of subjects.
26	II	4.29	7	As student results improve, the learning content level rises.
26	II	4.29	18	If the learner becomes "Stuck" during the interaction, the correct answer is displayed and explained.
29	IV	4.14	15	The appearance such as illustrations, tables / figures and photos, etc. is of good quality.
30	I	4.00	3	It is easy to understand the target of the site.
30	IV	4.00	26	Colours are used appropriately.
32	VI	3.86	6	Site is updated with appropriate regularity.
32	V	3.86	33	There is some kind of clear display to show whether inputting has been successful or not.
34	III	3.71	19	Learners can skip and repeat the explanation, practice, the result, and each part of the summary at their convenience, etc.
35	I	3.29	11	If there are learning tasks, etc. in game format, it is not necessary to look at the manual to understand the game rules.
35	II	3.29	35	Some kind of reward is given for exercises.
37	VI	3.14	42	There is a description of information / communication fees.
38	II	3.00	17	There are interaction such as feedback and exercises for wrong answe
39	III	2.86	32	It is possible for learners to participate in and decide how information is displayed on the screen.
40	VI	2.57	9	Guidance with interesting supplementary information or projects are proposed.
40	VI	2.57	44	The provider company is actively discussing why customers are dissatisfied with their site.
42	I	1.86	5	The site contents include multiple fields.
43	VI	1.43	43	The provider company is conducting surveys in order to check the validity of its site.
43	II	1.43	16	There are hints for the correct answers.

e-learning, has not yet been practiced. However, this kind of issue does not only occur in mobile phones but is similar to other types of e-learning (Shimizu & Miyazawa, 2005; Hirakawa, Ihori, & Sakamoto, 2005). In particular, the processing capability of mobile phones is limited when compared with computers, and it may not be easy to provide such functions.

Furthermore, there was an issue with limitations in learning materials fields. As the majority of mobile phone e-learning contents handled only English learning (Item 5), we can expect the development of contents in various fields in the future.

Conclusion

This study used the method of content analysis to evaluate and analyze the characteristics of mobile phone e-learning systems in Japan. The results confirmed that the technology (operability, design, and system) was excellent. In contrast, it was suggested that (a) service providers improve issues concerning management, (b) feedback and hints on study guidance were insufficient, and (c) the sites needed to develop contents in various fields on learning materials.

It seems that up until now research on mobile phone e-learning had mostly concerned the development and evaluation of individual systems/contents and practical trials to integrate these into school education. In contrast to this, the present study attempted to systematically understand the overall characteristics of mobile phone e-learning. It is considered that among a variety of possible research and development tasks, the need to obtain suggestions for future directions has a significant meaning.

The checklist developed in this study can be used with the 3-point scale, and even with this checklist, it is possible to evaluate mobile phone e-learning systems. However, if the accuracy of the 5-point scale is required, it is necessary to improve this checklist further, and this could be an issue for future research.

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