MANUAL FOR USING ICT
AND
TEACHING ITS EFFECTIVE USE

Volume 4 Children/Persons with developmental disabilities

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PREFACE

ICT stands for Information and Communication Technology. Although the progress of ICT has induced the issue of the digital divide, ICT can be extremely useful for life and independence support for people with disabilities.

This manual is in four volumes. It summarizes elements of the knowledge on teaching and using ICT, which staff members of the National Rehabilitation Center for Persons with Disabilities have cultivated in training, research, and clinical practice for people with disabilities.

Volume 4 explains how hospital staff member who assist persons with developmental disabilities can use ICT as a means of supporting the learning, communication, and daily living of such people, and provides relevant information mainly to these supporters.

The URLs in this manual are current as of March 2021.

Currently, Japan is entering the world of 5G mobile communication systems, and ICT is expected to keep evolving. Hopefully, the teaching strategies in this manual should serve as a reference for the development and use of ICT.

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Chapter 1.
ICT Use by Persons with Developmental Disabilities

1) Developmental Disabilities and ICT

In Japan, the "Law to Support Persons with Developmental Disabilities" enacted in 2005 defines "developmental disabilities" as: "autism, Asperger's Syndrome, and other pervasive developmental disorders (PDD); learning disabilities/disorders (LD), attention-deficit hyperactivity disorders (ADHD), and other similar cerebral dysfunctions whose symptoms appear in childhood." In this manual, we refer generically to developmental disabilities as a concept that encompasses innate cognitive, speech-language, and behavioral disabilities including intellectual disabilities.

Persons with developmental disabilities use ICT for two main purposes: 1) to compensate for their difficulties in daily living and communication, and 2) to receive support in learning difficult subjects and reading/writing.

2) Benefits of Using ICT

Persons with developmental disabilities face difficulties in various situations. Information and Communication Technology (ICT) use can provide customized support that meets diverse needs, for example, "awkward verbal interaction," "difficulties in communication," "poor reading, writing, and numerical skills," "hearing difficulties," "carelessness," "poor organizational skills," "inability to learn or remember," and "clumsiness."

The rearrangement of visual data and text-to-speech conversion, or vice versa, are basic functions incorporated in personal computers, tablets, and smartphones. Moreover, the use of software and apps enables precise solutions tailored to individual differences. The ability to organize and utilize information in a variety of formats combining sound, text, photos, and videos is another benefit.

Since the screen can be directly manipulated by touch or writing with a finger or pen, individuals with limited cognitive or learning capacity find these devices easy to use. Being portable anywhere, they can be used in a variety of settings regardless of time or place. Another major benefit is the ability to send information quickly to people in different locations. As enormous amounts of information can be stored electronically and any data later required can be instantly retrieved, they can also help people with memory problems or poor organizational skills.

3) Comprehensive Educational/Support Programs and ICT

ICT serves as one of the numerous support methods. Its role is incorporated into educational and support plans customized to fit specific stages of developmental disability or individual needs. ICT is, first and foremost, a tool; its use should not be the final objective. Our task is to find ways of exploiting its capabilities to compensate for individual disabilities.

For instance, in the case of children who have trouble writing characters, it is not advisable

to immediately start using tablet application software in writing classes. The child's situation and difficulties should first be assessed before taking any remedial measures. Sometimes, simple steps, such as replacing a writing instrument with a marker pen during learning sessions or letting children practice drawing lines in a notebook, can resolve the problem effectively without relying on ICT.

As children grow and their needs evolve/expand, approaches to ICT use should also change. Reflecting assessment results, plans will need to be modified. Likewise, it is important to create long-term plans, keeping in sight the individual's future growth and escalating needs.

In the following section, we highlight ICT use adapted to user needs in the areas of "learning support focusing on reading/writing," "communication," and "daily living activities."

Chapter 2.
Learning Support - focusing on Reading/Writings

1) Importance of reading/writing

Reading and comprehension, as well as writing ability, affect learning in various other areas. Reading/writing skills enhance the expansion and retention of knowledge, as well as the orderly organization of thoughts and ideas. When literacy training stumbles, learning also slows down. As reading/writing skills are often required in social and occupational activities, learning support for reading/writing are essential.

For individuals with reading/writing difficulties, activating the text-to-speech function in ICT for the former and the speech-to-text function for the latter, will not solve everything. Writing letters and characters, for example, can be simplified in some cases by replacing the writing instrument with a marker pen during practice sessions or by writing auxiliary lines in a notebook as a guide. The important thing is that the exact source of difficulties in the reading/writing process must first be pinpointed before deciding on a support program. In the case of reading, depending on whether the problem lies in recognizing vocal sounds, converting characters to sounds, grasping the shapes of written characters, or an interplay of various processes, support medevicesthods will differ. Likewise, in the case of writing, support strategies will vary depending on whether insufficient dexterity for writing, inability to mentally visualize character shapes.

Assessments are made by testing overall intellectual ability, especially language development, reading and writing proficiency level, phonological recognition ability, visual perception, and hand/finger coordination. The findings are used to identify the mechanism by which the individual's difficulties occur and to prepare support measures. It is also important to measure the effects of interventions that had been made over a set period of time and re-examine the methods used. (See References 8, 9, and 10)

Reading and Writing Japanese

The Japanese language is written using "kana" ("hiragana" and "katakana") and "kanji" (Chinese characters).

Kana are phonetic characters roughly corresponding to phonological units called "mora" ("haku" in Japanese). As in Spanish and Italian, there is a generally fixed correspondence between a character and its vocalized sound in Japanese. However, in English, this correspondence is variable; hence, learning the language is relatively difficult. It is reported that incidence rates of dyslexia are low among Japanese and Spanish speakers, but high in English-speaking countries.

Kanji are ideographic characters. In Japan, an enormous number of kanji must be learned: more than 1,000 characters ("kyouiku kanji") in elementary school, increasing to over 2,000 ("jouyou kanji") in middle school. Moreover, there may be multiple ways of reading (pronouncing) a kanji character, and knowledge of these readings is also related to the range of one's vocabulary. As complex shapes and multiple writing strokes are involved, repetitive writing practice is required to retain them in memory.

2) Support for learning to read and write

When Japanese-language characters are first introduced in class, the correspondence between each character and its phonetic sound is taught, and students are asked to trace or copy the character repeatedly as writing practice. However, there are many children who have problems with this traditional teaching method. When conventional methods fail to advance learning, the learning environment, educational tools, and teaching methods should be re-examined.

First, adjust the environment and formulate tools to match the child's level and abilities. Regarding the environment, the height of desks and chairs, lighting, and glare levels should be adjusted. As for learning aids, the use of a transparent sheet placed over a page being read, reading slits to highlight lines being read, note paper ruled with thick and widely-spaced lines, and marker pens can be appealing to a child and stimulate the learning of writing skills.

Teaching methods should likewise be reviewed. Appropriate methods deriving from such reassessments should be trialed. For instance, if children still cannot remember how to write characters even after tracing or copying characters in practice sessions, teaching strategies should be modified to reinforce memory. One way is to break up a character into its components and let the children practice writing them separately. Another method is to verbally describe the writing of characters (for example, "There are 2 vertical lines on the side…"). Simply replacing a pencil with a tablet or instructing them to trace or copy characters on a tablet app will only perpetuate the inability to learn writing those characters. If a child is not good at writing characters because of difficulty in reading and understanding them, provide reading assistance preferentially and/

or concurrently. Numerous references are available on reading/writing and learning support, including the use of ICT, so please refer to the end of this volume.

To foster the learning of written characters, it is also important to increase reading and writing opportunities. Daily scenarios where reading/writing skills are exercised and learning motivation is boosted should be multiplied. Children should be encouraged to search for videos they wish to watch, music they wish to hear, or topics they are interested in by keying in the titles themselves. ICT is ideal for creating opportunities where children can familiarize themselves with written characters and use them, as in learning sessions where educational software with the feel of a video game is repeatedly "played" by the children as practice.

3) ICT-supported reading and writing

(1) Reading support

Personal computers, tablets, and smartphones are basically equipped with the text-to-speech function, which is beneficial to not only visually-impaired individuals but also those who have difficulties reading text. These individuals can enjoy e-books that are read aloud by the function and access digital textbooks available free-of-charge in Japan, as listed in the following table.

Table 1 Digital Textbooks in Japan

Website	Publisher	Features
Multimedia DAISY Textbooks http://www.dinf.ne.jp/doc/daisy/book/daisytext.html	Japanese Society for Rehabilitation of Persons with Disabilities The DAISY Consortium	DAISY (Digital Accessible Information System) is the international standard for digitized documents. One can view text and images in textbooks, listen to text-to-speech audio while reading the highlighted text, and view pictures.
See the DAISY Consortium for access to published material in languages other than Japanese. https://daisy.org/		The DAISY Consortium is a global consortium of organizations, established to develop, maintain, and spread the DAISY standard, with the goal of guaranteeing equal access to information by all.

Website	Publisher	Features
Access Reading https://www. accessreading.org/	Tokyo University Research Center for Advanced Science and Technology	An online library offering electronic and book-sourced data from textbooks and educational materials. Offered in EPUB or DOCX formats. In Japanese only.
Audio materials BEAM https://www.npo-edge.jp/support/audio-materials/	EDGE Special Non-profit Corporation	Textbooks for elementary school (Japanese Language and Social Studies); middle school (Japanese Language, Geography, History, and Civics); and high school (Basic Biology) are offered in MP3 format. In Japanese only.

(URL as of November 1, 2021)

If the text has not yet been digitized, a hard copy can be scanned, and the characters can be digitized by Optical Character Recognition (OCR) software. Nowadays, OCR camera application software capable of digitizing text images just by taking a photo are also being used.

If an individual does not know how to pronounce a character and is unable to enter it on the keyboard, the character can be handwritten on the screen for optical recognition. An OCR camera app will take the image and search for the character's pronunciation. Furthermore, Google provides a function that will perform a search simply based on a character directly handwritten on the screen (Fig.1).
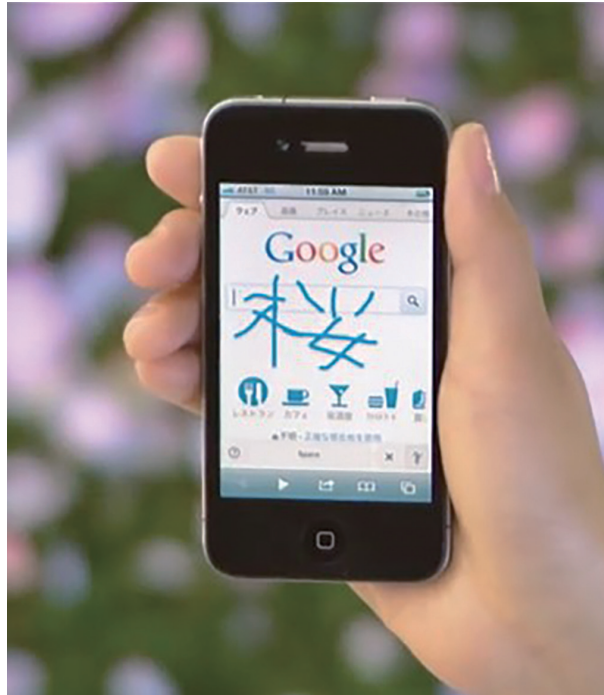
Figure 1. Google search based on handwritten input
        After enabling handwritten input in the search settings, tap "g" at the bottom right of the screen and write the character on any part of the screen to begin the search.
        (https://www.youtube.com/watch?v=uyeJXKfAcpc)
        (Handwrite, a new way to search on Google)

\<Case A\>

A student in the middle school section of a special needs school. Severe hearing impairment and autism spectrum disorder present; communicates by sign language. Motor skill knowledge is in the normal range; but unable to comprehend or express spoken language. Understanding of written language is at early primary school level. Able to understand the meaning of characters frequently seen ("arithmetic," "graduation," etc.), and able to copy them as well. However, not knowing how to read the characters, student is unable to learn how to search a dictionary or the internet.

By copying the characters on a smartphone that digitizes them, the student is now able to search and retrieve corresponding images on the internet, for example, the route to a destination.

(2) Writing alternatives

Letters can be written by tapping the keyboard or touching the screens of tablets and other terminals. With tablets and smartphones, functions such as QuickPath and Gboard's Glide typing can be used that allow words to be entered by sliding fingers on the keyboard.

iOS uses QuickPath.

https://support.apple.com/ja-jp/guide/iphone/iph3c50f96e/ios

https://www.youtube.com/watch?v=D2XyP7iUErI

Android uses the Gboard app and its Glide typing function.

https://support.google.com/gboard/answer/2811346?hl=en&co=GENIE.Platform%3DAndroid

The app predicts words simply by having the user swipe between letters on the keyboard.

It works in English and other languages.

When keyboard inputting is difficult or time-consuming, IC recorders and tablet voice recording application software can be used to record speech. Using the voice recognition function, voice inputs in the tablet and other devices are converted to text, thereby transcribing the spoken language.

Utilizing memory application software, for example, "Evernote," "OneNote," and "Memo," as well as digital notes, one can create notes from classes and lectures that combine text entered via a keyboard, handwritten text, hand-drawn pictures, and photos.

Taking full photos of whiteboards, text on the blackboard, and other posted material is the most popular storage method, as it requires minimum effort while preserving maximum accuracy. It is exceedingly convenient when one has little time for note-taking or wishes to check the entire document sometime later.

4) Benefits of ICT use in classroom learning

By utilizing ICT, learning and teaching are now facilitated by various audiovisual teaching aids synthesizing audio, photos, and videos. Moreover, learning application software for school or home use are easy to find for any course.

Since the level of difficulty, amount of information, and order of presentation of topics can be adjusted in courses utilizing ICT, preparing lessons on an individual level has become easier. Outcome feedback is clear, achievement levels rise, and rewards, such as extra tokens, are available. These features are well-suited to repetitive learning. Since effective ICT use can prevent academic decline and psychological instability caused by cumulative failure, it is enormously beneficial in boosting learning motivation.

Chapter 3.
Communication Support

1) Augmentative and Alternative Communication (AAC)

Persons with developmental disabilities have a limited comprehension of language, manifested in the inability to express themselves effectively through words, difficulty engaging in or maintaining a conversation, or poor reading/writing skills. In other words, they have problems understanding/expressing spoken language or carrying on a conversation. ICT can be used to mitigate these communication drawbacks.

AAC is an approach that expands or supplements communication to meet the needs of individuals with limitations in either the comprehension or expression of speech - language, or both. Non-phonetic formats, for example, pictures, photos, text, gestures, and sign language, as well as various tools and devices, such as slates, personal computers, and smartphones, are utilized.

Characteristics of phonetic (auditory) and visual signals

Since the link between the signal format and the significance (idea) is arbitrary in spoken and written language, the signals require a certain amount of learning. Compared to phonetic signals, the link between signal and significance is easier to grasp in the case of gestures, pictures, and photos. Accordingly, for individuals limited in their use of spoken or written language, exchanges using pictures and photos are relatively easier, expanding the range of communication.

Visual (graphic) signals, for example, text, pictures, and photos, enable the perception of a totality all at once. Moreover, since they can be continually presented, one can view them repeatedly over time for a clearer understanding. However, since phonetic and gesticular signals are momentary, the listener must comprehend them sequentially. Hence, in order to accurately convey information and remember/store information, we habitually employ visual (graphic) signals. Some examples are blackboards, slides, resumes, flyers, advertisements, restaurant menus, marks, signs, memos, letters, etc. - the list is endless.

Some AAC tools and devices (e.g., slates and communication notes) do not employ electronic technology, while others do, for example, personal computers, smartphones, and VOCA * (Voice Output Communication Aid). Appropriate signals and tools matching the characteristics and stage of a user's developmentaldisability, needs, and usage setting are selected for use in conjunction with each other. However, in the case of infants or individuals with mental disabilities, learning

sessions are usually more effective when methods not using electronic technology, such as real objects, picture cards, and gestures, are first employed, until they are eventually able to communicate smoothly in daily living. At that point, exchanges using ICT can gradually be introduced.

*VOCA is a device that generates audio output corresponding to text, pictures, or photos that are pointed at to communicate with the user. Previously, it was necessary to purchase the device at high cost. Nowadays, numerous application software with this function are available for tablets and other devices.

2) Communicating by writing

Even when oral communication is difficult, if the individual can read and write, it is possible to converse by writing on paper. Communicating by writing is a very convenient method. There are also tablet and smartphone application especially designed for this purpose (Fig.2).

When writing by hand is difficult or time-consuming, text can be composed by using the keyboard and numeric keypad. By using the predictive text function, after inputting just 1 or 2 characters, text suggestions will appear. Even if the individual cannot compose the text correctly, the desired words can be selected from those suggestions to complete a message (Fig.3). When it is difficult to input characters one by one, or doing so takes too much time, another convenient method is to store frequently used words and sentences beforehand for future selection.

Figure 2. Example of how to use the *"Hitsudan Pat"* app communication written pad?
In this app, characters written or pictures drawn by the user are reversed upside down to face toward the conversation partner.
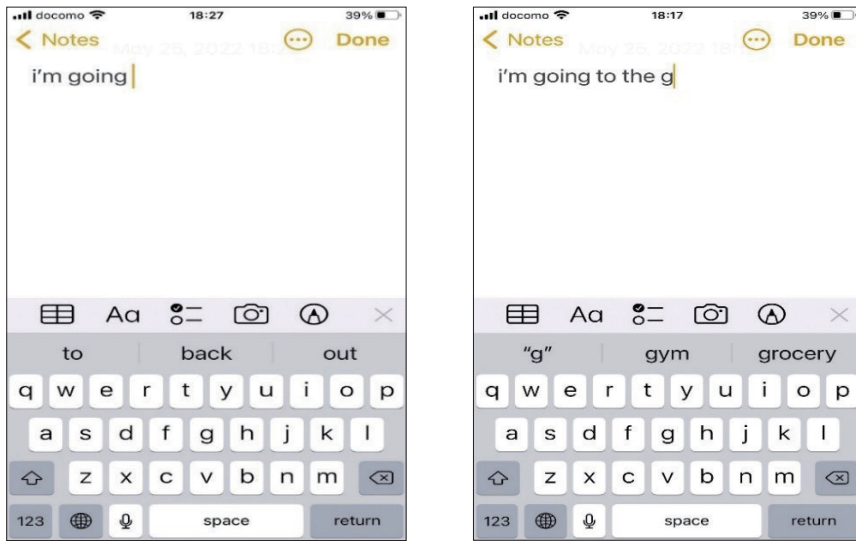(https://apps.apple.com/us/app/筆談パット/id367196546?ign-itsct=apps_box&ign-itscg=30200)

Figure 3. Example of the predictive text function in use
Entering "g" displays likely words such as "gym" and "grocery," so the whole word can be determined by simply choosing it.

By using application allowing both voice and text input/output, not only text-to-text, but also text-to-speech, or conversely, speech-to-text conversations are made possible (Fig.4). Application software designed for the hearing-impaired or for conversing with foreigners may also be useful for this purpose (Fig.5).
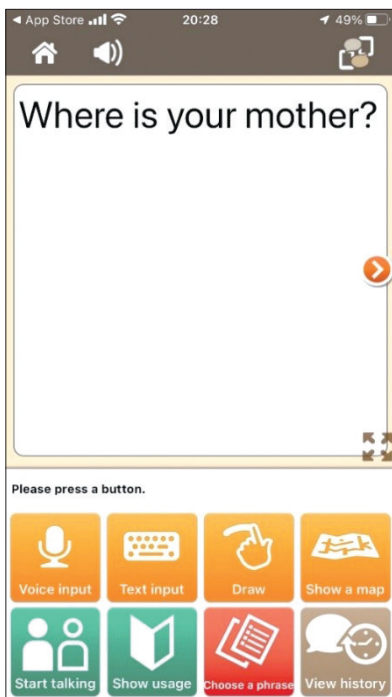

Figure 4. Example of how to use the *"Koetora"* app
Voice and text input/output are enabled. Standard text can be stored. Emojis, diagrams, and maps can also be conveyed. Standard text can be stored, and emojis, diagrams, and maps can also be used to convey messages. Pressing the microphone button and asking "Where will you go today?" immediately displays the spoken words in text form.
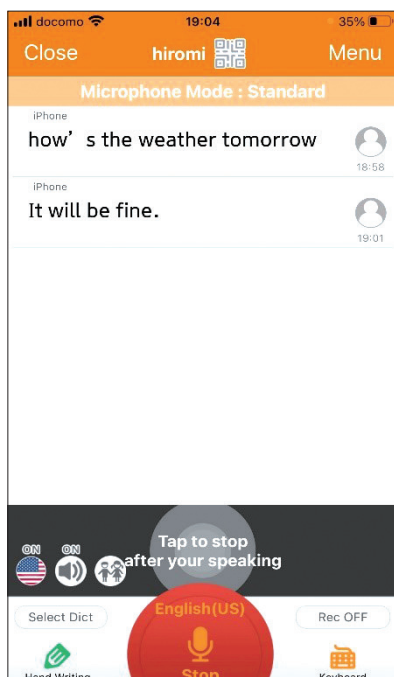(https://apps.apple.com/jp/app/koetora/id653293704)

Figure 5. Conversation using the *"UD Talk"* app
This multi-purpose communication app is equipped with multilingual translation, voice recognition, and voice synthesis functions. Inputting "How's the weather tomorrow?" as text and replying "Probably sunny" displays the spoken answer in text form as well.
(https://udtalk.jp/en)

\<Case B\>

A student in the senior elementary school section of a special needs school. Cognitive impairment and autism spectrum present. Communicates by gestures and picture cards. In the early years of elementary school, the student was accompanied by a parent to school. While sitting calmly in the train, as a learning activity, the student was regularly asked upon arrival at a station to identify the station by selecting from cards showing station names in "kanji" and "kana." The student currently goes to school unaccompanied. After arriving at a transfer stop, the student sends an email notifying the parent: "I've arrived at X station."

\<Case C\>

A student in the high school section of a special needs school. Cognitive impairment and cerebral palsy are present. Able to understand spoken language but verbal expression is at the word level and extremely unclear. Facial expressions are abundant; gestures are frequently used, but sometimes difficult to interpret due to clumsiness. The student can write "hiragana" characters in large script; however, due to slow speed and frequent errors, writing skills are not practicable.

After learning how to line up character chips one by one to form words, although making mistakes, the student is now able to form words by pointing to characters on a Japanese-language syllabary chart. The student has started practicing how to input characters on a tablet keyboard showing the Japanese syllabary. Currently, communication employing various methods, such as facial expressions, voice, gestures, and text, is being encouraged.

3) Communicating by showing pictures and photos

For individuals who find oral or written communication difficult, communication using pictures, diagrams, or photos is more effective. Ordinarily, we also communicate with each other by showing symbols other than text, for example, by showing real objects, drawing diagrams, or pointing at photos on a menu. In text exchanges, inserting emojis or stamps to convey a message is also a common practice.

Taking photos for communication has become remarkably easy due to the proliferation of digital cameras and smartphones. Photos can be sent by email or social media as soon as they are taken, even to people in distant locations.

Creating pictures, photo cards, and communication notes has been greatly facilitated by ICT than before. Many specialized application software can now also generate audio when pictures or symbols are pointed at (Fig. 6)
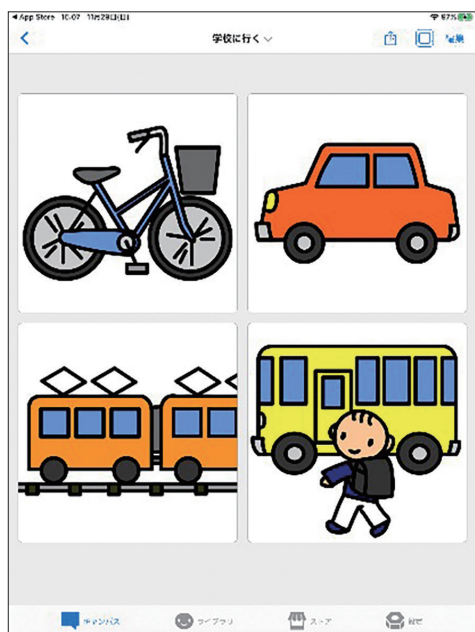

Figure 6. Example of how to use the "DropTalk" app
"DropTalk" is a VOCA app capable of generating a combination of pictures, symbols, and voices. Family members and supporters select pictures from the app and place them on a sheet. Children can point to the pictures to convey messages such as "(I want to ride) a train" and "(I came here by) bus," etc. (https://apps.apple.com/jp/app/droptalk/id373051396)

Drop Talk works only in Japanese. However, numerous English-language application software are equipped with similar functions.

4) Communicating by gestures

When comprehension or expression of spoken language is limited, gesturing is an important communication method. Nowadays, by using videophones and video conferencing, people in different locations can communicate with each other using gestures and sign language. For individuals whose voices do not travel clearly through the phone, communication is possible through a combination of gestures and sign language, as well as facial expressions, physical

appearance, and the surrounding ambience. As a result, the amount of information conveyed is magnified and mutual understanding is enhanced.

Chapter 4.
Support for Daily Living Activities

1) Managing time and schedules

Managing one's time and schedule is essential for living autonomously. Individuals prone to forgetting promises or frequently arriving late can avail of online calendars and reminders. Non-electronic methods, such as kitchen timers, are also simple and convenient. Sharing an online calendar with others is even better, as someone can call to remind us of an appointment in case we forget.
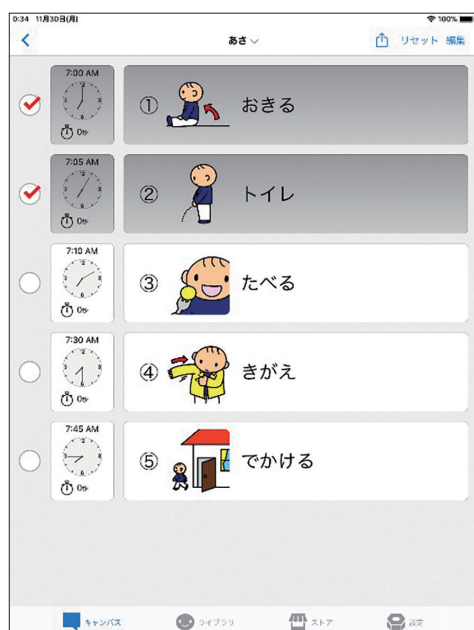
① Get up
② Go to the washroom
③ Eat
④ Change clothes
⑤ Leave

Figure 7. Example of how to use the "DropTalk" app
A morning schedule is shown above in pictures and text.
This is a table of morning routines that the child's family had created by placing illustrations available inside an app and adding texts and time. The child looks at the pictures, checks what to do next, and ticks after finishing it.
(https://apps.apple.com/jp/app/droptalk/id373051396)

When children have no idea of plans or schedules of upcoming activities, they cannot go about calmly in their daily routines. Some may even panic. It is advisable to set up easy-to-understand calendars and schedules by including text, pictures, and photos to show the plans. When they are created using ICT (Fig. 7), previously taken photos can be inserted, a large quantity of pictures

and photos can be selected from stock and included, and segments of previous schedules can be easily modified and reused. These can be printed and carried around or shown directly to others on tablet and smartphone screens.

Some apps even visually show the time remaining before a scheduled time comes up. Even those who cannot read the time on a clock or watch, can have a graphic sense of the amount of time remaining (Fig. 8).
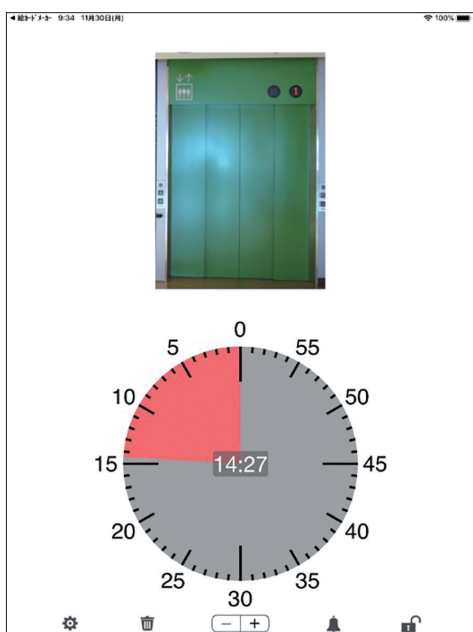

Figure 8. Example of how to use the "*Ekaadotaimaa*" ("Picture-card Timer") app
This app graphically depicts the time remaining before someone must take their favorite elevator.
(https://apps.apple.com/jp/app/picture-for-autism)

2) Consolidating information to aid memory

When remembering or organizing information is difficult, or when even the locations of reminder memos are easily forgotten, ICT comes to the rescue. When information is consolidated into a digital notebook, tablet, or smartphone, there is no danger of losing track of reminder memos. By using cloud services, such as Evernote, OneDrive, Dropbox and iCloud, information can be consolidated/stored in the cloud and accessed/manipulated from multiple devices..

3) Checking sequence of activities

When individuals cannot remember a sequence of steps explained verbally, for example, morning routines, tooth brushing, folding origami, furniture assembly, etc., a visual representation using text, pictures, photos, or videos is effective.

When teaching daily living activities or explaining a sequence of steps for a task, showing a sequence chart with pictures or photos while performing the steps together may gradually enable

an individual to refer to the chart and perform the activity independently. Application software that can easily prepare sequence charts and manuals are available.

4) Enjoying leisure time

As personal computers, tablets, smartphones, and video game consoles can be used to access audiovisual content and play electronic games, ICT is also useful for enhancing the enjoyment of individual leisure time. Children unable to play complicated games due to severe mental disabilities can spend time playing simple games, listening to music, and watching movies - activities contributing to the stability of daily life for both the individual and the family.

Social media can be used to discover and interact with people having the same hobbies/interests, as well as exchange information and share concerns with them. Thus, ICT use can lead to making new friends

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In case of hearing problems

In a noisy environment, there are people who find it difficult to distinguish voices from other sounds in the background. In this case, noise-cancelling earphones/headphones can be useful in reducing noise. Furthermore, the speaker's voice can be directed through a parabolic microphone toward the receiver of a listener's hearing aid to assist hearing in noisy settings, such as classrooms or lecture halls.

Since displaying subtitles may complement hearing, when watching television or viewing something on a personal computer, the subtitle function can be switched on.

Chapter 5.
Points to Remember when Using ICT in Teaching

1) Teach proper information handling and etiquette

The internet is full of both useful and harmful information. In the case of children, the filtering function should be enabled to prevent access to unnecessary sites.

While internet use can be convenient, it brings the risk of crime or involvement in consumer disputes. Furthermore, information may be unlawfully copied, others may be harmed, and a user may turn into a perpetrator. For safe and secure ICT use by persons with developmental disabilities, it is important to explain information ethics in easy-to-understand terms.

When teaching these rules, the method must be adapted to the developmental stage and characteristics of the developmental disability. Web pages with illustrations and simple explanations, as well as printed publications, should be used to convey internet usage rules. To ensure that the individual fully understands the rules, the merits and demerits of internet usage should be visually illustrated with pictures and videos, prior to setting down rules based on the individual's understanding and agreement. It is also important that the rules imposed can be realistically followed. If smartphones are allowed in the bedroom, a "No smartphone usage after 10 p.m." rule will normally be ignored. Similarly, a "30 minutes only" rule will likely be ignored if a long-running video game has already started.

2) Preventing excessive use and addiction

As excessive use of and addiction to video games, videos, and social media have a substantial effect on learning and daily living activities, preventative measures should be adopted. Once excessive use is foreseen, gaming and such activities should be suspended for the time being.

Usage rules, such as the prohibition of smartphones in the bedroom at bedtime, should be instituted beforehand. Disabling tablets and smartphones at bedtime is also another option.

Since personal computers and tablets are multifunctional, everyone has probably experienced launching other application software or checking social media during work or class hours. Theses devices can also be set to allow only 1 application software on at a time to prevent usage of other application software.

At times, it is more reassuring to restrict usage of a device to a specific purpose. For instance, tablets can be designated only for reading/writing lessons, and video games must be played on consoles. Another option is "pomera (kingjim)" (https://www.kingjim.co.jp/pomera/), a text input-restricted device equipped only with text input/editing functions dedicated to composing textual material.

3) Central role of the user　　User centered utilization of ICT

When ICT satisfies user needs, the user realizes its convenience and effectiveness and engages actively in its use. Ease of use is also a major consideration; if manual maneuvers are complicated or the cognitive processing load is substantial, ICT usage cannot be sustained.

It is essential that ICT always serves to promote the social inclusion of users and enhance their QOL.

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