

# Construction of Guideline for Mobile Learning Contents

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**Abstract:** This paper is a report on the findings of a study based on empirical research on mobile learning. We conducted concrete and theoretical research on the modern problem of mobile learning considering the learning environment. Although lifestyle and transportation differ in each country and area, we used an audio-visual test of contents, questionnaire surveys, a performance test in train and room environments and then we had experiment for media comparison. As a result, the questionnaire survey revealed that many learners tended to regard the room environment as suitable for study. On the other hand, a significant main effect was detected in the contents with the caption in the performance test. But, in experiment for media comparison, we don't have main effect for everything. We reflected on the problems of the modern mobile learning study and performed a substantial study of the theory of mobile learning that considers the learning environment.

## Introduction

The next generation's, people will not specify place for studying, because we are losing a concept of "Classroom". Study became the one of free "The environment is not chosen". Not only "Facing lecture" of the old model but also the lecture of the university has various the one. It is Distance Learning (d-Learning) that uses the Internet and satellite broadcasting, e-Learning, and mobile learning (m-Learning).

Recently, many countries have actively begun practicing mobile learning. For instance, Teresa Franklin et al. (2007) reports on the practices in the teacher training course at a Midwestern university in the U.S. These practices entailed the use of a personal digital assistant (PDA) that could be connected to a wireless network, and the class support was done to students. The report, etc., were supported by simple Microsoft Office soft functions of word processors and spreadsheets, etc. Moreover, Yamamoto et al. (2006) are developing a class support system in a Japanese university that includes the development of attendance management, voting, class information mail delivery, opinion collection, a homework bulletin board, and students' discussion tools. As a result, it is clear that those who attend a lecture can participate in class with interest. Watanabe et al. (2008) evaluated the university's Teacher Education Program with an iPod. However, a basic research on mobile learning has not been conducted thus far. However, a basic research on mobile learning has not been conducted thus far.

## The Study

Experiment 1 focused on mobile learning in Japan and conducted actual experiments in both a general room environment and a train environment. Concretely, the examiner observed and heard animation contents in both the environments and subsequently performed a performance test. The examiners comprised 20 university students and postgraduates living in the metropolitan area (13 men, 7 women; average age of 21.2 years). The experiment was conducted in July 2007.

The investigation items were a questionnaire survey, a performance test. We divided the questionnaire survey into two periods (before and after). Further, we investigated the degree of the factor that can be obstructive in the two environments, the method of daily studying and make them describe and impression make them describe freely. Within the performance test, a key word reproduction test, a correction judgment test, and a content explanation test were set as per the attention contents. Table 1 provides the outline of the investigation.

Examiner	University student
Time	August 2007
Participant	20 (Male 13, Female 7; Avg age: 21.2)
Investigation form	Questionnaire form (scale + free description) Performance test

Table. 1 The outline of the experiment

This experiment was conducted in both environments. The train experiment was conducted in a commuter train in Tokyo because of the following main reasons. (1) The surface of the route is mostly flat; (2) there is no tunnel on the route, so the brightness is almost constant; and (3) since there are no abrupt curves, safety can be assured. Moreover, the experiment operator accompanied the participants every time in consideration of their safety. Close attention was paid in the train so that the other passengers were not troubled. Each time, we boarded the same compartment in order to arrange the experimental conditions. The room environment experiment was conducted in a general room. Fig. 2 illustrates the experiment scenario of both environments.



Fig. 2 Both of the experimental environments

The following are the three investigation items: a questionnaire form (scale + free description), a performance test, and a measurement of visual range. In the questionnaire survey, we questioned the examiners about the two environments before and after the experiment. The same question about the environments is investigated for the obstruction factor concerning the study. In the performance test, study corresponds to memory and understanding refers to active learning according to Mayer (2005). Therefore, memory can be measured in the key word reproduction test and the correction judgment test. In addition, understanding can be measured in the content explanation test. Concretely, information by caption is presented in ten places, and the ten places are divided into four contents. The ratios of setting questions were united by all contents. Table 2 shows the detailed ratio.

Viewpoint of question	Number of questions
Understanding: Content explanation	3

Memory: Key word reproduction	3
Memory: Correction judgment	4
Total	10

Table 2 Ratio of setting questions for the performance test

Furthermore, approximately 3 minutes before the performance test, the examiners obtained the calculations of 20 questions (mixture of the arithmetic operation at the elementary school level). The purpose was to discourage the examiners from memorizing the contents by rehearsal before the test. In the questionnaire survey, it questions after an environmental thing of the room the questionnaire after a prior questionnaire and an environmental thing of the train, and it has questioned after the fact. The frame of each questionnaire is shown in the following table. The same content in two environments is investigated for the obstruction factor concerning the study depicted in the broken line in Fig. 2.

Experiment 2 applied animation content and required the learners to study in a moving train. The purpose of this experiment was to identify a suitable media for mobile learning. In this experiment, we tried to assess the suitability of each media using a performance test. Four content types (Only Caption, Caption with Audio, Caption with Video, Caption with Audio and Video) were prepared; these content types were chosen as it was thought that these were expected by the learners. These are shown in Fig. 3.


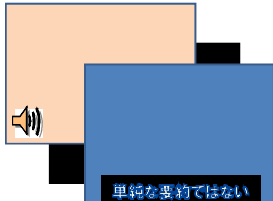


Caption	Caption with Audio	Caption with Video	Caption with Video and Audio
			

Fig.3 Contents used in the experiment

The outline of the experiment and the contents of the test are the same as in experiment 1. After the test, the learners were asked questions regarding their satisfaction with the teaching material and the instructor's presence along with the different media that has been used. Table 3 provides an outline of the investigation.

Examiner	University student
Time	October 2008
Participant	24 (Male 16, Female 8; Avg. age: 22.1)
Investigation form	Questionnaire form (scale + free description) Performance test

Table 3 Outline of the investigation

## Findings

In experiment 1, the results of the investigation of the questionnaire are described below. Tables 4, 5 show the result of each investigated item. Table 4 is the result of comparing the mean values in the train and room environments using a *t*-test. According to Table 4, the items "Concentration," "Easy to study," and "Effective environment," have a mean value that is significantly higher in the room environment than in the train environment. On the other hand, the items "Surrounding eyes are anxious," "A surrounding noise is anxious," "Scenery outside is anxious," and "The volume has often been adjusted," etc., have a higher mean value in the train environment. This enables us to understand that many examiners think that the room environment is more suitable for study than the train environment. Table 5 describes an investigation of a peculiar obstruction factor of the train environment.

	Room		Train		<i>t</i>
	M	SD	M	SD	
Easy to see	4.60	0.88	4.75	0.55	0.68

Minds peoples' attention	1.20	0.52	<b>2.10</b>	1.25	3.11	**
Easy to concentrate	<b>4.15</b>	0.81	3.35	1.04	2.43	**
Easy to study	<b>4.10</b>	0.79	3.15	0.99	3.33	**
Effective environment	<b>4.35</b>	0.88	3.55	1.00	2.49	*
Noisy	1.10	0.31	<b>3.15</b>	1.6	6.10	**
Brightness of the room	1.40	1.10	1.65	1.04	0.71	
Scenery outside the window	1.10	0.45	<b>2.40</b>	1.43	4.21	**
The volume has often been adjusted	1.45	1.10	<b>3.70</b>	1.53	5.33	**
N = 20		1-5 Likert scale				
						* $p < .05$ ** $p < .01$

Table 4 Investigation result of the obstruction factor

	M	SD
Announcements in the train and at the station	<b>3.10</b>	1.77
Boarding and alighting with surrounding passengers	2.15	1.42
Vibrations of the train	2.25	1.37
A sense of resistance on seeing animation in the train	1.15	0.49
Volume adjustment	1.70	1.13
N = 20    1-5 Likert scale		

Table 5 Peculiar obstruction factor investigation of the train environment

As the result of the questionnaire reveals, it was clarified that in many respects, the examiner tended to think it was easy to study in the room environment. On the other hand, it was also clarified that many of the examiners thought that there were a variety of obstruction factors in the train environment.

The performance test was standardized taking into consideration the level of difficulty. An ANOVA was performed on the score after it was standardized by two environmental levels (train or room environment) and two caption levels (with or without caption). Table 5 present the results of analyzing the questions in detail. The horizontal line denotes the question type, and the vertical line denotes the standardized score. This kind of problem contains three levels of the key word reproduction test, the correction judgment test, and the content explanation test. These were analyzed in the question type factor, the environmental agent, and the caption factor. As a result, significant main effects were detected only in the caption factor; they were not detected in the environmental agent or the alternating cropping. Therefore, it is observed that learning was effective in the caption, and there was no significant environmental difference in the question type.

	SS	DF	MS	F
Environment	1.74	1	1.74	1.81
Caption	13.9	1	13.9	17.4 *
Question	2.78	1	1.39	1.59
Environment X Caption	0.03	2	0.03	0.05
Environment X Question	0.05	2	0.02	0.04
Caption X Question	0.93	2	0.46	0.59
Environment X Caption X Question	0.71	2	0.35	0.49

\* $p < .05$

Table 5 ANOVA Results

The results of the questionnaire used in experiment 2 are described below. Table 6 shows the learners' assessment of each content type. Table 7 shows the satisfaction ratings on a scale of 1-10 with 10 being the highest. The results of the posttest questionnaire are shown in Table 8 Table 9 and Fig. 4 show the results of the performance test. The results of the performance test were calculated on the basis of the standardization score.

Focus of learners' attention	Only Caption		Caption with Audio		Caption with Video		Caption with Video and Audio	
	M	SD	M	SD	M	SD	M	SD
Caption	4.75	0.52	4.67	0.55	4.46	0.87	4.50	0.58

Video	1.54	1.00	1.54	1.04	3.71	1.10	4.29	0.79
Audio	1.50	1.15	4.58	0.91	1.54	1.08	4.54	0.71

N = 24 1–5 Likert scale

Table 7 Focus of learners' attention

	M	SD
Only Caption	3.75	2.44
Caption with Audio	6.17	1.91
Caption with Video	5.21	1.66
Caption with Video and Audio	8.13	1.88

N = 24 0–10 scale

Table 8 Content satisfaction rating

	Only Caption		Caption with Audio		Caption with Video		Caption with Video and Audio	
	M	SD	M	SD	M	SD	M	SD
helpful	3.16	1.14	2.52	1.05	3.44	1.04	3.60	1.12
interesting	3.36	1.11	2.80	1.29	3.28	1.21	3.96	1.06
feel something familiar to lecturer	1.24	0.66	2.08	0.81	1.84	0.94	3.48	1.26
deep understanding	3.04	1.21	2.32	1.03	3.40	0.82	3.60	1.19
easy to think	3.64	0.99	3.32	1.22	3.88	1.01	3.72	0.74
easy to relax	2.56	1.26	2.08	1.08	2.92	1.26	3.20	1.19
easy to concentrate	3.32	1.25	2.68	1.18	3.04	1.17	3.36	1.11
easy to study	2.68	1.22	1.96	1.02	3.04	1.10	3.44	1.08
wanted to study more	2.76	1.33	2.52	1.12	2.76	1.05	3.64	1.08

N = 24 1–5 Likert scale

Table 9 Result of the posttest questionnaire

	Only Caption		Caption with Audio		Caption with Video		Caption with Video and Audio	
	M	SD	M	SD	M	SD	M	SD
Content explanation	0.07	0.77	-0.10	1.15	-0.10	1.02	0.13	1.08
Key word	-0.11	1.15	0.25	0.77	-0.18	1.04	0.04	1.03
Correction judgment	0.13	0.89	0.00	1.05	-0.20	1.09	0.06	1.02
Total	0.02	1.05	0.09	0.93	-0.19	1.10	0.08	0.97

Average Standardization Score

Table 10 Result of the performance test

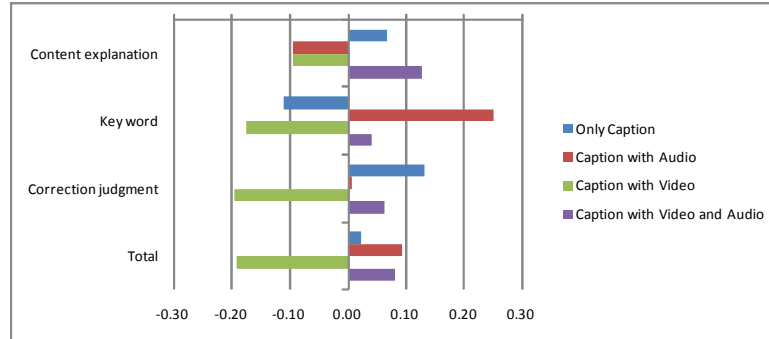


Figure 4 Results of the performance test

From these results, it is understood that the learner paid particular attention to the video. Moreover, as the number of media increased, the satisfaction rating rose; this conclusion can also be reached from Table 8. The influence of the lecturer's presence is thought to be larger than that in Table 9. However, a significant main effect was not detected by a decentralized analysis of the performance test results.

## Discussion

Considering the circumstances mentioned above, it is clear that we can maintain the performance even if the learning environment is changed by Caption. Moreover, there are a lot of people who answered that incorporating other media led to a rise in the satisfaction rating and that the presence of a caption would make it easier to learn. It was suggested that there is a possibility that these measures might prevent dropouts.

## Conclusion

The research on mobile learning is relatively new. Therefore, it is necessary to conduct the basic research accurately. In the future, we will not be able to develop even the contents of mobile learning solely on the grounds of practice.

Lorna Uden (2007) shows the development and evaluation method of a mobile learning application using Active Theory. According to the author, to realize a method for developing mobile learning content, a detailed discussion is necessary along with a similar such attempt and an empirical experiment.

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