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Education Practices Incorporating Technologies in the Field of Visual Impairments at a Special Needs Education School for Orthopedically Impaired Children

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Abstract: This paper reports on the use of technological applications for specific educational visual impairments at a special needs education school for orthopedically impaired children. Tactile graphics and voice IC tag recorders were introduced as educational materials for students who had difficulties in visual recognition and speech production. Compared with conventional educational materials, these innovative technologies were expected to increase student interest and overall satisfaction.

Keywords: Assistive technology, Special needs education school for orthopedically impaired children, Tactile graphics, Visual impairments, Voice IC tag recorder

1. Introduction

This paper reports on educational practices that apply information support and disability compensation technologies to an education site, targeting students at a special needs education school in Ibaraki Prefecture to discover new application methods and to increase student learning and engagement.

Tactile transmission and voice output devices developed for the visually impaired have the potential to support learning for people with visual recognition and speech production difficulties. The educational practices described in this paper can broaden the scope of use and application methods for conventional visual impediment technologies. At the same time, these practices demonstrate how such technologies could be adapted for people with specific types of disabilities and how they could be used for a wider range of disabilities. Preparations and trials for the educational use of these technologies have been conducted at a target school in Japan since 2009, and based on the results, this paper reports on the educational practices that have made the best use of the most promising technologies: tactile graphics and voice IC tag recorders.

2. Methodology

Target students, subjects, and teaching materials were decided upon in consultation with the teachers in charge. The teachers prepared the teaching materials using devices borrowed from the Tsukuba University of Technology,

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and reported on the results of introducing those materials in class. Meetings with the teachers were held on a regular basis, and the results of the practices were analyzed to determine how the teaching materials and application methods could be improved. Application methods for each device and classroom case studies of practice are discussed below.

2.1. Tactile graphics

A Quantum Technology “PIAF” machine (Fig. 1) was used for this process. Tactile graphics printing is done by taking diagrams drawn on special paper (called capsule or swell paper) and putting them through a PIAF machine. This technology causes the contours in the diagrams to rise sterically so that they are identifiable by visually impaired people. It is regularly used in special needs education schools for the visually impaired [1]. In this educational practice, the technology was used to design teaching materials that swelled the edges of the figures, allowing students who were unable to focus on ordinary teaching materials to draw lines and pictures on other areas to enhance learning.

2.1.1. Case 1

Tactile graphics printed teaching materials based on a commonly used coloring book were developed for sixth grade elementary students. The teacher instructed the students to color the line drawings with crayons.

2.1.2. Case 2

Teachers developed tactile graphics materials based on handwriting practice teaching material for fourth grade elementary students (Fig. 2). The teacher first instructed the students to check the frame lines by touching them. Then, the pupils were instructed to “write without deviating from the path,” and to draw lines using a pencil to connect both ends of the figures.

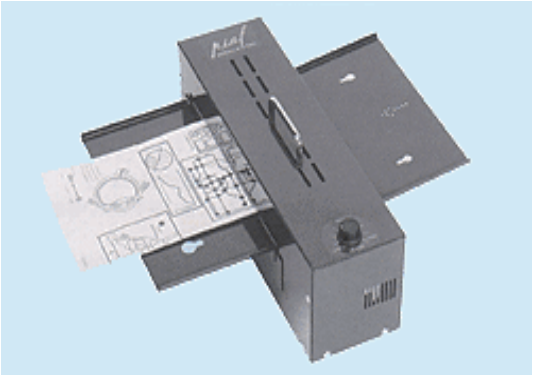

Fig. 1 “PIAF” machine

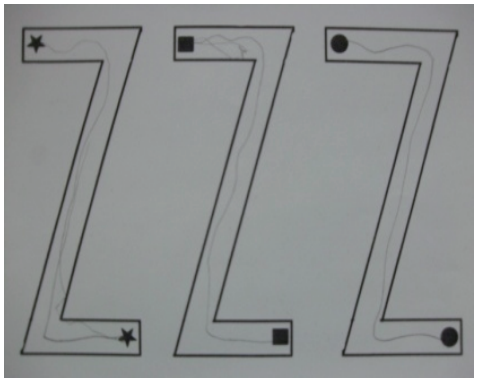

Fig. 2 Example of tactile graphics material

2.2. Voice IC tag recorder

The Panasonic “Monoshiri Talk” (Fig. 3) and UD Create “Touch Memo” (Fig. 4) voice IC tag recorders were used. Voice IC tag recorders are generally used to easily identify personal belongings for visually impaired people. When an IC tag is placed on an object, the information is registered on the special recorder, which, when needed, is held over the object by the user to hear the registered contents and therefore identify the item. In this educational study, IC tags were placed on hiragana (Japanese alphabet) letters and cards, on which frequently spoken sentences were written, to register the phonetic information on the recorder. The voice from the recorder was then played to the students, most of whom were unable to steadily gaze at objects, and was used to develop teaching materials for students who had difficulties forming words.

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Fig. 3 Panasonic “Monoshiri Talk”

Fig. 4 UD Create “Touch Memo”

2.2.1. Case 1

Letter cards were made on which hiragana letters were written for first year junior high school students. The letter cards were then tagged to register the phonetic information (Fig. 5). Rather than the teacher telling the students how to read the letters, the students were instructed to individually check the phonetic information by operating the Monoshiri Talk devices.

Fig. 5 An example of a letter card with the IC tag

2.2.2. Case 2

English conversation teaching materials were designed for second year junior high school students. Some of the cards were put in a notebook and tags were applied to the back. The English sentences that corresponded to each tag were voice registered by the teacher. The teacher asked the students English questions and the students then chose the cards with the appropriate responses from the tagged notebook, and then supplied answers by playing the cards’ phonetic information using the Monoshiri Talk devices. It was found that the Monoshiri Talk devices were too heavy for the students and that it was difficult for them to press the play button when holding them. Therefore, we tried the Touch Memo devices, which were lighter than the Monoshiri Talk and enabled students to play the voice without needing to press a button.

3. Results and analysis

The tactile graphics printed teaching materials were found to attract the attention and interest of the students. The tactile stimuli and visual information increased the attention of the students who were unable to gaze attentively at objects. Furthermore, as the students were able to draw along the sterical frames and lines, they found that they were able to stay within the lines, which significantly increased their satisfaction levels. It is expected that in the future, by making a gradual shift to regularly printed materials, the students will be able to better achieve the learning objectives.

As in the tactile graphics cases, the use of the voice IC tag recorders in Case 1 was an attempt to use auditory stimuli to increase the attention of students who were unable to steadily gaze at visual information. The students in this class, who tended to have a passive attitude when their teacher read out the hiragana letters written on cards, became interested in playing the voice using the Monoshiri Talk and actively checked how the letters were read.

The use of the voice IC tag recorders in Case 2, however, targeted students who had difficulty expressing their feelings and opinions because of various voice disabilities, so the voice conversations were generated using the devices. Rather than using the conventional method for answering teacher questions by pointing at the English

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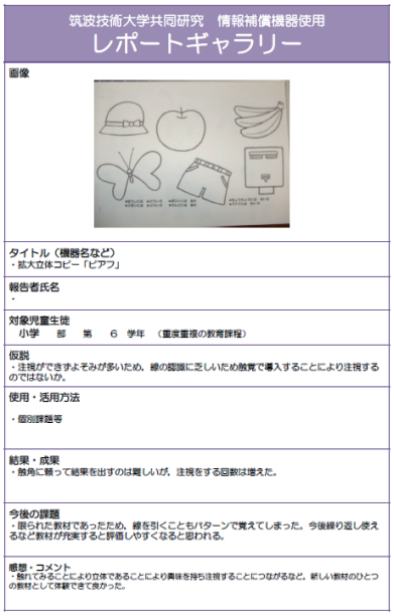
sentences, the students were able to have voice exchanges by holding the IC tag recorders over the corresponding English sentences, which increased their satisfaction levels. The conventional recorders were replaced with lighter products that were easier to manipulate, which made it possible for the students to use them by themselves, significantly increasing their learning autonomy.

In each of these practices, the teachers came up with the ideas and designed the teaching materials using the various technologies. Teachers commented that as it was relatively easy to design the teaching materials, they felt confident in using them for future lessons. The results of these case studies were collected in an A4 “Report Gallery” (Fig. 6), which included the images, application methods, results, and teacher opinions. The initiatives reported in this study will help establish a productive and useful learning system for students with various disabilities.


筑波技術大学共同研究　情報補償機器使用
レポートギャラリー

画像

タイトル（機器名など）
・拡大立体コピー「ピアフ」

報告者氏名

対象児童生徒
小学　部　第　6　学年　（重度重複の教育課程）

仮説
・注視ができずよそみが多いため、線の認識に乏しいため触覚で導入することにより注視するのではないか。

使用・活用方法
・個別課題等

結果・成果
・触角に頼って結果を出すのは難しいが、注視をする回数は増えた。

今後の課題
・限られた教材であったため、線を引くこともパターンで覚えてしまった。今後繰り返し使えるなど教材が充実すると評価しやすくなると思われる。

感想・コメント
・触れてみることにより立体であることにより興味を持ち注視することにつながるなど、新しい教材のひとつの教材として体験できて良かった。

Fig. 6 An example sheet of Report Gallery

4. Conclusions

This study presented a number of classroom initiatives confirming that visual-impairment-focused phonetic and tactile stimuli information support, and disability compensation technologies are useful for people who have difficulties in visual recognition and speech production. The scope of use and application methods of these technologies are expected to expand in the future. However, even though it appeared that the student learning effects were enhanced, we were unable to scientifically confirm them as we did not evaluate the learning effects of each practice. In the future, we plan to include evaluation methods in our studies on the effectiveness of these technologies.

5. Acknowledgements

This research was supported by Special Research Funds from the Research and Support Center on Higher Education for the Hearing Impaired and Visually Impaired of the Tsukuba University of Technology.

References

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