Chapter 20
Multimedia-Enabled Dot Codes as Communication Aids

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ABSTRACT

Grid Onput is a set of novel two-dimensional codes comprising extremely small dots. The present authors recently developed software to overlap the dot codes on the user's designed sheet, to create a content to replay audios, to create a standalone application to replay multimedia, and to create an application to replay multimedia on iPad. Simply touching the dot codes with a speaking-pen and/or a dot-code reader enables users to directly access the corresponding digital information; a maximum of four mediums can be easily linked to each dot code icon. In collaboration with schoolteachers all over the world, one of the authors, Shigeru Ikuta, has been creating a variety of original self-made content and conducting various activities at both general and special needs schools. This chapter outlines the recent development of the state-of-the-art Grid Onput dot code technology and presents basic information regarding the creation of original teaching materials using newly developed software and the use at both general and special needs schools.

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INTRODUCTION

There are many reasons why students may struggle in the classroom. As educators and parents look for ways to help children, they often find undiscovered learning disabilities that interfere with learning. These disabilities know no cultural or geographical boundaries. The identification of students with special needs may vary, but the overwhelming need for understanding best educational practices does not change.

A disability is defined as a condition or function judged to be significantly impaired relative to the usual standard of an individual or group. The term refers to individual functioning and includes physical impairment, sensory impairment, cognitive impairment, intellectual impairment, mental illness, and various types of chronic disease. It also includes learning disabilities, which are neurologically based processing problems that can interfere with learning basic skills such as reading, writing, and/or mathematics, as well as with higher-level skills such as organization, time planning, abstract reasoning, and long- or short-term memory and attention (Leaning Disabilities Association of America, 2019). Each student with Autism Spectrum Disorders (ASD) has some problematic core verbal and nonverbal communication symptoms, such as a delay in learning to talk or a complete lack of verbal ability (WebMD, 2019; National Institute of Mental Health, 2019).

The availability of computers and a concept keyboard specially adapted for Pictogram makes it possible for students with nonverbal communication to tell others their will and desires. This has led to Pictogram's use today as one of the main alternatives to the written word. These picture symbols provide children and adults who lack the ability to read and write in normal texts with a simple aid for their memories and thoughts, making it possible for them to keep diaries of what they have done and use their calendars to plan what they will do in the future (Dubé, 2019; Falck, 2019).

Each student with a disability has different hopes, needs, and desires, and a unique learning history. Each year, teachers at special-needs schools feel it deeply when a wonderful teaching aid and specific materials suitable for one student in the previous class do not fit a new student at all. Because each student with a disability may need individual self-made teaching aids and materials, a reasonable possibility might be easier-to-handle and cheaper software and tools that could provide the indispensable means for schoolteachers to create their own content for each student in their classes.

Widely used augmentative and alternative communication (AAC) technologies provide students with severe speech, language, and communication difficulties with opportunities to improve their communication and, by extension, their relationships with others. AAC systems utilize assistive technology (AT) devices that range from no-tech to high-tech (Beard, Carpenter, & Johnston, 2011; Beukelman, & Mirenda, 2012; Theng, 2011). Dell, Newton, and Petroff (2012) describe the practical use of such devices in a classroom. A widely used AAC tool, voice-output communication aids (VOCAs) or speech-generating devices (SGDs) (Communication Matters, 2017; Inclusive Design Research Center, 2017; Research Autism, 2017) utilize single-level or multilevel outputs to convey sounds. Although a variety of VOCAs cater to students with different abilities and needs, most devices are severely hampered by their low-output numbers and short lengths of recording time.

More than 14 years ago, in order to address these problems, Shigeru Ikuta, one of the authors of this chapter, started using Scan Talk dot codes, developed by Olympus Co. (1999) (Ikuta, Endo, Nemoto, Kaiami, & Ezoe, 2013). Such codes transform voices and sounds into two-dimensional dot codes directly outputted on ordinary paper. However, students with severe hand, finger, or mental challenges could not correctly trace fairly long Scan Talk codes using the Scan Talk Reader. Therefore, Ikuta used new dot codes (Grid Onput) that Gridmark Inc. (2004), the company of Masamichi Watanuki and Shinya Abe