

# “Integrative Education Environmental System” Operated by Active Learning System Using Smart Phone

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## Summary

Currently, the Smart Phone spread all over the world. Of course, the diffusion rate in Japan increases rapidly, too. Particularly, as for the Japanese university student, most students possess a Smart Phone. According to this, university start practicing the new class form called “The smart phone using class”. The diffusion rate of Smart Phone continues grow and grow. Therefore, we thought that “The smart phone using class” is useful. However, a big problem is left. It is “Inappropriate use” of the smart phone. This problem is very serious in the present. So in this research, we propose an integrated learning environment system to realize the class use of the smart phone. As the method, we build the class environment that students use Smart Phone appropriately. In addition, we developed application for classes that students can participate in a class with the Smart Phone. By these two structures, we build “Integrative Education Environmental System” that enables class assistance using the smart phone while limiting “Inappropriate use”.

### Key words:

*Smart phone, Inappropriate use, Class assistance, Environmental System*

## 1. Introduction

A cellular phone is the electronic equipment that everybody knows now. Also, it is household electricity having closest relation to a person. In late years, especially, the businessman and the student users are increase. The diffusion rate of the cellular phone is increased. According to this, the cellular phone becomes a matter of basic needs for a person. A background of this includes the development of the new cellular phone called “Smart Phone”. Smart phone is developed based on the function of the computer, unlike a conventional cellular phone. As other characteristics such as a telephone function and email function, Internet and a PDA function is possessed. The interface becomes the touch screen form, not a conventional button form. In this way, it is a very high-performance cellular phone.[1][2] It spreads mainly on 20s, and many university students having a smart phone now. For example, in the scene of the class, there are many students utilizing it as “Class use” to check substitute for dictionary and that they could not understand.

Furthermore, there is the example utilizing a smart phone by a class although being experimentally.[3][4][5] Because of this, we recommend that the class using a smart phone is useful. In addition, there is the example system to find out illegal use such as the cheat in an examination by using high-performance cellular phone such as the Smart Phone. Furthermore, the development of the countermeasure of the illegal use by a high-performance cellular phone is necessary. Of course there are so many students carrying out “Inappropriate use” irrelevant to the class that I utilize a smart phone in a class purpose. Therefore, we assume the scene where a student uses Smart Phone by a class. In this case, “Inappropriate use” such as a game or the unrelated Internet surfing possibly happens all time. Furthermore, a Smart Phone has to be used appropriately by all students. However, this is very difficult problem and has to be careful in “Inappropriate use.” In conclusion, using a Smart Phone in class is useful, but there are many problems for the realization. Therefore, it is the present conditions to extremely have difficult realization of the class using a smart phone.

## 2. Purpose

The purpose of the research is development of the environment system that can utilize the high-performance mobile terminal such as the Smart Phone by class positively. Therefore, in this research, we build the environment that we can use a Smart Phone in class as the first step of class use of it. We build the environmental system that “Inappropriate use” does not allow. Furthermore, we propose the class assistance application to be able to participate in a class positively and develop the prototype system.

## 3. Summary of Environmental System

In this paper, we developed a learning environment system to realize a positive use of Smart Phone in class. As the method, we build environment that limiting “Inappropriate use”. In addition, we developed the contents that a

student can participate in a class with a Smart Phone positively.

First of all, environmental construction to limit “Inappropriate use” is necessary to build for this integrated environment. As a method to build it, we plan this by three structures.

### 3.1 “Outside” of the Mobile Device such as The Smart phones in Classroom

As the first structure, we build environment with the radio wave canceller and make the high-performance mobile device as the outside. By this environment, the systems do not let your Smart Phone connect to Internet by using the cellular radio wave that which the mobile terminal uses. Using this structure, we limit “Inappropriate use”. The mobile terminals such as the Smart Phone in the classroom system constitution (1) of “Outside” is structure.

### 3.2 WiFi Connection Using The Wireless LAN that set Access Restrictions of Class-Limited

As the second structure, we build the wireless LAN environment that set access restrictions of the class-limited. By this structure, the system let students get class contents. Every Smart Phone has the wireless LAN connection function so if classroom have WiFi connection, students could access class server. By using this function, the Internet connection that used WiFi function is possible even if condition that a mobile device is in “Outside” status by structure of system constitution (1) and is considered to be it.

In addition, we set access restrictions in wireless LAN. This wireless LAN sets it to admit the connection only for address that the teacher appointed. By such structure, we build environment that limiting “Inappropriate use”. In other words, we build the wireless LAN that only a specific address is accessible in classroom while limiting the Internet connection with cellular radio wave. By this environment, students could access to only an address that uses in class that a teacher appointed. It is WiFi connection by the wireless LAN that this set access restrictions of the class-limited of system constitution (2).

### 3.3 Offer of The Application for Classes to Enable Class Assistance

Then, the system that can participate in class through the mobile device such as Smart Phone from the state that limiting “Inappropriate use” is necessary. Therefore, we developed the class contents and assistance tool application that a student could participate in class positively. As the method, we construct contents application for class assistance in the accessible address that a teacher appointed in system constitution (2).

Furthermore, we construct the interface to enable the operation from Smart Phone.

As for this class contents and assistance tool, various contents are including in system assumed by class in perfection. We assume the needs by the common class in this research, and suggest class contents and assistance tool and then develop prototype application.

By this class contents and assistance tool, we build the environment where a student can participate in class positively.

### 3.4.1 Acquisition and Reading of The Teaching Materials

First, it is necessary to get the teaching materials for class. We show the summary of the interface of the teaching materials in figure 1.

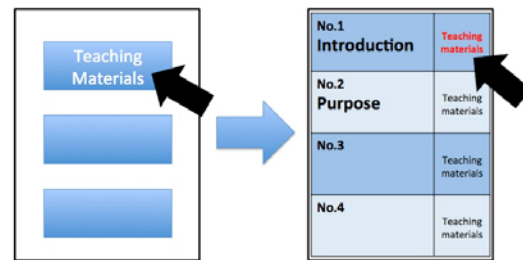


Fig. 1 Summary of teaching materials interface

The system builds the exclusive page such as “Teaching materials place” in the accessible address that theater appointed. The teaching materials are installed when students accessed exclusive page. By downloading the materials, the student assumes it the specifications that they could read the teaching materials to use in class with Smart Phone. These digitalized teaching materials set it as a PDF file for the prototype application as general-purpose form not to choose environment as.

### 3.4.2 Contribution and Sharing of The Question

As the previously mentioned materials, we build an exclusion page to share it with a question distribution.

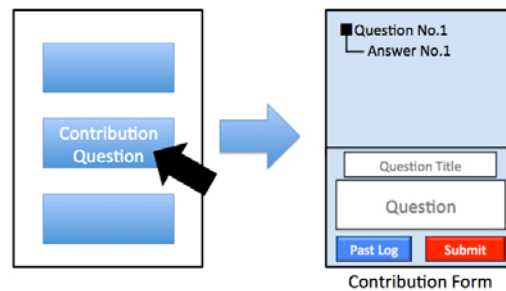


Fig. 2 Summary of teaching materials interface

The page where students could post the question of the class is displayed when they connected to the exclusive page for question posting. First, the students need to input the title and the contents of the question into posting form. Next, the student could post a question by pushing a submit button.

In addition, if all students using this question function, teacher could answer their question. Recent questions are all remained in the page. By this, the students could obtain an answer without repeating a similar question.

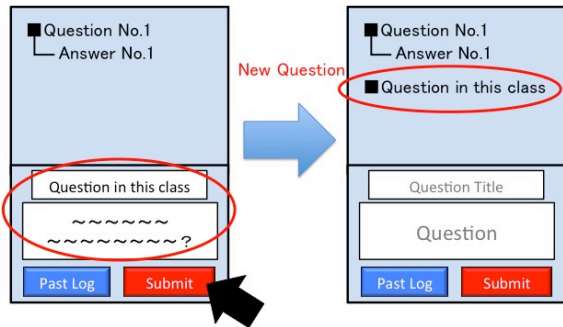


Fig. 3 Summary of question posting interface 2

In addition, question-posting function could hold the past log of the questions. Students could read a past question and the answer. As the method, we make “Past log” on the question contribution page. By this system, the students assume it the specifications that can read a posted question and answer before.

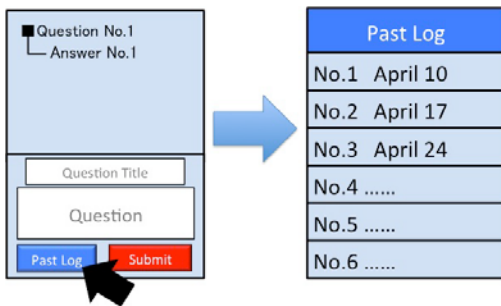


Fig. 4 Summary of the question sharing interface 1

### 3.4.3 Answer to Question or Questionnaire From a Teacher

The questions from student to a class assumed it the way that student could perform from the question posting page. On the other hands, there are the scenes where teacher ask a question to a student usually during a class. Therefore, the tool that student could easily reply for the question from a teacher is necessary. We show the summary of the teacher-asking tool in figure 5.

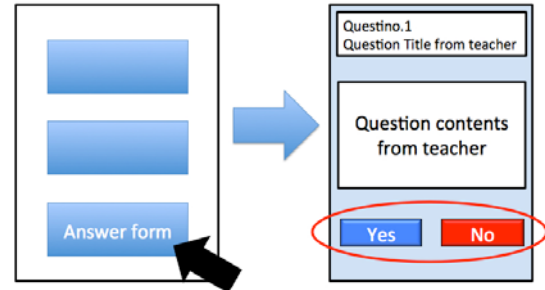


Fig. 5 Summary of the question answer interface from a teacher

This tool could reply the simple question or questionnaire from a teacher with two buttons “Yes” or “No.” Of course teacher could easily change the setting of the buttons. They could set questionnaire and change “Yes” or “No” to something else easily.

## 4. Construction of Environmental System

The integrated education environment system that we suggested in this research is comprised of follows:

- (1) Interception of the cellular phone communication environment with the cellular radio wave jamming device
- (2) Internet connection field using the WiFi function of Smart Phone by class-limited wireless LAN
- (3) Development of class contents and assistance tool application system prototype

### 4.1 Interceptions of The Cellular Phone Communication Environment with The Cellular Radio Wave Jamming Device

First of all, the learning environment system in this research needs constitution to limit “Inappropriate use.” Therefore, in this research, we build it by a method to cut off the communication environment using cellular radio wave in classroom. As a method to cut off the Internet connection using cellular radio wave of Smart Phone, we use a cellular radio wave jamming device.

#### 4.1.1 Cellular Radio Wave Jamming Device

In this environment system, we use a cellular radio wave jamming device. In this research, we use “Super Keita DCX1000 MK2” sold in Japan. “Super Keita DCX1000 MK2” is the device that may interfere with a cellular radio wave. This device could jamm with a cellular radio wave in the range of up to approximately 20 meters. By this effect, we could make the Smart Phone in the classroom “Outside.” In addition, “Super Keita DCX1000 MK2” heat radiation processing is taken for heat to be generated by a device. In this way, the long-time consecutive use such as the class is enabled.

Furthermore, 96% of the Japanese Smart Phones are connected to Internet by 3G network. According to this, the interception of the cellular radio wave is possible. Furthermore, the interception of the cellular radio wave of “3G type” used in 96% of Japanese cellular phones and smart phones is possible. In addition, this device can interrupt the cellular radio wave of GSM procedures used with a world cellular phone. In other words, “Super Keita DCX1000 MK2” has very high versatility.



Fig. 6 “Super Keita DCX1000 MK2”

Therefore, we thought the device that could show an effect enough for building environment of “Inappropriate use” of Smart Phone.

#### 4.2 Internet Connection Using The WiFi Function of The Smart Phone by Class-Limited Wireless LAN

As one of the methods to limit “Inappropriate use,” we install class-limited wireless LAN for system constitution (1).

Because of effect range of the cellular radio wave jamming device, for the Smart Phone, the Internet connection using cellular radio wave becomes impossible. However, the method for connecting the Internet to a smart phone includes a connection method using “WiFi function.” As for the current Smart Phone, WiFi function is possessed basically. Internet connection is able by being connected to the wireless LAN using this WiFi function. In addition, as for this wireless LAN, only a specific address or domain could access. By this method, this wireless LAN became the “Class-limited” tool.

##### 4.2.1 Setting to make Connection of The Wireless LAN Class-Limited

This research is gained as the method to limit the connection except the address that we are appointed to use “Squid,” proxy server software. “Squid” is the proxy server software that broadcasts and cache perform of communication such as HTTP and HTTPS, FTP, SSL, etc. It is free software, so anybody could get.

This system permits connection by the only specified address or domain using “Squid,” and restricts the other

connection. There is the setting method: At first, a file called “squid.conf” is installed when we install “Squid” software. In “Squid,” various setting is possible by editing a file called “squid.conf.” For the setting method, we define the access control list (Whitelist) of the address or domain that permits connection to “squid.conf.” Then we set an address or domains that we want to admit access in a whitelist. By this setting, limited address or domain that we set becomes accessible because it is on the whitelist. The website with an address or domain that is not described in a whitelist refused to access. By this setting, we could limit the connection except the address or domain that the teacher appointed.

#### 4.3 Development of The Prototype Application of The Class Contents and Assistance Tool

By this environmental system, we build the environment that assists active class participation while limiting “Inappropriate use.” As a method of that purpose, we developed class contents and assistance tool application for classes. As the prototype application, we develop three contents that we assumed in Chapter 3 “Summary of Environmental System.”

In addition, it is necessary to be general-purpose high application for uses of class contents and assistance tool. According to this, the class contents and assistance tool aims to the application not to limit a platform and carrier in this research. Furthermore, we developed the class content and assistance tool as Web application. By making Web application, we could list up the addresses on a whitelist of “Squid.” By this, we could construct the environment limiting “Inappropriate use,” and students could use class contents and assistance tool.

For this application, we build the server part that save and handling of information as CGI by the Perl. The interface part that a teacher and a student use implements it by HYML and Java Script.

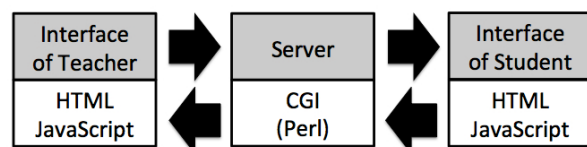


Fig. 7 The prototype application Environment of the development

#### 4.4 Summary of The Prototype Application

This chapter describes the example of execution of operation by Smart Phone of a prototype application. As a premise, the environment restricts “Inappropriate use” by jamming device of cellular radio wave for Smart Phone. It is possible to limit Inappropriate use by wireless LAN of access restriction. This system moves to the top page of

figure 8 when students connected to the address that admitted to access.

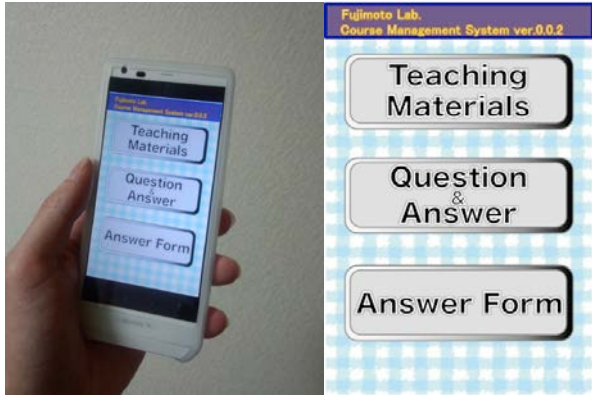


Fig. 8 Top page of application

#### 4.4.1 Acquisition and Reading of The Teaching Materials

When students accessed to page and tap a top button of "Teaching Materials" established in the top page, student move to page of figure 9.

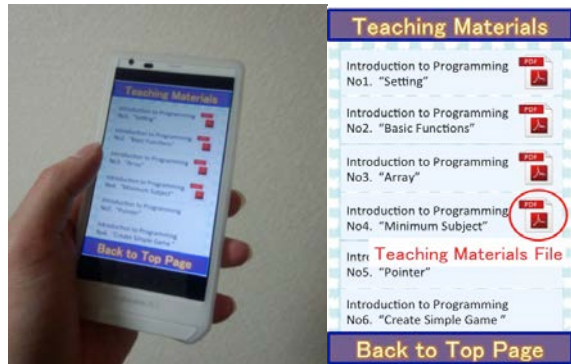


Fig. 9 Acquisition of teaching materials

The teaching materials are able to install on this page by the PDF form. The students could download the materials by tapping an icon of PDF. Those teaching materials are set as only for student Smart Phone. If students are using iOS, they could open the file without download any software. However, PDF file browsers were such as "Adobe Reader" is necessary if students using Android OS Smart Phone.

#### 4.4.2 Contribution and Sharing of The Question

When students want to post and share the question, tap "Questions and Answers" button located in middle of the top page, then student move to the page of figure 10.

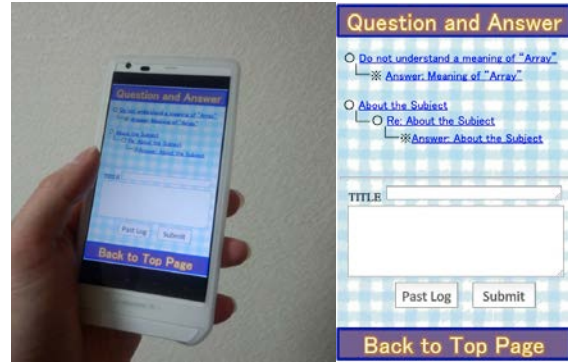


Fig. 10 Question Posting

First, when a student post a question, it is necessary for the students to input a question into an input form located in bottom of the page on figure 10. Next, when the submit button is tapped, the students could add the question to the upper part of the page.

If student want share the question and answer, tap "Past log" button beside the submit button, the student move to the page, figure 11. This page shows you the past question and answer. In addition, all of those pages are open for everybody who taking the class.

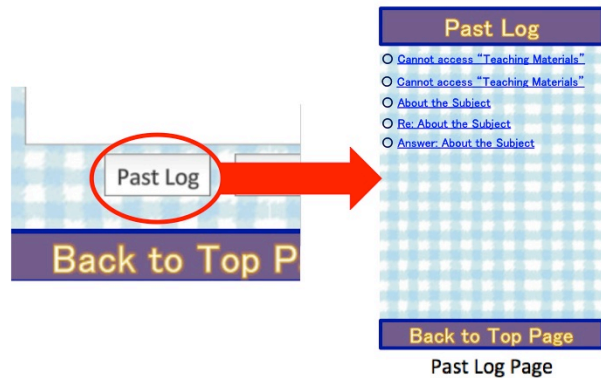


Fig. 11 Question share page

#### 4.4.3 Answer to Question or Questionnaire From a Teacher

The answers for the questions or questionnaire from the teacher are located in the same as other contents, and moving from the top page. Only student has to do is tap "Answer form" button.

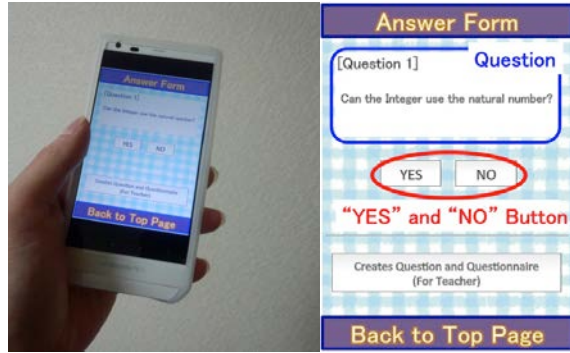


Fig. 12 Question and questionnaire reply form from a teacher

The question or questionnaire from a teacher is listed on this page. The student could reply easily by tap the button “Yes” or “No” on the page for the question or questionnaire.

### 5. Construction of “Integrative Education Environmental System”

In chapter 3, “Summary of Environmental System,” and chapter 4, “Development of Environmental System Prototype,” we described the materials to be necessary for the construction of our environmental system. In this chapter, we describe the construction of “Integrative Environmental System” that puts all of the constitution of this system.

At first, by previous preparations for teaching, we build “Control System of the Communication Environments using the Cellular Radio Wave,” that is the one of the system constitution. Therefore, we set “Super Keita DCX1000 MK2” in the classroom where the cellular radio wave jamming device occurs. The cellular radio wave jamming device starts itself with the chime ring.

Next, we install the wireless LAN that set connection restrictions in the classroom. This wireless LAN connects it using the WiFi function with the Smart Phone through a proxy server. By this, the device interrupt connection other than a specific address to use in class. At this point, classroom becomes the limited an act to correspond to “Inappropriate use” with the Smart Phone field. In addition to this system, we open an address of the Web application of the class contents and assistance tool to a student. As for the student, the permission of the application is given by connecting to the address by the WiFi function of the Smart Phone.

By all of those systems constitution, this environment system becomes the “Integrative Education Environmental System” that enables class assistance with the Smart Phone while limiting “Inappropriate use.” We

show the summary of the “Integrative Education Environmental System” in figure 13.

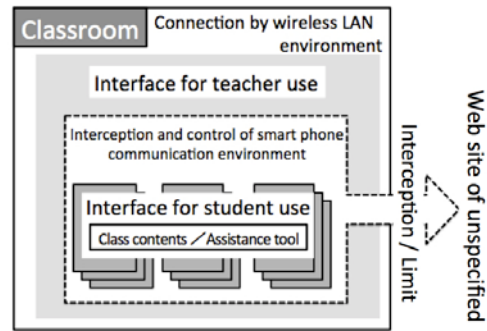


Fig. 13 “Integrative Education Environmental System”

## 6. Subject of an Experiment

In this paper, we proposed the environment system that enabled to use for class assistance while limiting “Inappropriate use” and class contents or assistance tool. In addition, we built “Integrative Education Environmental System.” Furthermore, by using prototype of the “Integrative Education Environmental system,” we carried out the subject of an experiment. In the experiment of this system, we practiced the class using of “Integrative Education Environmental System” that we proposed and then we heard opinions and impressions about this system in a questionnaire form.

### 6.1 The Method of Subject of an Experiment

First of all, as a method of the experiments, we build the environment system that restrained “Inappropriate use” by using a cellular radio wave jamming device and the wireless LAN that set connection restrictions. In this system, we made university students using a Smart Phone cooperate and performed in class using “Integrative Education Environmental System.” In addition, we carry out a questionnaire after an experiment and hear the opinion about this system.

Table 1: Questionnaires contents

(1) Do you think this system could be easy way asking question in class ?				
Excellent	Good	Average	Fair	Poor
(2) Do you like this system compared with the usual class?				
Excellent	Good	Average	Fair	Poor
(3) Do you think this environment system is useful while limiting “Inappropriate use”?				
Excellent	Good	Average	Fair	Poor
(4) Which class form do you think is good for the students who taking the class with this system or the usual class?				
Special class with system	Neither	Regular class		

In the experiment, we have a teacher to cooperate and experiment using the class for 90 minutes that is usually class.

For this experiment, we divide the class in the first half and second half. We performed a regular class in the first half, and perform a class using “Integrative Education Environmental System” in the second half. Next, we ask students compare two class methods and have opinions or impressions about this system and reply it by a questionnaire. Then, we consider the result of a questionnaire and verify the usefulness of this research. We show you the result of this experiment in table 1.

Table 2: Answer result of question (1)

(1) Do you think this system could be easy way asking question in class ?				
Excellent	Good	Average	Fair	Poor
11	18	3	0	0

### 6.2 Result and Consideration of The Subject of an Experiment

We had 32 university students cooperate for this experiment and added up the result. We listed below the result of the experiment. Firstly, we show a result of question (1) in table 2.

By this question (1), the result was as follows.

- ”Excellent” : 11 people
- ”Good” : 18 people
- ”Average” : 3 people

In this question, the sum total of “Excellent” and “Good” brought a result of 29 people by 32 people. According to this, most students thinking that questions systems etc. are easier to ask. Because of this, we think most of the students who experienced the system become easy to ask teacher a question in class.

However, there was the opinion “I think that is easy to do the question very much, but time lag until posting answer,” form the student who answered that it was “Average”.

Table 3: Answer result of question (2)

(4) Which class form do you think is good for the students who taking the class with this system or the usual class?		
Special Class with system	Neither	Regular class
11	8	13

Next, we show a result of question (2) in table 3.

By this question (2), the result was as follows.

- ”Excellent” : 5 people
- ”Good” : 9 people
- ”Average” : 10 people

- ”Fair” : 8 people

In this question, the sum total of “Excellent” and “Good” became 14 people, and there was a student who can concentrate.

However the sum of total “Average” and “Fair” become 18 people, and there were also in the student who cannot concentrate. The cause that turned out included an opinion “In order to concentrate on operation of system, it is difficult to corporate on class” by questionnaire (2). In the other words, we need time to teach how to use the system is necessary when a student uses “Integrative Education Environmental System” for the first time.

Next, we show a result of question (3) in table 4.

Table 4: Answer result of question (3)

(3) Do you think this environment system is useful while limiting “Inappropriate use”?				
Excellent	Good	Average	Fair	Poor
9	17	6	2	0

By this question (3), the result was as follows.

- ”Excellent” : 9 people
- ”Good” : 17 people
- ”Average” : 6 people
- ”Fair” : 2 people

The sum total of the students who answered that they were “Excellent” and “Good” become 26 people, and it brought the result that most students were said useful. According to this, we think the “Integrative Education Environmental System” to be very useful.

Next, we show a result of question (4) in table 5.

Table 5: Answer result of question (4)

(2) Do you like this system compared with the usual class?				
Excellent	Good	Average	Fair	Poor
5	9	10	8	0人

By this question (4), the result was as follows.

- ”Special class with system” : 11 people
- ”Neither” : 8 people
- ”Regular class” : 13 people

In this question, the positive and negative answer brought a result of the about the same number. As the background, there was the opinion “I think that it is a good system, but I hate a private use being limited” from the student who said the negative answer.

From this, we think students dislike this system who has a Smart Phone when system restricted Inappropriate use during class. In addition, as well as “Inappropriate use,” we think that it is a problem to limit to the private of student. This research needs to solve the problem of “the range that restricts Smart Phone”. This is the subject that we have to solve for this research.

### 6.3 Conclusion of The Subject of an Experiment

In this research, we had 32 university students cooperate and carried out a subject of an experiment. As the method, we divided a class into two and performed different classes of the usual class by using “Integrative Education Environmental System.” Then we asked a questionnaire to compare two classes.

By the questionnaire in this experiment, the question (1) showed us the result that almost all students asked a question etc. easily. Moreover, in the question (2), almost all students answer the system could be concentrate. According to this, we think that “Integrative Education Environmental System” proposed by this research is useful as compared with regular classes. Furthermore, in the question (3), the student who answered that it was useful result exceeding a half. Also, from this, we thought “Integrative Education Environmental System” is very useful.

On the other hands, in the question (4), students who answer the positive answer and the negative answer brought a result about the same number. There is an opinion that student said, “I think this is a great system, but it is disagreeable to restrict a student’s private” as listed in an answer result of question (4). In other words, it is thought that there were many students hate restricted in a Smart Phone use being limited for “the classes.” In addition, there was an opinion student said, “I miss the explanation of the teacher when I operate the Smart Phone.” Class assistance of teaching materials and question, etc. ware good for “Integrative Education Environmental System” proposed in this research. However, it is impossible to assist all the class under the present circumstances. We thought that we want to build the system that could carry out a class only in “Integrative Education Environmental System” in the future.

## 7. Conclusion and Consideration

In this paper, we were intended to build the environment system that enabled class assistance while limiting “Inappropriate use”. As a method, we developed the prototype system using by various structure such as “Jamming device of cellular radio wave,” “Wireless LAN that set connection restrictions,” and “Class contents and

assistance tools.” Then we thought that the purpose of this paper has been achieved by this environment and system. In addition, we could carry out the active learning with the Smart Phone by using “Integrative Education Environmental System.”

In the world, the Smart Phone suddenly spread. However, in japan, the diffusion rate of the smart phone is still low with approximately 20%. Therefore, it is difficult for the “Integrative Education Environmental System” to propose in this research to function in perfection under the present. However, in the predictive investigation by the seed planning Co. Ltd., there is find out the diffusion rate of the Japanese Smart Phone exceeds 70% in 2016. According to this, we thought that the “Integrative Education Environmental System” of this research has a very bright future. Furthermore, the research using a Smart Phone for teaching does not exist while limiting “Inappropriate use,” and novelty is extremely high. Therefore, we think it has a possibility that a new class form using a Smart Phone could be built.

## 8. Future Work

The present conditions, in this research, we can build the environment to limit “Inappropriate use”. However, the application for class has only minimum function. Therefore, under the present conditions, we design the contents application for classes to enable class use. Because use enables a class, the contents application for classes has to implement various functions. Therefore we think in the viewpoint from a student and grope for “What is necessary, and what is unnecessary”. So we think about the enforcement of the questionnaire now. Form this questionnaire result, we implement a necessary function as contents application for classes. In addition, we develop class contents application now. We are referring to various researches, in order to develop a function required for class.[6][7][8][9][10][11]

Furthermore, this research thinks about enforcement of the “Active learning” using the smart phone. “Active learning” is an active class form to lean while a student performs discussion and debate etc. As the recent Japanese university, there are approximately 100 students for one class. Therefore it is difficult to carry out learning such as the discussion and debate. Form this, in Japanese university, it is difficult to carry out “Active learning”. This research aims at the system that using “Integrative Education Environmental system” enables “Active learning” using a smart phone.



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limiting "Inappropriate use".

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