The development of behavioral understanding support system for children with developmental disorders

Sakiko Ogoshi†, Toru Saitou, Yuuiti Takaku
Department of Electrical Engineering and Computer Science
National Institute of Technology, Fukui College, Geshi-cho, Sabae-shi, Fukui, 916-8507, Japan
Tel: +81-778-62-8280, Email:ogoshi@fukui-nct.ac.jp
Tel: +81-778-62-8278, Email: t-saitoh@ei.fukui-nct.ac.jp
Tel: +81-778-62-8279, Email:takaku@ei.fukui-nct.ac.jp

Yasuhiro Ogoshi
Graduate School of Engineering,
University of Fukui, 3-9-1 Bunkyo, Fukui 910-8507, Japan
Email: y-ogoshi@u-fukui.ac.jp

Masahiro Asahara, Yoshinori Mituhasi
Faculty of Education and Regional Studies
University of Fukui, 3-9-1 Bunkyo, Fukui 910-8507, Japan

Sinzou Isigami
Department of Electrical Engineering and Computer Science
National Institute of Technology, Fukui College, Geshi-cho, Sabae-shi, Fukui, 916-8507, Japan
Tel: +81-778-62-8279, Email:takaku@ei.fukui-nct.ac.jp

Seiichiro Miura
Department of Mechanical and Electrical Engineering
Institute of National College of Technology, Japan,Tokuyama College of Technology,
Gakuendai, Shunan-city, Yamaguchi Pref. 745-8585, Japan
Tel: +81-(0)834-29-6288, Email: miura@tokuyama.ac.jp

Takashi Oyabu.
Academic President
Kokusai Business Gakuin College
Minami-cho 6-12, Kanazawa, 920-0919 Japan
Tel: +81-76-234-3311   Fax: +81-76-234-3432

Abstract. In recent years, the number of children requiring special support has increased significantly, and satisfying the support and education needs for such individuals has become a critical problem. Many such students have been diagnosed with one or more developmental disorders, such as Asperger syndrome, high functioning autism, attention deficit disorder, hyperactive disorder, and learning disabilities. Some special needs children are attention deficit hyperactivity disorder (ADHD) hyperactive/impulsive types that present certain behaviors, such as excessive fidgeting, talking out of turn, and running around.
Other special needs children are ADHD inattentive types who are often distracted and forget things at home or school. These characteristic children also experience difficulties during organized activities. These difficulties can have a negative impact on a child's learning and self-confidence. Addressing this difficulties as early as possible can have a positive impact on their performance at school. In this study, we propose a collaborative system that can be utilized by teacher, parents and supporters.

Keywords: support system, developmental disorders, ASD, ADHD, LD

1. INTRODUCTION

In recent years, the number of students who struggle in school has increased in Japan. Many such students have been diagnosed with one or more developmental disorders, such as ASD (Autistic Spectrum Disorder), ADHD (attention deficit disorder, hyperactive disorder), and LD (learning disorders). Children with these disorders can receive inadequate support, and the impact of these disorders is serious. Therefore, we must support people with developmental disorders individually because each person has individual needs and disorder characteristics. Developmental disorders have recently been estimated to afflict as many as 10% of students in regular classes (Hertz-Picciotto et al., 2003, Polanczyk et al., 2007, Maja et al., 2007, Georgia, 2006, Westwood, 2006, Xu et al., 2002). For children with developmental disorders, special support is required to aid them in many aspects of life, and individual education support is of particular importance.

Recent developments relative to the role of ICT (Information and Communication Technology) in special education are considered significant. Currently, ICT can foster the knowledge and experiences in the areas of needs that it serves because it is significant for teaching and learning processes. Recent studies have examined the benefits of various forms of ICT tools for children with developmental disorders (Athanasios et al., 2013). There has been an increasing interest in assessing children with special needs using ICT systems in order to overcome difficulties in the learning process. ICT can maintain a child's skills and build an appropriate learning environment relative to their individual needs and curriculum requirements. ICT in special education can provide children with many opportunities for rich learning activities that are relevant to their growth and may have positive effects on their learning difficulties.

In addition, ICT can play a prominent role in achieving curriculum goals in all areas and subjects if the provided software tools are developmentally appropriate and employed in suitable education scenarios.

Children spend most of their time at school with teachers or at home with their parents; thus, it would be beneficial if teachers and parents were able to assess and react to specific behavioral challenges (Barkley, 2002).

2. COLLABORATIVE KNOWLEDGE MANAGEMENT SYSTEM FOR INDIVIDUAL EDUCATION PROGRAM

2.1 Guidelines of the Proposed Method based on Collaborative Support

In this study, we adopt the structure, positive (approaches and expectations), empathy, low arousal, links (SPELL) framework to develop a collaborative support system.

SPELL (from The National Autistic Society, United Kingdom) is a framework for understanding and responding to the needs of children and adults on the autism spectrum. It can be noted that SPELL has been developed through evidence-based practice. It focuses on five principles that are identified as vital elements of best practice and emphasizes methods that can be used to change the environment and our approaches in order to satisfy the specific needs of children and adults suffering from autism.

We believe that a number of interlinking themes are known to benefit children on the autism spectrum. By building on strengths and reducing the disabling effects of the condition, personal growth and development can progress. In addition, opportunities to improve the quality of life of these children can be promoted.

The five principles of SPELL are as follows: (1) structure, (2) positive (approaches and expectations), (3) empathy, (4) low arousal, and (5) links.

(1) Structure

The importance of structure has been recognized. Structure plays to the strengths of a sense of order and preference for visual organization commonly associated with the autism spectrum, e.g., "when," "where," "what," and "how."

(2) Positive (approaches and expectations)

Self-confidence and self-esteem must be established and reinforced by building on natural strengths and abilities.

(3) Empathy

Making every effort to understand, respect, and relate to the experiences of a person with autism will underpin our attempts to develop communication and reduce anxiety. Thus, the quality of the relationships between an autistic person and their supporters is important. Effective supporters should be calm and predictable and have good humor, empathy, and an analytical disposition.

(4) Low arousal

Clear information is provided and care is taken to not overburden the individual.

(5) Links

Communication links between people (e.g., parents and teachers) will provide a holistic approach and reduce the potential for misunderstanding and confusion or the adoption of fragmented, piecemeal approaches.

The SPELL framework can be applied across the autism spectrum. It provides a context for and is complementary to other approaches, notably the Treatment and Education of Autistic and Communication related handicapped children approach.

2.2 Individual Support System Architecture

We have identified the following key elements in the design based on a system that aids the support of students.

(i) Feedback from teachers

Students spend a large portion of their day in the care of teachers, where teachers observe them and interact with them. Typically, parents' concerns involve the performance and behavior of their children in the classroom. If the child's performance is poor, parents should be able to respond appropriately. Traditionally, parents interact with teachers via report cards and interviews. The feedback from teachers is of great value when supporting students with developmental disorders. In this system, we achieve it by using the web database system and e-mail.

Fig. 1-a Feedback from teachers

Daily check

☑ Check Item

Daily behavior check item	Evaluation
There was a great scene	★★★★★
Often talks excessively	★★★★★
Do not leave something	★★★★★
Is often forgetful in daily activities	★★★★★

☑ Comment

He was able to sing a song

Fig. 1-b Teachers side check screen

(ii) Continuous observation in and out of school

Teachers, guardians, and experts can share observations and then judge the efficacy and appropriateness of various remediation and support measures.

(iii) Observations should be communicated immediately and be easily accessible

Effective scheduling can be implemented by making information available immediately and easily accessible to all stakeholders.
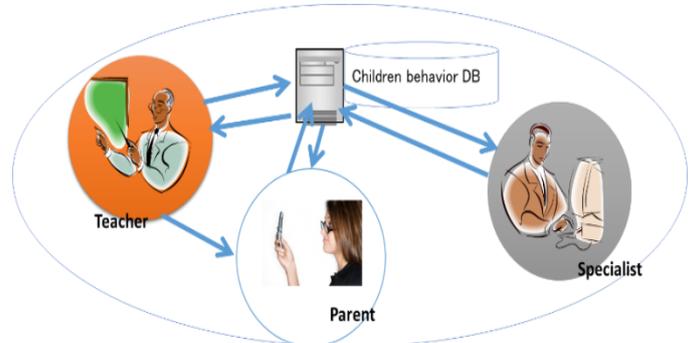

Fig. 2 Collaborative support system for children with developmental disorders

This facilitates timely implementation and adjustment of support measures. The ubiquitous nature of smartphones, their ease of use, and their ability to access the Internet makes them an ideal part of the support system. Design elements (i), (ii), and (iii) allow a teacher to quickly and simultaneously communicate observations to stakeholders and a database using a smartphone or personal computer.
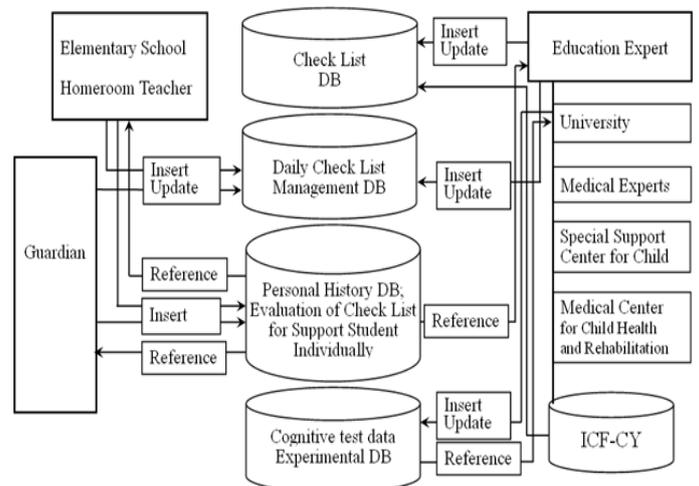

Fig. 3 Schematic representation of the collaborative support system

A checklist of observations allows a teacher to enter data quickly. Each child's checklist is assembled from a master list of possible items. A checklist can be created using input from teachers, guardians, and experts, and it should contain a limited number of elements in order to minimize the time required to create the checklist.

2.3 Knowledge Management System using Double-loop Plan-Do-Check-Act cycles

The Plan-Do-Check-Act (PDCA) management cycle is a four-step performance management method that aims to establish a cycle of continuous improvement for a process or product. It is important to note that this is a cyclical evaluation method. When the fourth step, i.e., Act or Adjust, is reached, the process begins again from the start.

PDCA Procedure:
(a) Plan
Recognize an opportunity and plan a change.
(b) Do
Test the change. Perform a small-scale study.
(c) Check
Review the test, analyze the results, and identify what has been learned.
(d) Act
Take action based on what was learned in the previous step. If the change did not work, repeat the cycle with a different plan.

First, a local PDCA procedure can help individual behavior (Fig. 4). The PDCA cycle can be used to evaluate children's behavior by a teacher at school and parents at home; experts can then evaluate the recorded behavior data.
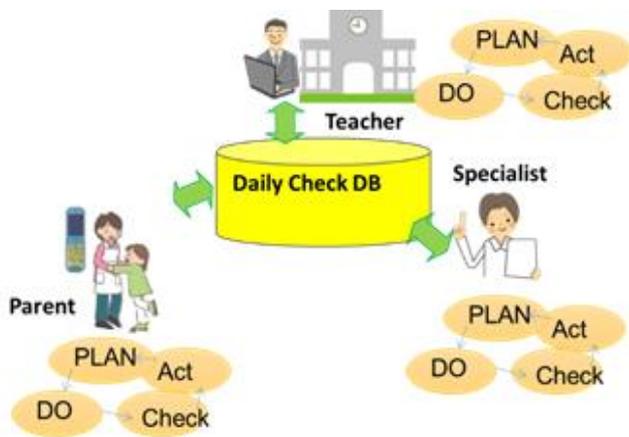
Fig. 4 Local PDCA cycle

Then, a global PDCA procedure can help to manage the collaborative knowledge. It is possible that manage knowledge use Global PDCA cycle which teacher send information of evaluation of the behavior of in children of school.(Fig5). For example, when a child behaves well at school, the parents can immediately offer praise.
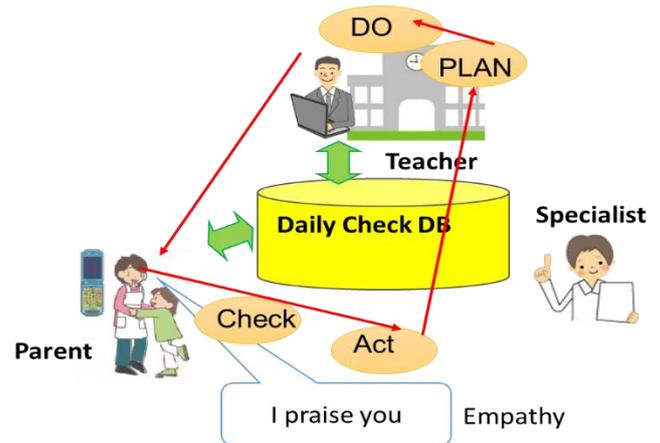
Fig. 5 Global PDCA cycle

We propose a knowledge management system that employs this double-loop PDCA cycle using ICT.

CONSIDERATION

We have proposed a support system based on the behavior characteristics of people with developmental disorders. The proposed system quantifies the daily behavior of people and achieves collaborative support. This knowledge management system employs a double-loop PDCA cycle from global and local perspectives.

In future, we will extend the functionality of the proposed system to include detection of a child's condition and position. In addition, we plan to perform a detailed analysis of the proposed system.

ACKNOWLEDGMENTS

REFERENCES

Hertz-Picciotto I, Delwiche L. (2009) The rise in autism and the role of age at diagnosis. *Epidemiology*, 20(1), 84-90.

Polanczyk G, de Lima MS, Horta BL, Biederman J, Rohde LA. (2007) The worldwide prevalence of ADHD: a systematic review and metaregression analysis. *Am J Psychiatry*, 164(6), 942-948

Maja Altarac, MD, PhD, Ekta Saroha, MA (2007) Lifetime Prevalence of Learning Disability Among US Children. *PEDIATRICS*, 119 Supplement, S77-S83.

Georgia D. Tsiotra (2006) A Comparison of Developmental Coordination Disorder Prevalence Rates in Canadian and

Greek Children. *Journal of Adolescent Health*, 39, 125-127.

Westwood, P. (2006) Teaching and Learning Difficulties: Cross-curricular Perspectives. Camberwell, ACER Press 2006

Xu, C., Reid, R., & Steckelberg, A. (2002) Technology applications for children with ADHD: Assessing the empirical support. Education & Treatment of Children, 25(2), 224-248.

Athanasios S. Drigas , and Rodi -Eleni Ioannidou (2013) Special Education and ICTs. *International Journal of Emerging Technologies in Learning*, 8(2), 41-47

Barkley, R. A. (2002) Major life activity and health outcomes associated with attentiondeficit/ hyperactivity disorder. *Journal of Clinical Psychiatry*, 63(12),10-15.