Articles

Production of Video Teaching Materials in Cooperation with Koshigaya City Science and Technology Experience Center: Based on Knowledge of Digital Museum Concept

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Abstract

The concept of cooperation between museums and schools is all the more important from the point of view of the 'curriculum open to society', which is emphasized in the next National Curriculum Guidelines. In Koshigaya City, there is a science experience center named Koshigaya City Science and Technology Experience Center: Miracle (hereinafter called 'Miracle'), where an extracurricular course is designed for all the third- and fifth-grade elementary school students and all the first-grade junior high school students in the city. This course, which has been offered over the past ten years, are fairly satisfactory, but it has had problems such as insufficiency of the materials for introduction of the course to the students and the resulting mismatches between their expectations and actual experiences. Therefore, the 'Koshigaya Society for Research on Creation of Classes Using ICT', an independent teachers' training organization, and student volunteers produced 30 videos for introduction of the hands-on course for the elementary school students in cooperation with Miracle and uploaded them on its website. Through this approach, we have been able to obtain knowledge for utilizing ICT to improve the projects being carried out under cooperation between museums and schools (for instance, how to determine the assignments useful for only the school children in the city, and unified formats that can be prepared by basic skills).

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1. Introduction

During the process of partial revision of the National Curriculum Guidelines in late December of 2003, new policy items- 'utilization of school libraries, cooperation not only with public halls, libraries, museums and other social education facilities but also with social education organizations and other related groups, and more worked-out approaches to active utilization of museums and other social education facilities'-were added. That was the first time that the cooperation with museums and other social education facilities was clearly mentioned in the National Curriculum Guidelines.

Ever since then, the ideal ways of utilizing museums with the aim of improvement and enhancement of the content of 'comprehensive learning classes' have been widely reported not only in case studies conducted in line with the current National Curriculum Guidelines but also in research results published by museums[1].

Furthermore, the next National Curriculum Guidelines also emphasizes the importance of cooperation between local museums and other social education facilities and schools (cooperation between museums and schools), indicating that a 'curriculum open to society (refer to pp. 3-4 of 'Summary of Issues') is intended to implement the curriculum by effectively using human and material resources in the community and engaging students in social education activities after school, on Saturdays and in the holidays, and to accomplish educational goals by sharing

them with the community and providing education outside the school system[2]. However, it must be a great challenge to continuously and systematically incorporate these approaches in the curriculum[3].

Fortunately, in Koshigaya City, where the Koshigaya Campus of Bunkyo University is located, a variety of social education facilities actively provide support for schools. Particularly it is worth noting that all the third- and fifth-grade elementary school students and all the first-grade junior high school students in the city are supposed to participate in the hands-on course for scientific experiments and handiwork (hereinafter, called the 'hands-on course), which are prepared in response to the needs of schools, at a science experience center named Koshigaya City Science and Technology Experience Center: Miracle (hereinafter called 'Miracle'). The cost of the buses taking the students to and from the center is paid from the budget of the Koshigaya City Education Board. These kinds of approaches need to be enhanced to implement the 'curriculum open to society' in the future.

The table below shows a list of classes in the hands-on course, which are designed for elementary and junior high schools (experiment and handiwork classes included in the curriculum that cannot be carried out at schools), and the number of participating schools and students in school year 2016.

On the other hand, in Koshigaya City, there is an independent group for research on utilization of ICT named the 'Koshigaya Society for Research on Creation of Classes Using ICT' (hereinafter called 'Koshigaya

Table: List of Classes in the hands-on Course at Miracle in School Year 2016
(for Elementary and Junior High Schools)

For Elementary Schools				For Junior High Schools			
	Class Names	No. of Schools	No. of Students		Class Names	No. of Schools	No. of Students
Experiments (for Third Graders)	Let's Play with Magnets.	8	261	Experiments (for First Graders)	Chemical Changes and Molecular Models	3	210
	Sunsets and Rainbows	6	298		Aluminum Foil Batteries	2	129
	Let's Play with Solar Cars.	9	245		Let's Study Fuel Cells	3	110
					Let's Observe Brownian Movement.	1	42
	Let's Make Black Slime.	15	805		Let's Study Static Electricity.	0	0
	Let's Make Charcoal Batteries.	8	205		Edison Bulbs	2	91
					Let's Make Crystal Snow Fall.	5	303
	Air and Water	4	145		Wonder of Vacuum	4	199
	Secret of Steam and Vapor	0	0		Is it Possible to Measure Volume Using Scales?	1	62
Handiwork (for Third Graders)	Let's Make Cartesian Divers.	1	24		What Happens when 'Acid' and 'Alkali' are Mixed?	1	34
	Let's Play by Turning Things around.	9	142		Wonder of Ultraviolet Rays	0	0
	Let's Play with Balancing Toys.	3	82	Handiwork (for First Graders)	Chemical Changes and Molecular Models	3	242
	Let's Make Fluffy Balls.	7	170		Rainbow Scope	1	29
	Balancing Dragonflies and Gliders Made of Seeds	8	349		Aerodynamic Winged Boat 'Ram'	7	401
	Let's Make Rubber Rockets.	13	238		Stirling Engine	1	30
	Let's Make Straw Pan Flutes.	13	307		Protractor	2	61
					Nature of Metals	1	101
					Scope with Lenses	4	223
					Polarized Kaleidoscope	4	127
	Earth and Moon	2	35		Total	45	2,394
Experiments (for Fifth Graders)	Let's Observe Microorganisms.	14	353	Number of Junior High School Students who Visited the Museum: 1,277			
	Secret of Soap Bubble Films	12	290				
	Wonder of Flame Reaction	18	428				
	Let's Burn Match Sticks Using Water Vapor.	12	226				
	Let's Study with General Contractors.	0	0				
	Let's Observe the Power of Magnets.	3	113				
	Let's Make Microscopes Using Pet Bottles.	7	220				
	What is Melting? (How Things Melt.)	4	84				
Handiwork (for Third Graders)	Let's Make Ocarinas.	18	757				
	Let's Make Insect Whistles.	12	362				
	Let's Make Wondrous Pendulums.	10	305				
	Let's Make Pinhole Scopes.	14	573				
	Wonder of Air	8	218				
	Let's Make Motors.	5	153				
	Let's Make Sundials.	5	142				
	Total	248	7,530				
Number of Elementary School Students who Visited the Museum: 3,804							

ICT'), whose members consist mostly of voluntary elementary and junior high school teachers in the city, and they are mainly developing digital teaching materials for use by local school children and teachers. Toward the implementation of the next National Curriculum Guidelines, it was proposed as an important step to produce 'introduction videos' of the hands-on course at Miracle as supplementary teaching aids in order to further improve the content of the course.

Miracle's hands-on course is highly appreciated by school children, and the content of the course is revised and updated each year. However, as has been pointed out every year, school children need to choose the right classes in the hands-on course. That is to say, there has always been a problem of mismatches between their expectations and actual experiences.

This research summarizes the key points of the cooperation between museums and school education first by discussing how such collaboration is related to the 'digital museum concept' presented by the Ministry of Education, Culture, Sports, Science and Technology.

Motivated by the concept, Koshigaya ICT, which is a relevant organization in the city where our university is located, produced 30 videos for introduction of all the 30 classes in the course for third- and fifth graders in cooperation with Miracle and uploaded them on its website. Reported below are the summary of Koshigaya ICT's activities, the cooperation between museums and schools, which was demonstrated during their activities, and considerations for production of digital teaching materials.

2. 'Vision for Computerized Education' and 'Digital Museum Concept'

On March 30, 2009, the 'Guidance on Digitalization of Education' was issued by the Ministry of Education, Culture, Sports, Science and Technology as an introduction of computerized education in response to the new National Curriculum Guidelines. In relation to 'introduction of computerization', the Ministry displayed the following illustration showing the predicted images of classrooms in 2015 (Picture 1).

Picture 1: Predicted Images of Classrooms in 2015
(JAPET: Japan Association for Educational Technology)

On April 28, 2011, the 'Vision for Computerized Education (hereinafter 'Vision for Computerization')' was issued in response to the new National Curriculum Guidelines. Toward the goal of establishing the environment for each student to use one information terminal at school by 2020, and characteristically the Vision for Computerization provided the comprehensive framework for enhancement of the effectiveness of digital teaching materials (both for teachers and students respectively), the use of paper textbooks, improvement of related infrastructure, review of the text screening system, the ways of dealing with copyrights, etc.

The learning environment as shown in the predicted images of classrooms in 2015 in the picture above, where an electric information board is installed in a classroom and tablet terminals are used in a group study or fieldwork, is considered to have already been established as of 2015. The education service is being computerized and digitalized, and it is necessary to observe this tendency to appropriately deal with information and media provided by museums.

On the other hand, in 2007, the Ministry of Education, Culture, Sports, Science and Technology issued the 'Creation and Communication of New Digital Culture (Research Report on the Digital Museum)', which presented the framework for research and development not only of technologies for storing cultural resources in the next generation digital archive and for utilization, distribution and networking of the archives but also of the system for demonstrating the 'digital museum'.

The digital museum concept is intended to prioritize the encounter with original real tangible materials (objects) as a key factor,

Picture2: 'Image Finder' in the National Museum of Ethnology-Information related to exhibits can be searched intuitively.

Picture 3: Teachers Training for Use of Museum's Digital Data at the National Museum of Ethnology

provide media as cultural devices for accepting and experiencing the peripheral information of the materials by a variety of means including virtual ones, overcome distance and physical barriers through the utilization and distribution of the network, and to eventually contribute to the happiness of mankind. Digital information uploaded by museums on their websites is very useful, and a variety of information systems are introduced and improved at museums every year. Furthermore, training for using the systems is provided there (Pictures 2 and 3). In the context of the vision for computerized education and the digital museum concept, the museum's media literacy program is drawing fresh attention as an urgently required step[5].

3. Current Hands-on Course and its Challenges

Miracle is a municipally-run experience center in Koshigaya City, Saitama Prefecture, where visitors can enjoy science through experience of experiments, handiwork and other activities. The goal of extracurricular activities provided there is to 'arouse students' interest in science and technology, and to foster creative human resources who will play important roles in the future'.

All the third- and fifth-grade elementary school students and all the first-grade junior high school students in the city (there are 30 elementary schools and 15 junior high schools) are obliged to participate in the hands-on course at least once a year as part of extracurricular activities. Miracle is really an important educational facility in the city. There are about 15 experiment and handiwork classes altogether for each grade, and the students take two classes at a time (refer to the Table).

At each school, teachers explain the course to students using the guide prepared by Miracle first, and then students select the classes they want to take. On the day of their visit, the students separate into groups to take the two classes they have selected. This hands-on course is an activity unique to Koshigaya City which has been continuing for more than ten years.

However, teachers' oral explanation using paper materials is not sufficient for students to understand the content of the hands-on course, and the mismatches frequently occur. Actually, Miracle's 2015 Annual Report included requests from some teachers for 'distribution of the materials introducing the activities in the course'. Furthermore, after the course is over, the students are only required to give their impressions of the experience classes during the post learning session at school. Therefore, it has been pointed out as an important issue every year that it is necessary to get the students to deepen and widen the knowledge they acquire in the hands-on course.

4. Efforts by Koshigaya Society for Research on Creation of Classes Using ICT

In order to resolve the above-described issues regarding the hand-on course and to further improve the precious

extracurricular activities unique to Koshigaya City, 'Koshigaya Society for Research on Creation of Classes Using ICT (hereinafter referred to as the 'ICT Research Society')' produced the video materials for choice of the classes in the course (hereinafter, the 'introduction videos') and established its website named 'Koshigaya ICT: VIVA Learning!' [6] in which local school children can view the videos any time. In 2016, the introduction videos of all the 30 classes for third and fifth graders were produced.

The ICT Research Society has produced many digital teaching materials so far. In the past, video teaching materials have been produced and distributed by textbook companies, education boards and other organizations producing educational content.

Amid the rising trend of digitalization, the ICT Research Society were discussing the necessity of production of digital teaching materials and the originality of the materials required to be created. The digital teaching materials (videos) produced by the ICT Research Society in the approach discussed in this research are designed only for all the 30 elementary schools in Koshigaya City, but actually they are certainly useful for all the children in the city. Importantly, it was commonly recognized as an ideal point of view that classroom teachers should create digital teaching materials (videos) in line with activities unique to a city so as to encourage students to learn proactively. Since only basic ICT is used, students, teachers and everyone can participate in the creation,

and therefore the approach discussed herein is likely to be widely adopted.

The ICT devices used in the video production were only iPad, digital cameras and personal computers. The videos were produced using tablet terminals with the all-in-one function for filming and editing, so that not only teachers belonging to the ICT Research Society but also university student volunteers and other people could take part.

The time of each video was set at 40 seconds considering children's concentration. Each video consists of the same 4 parts, each of which lasts for the same length of time: the opening, the description of the aim, the instruction scene, and the scene of students' participation. It takes only 15 minutes to watch all the videos. The videos can be viewed by all the students at the same time on a large TV screen or individually by each student using iPad distributed to each group. As a result, the time and effort spent by teachers in making students select the classes in the hands-on course were greatly reduced compared to before.

5. Considerations for Production of Introduction Videos

The following four points were considered in the video production.
(1) As the opening scene, part of the free videos downloaded from the 'NHK Creative Library', a scene produced mainly by volunteer students or other appropriate material were used. In order to evoke the image related to an experiment or

handiwork class in the minds of students, for instance, a spectacle of fireworks was displayed in the opening scene of the introduction video of 'Wonder of Flame Reaction'

(2) Each experience class in the hand-on course is a part of school curriculum, and it is necessary to make student understand the aim of the class. In this part of the video, therefore, the time was displayed, and the Chinese characters considered to be familiar to the students were used to describe the aim.

(3) The third part of the video showed the scene in which the instructor was conducting the updated class in this year's course, so that students could feel as if they were actually taking the class on the day of their visit.

(4) The last part of the video shows the scene in which students were making experiments or doing handiwork. This scene was filmed during the actual class. The scene was carefully edited to motivate students to participate in the class. However, it was necessary to keep the climax a secret to avoid 'spoiling' the class before students actually take it.

6. Achievements and Challenges of 'Introduction Videos'

This research is mainly intended to propose the ideal content of the digital teaching materials that are produced through cooperation of local teachers and uploaded on their website for sharing purposes. Miracle provides the important and valuable extracurricular course which

all the school children in the city are supposed to attend three times during their compulsory education period, but it has been pointed out for years that students need to choose the right classes in the course. Many excellent digital teaching materials have been published by HNK for School, textbook companies and other organizations. Many teachers participate in related research activities on a voluntary basis, and further discussion needs to be made on the ideal digital materials produced by teachers, considering time, costs and other parameters.

The approach discussed herein is likely to be widely adopted, not merely because member of education facilities, teachers, student volunteers and other people can easily take part in it using all-in-one iPad based on a unified video format, but also all the people involved including school children can feel the usefulness of ICT.

At one elementary school in the city, the students viewed the introduction videos on a large TV screen (website) in a simultaneous class before visiting Miracle (Picture 4). The results of the questionnaire conducted after the course showed generally positive attitudes of the students toward the introduction videos. One student said, 'I was happy to experience the rest of the video', another student answered, 'The videos made me want to go to Miracle to do the handiwork as soon as possible', and yet another said, 'I felt like filming a movie of my rocket flying, using iPad myself.' One university student volunteer promised continued support, saying, 'I always create videos just for fun, and I am glad to use my

Picture 4: Students Viewing Introduction Videos in Class

skills for cooperation in the community.' One teacher who have never taken students to Miracle said, 'This was my first time, so I was not sure I would be able to explain the course well to my students. But the videos made it possible for me to share the images with them.'

The approach discussed herein was planned in April, and all the 30 introduction videos were produced and uploaded on the website as early as the beginning of September. This is principally because all the teachers, personnel of Miracle, student volunteers and other people involved recognized the significance of this approach and there were few hurdles to clear in terms of skill.

In the future, we are going to make further discussion on the ideal digital teaching materials produced by teachers so as to encourage independent use by teachers of ICT and strengthen cohesion among teachers. We are planning to produce the remaining 10 introduction videos of the experience classes for junior high school students and improve the approach after receiving the feedback about the videos from all the schools. Furthermore, it is important to deepen discussions on 'post learning' for reviewing the experiences at Miracle, thereby establishing a series of programs[7] including prior and post learning.

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Supplementary Note

This thesis summarizes part of the joint research of the Shonan Institute of General Research of Bunkyo University in 2016, based on 'The Development of Website for Expanding Learning Opportunities in Collaboration with Koshigaya City Science and Technology Experience Center "Miracle"' (representative of research: Koichi Imada and person in charge: Masahiro Teshima) issued by the institute.

References and Notes
1) Refer to 'International Understanding Education Workshop Established by Schools and Museums' on p138 of 'Research Report by the National Museum of Ethnology' issued by the National Museum of Ethnology (2016).

2) Refer to the Education Curriculum Committee's Document No.5 issued on April 20, 2016 and acquired on August 23, 2016:
  http://www.mext.go.jp/b_menu/shingi/ chukyo/chukyo3/004/siryo/__icsFiles/ afieldfile/2016/05/09/1370464_5 pdf

3) Refer to 'Chapter 8: Cooperation between Schools and Society-Based on Cooperation with Museums' written by Koichi Imada, on pp78-84 of 'Frontiers of Education

Curriculum' edited by Naoshi Otsu, Kazuo Ito, Yoshitaka Ito and Kaoru Nakatani and issued by Koyo Shobo Corporation (2015).

4) The Koshigaya Society for Research on Creation of Classes Using ICT' is an affiliate of 'Digitama (digital teaching materials in Saitama)' established upon proposal by Mr. Hisao Onishi, then principal of Obukuro Junior High School in 2010. In 2013, the society was officially recognized by the Koshigaya Education Board as a research institute to which the research grant is provided. It holds a workshop once a month at Bunkyo University, and the number of its members is currently about 170. Shimizu, an author of this thesis, serves as the secretary general thereof, and Imada, another author, serves as an advisor.

5) Refer to 'Introduction to New Media: Museums' Media Literacy' written by Koichi Imada, on pp 67-84 of 'Museums' Information: Media Theory' edited by the Japan Association for Educational Media Study and issued by Gyosei (2013).

6) Visit 'VIVA Learning', the website of the Koshigaya Society for Research on Creation of Classes Using ICT:
http://www.koshigayaict.com/

7) Refer to 'Handiwork and Field Study Using iPad' written by Koichi Imada, on pp149-156 of '2016 Investigation Report by the National Museum of Ethnology' edited by Yoko Ueba, Hiromitsu Nakamaki, Kyoko Nakayama, Takaaki Fujiwara and Takeo Morishige (2016)