Designing Education Process in an Elementary School for Mobile Phone Literacy

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Abstract

In Japan, 53% of children from 10 years old to 17 years old use mobile phones. Filtering technology and systems to protect children are progressing day by day, however, they are still liable to become victims of crime through community sites and 1,239 trouble cases were published in 2010. It is strongly required that children should learn how to treat information on mobile phones. In this paper, we discuss our learning model to learn literacy of mobile phone and the result of our experiment to learn literacy of mobile phone using our model and tool. We call the tool PNS (Pupils Network System) that is designed based on our survey at an elementary school in Tokyo for four years. We confirmed that our methodology is useful to learn literacy of mobile phone.

Keywords: Mobile phone, digital literacy, moral education, e-learning, SNS.

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1 Introduction

Mobile communication gives us an access to others whenever wherever we want. We have many benefits from the use of ICT technology. However, from the viewpoint of human developmental psychology children cannot learn this communication of their own accord. A child develops step by step. At first a baby comes to recognize his or her mother and then comes to know its surroundings. After recognizing actual objects, human recognize abstract ones. ICT communication, including mobile communication, doesn't have such steps rising above real places. Operations of mobile phones is so easy that children can use them without lessons even though they cannot recognize what is happened beyond the screen. As a result of such unconscious use cases children become victims of the Internet crimes. The cases of troubles were 1,239 in 2010 in Japan and increased 9.1% compared with the previous year “the Metropolitan Police Department Home Page, February 17, 2011” [1]. The increase of smart phones users in many countries will create the same problems as Japan has. We have studied methods to solve this problem empirically with teachers of elementary schools. In order to teach ICT literacy, we have had trial lessons with 3rd to 6th grade children in Tokyo. Children have opportunity to use PCs in their school. However, they tend to investigate some bookish information or simply learn how to operate a PC. We suggest that it is important for children to learn basic information flow and recognizing human beyond the PC screen, in order to live actively in the ICT society nowadays where abundant information is circulated. In this paper, we discuss our learning model to learn literacy of mobile phone and the result of our experiment to learn literacy of mobile phone using our model and our tool. We call the tool PNS (Pupils Network System) that is designed based on our survey at an elementary school in Tokyo for four years. We confirmed that our methodology is useful to learn literacy of mobile phone. In Section 2, we introduce related works. In Section 3, we discuss our stepwise approach to learn literacy for mobile phone. Then in Section 4, we describe in detail of how we design PNS. Section 5 explains the result of experiment using PNS in 2011. In Section 6, we discuss the result of the experiment. Finally, we present the conclusion of this paper in Section 7.

2 Related Works

The effectiveness of ICT equipment for children was studied practically by using tablet PCs, or PDAs [2] and Interactive white boards [3]. Some teachers
created software and shared them. Some schoolbook publishing companies already started ICT contents services for teachers of elementary schools [4]. However, many researches of mobile learning are targeting university children [5, 6]. In 2009, Ministry of Education, Culture, Sports, Science and Technology (MEXT) published a notification to prohibit taking mobile phones to elementary schools [7]. Before the notification, there were several researches on applying mobile phones to education [8, 9].

3 Stepwise Approach of Literacy Education of Mobile Phones

3.1 Environment of Education of Mobile Phones

Since 2001, after e-Japan project of Japanese government, there were many researches to support collaboration learning using mobile phones with built-in camera [10]. After January 2009, MEXT prohibited to bring mobile phones to elementary school because of increasing of crimes, relating to mobile phones, targeting children in elementary school [7]. The notification of MEXT mentioned that cyber crimes are increasing, especially caused by malicious use of mobile phones. Consequently further researches of mobile learning at elementary school cannot be continued. However, there are over 1 million subscribers in Japan. It means 87.8% of Japanese have their own mobile phones according to the Internal Affairs Ministry of research (March 2011) [11]. After that point, researches relating to education using mobile phones were almost dying. However, this situation is not good for children since they have to learn literacy of mobile phone before they use mobile phones actively after they enter junior high school. However, in the guideline about the information of the education in Japan [12], MEXT wrote that

> When teaching subjects etc., each school should improve learning activities so that pupils become familiar with information devices, such as computers and information and communications networks, acquire basic operation skills, such as typing letters on a computer keyboard, and information ethics and are able to use information devices appropriately. In addition to these information devices, each school should also use other teaching materials and aids properly, such as audiovisual materials and teaching and learning devices.
The prohibition to use mobile phones in a elementary school and the guide line are contradictory. So that, we have to teach children how to use mobile phones and mobile information. We started study of literacy learning of mobile phones since 2009 [13–16]. Our target is how to make children in elementary school understand “invisible” flow of information in the cyber world. A mobile phone is a kind of gateway to access the Internet. We set three directions to teach mobile phone literacy.

- Mobile phone is a personal device, so that it is not easy that their parents observe every behavior of children. There is a possibility for a child to be a sacrifice of crime on mobile phones. It is important for them to learn literacy of mobile phone.
- Mobile phone is a small and light, so that is way for children to use. Also, a mobile phone equips a lot of useful devices and functions such as camera, recording sound and input text.
- It is easy to send data, such as photo or mail, from a mobile phone to other phones by using IR (Infra Red) and Bluetooth by using mobile phones. They can realize and understand how the information flows in the network.

3.2 Our Learning Model for Literacy of Mobile Phones

In Figure 1, our model for education of literacy of mobile phone is described. There are two main parts, one is developing skills and another is moral. In the skill part, there are six boxes. Each box means each grade of an elementary school and displays the step-by-step learning of functions of mobile phones and lessons in a class such as gathering materials when they visit out side of the school. We have not yet performed mobile phone literacy (skill up) class for 1st, 2nd and 6th grade, so that the box is described by dotted line. Details of classes for 3rd, 4th and 5th grade will be explained later. On the other hand, right part is moral education such as not to expose face clearly, not to write abuse, not to expose personal information in profile site. Moral education is important to prevent risk in the Internet and manner. Moral education is simple, but it is important to learn it again and again until the knowledge is a part of a brain. Firstly, we define the following flow to learn moral of mobile phone as described in Figure 2. As an introduction, children attend a lecture of general information of risks of mobile phones, then, they learn about what is personal information and importance of personal information. Next, learn about what is communication and at last, they learn about the crimes especially contact from unknown person. As skills of using mobile phones, we
define the following flow described in Figure 3. This flow is based on the main functions of mobile phones. A mobile phone has five major functions as follows.

1. Communication (voice and data)
2. Application
3. Camera
4. Address book
5. SNS

A flow of learning skill of mobile phones is based on these core functions. Firstly, taking picture and input text. Then write articles using picture and text. Next, they study what is communication by sending picture to others. Then provide information to others and how to respond to others. We started literacy education of mobile phones based on this model and continuing from 2009. On 2010, we apply this model to fifth grade of the elementary school
and 2011, we continued the education to fourth grade children. We would like to explain details of our trial.

### 3.3 Learning Trial in Third Grade

As a lesson of moral, we learned general information of risks of using mobile phones. We used one unit (45 minutes) for this purpose. Then we learned the risks again by using mobile phones. The purpose was to learn information sharing and how to manage risks relating to sending information. For that purpose, we used mobile phones without SIM (Subscriber Identity Module) cards to prevent unexpected communication to outside a classroom. Using this mobile phone, they learned how to send and receive photos using IR. Figure 4 displays the three steps of learning communication using mobile phones. At first, bottom of the figure, they learned face-to-face communication since IR communication is limited within 30 cm. Then they created their own newspaper based on the research at wholesale market and the observation of trees in around the school. They are satisfied with the result and felt as if they developed a newspaper as real one using photos and text gathered by mobile phones. The flexibility and portability of mobile phones were useful and effective. Also, children who are not aggressive in a class could also join the development process easily.
3.4 Learning Trial in Fourth Grade

3.4.1 Learn about Communication
In 2011, we firstly performed moral class for understanding how fast information is superadded in the Internet and how dangerous it is. We also used mobile phones without SIM card and send a photo each other by using IR. We measured how fast the photo is shared in the class. It was only three minutes. Then we used Bluetooth to send photo each other as described in the middle of Figure 4. This is not face-to-face communication, so that this is a preparation of real Internet communication. After these trials, we learned the crime case of young schoolgirl caused by mobile phones and understood how to protect themselves from malicious people.

3.4.2 Learn about Message Exchange
In July 2011, we performed three classes, total 90 children, to learn Japanese short poem, TANKA [17], by using real Internet. TANKA has traditional message exchange format in Japan and it started about 1,000 years ago. TANKA is similar to time line, however, it is very polite communication tool for ancient Japanese people. One student creates short sentence (17 characters), then one of classmate adds short comment as displayed in Figure 5. We
developed a closed group in Twitter. Details were described in our previous paper [18]. Children heard about risks of the Internet, however, they could not understand the risks clearly. This is the reason that we prepared closed group in Twitter. In this environment, only user ID and articles can be accessible. They learned how to describe articles on the Internet and comment on it. They knew about the Internet and risks on the Internet, however, most of them did not have experiences to use it. Their knowledge came from their parents, TV and books. They were very excited to use mobile phones and the Internet. When teachers asked them to take pictures, 28 of 30 children in a class took face of their friends. They almost forgot what they learned last year at the moral of using mobile phones. The teacher asked them to remember what they had learned. Then they remembered that it was not allowed to take photo of face of their friends and be careful to submit articles on the Internet. After preparation described above, they took photos and tried to create TANKA relating to the photo. They worked aggressively. Some children created several TANKA. Of course, they made a lot of mistakes and uploaded TANKA before completion. After each student uploaded TANKA, other children commented on them. They worked very well. They could add gentle and thoughtful reply to TANKA. Figure 5 describes this process. First, #2 sent TANKA, and then #9 commented on this TANKA. In the classroom, they shared timeline by using projector and presented their TANKA and printed it. Figure 6 shows the result of a questionnaire to children who attended this trial. The questionnaire asked whether they would like to use the smart phones in the class again or not. At least 70% of children would like to use it again. However, 300% of children answered negative since text input on mobile phones was not easy for them.

We think that the difficulty of inputting text on mobile phones did not neglect their motivation. Also, projection on screen to share the contents and
printing to personalize their TANKA work increased their motivation very much. On the other hand, some children uploaded 20 photos. We thought that the environment to study skill and moral of mobile phones are required to increase their literacy. We think that this kind of environment to allow children to represent their feeling directly is very valuable for them. So that we believe that the idea of PNS should work well. In a class, the teacher checked children’s work very carefully. About half of the children in the class answered the questionnaire that the operation of smart phone was difficult, however, they would like to use the smart phones in the class again as the same percentage as in other classes. We can summarize our survey that young children in an elementary school cannot imagine the worst case and accept the fact directly. So that, they are sometimes caught by malicious trap. In the next section, we define the requirements for a system to support ethic education for the mobile phone literacy.

4 Designing PNS: A Tool for Ethic Education of How to Use Mobile Phones

Now we would like to start to design PNS (Pupils Network System) for ethic education of mobile phone literacy. We intended to use PNS from third grade in Figure 1. With this system, children upload information and communicate with others. The most remarkable point is that this site will give a place for children to evaluate the subject with autonomy and check each other. When a student sends some information, the other children in his group check the
Table 1: Functions of each player.

<table>
<thead>
<tr>
<th>Target</th>
<th>Suggestion and Recommendation</th>
<th>Write articles</th>
<th>Check details</th>
<th>Approval</th>
<th>Write Comments</th>
<th>Perusal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student (contributor)</td>
<td>◦ ◦ ◦</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Student (advisers)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

posted articles and send back an evaluation report. If two or more persons agree, the article will be uploaded on the site. Children in 3rd to 6th grades can vote for good articles (refer to Table 1). The student who gets good feedback can be the new leader of a group. Teachers and parents can peruse articles. As a result we wish to work on the following points:

- From the results of the moral class – Feeling of reality, taking responsibility for what the student writes.
- From the view of internet literacy education – Safety, including communication with distant places.

4.1 Behavior of PNS

First of all, we would like to explain the behavior of PNS. Figure 7 displays the flow of the submission to PSN and publishing articles to parents.

**Step 1:** A student inputs an article (maybe with photo).

**Step 2:** Firstly, the article should be checked by three children. They are classmates and/or children in senior classes. They checked that the article is appropriate to submitted to PNS, such as the theme is relating to subjects and there are no grammatical mistakes. Also, they check there is no prohibited word in the articles. At this step, children learn ethics of using mobile phones and the Internet services.

**Step 3:** Then the article is opened to other children. They can add comments on that article.

**Step 4:** A teacher checked the article and if it is good to open to parents, he/she uploads the article to the website of the school.

**Step 5:** Parents can see the article, such as reports of outdoor activity or poems.
4.2 Requirements for PNS

Then, we set up the following requirements for PNS as a tool for ethic education.

(R1) Write articles and add comments on that article easily.

(R2) Approval process should be prepared. Children sometimes write inappropriate article to be published.

(R3) The article should be described in not too long but not too short. Teachers can decide the length.

(R4) Children sometimes use bad words, so the system should automatically check such words and displays alert.

(R5) PNS should be closed in a school. Going outside and accessing from outside should be prohibited to protect personal information of children to prevent criminal.

(R6) Every grade, classmates are changed, so to reduce operation by teacher, user database of PNS should be automatically updated by reading a name list of a class.
(R7) PNS should be controlled by teachers in detail.

(R8) The UI of PNS should be beautiful and considered to meet the recognition process of young children under 10 years old.

(R9) Encourage children to access the system.

(R10) Easy operation. Teachers are busy, so maintenance free is ideal for them.

(R11) The operation cost should be minimized. Free to use is ideal.

Twitter has good appearance, free to use and is stable. But there is no administration and keeping safety function in Twitter, so we thought that we have to develop PNS by ourselves.

4.3 System Architecture of PNS

Based on the above discussions, we designed the PNS. By introducing simple and easy UI of Twitter, we would like to design several functions to protect children. Figure 8 displays functions of PNS and data types that are used in PNS. There are three components in the system, Contents management functions, Administration functions and Personal information management functions. Each function should satisfy requirements R1-9. R10 and R11 are general requirements, so that they are not directly implemented. The outline of each component is as follows:

Contents management functions:
- Input Function: Each student can input articles to PNS through mobile phones. (R1) (R3)
Evaluation Function: Who assigned as an evaluator for a student can review and evaluate that article. If three reviewers agree, that article can be published to all children. If the article is a question, they give an answer on that article. (R2)

Comment Function: Any child can comment on an article. (R1)

Word checking function: When inputting article, the system checks the words in that article include prohibited words, such as kill, foolish, or not. If there is a prohibited word, the system displays alert. (R4)

Contents Display Function: Each article is displayed in a readable form, color and font size. (R8)

Administration functions:

Uploading Function: A teacher can upload selected article to the website of a school. (R7)

Name List Management: A teacher can manage ID of student simply relating to name list of a class. (R6)

Arbitration Function: If some troubles happen on PNS among children, a teacher can interrupt the thread. (R7)

Personal information management functions:

Login Function: This function allows each student to enter the system and only the student is allowed to enter. (R5)

Point Manager: The number of comments is reflected as points of an author of an article. (R9)

Figure 9 displays the UI of PNS on Android.

5 Experiment of PNS in 2011

We used PNS at February 2012 in fourth grade classes. They input their photo when they are infants and describe their dream, such as to be a baseball player, to be a doctor. At last, all the articles are projected in the gymnasium and shared by children and parents. It was easy for children to use, they soon understand how to input articles and submit articles. They were satisfied to complete articles by themselves. We asked them what is the difference between Twitter and PNS to the third class of the fourth grade (30 children each). They answered on the questioner sheets. When we asked them about common point between Twitter and PNS, most popular answer was Upload file and Input Text. Only 6 of 30 children answered that both systems use Internet. Next, we asked them about difference between them. The most pop-
Table 2 Important points when we use the Internet from a mobile phone (including multiple answers).

<table>
<thead>
<tr>
<th>Answer</th>
<th>Number of Ans.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consider to handle personal information</td>
<td>14</td>
</tr>
<tr>
<td>Do not write real name (including friends)</td>
<td>14</td>
</tr>
<tr>
<td>Do not upload photo of persons</td>
<td>10</td>
</tr>
<tr>
<td>Do not access unknown sites</td>
<td>9</td>
</tr>
<tr>
<td>When using Twitter, it is required to ask parents</td>
<td>2</td>
</tr>
</tbody>
</table>

A particular answer was that Twitter was used for TANKA study and PNS was used for describing their dreams. In their mind, only the difference of contents was remaining. We encouraged them to remember the moral class last year. They found that they violated rules to prevent risks to use the Internet such as uploaded photo with face. Also, no one could not aware that difference of management mechanisms of both systems and of users. Even they learned about moral last year, they forgot details of the lesson. In Table 2, the important points when we use the Internet form a mobile phone (including multiple answer) are listed up. Also, impression of the Internet literacy class was described in Table 3. Their answers were interesting. They answered both under positive phycology and passive points.
Table 3 Impression of Internet literacy class.

<table>
<thead>
<tr>
<th>Answer</th>
<th>Number of Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not forget risks of the Internet</td>
<td>7</td>
</tr>
<tr>
<td>Be careful when using the Internet</td>
<td>5</td>
</tr>
<tr>
<td>Fun and attractive</td>
<td>2</td>
</tr>
<tr>
<td>Understand what is prohibited and allowed</td>
<td>2</td>
</tr>
</tbody>
</table>

6 Discussion

One of the major SNS in Japan is Mixi [19]. A report said that about 90% of teenager users of Mixi uses that service from mobile phones. It is clear that children of elementary school may access services on mobile phones soon after entering junior high school. It is important that they should learn and do practice how to use mobile phones safely through actual use of mobile phones under the controlled situation such as in a class room in the elementary school. As the result of experiments, children in an elementary school have knowledge of the Internet, however, their reaction to the problems is not always correct. Also their knowledge is not well organized, so if they do carefully upload their contents using mobile phones, they sometimes make mistakes. It is true that learning becomes real knowledge through mistakes. We confirmed that PNS is useful for them to learn literacy of mobile phones by making a lot of mistakes. We would like to give them skills to see facts using critical power. They can learn the critical power to the information on the Internet through learning and mistakes. It is also important to compare facts to cultivate criticism for the information on the Internet. We consider that PNS is useful to learn literacy of mobile phone as an SNS in a school. We would like to add moral lessons on using ICT equipment in PNS to cultivate literacy of using mobile phone and the Internet. One student who attended these classes did not understand the risk of accessing Internet. It is safe to use the Internet in an elementary school, however, there is a possibility to access the Internet from his home and becomes a sacrifice of a crime. We can teach him the risk of the Internet access through the individual guidance when teachers found the problem of understanding level of risks of the Internet in a classes. Also, there is a possibility to apply education using mobile phones to change or modify the structure of their cognitive functioning to adapt to the changing demands in a class as described in [20]. Learning using a mobile phone is good for personalized learning. In usual class, some children understand well and others are not. However, learning using a mobile phone allows a student to learn things step by step by confirming steps.
6.1 Further Study

To learn functions of mobile phones is easily to meet the step-by-step method as mathematics, etc., since children are familiar with accessing ICT equipment as a game machine or digital camera. It is natural for them to use mobile phones as Digital Native. However, the lesson of moral of using ICT equipment like mobile phones is a little bit different. Of course, it is not difficult as mathematics or foreign languages, but it is easy to forget important issues relating to moral on the Internet, such as not to upload photos that include faces of their friends, not to disclose their email addresses and phone numbers, etc. It is important to learn again and again especially on the moral of using mobile phones. We think that it is important to take learning history of moral education including attitude and response in the class and to share that history from the first grade to sixth grade. Also it is important to construct a system to teach moral based on the history of the children. We think that PNS may have possibility to realize that function. PNS is mainly covers left part (skill education) in our education model described in Figure 1, so that we would like to add function on PNS that realizes right part (moral education) of Figure 1.

7 Conclusion

Taking conclusion of research, we made educational SNS application for children to learn about communication literacy of the Internet by considering security issue based on our learning model. Our PNS had has some steps and it took time to circulate articles. However, convenience was not our purpose. We made the children to consider about the subjects. By using of PNS, children could consider and learn both good points and the risks of Internet communication step by step. In addition we would like to use this application not only for mastering operation of mobile phones, but also to connect with others in the society they belong to. There may be many other fields to help children connect to others, using PNS. We continue to do research in elementary schools.

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References

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