

# Proof of Concept: ICT System PicotTo for Individual Education Support

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**Abstract**—Children requiring special support are increasing in Japan. In April 2016, the government of Japan enacted a law supporting disabled people, which stipulates giving them reasonable consideration. This law mandates supporting children with special needs in all Japanese schools. Many children diagnosed with one or more developmental disabilities, such as autism spectrum disorder (ASD), attention deficit disorder (ADD), hyperactivity disorder (ADHD), and learning disability (LD), often struggle in school. Children with developmental disorders require special support to help them in many aspects of life, and individual educational support is crucial. We developed a collaborative system for managing developmental disorders using ICT that can be utilized by teachers, parents, and supporters. This study demonstrated and tested this system (PicotTo). We also evaluated using the system through a case study.

**Index Terms**—Individual education system, developmental disability, education support system.

## I. INTRODUCTION

It has recently been considered crucial to conduct education and support for children with developmental disabilities based on their characteristics [1]. These children include those with attention-deficit/hyperactivity disorder (AD/HD) [2], autism spectrum disorder (ASD) [3], [4], and learning disability (LD) [5]. They have unique learning, and daily life needs even if they study in regular classes. However, it is difficult to understand the conditions of children with developmental disabilities because each child has unique circumstances. Many aspects of support are insufficient for meeting the characteristics of individual children. Therefore, to support them according to their individual needs, it is essential to observe the daily activities of such children at school and home where they spend most of their time, and for parents and teachers to work closely together to comprehend the nature of each child. Nevertheless, close collaboration is

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complex in the real world, and inadequate support is often provided after problems are encountered.

In Japan, the Disability Discrimination Act came into effect on April 1, 2016, mandating the provision of an environment of "reasonable accommodation" for children needing special consideration. It is necessary to understand the condition and characteristics of a child and match the support method to make effective use of "Reasonable Accommodation." Children with developmental disabilities often behave differently from typically developing children, and teachers need to understand these individuals' behavioral patterns and characteristics. Moreover, observations are necessary to understand their specific features before providing support. It is also essential to share information among schools, families, and support organizations and understand "the kind of consideration and support needed" by each individual on a case-by-case basis before giving support, which requires an environment of "collaboration." It is also necessary to accumulate behavioral histories, whereas, in practice, it is challenging to develop histories that allow the clarification of detailed behavioral patterns for assisting busy teachers. Moreover, it often takes a long time to match special needs children with the available support even when support is available. Furthermore, busy teachers and parents need a solution to reduce their workloads without spending too much time on preparing materials such as individualized educational support plans.

Currently, daily observation records are maintained with a personal checklist of standards that can be individually specified, which is internationally standardized. However, no system can dynamically analyze and support changing conditions of children with developmental disabilities. Therefore, we have developed assistive devices and systems to help people with developmental disabilities, people with disabilities, teachers, supporters, and parents [6]-[13]. We might realize the goal of providing immediate support if we could make individualized suggestions to students with problems regarding the support required, inform them of the types of support available to them, and select the support method according to the situation.

In this study, we developed an educational support system that can provide support according to the individual characteristics of children with developmental disabilities to achieve these objectives. The purpose of the Proof of Concept (PoC) presented here is to identify the advantage and describe the challenges expected to be solved by using this system.

## II. THE SYSTEM AND THE POC

From October 2016 to March 2019, we conducted PoC of an ICT-based individualized education support system

(PicotTo) in 16 elementary, junior high, and high schools of Fukui Prefecture. Then, we inaugurated the PoC of PicotTo at elementary schools and special support schools in Fukui Prefecture on November 1, 2021.

The system we developed mainly supports children with developmental disabilities, including ASD and AD/HD children, and truants with physical and mental disabilities. The children's school teachers, parents, and supporters input the children's typical behaviors and feelings into the system, which are converted into big data. This collaborative support project is explained in Section A of this article. In this system, children's learning and behavioral records from school and work are accumulated, similar to a portfolio, enabling smooth information sharing even when the teachers' or supporters' environments change. The continuous support system is explained in Section B. of this article. In addition, this system allows the user to develop a personalized support plan and suggests learning materials and support services utilizing AI, which is explained in Section C of this article.

The system received high praise from children, parents, schools, and support organizations. They stated, for example, "I feel a sense of security knowing that my child's therapist is always there for me;" "It is possible to connect continuous support to employment;" "even if a person is replaced, there is no diffusion of the support," and "Paper-based contact forms can be digitized, leading to a reduction of the workload."

The results of the questionnaire for the system evaluated by the users of the system who participated in the 2016-2019 PoC are presented in Chapter 3. We plan to revise the system and conduct full-scale operations based on the 2016 PoC results. We also plan to implement a new demonstration of the system for elementary schools in Fukui Prefecture and verify the sustainability of operations.

**A. Realizing Collaborative Support Using the System**

The (PicotTo) system was developed to support children with developmental disabilities, which requires close collaboration between teachers, parents, and supporters. Even when teachers and parents try to help children, if their goals oppose each other, children will get confused without knowing what is best.

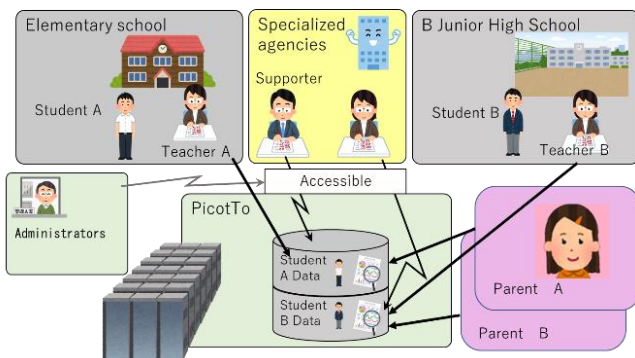


Fig. 1. An overview of the PicotTo system.

Therefore, it is necessary to promote a common understanding by building a collaborative system that allows teachers and parents to work closely together. Achieving this goal requires accumulating and consolidating information on children at school with daily details from home with different behavioral data on individuals, including data on learning, everyday life, interpersonal, and emotional factors. An overview of the system is shown in Fig. 1.

The system checks children's daily goals and makes comments. Fig. 2 shows an example of the daily checklist screen.

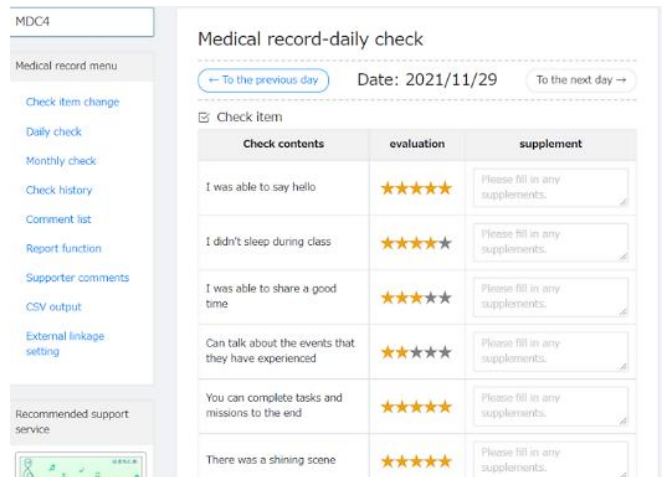


Fig. 2. Daily checklist screen.

The checked items daily vary based on the child's characteristics and goals. As shown in Fig. 3, the system has an interface that visually displays monthly changes in checklist items. In addition, we have developed a function to facilitate objectively visualizing and understanding teachers' and parents' support needs. The first function shown in Figure 4 indicates the daily situation in colors on a monthly calendar as action goal items.

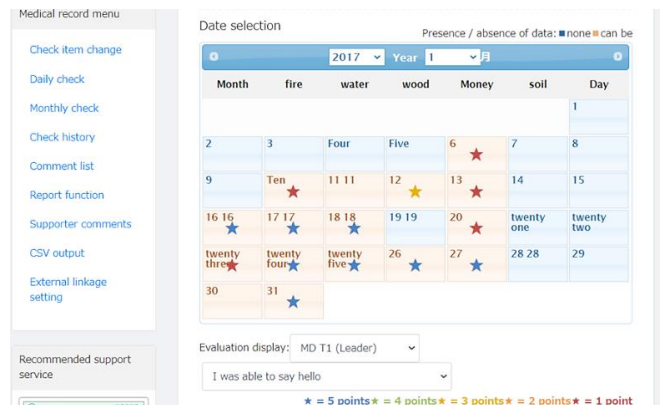


Fig. 3. Behavior visualization.

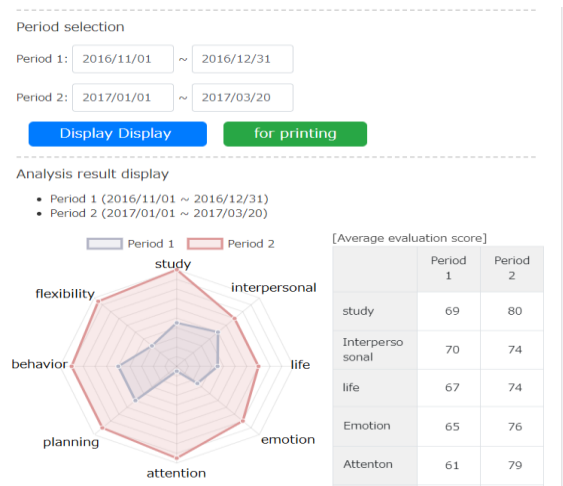


Fig. 4. Visualization of behavioral changes using radar graphs.

The system has a function showing a person's condition using radar graphs. This graph can compare conditions between two periods. In addition, as shown in Fig. 4, the checklist items are linked to "study," "interpersonal," "life," "emotions," "attention," "planning," "behavior," and "flexibility," among others. The interface visually presents the user with a table and a graph of each period. Graphing daily records facilitates visualizing reflections and motivation, which gives the supporters improved opportunities to complement their growth.

**B. The Ongoing Transfer System**

Ongoing support is crucial for children with developmental disabilities. Currently, it is compulsory to develop individual educational support plans. However, the history of a particular child is rarely maintained. Failure to pass on a child's history when the child moves to the next grade or college precludes teachers from understanding the child's characteristics. As a result, studying a child's history continuously despite changing teachers is essential. Thus, as shown in Figure. 5, it is necessary to accumulate successively increasing yearly data on a child's school and home activities.

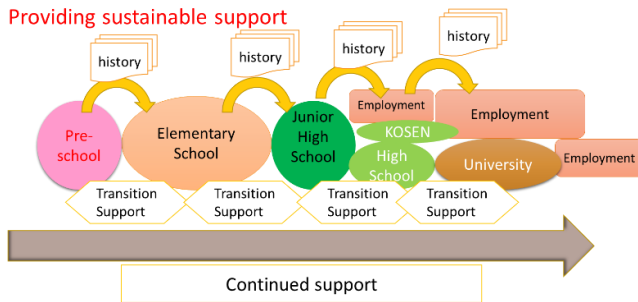


Fig. 5. Taking turns by users who add and refer to data: Using the system to accumulate different daily information on children at school and home, and taking turns in sharing big data among teachers.

**C. Identifying Individual Characteristics Using ICF Codes and Matching Them to Support Services**

This system enables matching assistive devices and services with children's characteristics. Teachers and parents can check daily behavioral items, and the related ICF code is weighted and linked to each of these items. Each assessment, assistive device, and support service is also associated with an ICF code associated with the cognitive function that it is intended to support. As shown in Figure 6, we have developed a process for helping support services by matching individual characteristics using these ICF codes.

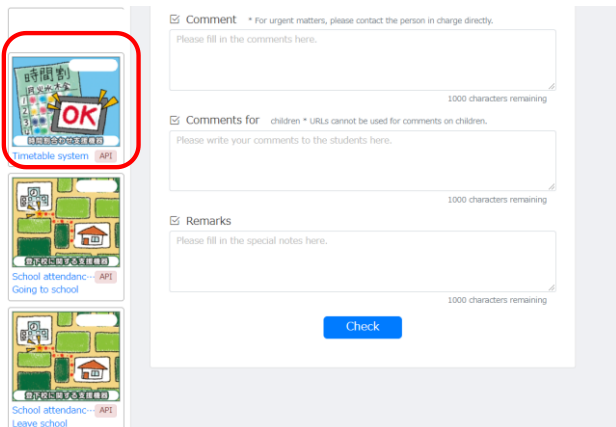


Fig. 6. Proposal of educational services according to personal characteristics.

The PicotTo system supports a person's entire life to ensure that no one is left behind, regardless of being disabled.

**III. QUESTIONNAIRE RESULTS ON PICOTTO AS AN INDIVIDUAL EDUCATIONAL SUPPORT SYSTEM**

Target: A questionnaire survey was conducted targeting the PicotTo Individual Education Support System users (Fig. 7).

Questionnaire administration: The Questionnaire was sent by post. There were 25 valid responses. The breakdown of the survey respondents included parents, teachers, supporters, and others.

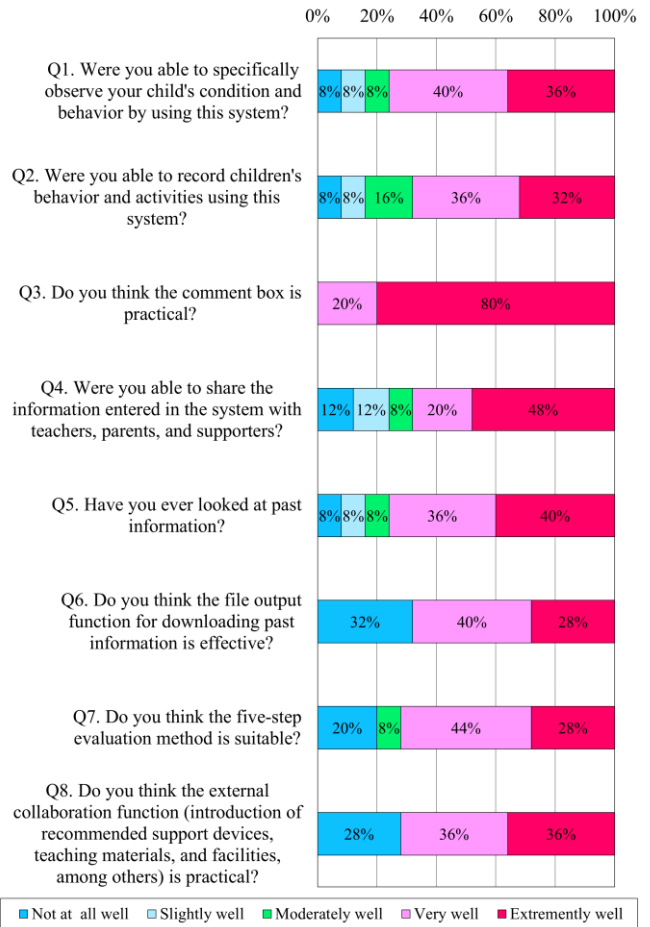


Fig. 7. Questionnaire results.

The questionnaire results indicated that all the respondents found that information sharing in the comments was effective (or generally adequate).

Regarding the 5-point scale, 72% of the respondents answered that it was suitable.

- Q1. Were you able to specifically observe your child's condition and behavior by using this system?
- Q7. Do you think the five-step evaluation method is suitable?

Moreover, 76% of the respondents specifically observed their children, and 68% could use the system to record their children's behavior and activities. Of the respondents, 68% felt that they could share information with teachers, parents, and supporters by looking at the information entered into the system. We also found that some respondents considered the information storage system adequate but could not see their

children's entries or enter data into the system, possibly because these teachers, parents, and supporters were too busy.

The visualization of children's conditions using the radar chart was used by only 20% of the respondents, suggesting that it was not used very often. An interview survey about this function indicated that people did not have an opportunity to use the radar chart because they were too busy. However, the teacher stated that she would like to improve this function to create individual education support sheets. We plan to link the radar chart function to developing individual education support sheets in the future.

- Q1. Have you been able to specifically observe your child's condition and behavior by using this system?  
Q2. Were you able to record children's behavior and activities using this system?  
Q3. Do you think the comment box is practical?  
Q4. Were you able to share the information entered in the system with teachers, parents, and supporters?

It is necessary to look back at past information to provide continuous support. Of the participants, 84 confirmed that they had looked at past information. In addition, 68% of the users responded that downloading past data was valid.

- Q5. Have you ever looked at past information?  
Q6. Do you think the file output function for downloading past information is effective?  
Q7. Do you think the five-step evaluation method is suitable?

Of the users, 72% responded that suggesting support services in the figure was effective.

It is necessary to increase external support services content in the future.

- Q8. Do you think the external collaboration function (introduction of recommended support devices, teaching materials, and facilities, among others) is practical?

Of the users, 72% responded that it was effective.

#### IV. CONCLUSION

We were able to confirm the efficacy of teachers, parents, and supporters in observing children in detail and sharing behavioral information by using this system. In the future, we plan to improve the system's interface so that teachers, guardians, and supporters can input information about children more easily despite being busy. In addition, the system needs a function of automatically developing individual educational support plans, which we plan to develop in the future. We also plan to validate the efficacy of this function for support services. There is a need to enhance the content of support services in the future. Therefore, we plan to examine the system's functions to provide other content that overlaps with normal school operations.

#### CONFLICT OF INTEREST

The authors declare no conflict of interest.

#### AUTHOR CONTRIBUTIONS

Y. Ogoshi. S. Ogoshi conducted the research; Y. Ogoshi, S. Ogoshi, Y. Saito analyzed the data; Y. Ogoshi, S. Ogoshi wrote the paper; Y. Ogoshi, S. Ogoshi, T. Saitoh, Y. Itoh, M. Wakamatu, T. Kanno and H. Hongo developed and operated

the system.

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