

Health Education that Breaks Through Language Barriers

Prototyping and Evaluation of Childcare-related ICT Self-learning Resource –

Toshinori ANZAI, Sapporo City University, Sapporo, Japan, t.anzai@scu.ac.jp

Kazuyo MATSUURA, Sapporo City University, Sapporo, Japan,

k.matsuura@scu.ac.jp **Takanobu YAKUBO**, Sapporo City University, Sapporo,

Japan, t.yakubo@scu.ac.jp **Tomoko MIKAMI**, Sapporo City University, Sapporo,

Japan, t.mikami@scu.ac.jp **Kouta UEMURA**, Sapporo City University, Sapporo,

Japan, k.uemura@scu.ac.jp

Abstract

This paper explores the findings of a study into the telecommunications environment in Mongolia. It was hoped that an effective self-learning resource for the prevention of developmental dysplasia of the hip (DDH) in infants for distribution to parents in that country could be created and evaluated using these findings. Based on a field survey conducted in Mongolia, the most effective format this resource should take was identified. A prototype was created that featured video taken from both a third-person and parent's (first person) perspective. After further evaluation, this prototype is to undergo revisions that will be assessed in Japan and Mongolia before a final version is distributed utilizing information and communication technologies (ICT). It was found that a visual message that did not rely on written language was the most effective means of communicating the desired message. With input from nursing staff in Mongolia, the Sapporo City University School of Design and School of Nursing came to leverage their respective strengths to create an effective prototype that will be used as the basis for a resource for relaying this preventive information to the target audience.

Prototyping, Evaluation, ICT, Language Barriers, Health, Self-learning

Background

Current Situation in Mongolia and Japan

The traditional method of swaddling infants, where arms and legs are extended and immobilized, is still common in Mongolia. This practice helps newborns stay warm and allows for them to be more easily carried around – beneficial in Mongolia with its harsh natural environment and where nomadic herding is a major industry and way of life. However, swaddling a newborn may lead to the abnormal formation of the hip joint and is a contributing factor to the onset of developmental dysplasia of the hip (DDH). Tightly swaddling newborns was also formerly practiced in Japan, as was placing them in traditional basket cradles to restrict the movement of the lower body. The incidence of DDH was higher when these techniques were more widely used. Measures to detect DDH at an early stage were incorporated into regular infant health checkups in the late 1960s. As a result of this and a public awareness

campaign to prevent DDH, the number of cases in Japan was dramatically reduced.

Conceptualization of Resource Distribution

Between 2013-2015, the Sapporo City University School of Nursing supported various training initiatives and the creation of childcare guidance material related to the prevention of DDH at the National Center for Maternal and Child Health Mongolia (Ulaanbataar). While moderate success was achieved through these efforts, the necessity to expand training throughout the country to those living nomadic lifestyles on vast steppes became a topic of discussion. It was expected that information and communication technologies (ICT) could provide a promising means of delivering training in preventive care to parents (primarily mothers).

Study Aims/Method

Study Aims

This study was aimed at creating and evaluating learning resources for disseminating DDH preventive care measures targeted at parents of newborns in Mongolia utilizing ICT and so on with the following objectives in mind:

1. Basic survey on the current state of communications in Mongolia
2. Trial of 'DDH Preventive Care' self-study material aimed at parents
3. Creation of prototype utilizing ICT
4. Conduct of hearings in the field and evaluation of prototype

Study Method

With the view of utilizing ICT, etc., to leverage the achievements obtained by the School of Nursing up to the end of FY2015 in the creation and distribution of learning resources, it was decided that the study proceed as follows:

Study on current state of ICT in Mongolia. Among developing nations, the infrastructure for mobile communications is often at a more advanced level than that for landlines. If Mongolia has a developed mobile network infrastructure, it may be utilized in order to deliver educational materials on preventive care to far-flung reaches of the huge country to a people who until more recent times lived a nomadic herding lifestyle.

This portion of the study was to be comprised primarily of preliminary web-based investigation conducted in Japan. Following this, interview surveys with integrated telecommunications services providers were to be conducted in Mongolia and educational materials that are suited to conditions in the country examined.

Examination of delivery format. Consideration was to be given to whether educational content should be distributed using physical media such as DVDs or via applications for smartphones or tablet devices based on the current state of communications in the country. The level of complexity of such an application was also to be determined, with questions asked as to whether selection or iteration of content is possible or whether learning progress could be recorded or not. In addition, the

method of delivery of the application was required to be decided upon (should it be web-based or to be downloaded?).

Target Devices. Based on the situation regarding adoption of devices among target users in Mongolia, types of mobile telephones, smartphones, tablets, PCs, etc., that may be used would be studied.

Characteristics of Learning Resource. As outlined in ‘Prototype Basic Plan’ below, consideration would be given to ‘Method of Presenting a Common Visual Message/Conveying a Strong Impression’ and ‘Importance of a Consistent Environment and Noise Reduction’ with the aim of realizing a synergistic effect using video and audio, relying as little as possible on representations using language. In addition, an attempt to effectively incorporate the points of view of regular third parties and parents (mothers) would be made.

Evaluation of Learning Resource Prototype. Evaluation at the trial level is to be carried out in Japan and a prototype created based on the results of these trials. This prototype will then be assessed in Mongolia and findings reflected in the final version.

Schedule. As shown in Figure 1, a survey plan will be drawn up between April and July 2016, and a basic survey conducted by early September. After this survey is completed, target devices and applications will be determined and from late September, a prototype will be created based on draft learning resource. The prototype will be evaluated in December, followed by localization. In February 2017, a representative from the National Center for Maternal and Child Health Mongolia will be invited to the Sapporo City University to take part in a technical workshop on handling and evaluation. Final evaluation will be completed by the end of the 2017 fiscal year.

Activity	Apr\$Jun 2016	Jul\$Sep	Oct\$Dec	Jan\$Mar 2017
Basic survey				
Target device review				
Application review				
Resource proposal and prototype creation				
Evaluation				
Localization				
Field verification				

Figure 1. Schedule.

Preliminary Survey

Mobile Phone/Broadband Penetration Rates

Figure 2 shows the number of mobile phone subscribers and mobile phone penetration rates in Mongolia based on figures found in the ITU World Telecommunication/ICT Indicators Database (WTID), 2014 (Ministry of Internal Affairs and Communications, 2016). The mobile phone penetration rate in 2013 was over 124%, indicating that each person owned at least one

phone.

When the research method was initially being considered, it was posited that the number of mobile phones would be greater than that for fixed phones. However, this high number of subscriptions was unexpected.

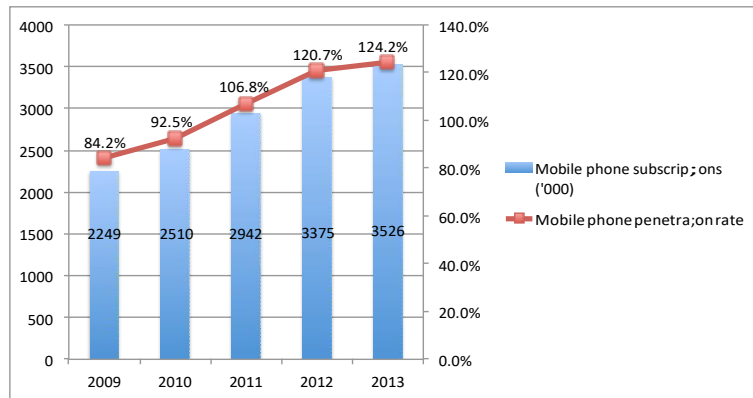


Figure 2. Mobile phone penetration rate in Mongolia, 2009-2013.

In contrast, Figure 3 shows broadband subscriptions and penetration rate based on the WTID. Compared to the number of mobile phone subscriptions, broadband adoption remains relatively low in Mongolia. Given this fact, sending huge amounts of data or downloading large files could be considered as problematic.

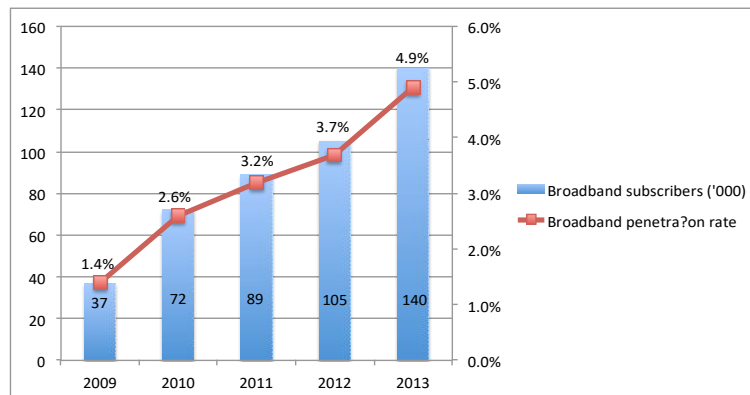


Figure 3. Broadband penetration rate in Mongolia, 2009-2013.

Internet Penetration Rate

Figure 4 uses ITU – ICT statistics (Sekai Keizai no Neta-cho, 2017) to compare Internet penetration rates in Japan and Mongolia. No data was collected in Mongolia between 2003-2006. As can be seen by this graph, the number of Internet users in Mongolia remains relatively low – another factor that may inhibit the exchange of large amounts of data or the downloading of big files.

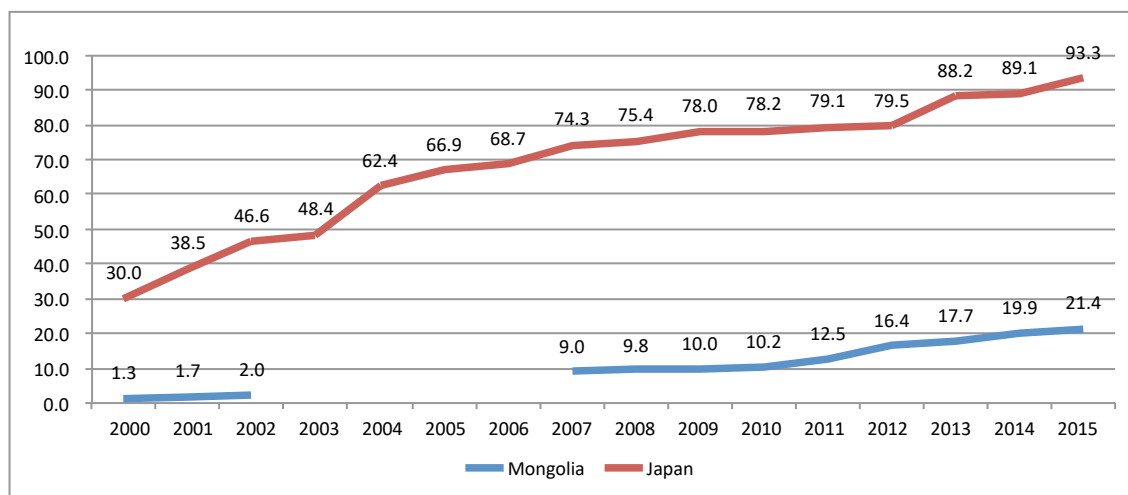


Figure 4. Internet penetration rate in Japan and Mongolia, 2000-2015.

Comprehensive Telecommunications Carriers

Table 1 outlines information based on the WTID on Mongolia's four comprehensive telecommunications carriers. They are listed in order of year of establishment. As it was seen as difficult from a time-related perspective to visit Mongolia and study all four companies, a decision was made to focus only on the two companies with a combined almost 70% market share, companies 'A' and 'C'.

Table 1. Telecommunications Carriers in Mongolia.

Company	A	B	C	D
Head Office	Ulaanbataar	Ulaanbataar	Ulaanbataar	Ulaanbataar
Established	1996	1999	2001	2006
Bands	W-CDMA/GSM	W-CDMA/ CDMA2000	W-CDMA	CDMA2000 W-CDMA
Subscriptions	385,000	155,000	255,000	148,000
Market share	41%	16%	27%	16%

Preliminary Survey Results

As shown above, the preliminary survey found that while the mobile phone penetration rate is extremely high, Internet usage and the broadband penetration rate remain low. In addition, it was determined that companies 'A' and 'C' would be the focus of further study. The survey was to include basic information such as broadband subscriber numbers, user plans, charges (by plan and class), applicable operating systems, OS penetration rates/usage figures, platform penetration rate, and popular applications as envisaged primarily in 'Study on current state of ICT in Mongolia' and 'Examination of delivery format'. In addition, it would seek to obtain advice on methods of distribution, such as to whether it would be better to be provided online or as a downloadable offering and so forth.

Survey in Mongolia

Overview

It was necessary to obtain a concrete idea of the telecommunications environment in Mongolia; while it was known that, like Japan, Mongolia had four major telecommunications carriers and that the mobile phone penetration rate was 124%, only by visiting the country could a detailed picture be obtained. This process started by arranging meetings with the two carriers chosen after examining the findings as shown in 'Comprehensive Telecommunications Carriers' via email and telephone from Japan.

'Company A' Survey Overview

Findings. The director of the Public Relations/Government Relations Department was interviewed for the purposes of this study. The company has 1.3 million users and 19% of these are on post-paid plans that include data allowances of between 1-10GB/month. **Advice Received.** Users rarely download files. It would be better for them to access information directly via a website or using SNS. In rural areas, the use of TV and printed pamphlets, etc., may be required. The suggestion of perhaps having the information incorporated into a health app, etc., was brought up.

'Company C' Survey Overview

Findings. The person interviewed was the person in charge of data and Internet services. Around half of the company's 1.1 million subscribers use broadband. Prepaid data usage was previously between 200 and 500MB, but this has recently increased to 600MB-2GB. The basic charge for post-paid types buys between 200MB and 2GB, with around 2GB used per month on average. **Advice Received.** Doubts were cast on the appeal of only distributing DDH-related resources. More interest may be generated if they were incorporated into a health-related app. Wi-Fi was not widely found in rural districts, and users are reluctant to download files. Web-based information rather than an app was recommended and SNS should be utilized.

Survey Results

In addition to the above findings, the details outlined below were also ascertained. In terms of utilizing a stand-alone application, while the penetration rate for mobile phones is a sizeable 124%, many phones are pre-paid. Even for post-paid type phones, users use only around 2GB/month on average; they do not perform a lot of downloads. For these reasons, having users download a mobile application was not seen as appropriate.

In regards to usage or distribution via the Web/Internet, it was suggested that SNS platforms such as Facebook or Twitter may be more effective, as may including content as part of a healthcare-related mobile app. There was an opinion that more thought about the method of distribution was required and there was a realization that a simple roll-out was going to be difficult.

In addition to this, it turns out that there is a considerable disparity between Ulaanbaatar and rural districts. A 4G network exists in the capital, and 3G is available in the center of other urban areas in the country. However, outlying towns and villages only have 2G. The idea of utilizing TV or pamphlets and so on in rural areas was also brought up.

From these findings, the ICT-related situation considered in ‘Study Method’ showed that there is a disparity in terms of connectivity between cities like Ulaanbaatar and rural areas and that providing the learning resource via mobile application download, etc., would face difficulties. It was therefore decided to exclude the concept of supporting individual operating systems or devices from the scope of learning resource creation. The delivery of the resource according to the Internet environment in each region and training situation would be a challenge to tackle going forward.

In the course of conducting this survey in Mongolia, it was found that initial assumptions were not valid.

In addition to the creation of a video, it was decided that the learning resource prototype aim to take the form of a mobile application that can be used for self-study. Based on the above, the future direction of the study was to include the following:

- Creation of a DVD that can be played in a loop (for instance, in waiting rooms at hospitals).
- Based on the video, create a mobile application for smartphones and tablets for demonstration purposes.

After implementing the above in the current fiscal year, it was decided that the following be considered for roll-out from the following fiscal year:

- Deploy content on website.
- Consider creating stills for use via SNS.
- Tailor content for upload to YouTube.

Video Shoot in Mongolia

Pre-shoot Practice Run

As explained in further detail in ‘Prototype’ below, an action camera was procured in Japan to perform a practice preventive care video shoot from both a third-person perspective and a mother’s (first-person) perspective. As seen in Figure 5, this practice run enabled verification of camera positioning and where the action camera should be affixed, for instance. In addition, storyboards were created, enabling a review of task flow.



Figure 5. Pre-shoot practice run.

Location Shoot

The National Center for Maternal and Child Health Mongolia (hereinafter, the Center) was the location for the shoot. The Center gained the cooperation of parents of infants only a few days old, enabling the recording of the way newborns are held, breastfed, and so on using real babies. Figure 6 shows a video still from the action camera worn on the head of one of the nurses to how the view from a third-person perspective.

Following this, a nurse from the Center used a doll to demonstrate how to change a diaper and so on. As the nurse was most accustomed to handling newborns, the initially envisaged scenario could be recorded. The doll was chosen due to ethical considerations as the video also included demonstrations of dangerous (or prohibited) ways of handling babies (see Figure 13).



Figure 6. Location shoot.

Prototype

Prototype Basic Plan

I

With the aim of developing a resource that would be able to cross language barriers, the following visual and auditory elements were considered:

Method of Presenting a Common Visual Message/Conveying a Strong Impression. The study focused on making effective use of the interaction between audio and visual elements in order to produce a common sensory quality (impression). For example, the impression of “brightness” is more strongly perceived when a “bright sound” is accompanied by a “bright color,” rather than when just the sound is produced by itself. This effect is called a synchronization of the senses. However, this synchronization does not only produce a feeling of “brightness” – a congruency between auditory and visual elements can also produce other types of impressions (Iwamiya, 1996).

Moreover, it was confirmed that the impressions observed across these types of multiple sensory modalities were limited not only to a Japanese language and cultural context, but could also be shared across the world in a variety of linguistic or cultural settings.

Importance of Consistent Environment and Noise Reduction. As a congruence could be deliberately created using visual and auditory stimuli that convey the desired message and in order to present a strong impression to viewers (Inao, Akita, & Koga, 2008), the points outlined below in particular were considered in the development of the learning resource. It was important to achieve a consistent environment and reduce noise, and frequent use of images for visual and auditory stimuli of a uniform nature was used to convey a strong impression.

In addition, the visual aspect was given particular attention for its role in self-study. Most teaching materials to now have used images shot from a third-person perspective. In order to ensure immediate and enhanced understanding, the learning resource prototype to be developed for demonstration purposes would also utilize images taken from a mother’s (first person) perspective to show actual mothers what they would see when looking at the baby. A storyboard (see Figure 9) was prepared in order to consider the overall flow and sub-content in the creation of the prototype for demonstration use.

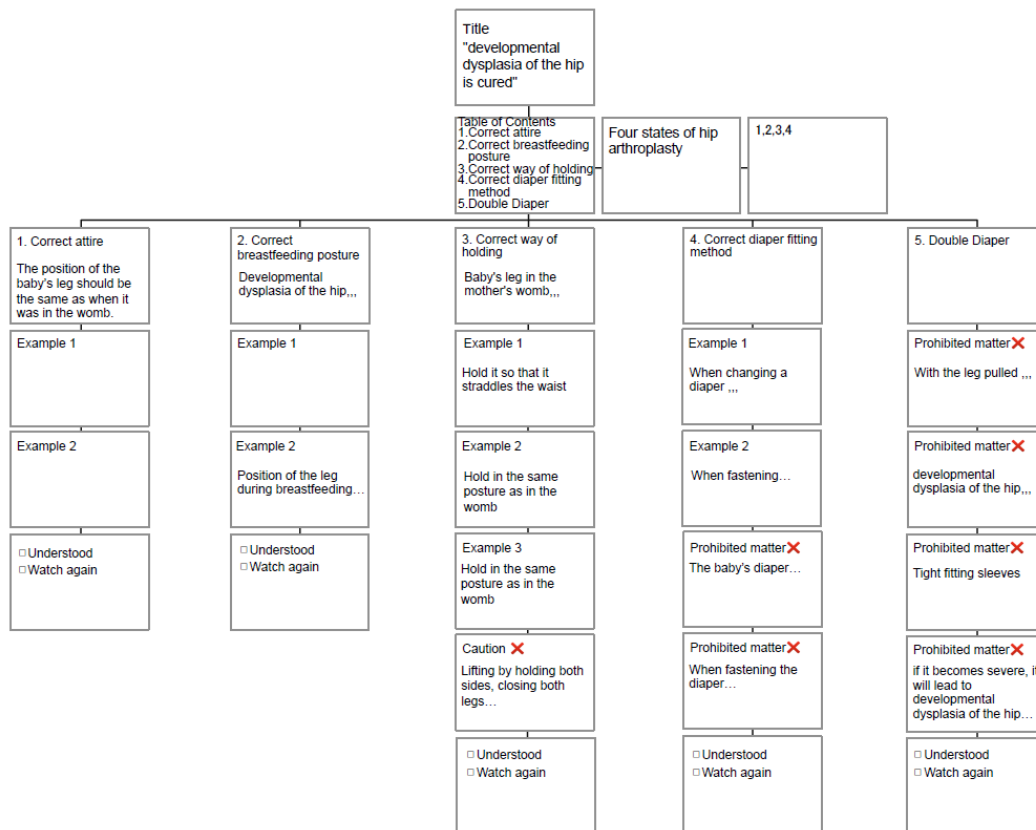


Figure 9. Storyboard.

Examples of Images Used in Prototype

Figure 10 shows a sample menu screen. While it uses text, it is quite simple in its design.

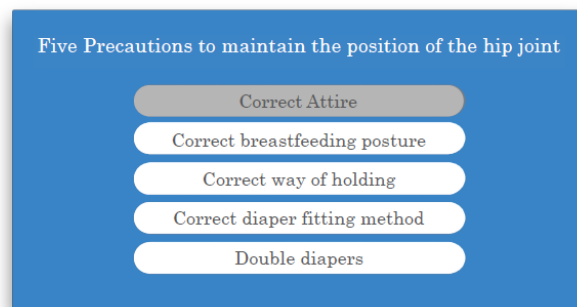


Figure 10. Sample menu.

Figure 11 shows a sample illustration. This example explains that when breastfeeding or changing diapers, for example, the infant's hip joint should resemble an 'M' shape, as it does when in the womb.

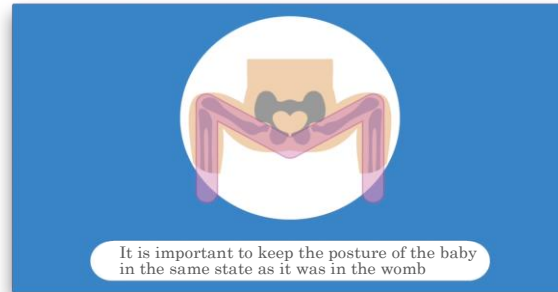


Figure 11. Sample illustration.

Figure 12 shows a sample image of the position an infant takes when nursing. Here, the main visual (video) shows the overall scene from a third-person's perspective. Superimposed at the top left is another visual (video) showing the mother's (first-person's) view. Both visuals are linked in order for the viewer to see actions overall and see how these look from the mother's point of view.



Figure 12. Sample video still.

Evaluation/Findings

Evaluation of Prototype for Demonstration Use

Date/time: November 7, 2016 (Mon), 16:30-17:30

December 14, 2016 (Wed), 17:00-18:00

Place: Sapporo City University School of Nursing (Soen Campus) Method: Check of video by 4-5 people involved

Outcome: It was decided that the following be addressed/changed:

- Overall flow/length
- Size of superimposed video
- Positioning of incorrect position warning, etc.

These internal evaluation sessions helped to enhance the synergistic effect of the third-person and mother's (first-person) views.

Figure 13 shows a still of an inappropriate action (prohibited action) using a doll. The viewer's attention is called by use of an 'X' mark accompanied by a buzzer sound. As mentioned in '5.1.

Location Shoot' above, a lifelike doll was used in the filming due to ethical considerations.



Figure 13. Example of an inappropriate action

2nd Evaluation Phase of Prototype for Demonstration Use by National Center for Maternal and Child Health Mongolia Staff Member

Date/time: March 6, 2017 (Mon), 16:30-17:30

Place: Sapporo City University School of Nursing (Soen Campus)

Method: Visitors from the National Center for Maternal and Child Health Mongolia looked over prototype and offered their opinions.

Outcome: While the prototype was seen as being easy to understand, staff assessing it had specific points of feedback. For example, they felt uncomfortable about the action camera worn by the nurse in the scenes using an actual baby. They also reported that the spreading of the infant's legs or the way in which its mouth was in close proximity to the nurse's uniform was unnatural. This type of feedback was given close attention and would be used to make further improvements.

Interim Conclusions

The interim conclusions regarding the four study aims are as follows:

Basic survey on the current state of communications in Mongolia. The current state of communications, devices, usage and so on in Mongolia was ascertained through interviews with local integrated telecommunications services providers. This step yielded advice on what form the self-study resource should take and how it might be distributed.

Trial of 'DDH Preventive Care' self-study resource aimed at parents. Prototype video content that included new footage taken from both a third-person and first-person (mother's) perspective was created based on learning material produced the previous year.

Creation of prototype utilizing ICT. A video/application production company has been tasked with creating a DVD video and a mobile application for demo use on iPhone/iPad platforms.

This will allow for broadcasting on TV/playback in hospital waiting rooms, etc., in Mongolia,

and for demonstrations using iPhones/iPads.

Conduct hearings and evaluation in the field regarding prototype. The staff member from the Center who visited Japan in February 2017 gave positive feedback on the prototype content. On a subsequent visit in March 2017, staff members from the Center went through each scene and identified problem areas. This feedback will be used to make further improvements.

Future Development

The nurses from the Center who visited the Sapporo City University School of Nursing in early March for training offered feedback on the prototype content from the point of view of those who would be using it. Where possible, this feedback will be reflected in the resource during the current fiscal year, after which a DVD video and mobile application is to be made. If demand is present, the resource will be rolled out in the western provinces of Mongolia during the following year. The authors of this study hope that this educational resource will assist in lowering the incidence in DDH.

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Author Biography

Toshinori ANZAI

Ph.D. in Engineering, Chiba Institute of Technology (2014). Graduated Master's Course at Graduate School of Engineering, Chiba University(1982). Mitsubishi Electric Co. Industrial Design Center(1982). Mitsubishi Electric Co. Advertising Dept.(2005). Professor, School of Design, Sapporo City University(2015).

Kazuyo MATSUURA

Ph.D. in Education, Hokkaido University. Professor, Sapporo City Univeristy(2000). After worked at Tenshi Hospital, School of Allied Health Professions Sapporo Medical College and Asahikawa Medical College, School of Nursing.

Takanobu YAKUBO

Ph.D. in Engineering, Graduate school of Chiba University (2015). Doctoral program in Graduate school of Chiba University (2015), Master program in Graduate school of Chiba University (2012). Sapporo City University (Assistant Professor) (2016).

Tomoko MIKAMI

Ph.D. in Medicine, Sapporo Medical University. Sapporo Nursing School, faculty member(2000). Assistant Professor, Sapporo City University, Japan. Teaching pediatric nursing(2007).

Kouta UEMURA

Sapporo Medical University Hospital in Department of Pediatric Nursing(1998). Research Associate, Sapporo Medical University(2004). Sapporo Hokuyu Hospital in Department of Pediatric Nursing Pediatric emergency telephone counselor(2009). Associate Professor, Sapporo City University(2014).