

COLLABORATIVE LEARNING WITH FIELDWORK LINKED WITH KNOWLEDGE IN THE CLASSROOM

Hiroyuki Tarumi

*Faculty of Engineering, Kagawa University & SpaceTag, Inc.
2217-20, Hayashi, Takamatsu, Kagawa 761-0396 JAPAN
tarumi@eng.kagawa-u.ac.jp*

Fumihiko Satake

*Faculty of Engineering, Kagawa University
2217-20, Hayashi, Takamatsu, Kagawa 761-0396 JAPAN
(Currently, OBIC, Co. Ltd.)*

Fusako Kusunoki

*Tama Art University
2-1723, Yarimizu, Hachioji, Tokyo 192-0394 JAPAN
kusunoki@tamabi.ac.jp*

Masato Takahashi

*Attachment of Department of Education at Kagawa University Takamatsu Elementary School
5-1-55, Bancho, Takamatsu, Kagawa 760-0017 JAPAN
takahash@ed.kagawa-u.ac.jp*

ABSTRACT

Thirty-nine pupils practiced fieldwork in a garden park. Prior to the fieldwork, they had prepared comments on interesting objects in the park. Pupils' comments were shown on GPS-phones at the location of each object. They could observe objects while reading comments written by their classmates. With this mechanism, real objects and knowledge in the classroom were linked. By a questionnaire, we found this system encouraged them to learn. In some aspects, different responses were found between boys and girls.

KEYWORDS

Fieldwork, Authenticity, Mobile Phones, Location-Awareness, CSCL.

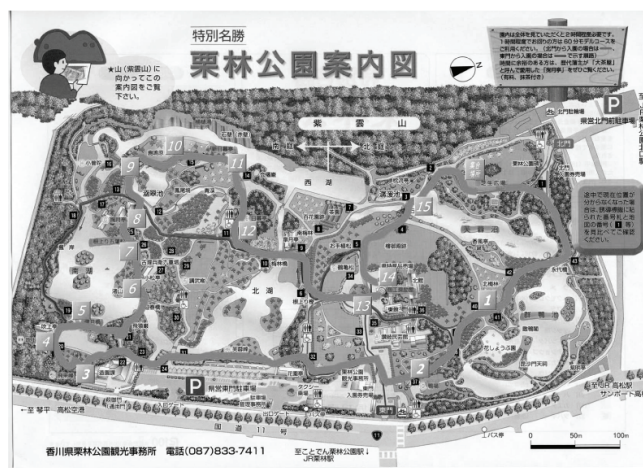
1. INTRODUCTION

By nature, children like fieldwork with collaborative problem solving or exploration. However, children have difficulties in linking authenticity (things they watch and touch in the field) and knowledge in the classroom. They sometimes cannot identify what to observe in the field with their knowledge.

In this research, we aim to introduce interactive orienteering system in order to encourage children to collaborate and learn both in the classroom and in the field.

For outdoor fieldwork, several researches have been reported (Benford; Bouvin; Halloran; Okada; Rogers). Our research is characterized as follows.

(1) Contents were authored by children themselves *in the classroom*, not in the field. If comments and photos are created in the field (like other researches), they are generally fresh and impressing, and better stimulate other children. However, they might be just descriptions of their impressions. On the other hand, in the classroom, children can create contents with more precise investigation. We tried to link the comments written in the classroom and objects in the field for better education.



(Numbers in squares indicate LOIs.)

Figure 1: Map of the Practice Field

(2) After the collaborative learning, we took a survey with a questionnaire sheet and found some interesting results. Especially we found that boys and girls differently responded to their experiences with mobile phones in some aspects.

(3) We used popular GPS phones in Japan. We found almost no difficulties in children's using such popular phones. Some researches employed only mobile camera phones for terminals (Takenaka; Mitchell and Race), but they did not make use of GPS.

2. PRACTICE

2.1 Overview of the Location-Aware Collaborative Learning System

The place for fieldwork was a famous Japanese garden park, which had an extent of 700 meters (north-south) x 300 meters (east-west). We had built a web server for the GPS-phones so that it could return location-dependent information when it received requests from phones. The server returned information on the closest location of interest (LOI) to the location of the requester. In the case of the following practice, fifteen LOIs were defined (Figure 1).

2.2 Development of Contents

Prior to the main fieldwork, 39 pupils (4th grade, 9-10 years old, 19 boys and 20 girls) had a 60 minutes preparative session in the park with GPS phones in November 2006. The aim of the preparative session was to learn how to manipulate the phone, and to grasp the geographical overview of park. The contents they enjoyed at the time were a set of pages for sightseeing guests prepared by us.

After the preparative session, the pupils got knowledge on the park from documents, in their classroom. Each pupil wrote a short comment on one LOI or more. Their teacher advised pupils to write comments to be read by sightseeing guests from other places. As the comments were written with pencils, we typed them into the server on behalf of pupils. For each LOI, we designed one web page containing three or four comments by pupils and a photo.

We also prepared four illustrations of characters. Two of them were pupil characters of a boy and a girl with the school uniform. Other two were historical person characters: Nishijima and Matsudaira. Nishijima was a famous civil engineer in the 17th century, who did a great work to change the flow of a big river, which flowed on the park before. Matsudaira was a lord of this area who lived in the same century and built this garden.

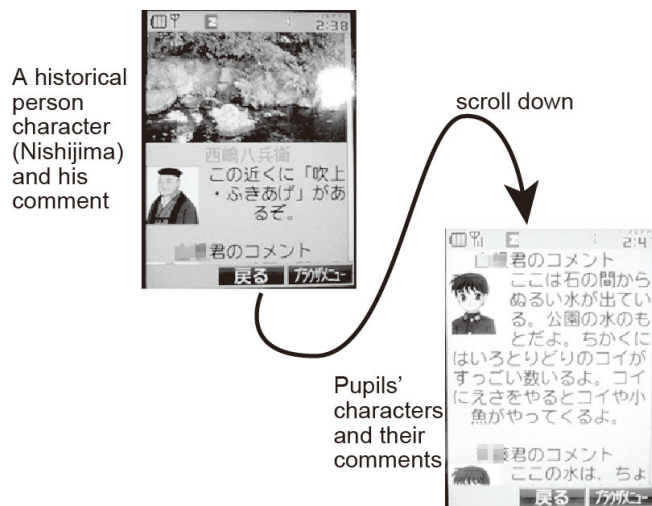


Figure 2: An Example of Page

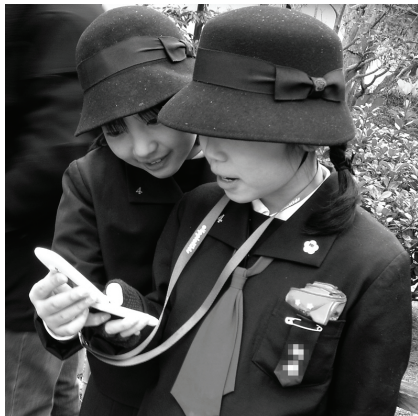


Figure 3: Snapshot of the Field Work

(They succeeded to get a page describing on the museum.)
 A: Here it comes!
 B: It's the local industry museum. Look, here is Taro's comment.
 A: I've already read it. Let's read Jiro's comment.
 B: Wait... "You can find the local industry museum around here. Many items are displayed there. A big HIMAYARA cedar tree is next to the museum."
 (After reading the next comment written by Hanako.)
 A: Wait, wait. I think it's HIMARAYA cedar. Is it HIMAYARA ???

Conversation between two girls (A, B) in front of the local industry museum.

Figure 4: A Transcript of a Conversation

A pupil character was shown with a comment by a pupil. One of the historical person characters was shown on one page, with a comment written by us that was supposed to be said by Nishijima or Matsudaira.

Figure 2 is an example of page containing historical person's and pupil's comments. Historical persons' comments were relatively short, as shown in the figure, since we wanted pupils to concentrate on other pupils' comments. By the pupil characters, we aimed that pupils could feel more reality that the comments were said by their classmates. By the historical person characters, we aimed that they could feel an encounter with a historical person.

2.3 Practice

On January 16, 2007, pupils had a 90 minutes field work in the garden park. As we could not give one phone for each pupil, we made 19 groups. One group had three members and two phones; other 18 groups were pairs of pupils with one phone each. Each group was instructed to visit as many LOIs on the map (Figure 1) as possible, to try to access the server with the phone at the locations, and to read comments shown on the phone (Figure 3). After the fieldwork, we had interview sessions with ten pupils. We also had a survey by a questionnaire sheet, later.

3. RESULT

Figure 4 is an example of conversation between pupils. They read aloud some comments and doubted their correctness. Here, they collaborated as a pair of girls and also collaborated with other pupils who had written the comment.

In the interview session, we recorded the following comments (C1-C5) from children. C1 shows that the system successfully linked the knowledge in the classroom and authenticity.

(C1) “A mobile phone was convenient because I could observe something on the spot while reading comments shown on the phone.”

(C2) “I was shy about my comments.”

(C3) “It was interesting because I could compare my comments with others.”

(C4) “It was wonderful that I found information I had never known.”

(C5) “I could share interests with friends. Our friendship has grown up.”

Table 1 shows part of the result of questionnaire survey. The table also contains averages and S.D. of answers from boys and girls. Some of the results were different between them with statistical significance (by analysis of variance shown in the last column).

- Pupils were almost glad that their comments were read by others (Q4).
- Answers to Q5 had larger S.D. for girls than for boys. Some of the girls were shy about showing their comments. However, most of the boys and more than half of the girls were not.
- Most of them felt a sense of rivalry when they read their friends’ comments (Q7).
- Mobile phones and location-dependent information were well accepted (Q6). Girls more liked mobile phones than boys did.
- Characters were effective to get pupils’ interest in mobile terminals. Especially, girls responded to them better than boys did (Q1, Q2, and Q8).
- However, pupil characters were not enough for them to feel that they were their friends. This was just because the illustrations were not portraits of real pupils (Q3).
- They wanted to get more information in detail from historical characters. (It was given by free comments by some pupils, which are not shown in Table 1). It was because we intentionally designed them with only short comments.

Table 1: Result of Questionnaire Survey (Excerpt)

Question	Total (N=39)		Boys (N=19)		Girls (N=20)		ANOVA (boys vs. girls)
	Ave.	S.D.	Ave.	S.D.	Ave.	S.D.	
1. Which do you think better, contents with the pupil characters or without them? (5=with, 1=without)	4.28	0.99	3.74	1.07	4.80	0.51	$F_{(1,37)}=15.16$ $p < .01$
2. Did you feel familiar with the pupil characters? (5=yes, 1=no)	3.92	1.05	3.42	0.88	4.40	0.97	$F_{(1,37)}=10.33$ $p < .01$
3. Did you feel that the pupil characters looked like your classmates? (5=yes, 1=no)	3.38	1.21	3.16	1.09	3.60	1.28	
4. Were you glad that your friends read your comments? (5=yes, 1=no)	4.05	1.01	3.84	0.99	4.25	0.99	
5. Were you shy about showing your comments to your friends? (5=yes, 1=no)	3.79	1.30	4.00	0.97	3.60	1.53	
6. Which do you like better, reading plenty of information through PC or reading information on the spot through mobile phones? (5=mobile phones, 1=PC)	4.41	1.03	3.95	1.23	4.85	0.48	$F_{(1,37)}=8.77$ $p < .01$
7. Did you feel a sense of rivalry when you read your friends’ comments? (5=yes, 1=no)	4.03	1.02	3.95	1.10	4.10	0.94	
8. Which do you think better, contents with the historical person characters or without them? (5=with, 1=without)	3.95	1.24	3.32	1.17	4.55	0.97	$F_{(1,37)}=12.19$ $p < .01$

4. CONCLUSION

We designed a collaborative learning system with GPS-phones for children and let them write location-aware comments for other pupils. Two ways of collaboration, intra-group (within a pair) and inter-group collaboration were found. Knowledge in the classroom represented as comments was effectively used to observe LOIs. Children liked mobile phones better than PCs as information devices. Most of them liked to show their comments to others and read other pupils', and were stimulated by them. However, some of the girls were shy about showing their comments. This system was more fit to girls than to boys, because they liked characters and mobile phones.

Finally, by using popular GPS-phones in Japan, the practice was successfully conducted with 39 pupils and we could collect an enough number of questionnaire sheets to find some statistically significant results.

In future, we are planning to enhance this system to utilize our 3D shared virtual world system (Tarumi) for pupils to have experiences that are more exciting. To realize it, we should examine the problems of user interfaces for children and evaluations from the viewpoint of education.

ACKNOWLEDGEMENT

We truly appreciate Takeo Nishikawa, Kazuhiko Oshima, and Mao Kohori (Attachment of Department of Education at Kagawa University Takamatsu Elementary School) for their cooperation in the practices. We also appreciate Prof. Shigenori Inagaki (Kobe University), Prof. Makiko Takenaka (Oita University), and KDDI Corp for their support for the practices. This research was partially supported by the Ministry of Education, Science, Sports and Culture, Grant-in-Aid for Scientific Research (B), 18300289, 2006.

REFERENCES

- Benford, S., et al. (2005) Life on the Edge: Supporting Collaboration in Location-Based Experiences. *Proceedings of CHI 2005*, ACM, 721-730.
- Bouvin, N. O., et al. (2005) Tools of Contextualization: Extending the Classroom to the Field. *Proceedings of IDC 2005*, ACM, 24-31.
- Halloran, J., et al. (2006) The Literacy Fieldtrip: Using UbiComp to Support Children's Creative Writing. *Proceedings of IDC 2006*, ACM, 17-24.
- Mitchell, K. and Race, N. J. P. (2005) uLearn: Facilitating Ubiquitous Learning through Camera Equipped Mobile Phones. *Proceedings of WMTE 2005*. IEEE, 274-281.
- Okada, M., et al. (2003) DigitalEE II: RV-Augmented Interface Design for Networked Collaborative Environmental Learning, *Proceedings of CSCL 2003*, Kluwer Academic, 265-274.
- Rogers, Y., et al. (2004) Ambient Wood: Designing New Forms of Digital Augmentation for Learning Outdoors. *Proceedings of IDC 2004*, ACM, 3-10.
- Takenaka, M., et al. (2004) Development of a Collaborative Learning Support System Using Camera-Equipped Mobile Phones: A demonstrative experiment in a 1st-grade class of a Japanese elementary school. *Proceedings of ICCE 2004*, 457-465.
- Tarumi, H. et al. (2006) KOTOHIRAGU NAVIGATOR: An Open Experiment of Location-Aware Service for Popular Mobile Phones, *Proceedings of the 2nd International Workshop on Location- and Context-Awareness (LoCA 2006)*, Lecture Notes in Computer Science, Vol. 3987, Springer-Verlag, 48-63.