Abstract: New software and hardware, which handle voices and sounds very easily, are presented. Voices and sounds are imported into a personal computer through a microphone or voice recorder, then transformed into two-dimensional dot-codes, edited with texts and pictures, and finally outputted with an ordinary printer. Then, the dot-codes on the printed sheet can be traced with a handy tool, Sound Reader, which decodes the dot-codes into the original voices and sounds. The present system has excellent characteristics such as original voices and sounds of children and teachers, which can be used as teaching materials for various activities in classes. In this paper, several curricular and extracurricular activities practiced at elementary and lower secondary levels of general and special needs education schools are presented.

Keywords: voices and sounds, curricular and extracurricular activities, dot-code

Introduction

Two-dimensional dot-codes are widely used. QR code [1] developed by DENSO WAVE Inc. is now very common in Japan. The QR code has a function which displays a web page on the screen of a cellular phone, if the cellular phone recognizes the QR code with its camera. On the other hand, SP code [2], which was originally developed by Kosaido and Original Design Inc., can keep approximately 800 characters in a fairly small space. A code reading device, “Speechio” can decode the SP codes and read them aloud with composed voices. Today, “Speechio” is used to help the visually impaired in reading texts.

In this paper, we present new software and hardware in which original voices and sounds, imported into a personal computer through a microphone or voice recorder, can be easily handled. New software, Sound card Print Lite, can encode the voices and sounds and change them into two-dimensional scan talk (ST) codes. ST codes were originally developed by Olympus Inc. Sound Card Print Lite can also edit these dot-codes with texts and pictures and output the edited format with an ordinary printer. New handy hardware, Sound Reader, traces the dot-codes and decodes them, and reproduces the codes in the original voices and sounds. The system, comprised of software and hardware, is named Sound Pronunciation System (SPS)). Here, we will report various curricular and extracurricular activities using the SPS at elementary and lower secondary schools.

Method

The SPS has two key technologies. One is software called Sound Card Print Lite. The software makes it
possible to transform voices and sounds into dot-codes. It also can edit the voices and sounds with texts and pictures, and output the edited format with an ordinary printer. The other is a tool called *Sound Reader*. It traces the dot-codes on the printed sheet and reproduces the original voices. [3-5]

Figure 1 shows a screenshot of *Sound Card Print Lite*. Imported voices are shown as dot-codes in the figure with texts and pictures. This sample sheet is part of teaching materials for “Period for Integrated Study”, used at Moto-Hachioji-Higashi Elementary School. We can listen to the original voices by right-clicking the two-dimensional dot-codes on the sheet. *Sound Card Print Lite* also supports a capability in which an ordinary printer can be used to output the edited format.

![Fig. 1 Screenshot of Sound Card Print Lite](image1.png)

![Fig. 2 Sound Reader](image2.png)

Figure 2 shows the *Sound Reader*, which can decode the printed dot-codes with an infrared ray and reproduce the original voices and sounds.

Up to now, as a matter of fact, at the Shinjuku Japanese Language Institute, teachers use the *Sound Reader* along with their original textbooks to teach international students Japanese.

**Curricular and extracurricular activities**

**Let's read more books!**

At Kashiwagi Elementary School in Hachioji, Tokyo, the teachers make a brochure, recommending students to read more than 300 books over their six-years there. The teachers also draw posters and put them on the wall, and volunteers (mainly mothers of the students) hold events where they read to the students in their classroom. In the 2006 academic year, the average number of books each student read was 32, but the teachers still want them to read more books.

In Japan, every elementary school has library helpers formed from higher grades, who put the books on the bookshelves and recommend students to read more books. The library helpers at Kashiwagi Elementary School worked on an exciting activity to introduce the plots of books to lower grades using the *SPS*. At first, they recorded the plots of the books with their voices through a microphone connected to a personal computer. Then, they transformed these recordings into dot-codes, and edited them with the title and picture of the book cover. Finally, they printed the edited format using a color page-printer. They made more than 50 pages with dot-codes, introducing the books to the lower grades. (see Fig. 3) The position of the book in the school library is also mentioned with the dot-codes at the bottom of the sheets.

The library helpers then introduced how to use the sheets and *Sound Reader* to all the other students at the gymnasium. (see Fig. 4) After demonstrating how to use this system, the other students were amazed. The lower
Graders learned how to use the Sound Reader in “Hours of reading books”. The students could listen to the plots of the books by tracing the dot-codes on the sheet at any time. Almost all the students enjoyed tracing the dot-codes and listening to the explanations. As a result, this system successfully promoted them to read more books.

The higher grades also felt a sense of pride from introducing the plots of books to the lower grades. The teachers now consider the Sound Reader as necessary to use in activities such as “introduction of books recommended by lower grades”, “introduction of books recommended by the reading volunteers”, “introduction of books recommended by teachers”, and “introduction of books recommended by authors”. These activities will successfully promote the students to read more books. [6]

Activity in “Moral Study”

“Moral Study” is required at elementary and lower secondary schools in Japan.

The activity at the Special Needs Education School for the Physically Challenged at Kirigaoka started after students received a letter from a teacher who had left the school. The students were eager to answer her letter. [7-9]

They all discussed and decided to send a reply-letter with dot-codes, which could reproduce students’ original voices. In the beginning it was difficult to record their messages using a microphone and personal computer and edit them with text and pictures, since all the students at Special Needs Education School for the Physically Challenged at Kirigaoka have some physical handicap. However they wrestled with such difficult tasks and finally sent a letter to the teacher. (see Fig. 5) The teacher sent back a letter with her speech as dot-codes to the students. (The Sound card Print Lite and Sound Reader were sent to the teacher in advance.) The students listened closely to her voice and some of them were moved to tears.

In these activities, students took part in the activities from the beginning, recording their messages with a microphone. At present, these letter-exchanges have continued between two teachers and some students at Kirigaoka School. These activities bring up the gentle feelings to the students.
Activity at “Period for Integrated Study”

“Period for Integrated Study” is also required in elementary (from third grade) and lower and upper secondary schools. At Period for Integrated Study, most schools treat one of the following subjects: international understanding, information study, environment study, health and welfare, or regional problems.

At Moto-Hachioji-Higashi Elementary School in Hachioji, Tokyo, they teach an international understanding through English lessons taught by a native speaker every year. Due to the budget, only four hours lessons are given to each class. Furthermore, they have other problems such as lack of communication between the native speaker and the homeroom teacher and lack of suitable textbooks.

The teachers discussed curriculum and formed teaching materials using the native speaker’s voice this academic year. They worked out a four-hour lesson curriculum and attractive teaching materials, which could be used with pleasure in lessons and also in the intervals between them. They made more than 100 cards using dot-codes with the native speaker’s voice. (see Fig. 6) On the front of each card, a simple word is depicted as dot-codes with text and a picture. On the reverse side of each card, the conversations using the word are listed as dot-codes. These artifices extend the possibility of the cards to help higher grades.

These cards are now placed at three elementary schools, where the native assistant language teacher has lessons. All the students enjoy using these cards with dot-codes very much and learning “international understanding” from a cheerfully assistant language teacher. [10] These cards are gathered and will be published as a book by Meijitoshoshuppan Corporation.

Support Book

Support Book, which is usually composed of many cards with pictures, is used by volunteers who support students with intellectual disabilities. The volunteer communicates with a student by pointing the pictures on the cards.

In this activity at Special Needs Education School for the Mentally Challenged at Otsuka, students have a support book using the SPS made by teachers. The teachers imported many pictures (for example, volunteers, mother, grandmother, train, bus, tram, etc.) and their voices and sounds, and edited them using Sound Card Print Lite. (see Fig. 7)

Using this new support book, the student could communicate with his volunteers and his family by tracing the dot-codes on the cards and reproducing their voices. After school, for example, he traces the dot-codes on the cards with his teacher’s help. He first knows the day’s volunteer by finding out the picture on the card and listens to his voice, “Let’s return home with me”. Then, he knows which volunteer will take him home that day. Before leaving, he also listens to mother and grandmothers’ voices by tracing the dot-codes to calm him down. [11]

Self-Help Activity in Special Needs Education School

It has become well known that audio aids sometimes work more effectively than visual ones in education or some children with intellectual disabilities; where they have better hearing than vision.
Teachers at the Special Needs Education School for the Mentally Challenged at Otsuka wanted to help a student to communicate with his classmates. In this case a student (8th grade) could not pronounce any words at all except one Japanese Hiragana character.

In the beginning he could not trace the dot-codes straightly. So the teacher first taught him how to move a small stone along a hollow in the assistant tool from right to left and vice versa, as shown in Fig. 8. The teacher next taught him the start and finish positions of the dot-codes by putting blue and red spots at both ends.

After practicing for three months, he could successfully trace dot-codes and listen to the voices and sounds. (see Fig. 9) Then something wonderful happenings occurred. His classmates, waiting for him to successfully trace the dot-codes, responded to him with a smile. He finally realized that tracing dot-codes reproduced the voices and sounds.

As a next step, the teacher tried to help him communicate with his classmates. The teacher had he act as the master of the morning meeting. At morning meetings, which are held every day in schools in Japan, a master confirms every classmate’s presence by calling his/her name. (see Fig. 10) Instead of calling the name of classmates with his voice, he traced the dot-codes on the card, on which the classmate’ name and his/her picture were implemented in advance by the teachers. His classmates answered after he successfully traced their card. The video-clip of these activities, which will be shown in the Conference, gives everyone deep emotion. [11]

The present SPS teaches us very important lessons which might help the mentally challenged to communicate with his/her classmates effectively.

Conclusion
School activities using voices and sounds help students cooperatively learn quite calmly and effectively. The present SPS is a quite helpful tool for the school activities at both general and special needs education.

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