

Video Teaching Materials to Train Deaf or Hard-of-Hearing Curators in Museums

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Abstract—We aimed to improve the information accessibility of museums based on the principles of “universal design” and “design for all.” Focusing on visitors who used sign language, we trained a curator to offer explanations via sign language to communicate scientific facts to visitors who were Deaf or Hard-of-Hearing (HOH). Demonstration training for hearing curators consists of observing the lecturer’s movements, dialogue with visitors, and consultation of teaching materials while listening to explanations. However, if trainees are persons with hearing impairment, they cannot observe the sign language interpreter, instructor’s movements, and teaching materials simultaneously. Consequently, trainees may overlook important explanations and dialogue with visitors. To address this problem, we recorded the lesson and created a video with captions for review. The materials can be operated on a tablet device, allowing trainees to study freely. We created two pieces of content, “shark eggs and sharkskin” and “human bone,” which were used in the aquarium and science museum, respectively. In this report, we describe the need for contents for visitors with hearing impairment in Section I and then introduce our related content for them and presents the reason to nurture curators who are sign language users with hearing impairment. Section III presents our curator training materials designed for trainees of sign language users who are Deaf or HOH. Lastly, we describe our future work.

Keywords- *science museum; training materials; Deaf or HOH curators; content design.*

I. INTRODUCTION

The definition of museum adopted by the International Council of Museums states [1]: “A museum is a non-profit, permanent institution... for the purposes of study, education and enjoyment.” Since the establishment of the Disability Discrimination Act in 1995 [2], advocacy for persons with disabilities has been a priority in most institutions. Museums therefore seek to reflect information in the discussion of museum research, policy, and practices. However, Atkinson [3] has warned that while exploring a museum collection constitutes a very visual experience, “deaf audiences are one of the most neglected by museums.”

According to the World Health Organization [4], there are 466 million people in the world who suffer from hearing loss. The World Federation of the Deaf estimates that there are about 70 million deaf people worldwide who use sign language as their first language or mother tongue. The National Deaf Center [5] explains that persons with hearing

impairment who are Deaf or HOH have different communication needs. Goss [6] advised that a wide range of multilingual communication is required for the diverse range of museum visitors who are Deaf or HOH. We therefore explored the different communication needs of Deaf and HOH individuals that must be addressed to break down both the physical and intellectual barriers they face in museums.

In this paper, we use the “uppercase D” Deaf to describe the cultural identity of people with hearing loss who share a common culture and have a shared sign language. HOH is used to indicate people with Japanese as their first language who lip-read and use hearing aids as well as sign language to help their communication. The remainder of the paper is organized as follows. Section II introduces the related works and presents the reason to nurture curators who are sign language users with hearing impairment. Section III presents our curator training materials designed for trainees of sign language users who are Deaf or HOH. Section IV compress point out the advantages of training materials using media technology for training curators with hearing impairment.

II. PREVIOUS AND RELATED WORKS

Sanagustín [7] reported on the effects of Quick Response (QR) codes in museums, stating that visitors prefer direct mechanisms for obtaining information about the exhibits, such as text on a panel or videos on a screen. Consequently, Namatame [8] initially provided the Japanese sign language explanation via QR code technology at an aquarium in Japan. QR codes are a cost-effective way of providing opportunities to transform the public’s experience in museum-like spaces. When visitors captured the QR codes in front of the aquarium tanks, explanations appeared that used sign language videos and superimposed captions, including KANA. This enabled us to implement a convenient system that encourages Deaf visitors to visit museums and enlighten themselves using the sign language explanations offered by QR code technology.

Deaf or HOH visitor groups who visit museums can be categorized into the following three groups: “spoken-focused,” “simultaneous language,” and “sign language-focused.” For the convenience of Deaf visitors who are sign language-focused, we designed the tour with a sign language interpreter in the science museum. Martins [9] has reported that Deaf visitors’ engagement is enhanced when tours are given by Deaf tour guides, so we tried to nurture curator sign language users who are Deaf or HOH. Doing so required that

we first design teaching materials for Deaf or HOH trainees. The Deaf or HOH trainees who came forward as candidates for this project were interested in science and had to be capable of using Japanese sign language to communicate and reading written Japanese without difficulty.

The next section reports the teaching materials we designed for trainees who are Deaf or HOH.

III. TRAINING MATERIALS DESIGN

In the demonstration training for curators, a hearing person can observe the lecturer's movements and dialogue with visitors, while consulting the teaching materials and listening to the explanations. However, Deaf or HOH trainees are unable to see the sign language interpreter, instructor's movements, and materials at the same time. Consequently, trainees may overlook important explanations and dialogue with visitors. We therefore recorded the lesson and created a video with captions for review. The materials can be operated on a tablet device, meaning trainees can study freely. We created two pieces of content. One was "shark eggs and shark skins," to be used in the aquarium, and the other was "human bone," to be used in the science museum.

A. Training Materials for Curators who Provide In-Person Explanations

The training materials were designed for the trainees to use at the space in the aquarium called the "desk." This space consists of a desk with some shark eggs and a shark skin displayed between the visitor and the curator, enabling the lecture to progress while communicating face to face (see Fig. 1). The curators in the lecture corner provide visitor experiences and in-person explanations and require conversational skills to provide visitors with new knowledge and stimulate their curiosity as well as the ability to field questions appropriately.

The training program was conducted from September 7, 2019 to December 5, 2019. The training process involved a team of four people: a Deaf curator candidate, an aquarium curator, a sign language interpreter, and an information supporter. It was designed to follow four units: individual visitor experiences, the study of knowledge about sharks using books, observation of demonstrations to learn how to interact with visitors, and a rehearsal. The individual training could be supported by both sign language interpreters and information supporters. However, the observation of demonstrations was very difficult for the trainee who was Deaf, the interpreter, and the information supporter, for several reasons: the voice conversation between the customer and the curator was fast and simultaneous. In addition, the voice conversation was conducted with the face turned down as the user touched several materials, one after the other. The time lag between the conversation and the interpreter's actions had disastrous consequences, and the trainee was unable to lip-read because the speakers' faces were turned down.

We designed two training materials based on our observation of demonstrations to help solve this problem. We used a speech recognition system to instantly transcribe

the description from the curator's voice. In addition, we photographed the materials to be touched on the spot with the transcribed text that was then superimposed on the images (see Fig. 3). Moreover, the video was recorded at a fixed point, with a focus on the hand. After observing the demonstrations, these videos were captioned and provided to the trainees who were deaf to help them learn how to better interact with visitors (see Fig. 4).

B. Training Materials for Curators who Provide Classroom-Style Lectures

These training materials were designed for trainees working in the "school program" at the science museum that is intended for school organizations. Participants in this program are students and schoolteachers. Students are led by the schoolteachers, and they listen to the lecture in groups (see Fig. 2). The materials and lecture rooms are provided by the museum. There are fixed scenarios in the content of the lecture, and the curator leads the class accordingly. Curators must have proficient teaching skills to encourage students' spontaneous thinking and promote the joy of discovery. They must also possess the ability to keep students engaged and answer questions correctly.

We conducted the training program from November 5, 2019, to December 6, 2019, with a team that consisted of an HOH trainee, a curator, an interpreter, a supporter, and a volunteer lecturer of the science museum. The primary training concerned how to teach appropriately. This program was very difficult for the HOH trainee, interpreter, and information supporter. The scenario involved several technical terms such as "skull," "rib," and "pelvis." The trainee was unable to comprehend the instructor's voice and, thus, encourage students' awareness in real time. The trainee was also unable to hear the unspecified number of students' voices, meaning he did not know why the instructor was making such remarks. In the classroom-style lecture, it was very important to understand the situation of the students and the timing of the instructor's utterances.

We designed the video materials for the lecture, which were divided in the unit according to the scenarios. The teaching materials consisted of multiple captioned videos, the scenario, a Q & A section, a figure with bone names, and the main menu. The trainee selected the necessary units from the menu and could study freely (see Fig. 5, 6).

IV. CONCLUSION AND FUTURE WORK

To comprehend the design and technology of suitable content that guarantees information accessibility for the Deaf or HOH trainee, we prepared the following combinations: the technical approach (automatic speech recognition and authoring), museum type (aquarium vs. science museum), and presentation scenario (face-to-face vs. classroom). In the paper's conclusion, we outline a methodology for adapting the proposed materials to other types of scenarios or different educational contexts.

This report introduced training materials for Deaf or HOH curators in a science museum and an aquarium. The training materials could be operated on a tablet device and were shown to be very good tools for enabling Deaf or HOH

curators in the science museum and aquarium. Two technology patterns were used to create the training materials. The first approach involved using speech recognition technology to rapidly superimpose the description of the real material. The second approach was to add captions to the video using an authoring technique.

Practical research in museums has taught us that the interpreter time lag represents a barrier to understanding conversations. Moreover, the physical distance of the exhibits and showcases impedes the ability to point at displays directly.

Technologies for superimposition of descriptions and speech recognition can be used to correctly indicate exhibition points. Video teaching materials can also reproduce subtitles to solve the time lag between the speaker and the interpreter and help Deaf or HOH individuals to understand conversations. Furthermore, multimedia technology can represent the dialogue setting and teaching materials on the same screen. This research convinced us that training materials using media technology were essential for training curators with hearing impairment.

Such types of content are adaptable and flexible for use in other types of scenarios or different educational contexts. However, they serve different purposes: one is suited to real-time communication about exhibits, and the other is suited to self-learning.

Future work is needed to evaluate the effectiveness of such training materials for Deaf or HOH trainees. The addition of sign language descriptions is planned for the next version of the video training material.

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Figure 1. Snapshot of the face-to-face lecture



Figure 2. Snapshot of the classroom-style lecture



Figure 3. Screenshot of speech recognition text superimposed on the image



Figure 4. Screenshot of video training materials to learn how to interact with visitors



Figure 5. Main menu of the training materials implemented on a tablet PC



Figure 6. Screenshot of the training materials with instruction points and the status video of the class