J D D R
Journal of Developmental Disabilities Research

2023
September
No.1

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The Japanese Association for the Study of Developmental Disabilities

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［Original Article］

Textual Requirements for High School Students with Developmental Disabilities: Text Analysis About Assessing Educators and Employment Support Professionals in Japan

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Abstract

Background: Individuals with developmental disabilities face various challenges in their educational journey, which often vary as per their particular disability.

Aims: This study aimed to clarify how information presentation should be considered in text teaching materials based on the characteristics of students with developmental disabilities.

Methods: 1. Creation of items to evaluate information presentation methods: As a preliminary survey, a questionnaire survey was conducted by mail (November–December 2008) to collect open-ended comments on "how to present information for creating text materials for children (persons) with developmental disabilities." Questionnaires were sent to 750 educational institutions and 550 employment support institutions in Japan regarding employment readiness support for persons with developmental disabilities. The educational institutions were (A) regular high schools and (B) special needs schools in the upper secondary school stage. The employment support organizations were (1) Public Employment Security Offices (in charge of employment for persons with disabilities), (2) Vocational Skills Development Centers for Persons with Disabilities, (3) Vocational Centers for Persons with Disabilities, (4) Work/Life Support Centers for Person with Disabilities, (5) Support Centers for Persons with Developmental Disorders, (6) Employment Support Centers for Persons with Disabilities, and (7) Employment Transition Support Offices for Persons with Disabilities throughout Japan. The overall response rate was 33.9% (441 responses), and that for free descriptions was 22.0% (n = 97). Based on the opinions (free descriptions) about text materials (n = 97) identified in the preliminary survey, 30 items were created with reference to the KJ method. 2.A questionnaire survey was conducted by mail from February to March 2010 to understand how to present information on developmental disabilities according to the characteristics of the disabilities. The number of questionnaire responses was 374 (28.6% response rate). The characteristics of the information presentation method based on developmental disability characteristics were revealed by a correspondence analysis and hierarchical cluster analysis. Respondents to the survey were either teachers at educational institutions or support personnel at employment support agencies.

Respondents had experience in providing employment support to persons with developmental disabilities, and based on their experience, they recalled the general disability characteristics of LD, ADHD, and ASD and responded to the information presentation methods that they considered most important for each of these disabilities. Respondents also responded only to the disability types (LD, ADHD, and ASD) to which they could respond.

Results: To understand the considerations regarding information presentation based on the characteristics of developmental disabilities, a correspondence analysis and hierarchical cluster analysis using the dimension score of the correspondence analysis were carried out (n = 173). The information presentation method considered each developmental disability (LD, ADHD, and ASD) and was classified into three groups. A correlation analysis was carried out on the relationship between disability characteristics (LD, ADHD, ASD), and each item (30 items) of the information presentation method was classified into the same group as each obstacle (n = 173). A significant correlation was found between the characteristics of each developmental disability and the information presentation method. Text mining was applied to the free description responses (LD: n = 114; ADHD: n = 152; ASD: n = 159). After the extraction of characteristics, sentences were identified containing characteristic words that indicated the considerations necessary for each disability type. For LD, "illustration," "ruby," and "picture" were extracted as characteristic words, and the contents of sentences indicated that the use of these words was cited as a device. For ADHD, "information," "short," and "many" were extracted as characteristic words, and the contents of sentences indicated that not increasing the amount of information and expressing it in short sentences were cited as devices. For ASD, "concrete," "necessary," and "content" were selected, and the content of the sentences showed that explaining specific examples of the content was cited as a device.

Conclusions: This study clarified supporters' consideration of the information presentation of teaching materials according to the characteristics of students with developmental disabilities.

Keywords: developmental disabilities, autism spectrum disorder, information presentation, text teaching materials, text mining

1. Introduction

1.1 What this paper adds?

For persons with disabilities, working is an important aspect of social participation and education is where students with disabilities acquire skills before entering the workforce. In learning situations, information is often presented as digital materials or paper texts. This study provides useful suggestions by clarifying the findings of practitioners who provide support in these situations. Previous studies report that developmental disabilities contribute to cognitive disabilities (Broman and Grafman, 2014) the degrees of which vary across developmental disorders (Kanai et al., 2012; Kanai et al., 2017). By clarifying how to present information so that it considers the characteristics of different developmental disorders, this study contributes to improving the learning effectiveness of persons with developmental disorders. Key attributes improving text comprehension (McTigue and Slough, 2010) and methods of information presentation for individuals with learning disabilities (Waight and Oldreive, 2021) have been studied. However, previous studies look at a single disorder, neglecting to compare disorders. Additionally, effective items were within the questionnaire set by researchers, and may not reflect unexpected content. Therefore, this study investigated ASD, LD, and ADHD. Further, to effectively reflect the experiences of practitioners in the data, we collected

data through free descriptions. Therefore, we add the cognitive characteristics of information for each developmental disability disorder and effective methods of information presentation, reflecting practical knowledge based on the experiences of practitioners of employment and education.

1.2 Brief overview of Japanese laws regarding persons with developmental disabilities

Learning disabilities (LD), attention-deficit hyperactivity disorder (ADHD), and autism spectrum disorder (ASD) were classified as developmental disabilities in Japan in 2005. The Act on Support for Persons with Development Disabilities was enforced in 2005. This act recommends support based on the characteristics of the obstacles persons with developmental disabilities face and the life stages of persons with such disabilities. The characteristics of the disabilities that are covered by this law are as follows: persons with LD have poorer calculation, writing, and reading abilities than those with typical intellectual development; the characteristics of ADHD include inattention, hyperactivity, and impulsivity; and the characteristics of high-functioning ASD are communication barriers, lack of interpersonal and social skills, patterned behavior, and wavering interest (Ministry of Health, Labour and Welfare, 2008). The Act on Support for Persons with Development Disabilities was revised in 2016. The revised law strengthened the conditions of providing appropriate educational and employment support based on the characteristics of these developmental disabilities. In the future, it is important to provide the support necessary for smooth transitions from education to employment based on the characteristics of an individual's developmental disabilities.

1.3 Issues Related to Transition to Employment for persons with Developmental Disabilities: on Textbooks to Support Work Readiness

In recent years, the difficulty of transitioning from school education to employment has become an issue for individuals with developmental disabilities such as LD, ADHD, and ASD. One of the pre-employment problems is the difficulty in choosing a career path suitable for them (Japan Parents' Association of Learning Disabilities, 2008), while another is separation from employment due to maladjustment in the workplace (National Institute of Vocational Rehabilitation, 2009; 2015).

In order to cope with such pre- and post-employment issues, it is important for students to deepen their understanding of such important aspects of work as social structure and occupational information (job understanding) and their understanding of themselves, such as their interests in work and their strengths and weaknesses (self-understanding), before they graduate from school, as these are fundamental for employment.

In addition, when providing career guidance to strengthen the job understanding of students with developmental disabilities, it is necessary to provide a wide range of information on such matters as vocational rehabilitation, a variety of career options including employment for persons with disabilities, and the differences between general employment and employment for persons with disabilities. As the amount of information to be provided has increased, it is necessary to provide information not only orally, but also in the form of textbooks (on paper). Under these circumstances, it is necessary to consider how to convey the information in the text in an easy-to-understand manner, taking into account the characteristics of disabilities. Accordingly, this study focuses on "employment" texts.

1.4 Disability Types and Cognitive Functioning Disorders in Developmental Disorders

Students with developmental disabilities face various challenges when seeking employment. Individuals with reading difficulties may face obstacles in comprehending and completing

employment-related materials. According to Broman and Grafman (2014), developmental disorders, such as ASD, contribute to cognitive impairment. Cognitive dysfunction negatively impacts reading, as reading requires short-term language memory (Castles et al., 2014). It has been reported that the degree of disability in such language memory varies depending on the disease; that is, verbal memory is high in Asperger's syndrome and low in other pervasive developmental disorders (Kanai et al., 2012). Cognitive functions other than verbal memory also differ depending on the disorder. Adults with ASD have higher language comprehension than adults with ADHD when evaluated by the Wechsler Adult Intelligence Scale-Third Edition (Wechsler, 1997), but the latter have higher picture completion skills (Kanai et al., 2017). In other words, since the characteristics of cognitive function differ depending on the disorder, the effective information presentation method should differ accordingly. Consequently, adults with ASD have lower language comprehension and higher painting skills than adults with ADHD (Kanai et al., 2017).

1.5 Issues related to reading materials and text presentation

The following are some of the ways in which textbooks are used in education. The authors of the current study focused on text teaching materials regarding employment for students (persons) with developmental disabilities. In the field of education, text teaching materials have been examined from the perspectives of plainness, ease of remembrance, and motivation. Specifically, previous studies have identified the following ways to increase users' understanding: including illustrations related to the written content (Larkin and Simon 1987; Mayer et al., 1995; Shimada and Kitajima, 2008); specifying the structure of training material contents, such as paragraphs and items, (Seki, 1997); and finally, providing titles for teaching materials and using illustrations and colorization to increase learners' motivation (Shimada, 2016).

Aside from these ways, the characteristics of developmental disabilities need to be considered, one reason being to create simpler specifications for students with developmental disabilities. The importance of providing teaching materials that consider the characteristics of developmental disabilities is that they guarantee information accessibility for persons with disabilities in the field of education. A previous study reported that it is important to consider the difficulty in finely adjusting eye movements for individuals with LD, impulsivity, and carelessness for individuals with ADHD, and the promotion of understanding through visual representation for individuals with ASD (Ministry of Education, Culture, Sports, Science and Technology, 2011). However, these simple examples do not sufficiently clarify the overall perspective on this issue. In the future, it will be necessary to accumulate basic knowledge. Specifically, text teaching materials should be developed while considering the characteristics of individuals with developmental disorders.

The following are some studies on the reading comprehension of persons with developmental disabilities. According to Hoover (2011), colored text is more effective than black and white text in presenting information to students with ADHD. In addition, there are reports that the use of graphic organizers is effective in presenting information to students with Asperger's syndrome. Research that focused on the reading comprehension abilities of students with ASD was reviewed (Singh et al., 2021). Effect size calculations indicated that visually cued instruction, metacognitive strategy instruction, and adapted text were highly effective, while collaborative strategies and technology-assisted instruction were moderately effective. This study highlights the effectiveness of visually cued instruction and adapted text in enhancing reading comprehension among students with ASD. In addition to graphic organizers, visual cues help students with high-functioning ASD process reading materials (Stringfield et al., 2011). Although some studies have examined the impact

of graphic organizers and technology-enhanced reading materials on learning among students with developmental disabilities and other studies have examined differences in processing textual information, there is less work regarding the ways to specifically present reading materials to persons with developmental disorders.

We highlight one study that indicates that text design is actually more important than technological enhancements; future studies could further test that finding. The significance of devising ways to present information in teaching materials is as follows. A survey of children with learning disabilities suggested that it would be effective to present both digital and paper materials to children with or without disabilities (Marino et al., 2014). There has also been research on online texts. Rello et al.'s (2012) experiment using online textbooks for persons with dyslexia showed which fonts and backgrounds, colors, font sizes, spacing (characters, rows, paragraphs), and column widths improved readability for persons with dyslexia. That is, sentences and figures are also displayed in electronic teaching materials. Therefore, the knowledge derived from this research can be used to improve the readability of electronic teaching materials. According to McTigue and Slough (2010), the main attributes that improve text comprehension are (a) text specificity, (b) the author's voice, (c) consistent descriptive structure, (d) selective use of visual information, and (e) integrated language and visual information. Further, Waight and Oldreive (2021) posit that it is important to consider the use of language, image, audio, and video in developing accessible information for individuals with learning disabilities. The use of clear and jargon-free language is also important (Waight and Oldreive 2021). Finnegan et al. (2016) integrated the results of previous studies and ascertained that direct instruction and graphic organizers positively affect reading comprehension for individuals with ASD. They also found collaborative learning, anaphoric queuing, and question generation to be promising.

However, electronic text does not affect reading comprehension. Even online and electronic books need to present the text in an accessible way. For this reason, as well as the fact that the main teaching materials for students with disabilities in Japan are printed, the current study focuses on print, (paper-based) materials. Furthermore, this study is highly relevant in today's scenario because there are still many teaching materials that are mainly printed on paper in some areas of the world. The cognitive functions involved in human information processing are important for both paper and digital teaching materials.

1.6 Focus on high school students with developmental disabilities who are about to enter the workforce

The Report of the Expert Group on Special Needs Education in the New Era (Ministry of Education, Culture, Sports, Science and Technology, 2019) points out that students with developmental disabilities "have difficulty adjusting to their environment and building relationships with others, and drop out of school or resign from their jobs, and become isolated from society. In some cases, they have difficulty adjusting to their surroundings or have trouble building relationships with others, and drop out of school or leave the company, leaving them isolated from society." The report also points out that "in addition to employment in the general framework, it is also possible to obtain a disability certificate and use the so-called 'employment framework for the disabled,' so it is necessary to understand how to deal with these systems and provide appropriate guidance and support accordingly." Under these circumstances, we considered it important to provide students with developmental disabilities with a wide range of information in an easy-to-understand manner at the upper secondary school level in order to enhance their future employment opportunities. As

a methodology to achieve this, we believe it is necessary to focus on text materials (information provided on paper), giving consideration to the characteristics of students with developmental disabilities.

1.7 Study objectives

Taking into account the discussion in the previous section, this study aimed to clarify the consideration of information presentation in text teaching materials based on the characteristics of high school students with developmental disabilities. Subsequently, the authors examined information that was particularly important according to the characteristics of LD, ADHD, and ASD. Therefore, this study is the first step in examining accessible texts in both printed and online media for students with developmental disabilities. Overall, the findings of this study are equally applicable to digital text and printed text.

2. Materials and Methods[*1]

2.1 Item creation for the information presentation method

2.1.1 Preliminary study

As a preliminary study, a survey was used to collect responses regarding the information presentation of text teaching materials developed for students with developmental disabilities through free description. The survey was conducted by mail using a questionnaire (November–December 2008) as part of the study reported in Terada (2006). Questionnaires were sent to 750 educational institutions and 550 employment support institutions in Japan. The former included 1) regular upper secondary schools and 2) departments of special-needs schools that fall under the upper secondary school stage. The employment support organizations comprised (1) Public Employment Security Offices (in charge of employment for persons with disabilities), (2) Vocational Skills Development Centers for Persons with Disabilities, (3) Vocational Centers for Persons with Disabilities, (4) Work/Life Support Centers for Person with Disabilities, (5) Support Centers for Persons with Developmental Disorders, (6) Employment Support Centers for Persons with Disabilities, and (7) Employment Transition Support Offices for Person with Disabilities throughout Japan.

The response rate for the preliminary survey was 33.9% (number of questionnaires sent: 1,300; number of questionnaires collected: 441). The response rate for the free description was 22.0% (number of effective answers: 97).

2.1.2 Creation of evaluation items for information presentation methods

Thirty evaluation items of information presentation were developed based on the opinions (free descriptions) about text materials (n = 97) collected in the preliminary survey (Table 1), and categorized with reference to the KJ method (Scupin, 1997). This method aggregates data by categorizing and naming it according to its content. This method was chosen because it is suitable for creating item content that reflects qualitative data. In addition, regarding the wording, a checklist about the information presentation method was being referred to while creating text teaching materials for teachers (Enomoto et al., 2016). In creating the items, the 15-item perspective on how to include information in texts presented in Terada (2006) was used as a reference. The categorization process was discussed by two researchers with knowledge of the subject matter of this study. Specifically, one was a researcher in psychology and the other a researcher in education specializing in the area of employment support for developmental disabilities.

Table 1 Information Presentation Method

LABEL	LABEL
1	A design that will prompt users to pick it up and read it
2	A design that is easy to read
3	A design that makes it easy for a user to understand the content
4	A design that makes it easy to figure out which information is placed where
5	Terms such as disabilities (or disorders) are handled considerately
6	The structure of the information is simple
7	The objective of the teaching materials is stated clearly
8	It is written in plain sentences
9	A design that considers the pride of the user
10	A design that makes it easy to understand important points
11	Information is presented in a reliable form
12	A design that makes it easy for a user to utilize the information
13	Charts, illustrations, photographs, and flow charts are utilized effectively
14	A design that can be easily filled with information
15	Contents that a user can relate to
16	Contents that help solve the problems of the user are selected
17	The sentences are engaging
18	Grammatically correct sentences are used
19	Many examples that can serve as a reference for a user are selected
20	An appropriate quantity of information is included in one book
21	The information provided has a consistent structure
22	An appropriate quantity of information is included on page 1
23	The purpose and method of usage are stated clearly
24	A design that makes it easy to understand contents
25	A design that makes it easy for a user to make plans
26	A design that makes it is easy to find the required information
27	Charts, illustrations, photographs, flow charts, and so on are created correctly
28	Information is not misleading
29	Characters and terms are used appropriately
30	A design that is easy to handle

2.2 Survey participants

As part of this survey, we investigated how information is presented according to the disability characteristics of developmental disabilities. A questionnaire survey was conducted by mail (February to March 2010) targeting all regions of Japan. Questionnaires were sent to 750 educational institutions and 556 employment support institutions. The educational institutions were "educational institutions for students at the high school stage," which are departments that fall under the high school stage of regular high schools or special needs schools, while the employment support institutions were basically "employment support institutions for developmentally disabled persons" who have already graduated from high school. The educational institutions specifically targeted were the same types of institutions as in the preliminary survey. Respondents were either teachers at the educational

institutions or support personnel at the employment support agencies. Each institution was asked to select one respondent most appropriate for the purpose of this survey.

The participants were informed that, by responding to the survey, they were considered to have consented to participating. Informed consent was obtained from all respondents. The study was approved by National Rehabilitation Center for Persons with Disabilities Ethical Review Committee. The study was conducted in accordance with ethical standards as specified in the 1964 Declaration of Helsinki and subsequent amendments or equivalent ethical standards.

2.3 Survey procedure

In this study, we analyzed a part of that survey; the actual questions are shown at the end of this paragraph. We focused on the content of the free text, and decided to examine the presentation of the text information. This study examines a survey used for a qualitative study we conducted ten years ago because the recent development of text mining software has made new analysis possible. Since human cognitive functions are unlikely to change significantly over the course of a decade, this study is still significant today.

In addition, with the development of information science and technology in recent years, text mining software that analyzes language quantitatively has become widespread. This made it possible to perform a mixed analysis entailing quantitative analysis of qualitative data, which was difficult at the time of the survey.

The self-report questionnaire concerned the development of text teaching materials for employment-preparation training of high school students with developmental disabilities and was constructed in a free description and selective style. This study analyzed responses to the information presentation method based on the characteristics of each developmental disability (LD, ADHD, ASD) that was part of the questionnaire. The concrete question items were:

1) The most important item among the 30 items of the information presentation method for LD, ADHD, and ASD: *selective answer* (Table 1)
2) Concrete information to create teaching materials considering point 1 (the most important item): *free description answer*

In the overall survey, respondents responded only to the disability types to which they were able to respond, given their experience in providing employment support to persons with developmental disabilities. Respondents were included in the analysis where they had indicated that they had direct support experience with any parties with LD, ADHD, or ASD (including those suspected of having such). The support experience is as follows. Respondents were those who answered "quite a bit" or "a little" with respect to "experience providing support to persons with (or suspected of having) LD, ADHD, or ASD developmental disabilities in preparation for employment." Based on their experiences, the respondents were asked to recall the overall characteristics of each disability — LD, ADHD, and ASD — and the most important issues for each, along with the reasons why they considered them most important. As a result, the responses represent a synthesis of the respondents' overall experience to date with regard to each of the disability characteristics of LD, ADHD, and ASD. Regarding diagnosis, responses were sought not only from those with a diagnosis of developmental disability, but also from those receiving support due to suspicion of a developmental disability.

2.4 Analysis methods

2.4.1 Selective type answer

Using correspondence analysis and cluster analysis, the information presentation method according to the characteristics of developmental disabilities was explored. Moreover, to check the absolute relationship between categories, a correlation analysis (ϕ coefficient) was conducted, and the existence and strength of the correlation were investigated.

2.4.2 Free description type answer

The free description responses were used to more concretely understand the selective type answers. Therefore, text mining was applied to the free description responses.

2.4.3 Statistical software

SPSS Statistics (Ver 24.0) was used to conduct the Mann–Whitney U test and hierarchical cluster analysis of the selective type answers. For the correspondence analysis of the selective type answers, the statistics analysis software HAD was used. KH Coder 3 was used for the text mining of the free description answers.

3. Results

3.1 Number of responses and response rate

The number of questionnaire responses in the final investigation was 374 (response rate: 28.6%). The number of educational institutions that responded was 197 (response rate: 26.3%). The number of employment support institutions that responded was 168 (response rate: 30.2%). The number of responses that did not specify the type of institution was 9. The numbers of responses and response rates by institution are shown in Table 2. However, effective responses differed for each analysis.

3.2 First-line information presentation method

3.2.1 Method 1

To understand the consideration of information presentation based on the characteristics of developmental disabilities, a correspondence analysis and a hierarchical cluster analysis using the dimension score of the correspondence analysis were conducted of the data for 173 respondents. Specifically, the data were for responses for all disability characteristics (LD, ADHD, and ASD) regarding the method of information presentation that was considered most important.

3.2.2 Result 1

The consideration of information presentation as per the characteristics of each developmental disability (LD, ADHD, and ASD) differed according to the results of the analysis. In addition, the information presentation method considered each developmental disorder and was classified into three groups (Figure 1).

Specifically, the results of the correspondence analysis of the multiple-choice responses showed that each disability type (LD, ADHD, ASD) was clearly identified as a separate group on the two-dimensional arrangement chart, and the cluster analysis results showed that each disability type group was defined by the respective following items: the LD group: 2. “easy-to-read design,” 7. “the purpose of the material is clearly stated,” 17. “the text is attractive,” and 18. “grammatically correct sentences are used”; the ADHD group: 1. “the design makes the user want to pick up and read the material,” 3. “the content is easily understood by the user: Design makes it easy for users to understand the content,” 4. “design that makes it easy for users to know which information is located where,” 5. “treats terms such as ’disability’ with consideration,” 15. “content that users can relate

Table 2 Number of responses and response rate per institution

Iinstitution	Number of responses (Response rate)	Iinstitution	Number of responses (Response rate)
Classification of educational institutions		Classification of employment support institutions	
High school	98（26.2 %）	Public employment security office (in charge of employment for persons with disabilities)	35（9.4 %）
High school stage of special needs schools	99（26.5 %）	Vocational skills development center for persons with cisabilities,	13（3.5 %）
Classification of high schools		Vocational centers for persons with cisabilities,	17（4.5 %）
Full-time, General Course	62（16.6 %）	Work/life support centers for person with disabilities	39（10.4 %）
Full-time, specialized courses	25（6.7 %）	Support centers for persons with developmental disorders	35（9.4 %）
Distance learning, credit-based system	3（0.8 %）	Employment support center for person with disabilities	4（1.1 %）
Part-time (Evening)	8（2.1 %）	Employment transition support office for person with disabilities	25（6.7 %）
Classification of special needs schools			
High school for special needs	88（23.5 %）		
Special support schools for higher education	10（2.7 %）		
None specified	1（0.3 %）		

to," 24. "design that makes it easy to understand the content," and 25. "design that makes it easy for users to plan"; and the ASD group: 9. "designed with user pride in mind," 11. "provides information in a reliable manner," 16. "content has been selected to address user concerns," 21. "information provided has a consistent structure," 27. "charts, illustrations, photos, flowcharts, etc., are correctly prepared," 28. "information is not misleading," and 29. "text and terminology are used appropriately."

3.2.3 Method 2

The characteristics of the information presentation method based on the characteristics of developmental disabilities were revealed by Result 2 of the correspondence analysis and hierarchical cluster analysis. To check whether the relationship was statistically significant regarding the information presentation method, the following analysis was conducted. A correlation analysis was carried out on the relationship between disability characteristics (LD, ADHD, ASD) and each item (30 items) of the information presentation method was classified into the same group as each obstacle (n = 173).

3.2.4 Result 2

A weak correlation was found between LD and "A design that is easy to read" (ϕ = .305, p < .001), "A design that makes it easy to understand important points" (ϕ = .160, p < .001), and "effective utilization of diagrams" (ϕ = .250, p < .001). Next, a weak correlation was found between ADHD and "A design that will prompt users to pick it up and read it" (ϕ = .170, p < .001), "amount of information in one volume" (ϕ = .112, p = .01), and "ease of understanding contents" (ϕ = .113, p = .01). Finally,

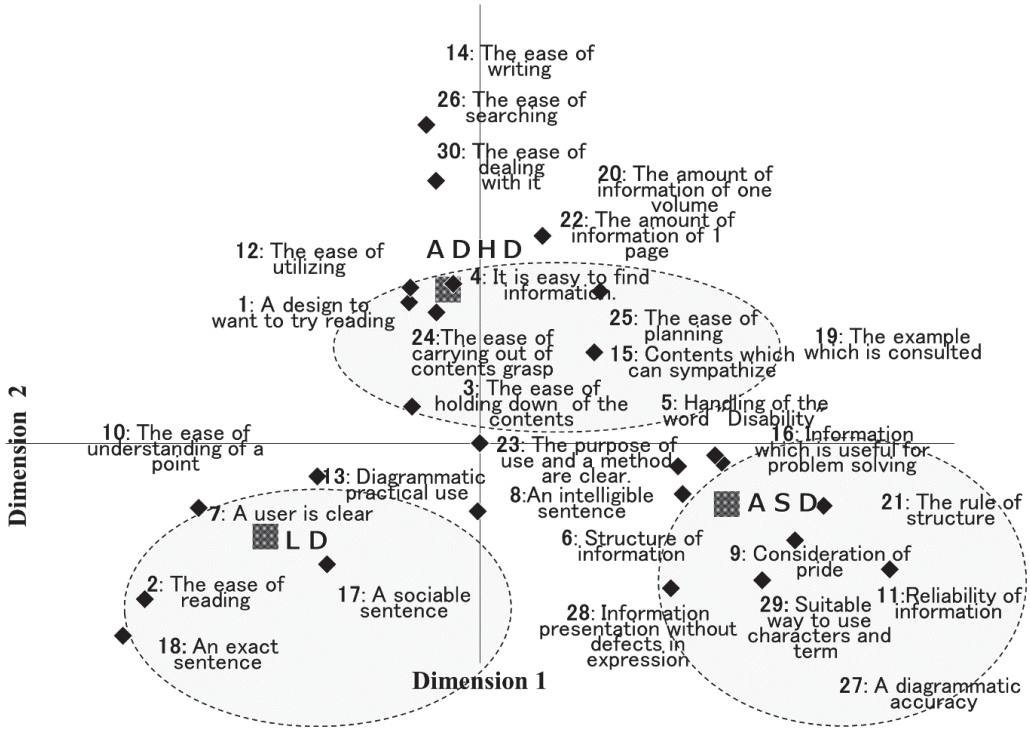

Figure 1 The results of a correspondence analysis of the selective type answers for the first-line information presentation method (the dotted line represents a group based on the results of a cluster analysis).

a weak correlation was found between ASD and "handling words such as 'disability' considerately" (ϕ = .112, p = .01), "simple structure of information" (ϕ = .158, p < .001), "consideration of the user's dignity" (ϕ = .176, p < .001), "information that is useful for problem solving" (ϕ = .228, p < .001), "consistent structure" (ϕ = .187, p < .001), "accuracy of diagrams" (ϕ = .141, p = .001), and "using characters and terms suitably" (ϕ = .116, p = .01). A significant correlation was found between the characteristics of each developmental disability (LD, ADHD, and ASD) and the information presentation method. Accordingly, the relationship between each disability characteristic and the information presentation method was statistically significant.

3.3 Difference in concrete consideration by disability characteristic

3.3.1 Method 3

The statistical relationship between the obstacle characteristics and some selective type answers to the first-line information presentation methods was examined. Based on this, the authors decided to devise an effective plan for the actual information presentation method. To this end, text mining was applied to the free description responses (LD: n = 114; ADHD: n = 152; ASD: n = 159). To create teaching materials based on the free description responses of those with experience in support for developmental disabilities, the necessary matter was discussed concretely.

3.3.2 Result 3

The authors decided to clarify the differences in the discussed matter to consider characteristics according to disability type. Therefore, the free description answer on the necessary device was

Table 3 Disability Characteristic Words

LD	Jaccard coefficient	ADHD	Jaccard coefficient	ASD	Jaccard coefficient
Illustration	.065	Information	.040	Consider	.066
Character	.060	Short	.036	Concrete	.054
Understanding	.055	Many	.035	Necessary	.054
Sentence	.054	Point	.032	Content	.052
Size	.051	Supporter	.032	Photograph	.044
Consideration	.045	Amount of Information	.028	Expression	.036
Ruby	.042	Time	.024	Many	.035
Teaching Materials	.041	1 page	.023	Explanation	.032
Photograph	.039	Think	.023	Case	.032
Comprehend	.036	Form	.023	Form	.027

Note. LD, learning disabilities; ADHD, attention-deficit hyperactivity disorder; ASD, autism spectrum disorder

analyzed. The Jaccard coefficient was computed to quantitatively clarify the difference arising from disability type. The authors extracted ten words with a high Jaccard similarity coefficient to represent each obstacle (Table 3). Then, the authors examined the sentences containing the extracted words and analyzed the contents of each sentence (Table 4).

For LD, the feature words "Illustration," "Character," "Understanding," "Sentence," "Size," "Consideration," "Ruby," "Teaching Materials," "Photograph," and " Comprehend" were extracted. The content of sentences containing feature words indicated the following as textual innovations.: "Use materials that can be understood without text," "Use illustrations and photographs," "The size of a character: Suitable size of a character, figure, and ruby," "A color and a feel," "Line is changed," "Unfilled space and contrast," "An itemized formis used," "Electronization of a textbook," "Assumed for upper elementary grades," and "Addresses reading, writing, and math disabilities; different design (a display in white, character style, etc.) with the same teaching materials is applied."

For ADHD, "Information," "Short," "Many," "Point," "Supporter," "Amount of Information," "Time," "1 page," "Think," "and "Form" were extracted. The content of sentences containing feature words indicated the following as textual innovations.: "Design the text to be organized, structured, and easy to find without increasing the amount of information," "Use short sentences," "Keep it simple and easy to understand," "Use bold text," "Use bullet points," "Be direct or specific," "Provide a comments section," "Make the text so that the reader can get a sense of accomplishment in a short time," "Make the first page of the talk a one-page summary; complete it on one page," "Data that can help consider what you should do," and "Composition made with intuitive vision, such as color and form, reliance."

For ASD, "Consider," "Concrete," "Necessary," "Content," "Photograph," "Expression," "Many," "Explanation," "Case," and "Form" were extracted as feature words. The content of sentences containing feature words indicated the following as textual innovations: "Explain by showing specific examples," "Use photographs, an example in question-and-answer format, or flowcharts," "Use simple and easy-to-understand expressions," "Avoid negative expressions and increase positive content and data from the survey," "Use a clear and concise format. Use simple, easy-to-understand expressions," "Avoid negative expressions," and "Increase positive content and surveyed data."

Table 4 Examples of sentences for Each Characteristic Word

Disability	Extraction word	Outline of the contents in a sentence
LD	Illustration, Character, Photograph, Understanding, Sentence	Text that can be understood even if there is neither a character nor a sentence is used. To make a character and a sentence empathic, a suitable illustration and photograph are used. The size of a character.
	Sentence, Ruby	An itemized statement is used. The level of elementary school upper classes is used.
	Size, Ruby	Suitable size of a character, figure, and ruby.
	Consideration	A color and a feel. A line is changed. Unfilled space and contrast.
	Teaching materials, Comprehension	The teaching materials of the contents correspond to the disability with respect to reading, writing, and arithmetic. A different design (a display in white, character style, etc.) with the same teaching materials is applied. Electronization of a textbook (teaching materials and sentence).
ADHD	Information, Many, Amount of information Short	The amount of information is limited and arranged. The flow of information is structured. A design that makes it easy to find information. Direct expression in a short sentence.
	Point	It is intelligible. It is simple. A bold letter is used. An itemized statement is used. A concrete expression is used.
	Supporter	While parents and a supporter communicate, a comment field is prepared so that problems can be dealt with and organized
	Time	Time is controlled. The text is written in a way that a sense of accomplishment is acquired in a short time.
	Page 1	It summarizes the talk on the 1st page. It is complete on page 1 and is not connected to the next page.
	Think	Data that can help consider what you should do, checking feelings and actions.
	Form	Composition made with intuitive vision, such as a color and a form, reliance.
ASD	Concrete, Necessary, Explanation Photograph, Content	According to various scenes, a concrete example is necessary. It enables understanding the contents with a photograph.
	Expression	Simple and clear expression. Negative expressions are avoided.
	Many	Affirmative contents are increased. The data investigated are increased.
	Case	An example in question-and-answer format.
	Form	A flow chart is used to make it easy for the user to obtain required information.

Note. LD, learning disabilities; ADHD, attention-deficit hyperactivity disorder; ASD, autism spectrum disorder

4. Discussion

This study examined the consideration of effective information presentation of text teaching materials based on the characteristics of students with developmental disabilities. First, the consideration of information presentation by a supporter by each obstacle classification was clarified quantitatively and statistically.

The relationship between each obstacle characteristic and the consideration of information presentation was ascertained. Next, to clarify the contents of the information presentation method, text mining was applied to the free description responses about the concrete matter of teaching materials that considered each obstacle characteristic. Further, the word characteristics of each disability were quantitatively extracted. Subsequently, the typical and concrete method of information presentation was arranged by reading and comprehending each sentence based on the results. We showed that effective information presentation differed according to disability classification through qualitative and quantitative analysis based on the participant's thoughts. However, regarding the evaluation of disability type and the effect, there is a limitation due to the subjectivity of the supporter who provided the response.

In line with a supporter's idea, the following is suggested based on the results of the correlation analysis, or characteristic word extraction and sentence reading comprehension. Regarding LD, "ease of reading" content on devices, such as "ease of understanding a point" and "effective utilization of diagrams" is critical. Further, teaching materials that consider various factors, such as "the size of a character," "use of an illustration and a photograph," and well-designed "intelligibility of a sentence or a character" are needed. Regarding ADHD, intelligibility (for example, a design that requires reading information in one volume) and ease of understanding the contents are required. Further, "shortening" of sentences, not being made to increase the information, ease of understanding important points, and information on page 1 are needed. For ASD, the following factors were considered important: accuracy, consideration of feelings, handling the word "disability" considerately, consideration of the user's dignity, structure of information, consistency of the information structure, accuracy of diagrams, a suitable way of using characters and terms, and information that is useful for problem-solving. The findings of this study regarding the consideration and use of effective information presentation methods for children with developmental disabilities by supporters are in line with those of previous studies. They correspond to the results of previous research on text teaching materials, such as illustrations (Larkin and Simon, 1987; Mayer et al., 1995; Shimada and Kitajima, 2008), clear statements (Seki, 1997) about the contents of teaching materials, illustrations and photographs, and colorization (Shimada, 2016). From this, it is suggested that the information presentation method for text teaching materials generally used is effective for persons with developmental disabilities. Moreover, in this study, consideration corresponding to the finer needs of each disability was suggested. Therefore, in the future development of teaching materials, it may be useful for support providers to consider information presentation corresponding to each disability characteristic.

This study highlights the importance of selecting characters, figures, photographs, and so on, tailored to each disease, as well as the specific content, format, and amount of information. This is consistent with the general text comprehension elements suggested by McTigue and Slough (2010): (d) selective use of visual information, and (e) language and visual information. Concurrently, it reinforces the importance of more specific content.

Moreover, this study shows the effects of using illustrations, photographs, ruby, colors, digitization, and so on, for learning disabilities. This information considers the use of elements for

learning disability information in Wait et al. (2021). In addition, this study embodies the clear and non-technical language pointed out by Wait et al. (2021) as follows. In other words, the writing should reflect the upper elementary school level. Furthermore, this study demonstrates that photographs, concrete examples, flowcharts, question-and-answer formats, and simple, straightforward, and positive expressions are effective for students with ASD. This is consistent with the graphic organizer found to be effective in Finnegan et al.'s (2016) study of ASD reading comprehension. It is also congruent with and reinforces the promising anaphoric queuing and question generation by Finnegan et al. (2016). However, no promising collaborative learning was identified. In addition, no electronic text was found to be ineffective. Based on the findings of Marino et al. (2014) and Rello et al. (2012), this result could apply not only to paper materials but also to electronic materials. Additionally, based on the findings of McTigue and Slough (2010), it can be applied to improve the understanding of general texts. A limitation of this study is that the results of this investigation on the topic of developmental disabilities in students are limited in terms of text teaching materials on employment training. However, information presentation can be applied regardless of the text content. Therefore, further verification is necessary. To clearly show whether the information presentation method extracted from this research is generalizable to other teaching materials and an understanding of the general contents of the study, it is necessary to conduct further research. However, one issue that should be openly addressed as a prospect for future study is interactive reading materials and other technological enhancements, which are an increasing research focus.

In this study, responses were not obtained by recalling individual cases, but through a procedure in which the respondents were presented with definitions of LD, ADHD, and ASD and asked to respond to the considerations for each disability characteristic based on their own experience in supporting persons with developmental disabilities in the workplace. Respondents responded only to those disability types to which they were able to respond based on their experience in providing support. Therefore, some respondents might have responded regarding all disability types, others only regarding some. However, respondents were not asked for details on which of the LD, ADHD, and ASD disability characteristics they had experience supporting, so they might not have experience supporting all disabilities. This point is considered a limitation of this study that should be addressed in future research.

5. Conclusion

This study clarified support providers' consideration of information presentation methods of teaching materials that consider the characteristics of students (persons) with developmental disabilities. The results of this study may contribute to the optimization of teaching materials for students with developmental disabilities to promote understanding and learning.

Acknowledgment

This work was supported by JSPS KAKENHI Grant Numbers JP20830144, JP20H01702.

Note

1. This study was conducted more than 10 years from the time of data acquisition to the time of analysis.

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［Original Article］

Relationship between Burnout, Mental Health, and Assertiveness among Nursery school teachers of Children with Special Needs

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Abstract

Background: It has been suggested that caring for children with special needs in the general classroom is a dangerous stressor that can lead to poor mental health among nursery school teachers. Another problem in Japan is the existence of nursery school teachers who hold certifications but do not work as nursery school teachers, or who leave their jobs because of workplace relationships.

Objective: To investigate the mental health of nursery school teachers when caring for children with special needs, we will identify the relationship between stressors, mental health, and burnout measures. Additionally, to examine the relationship between assertiveness and the mental health of nursery school teachers because it is expected to reduce relationship stress.

Method: A questionnaire was administered to nursery school teachers. Covariance structure analysis was used to determine the stressors scale in Inclusive Education (SSIE), burnout (J-MBI), mental health (J-WHO-5), and self-assertion (J-RAS) in an inclusive childcare environment for Japanese nursery school teachers.

Results: Approximately 60% of nursery school teachers were found to be in the mental health disorder group. Furthermore, it was verified that an increase in J-RAS not only decreases SSIE but also increases J-WHO-5 and may decrease burnout tendency. Nursery school teachers who currently care for children with medical care needs argued that they are more likely to experience stressors.

Conclusion: Nursery school teachers who care for children who need medical care are expected to experience worsening mental health, and immediate support is needed. Since nursery school teachers with high levels of assertiveness also have high values of mental health, we hope that assertiveness training for nursery school teachers will be developed.

Keywords: Japanese nursery school teachers, children with special needs, stressors and psychological response

1. Introduction

In Japan, preschool facilities are divided into three categories: kindergartens for educational purposes for children aged 3 to pre-elementary school, under the jurisdiction of the Ministry of Education, Culture, Sports, Science and Technology (MEXT); nursery schools and child welfare

facilities for children aged 0 to pre-elementary school, under the jurisdiction of the Ministry of Health, Labor and Welfare (MHLW); and certified childcare facilities that combine the functions of both kindergarten and nursery school, under the jurisdiction of the Cabinet Office (CAO). According to the survey conducted from 2021 to 2022, the number of children in nursery schools is approximately 2.6 million (MHLW, 2022), whereas the number of children in kindergartens is nearly 0.92 million (MEXT, 2022). Meanwhile, the number of children in certified childcare facilities is 1.06 million (Cabinet Office, 2021). According to Ikeda and Okawa (2012), kindergarten teachers and childcare workers are similar in several aspects, but they have different stressors and stress-related factors. Thus, the present study examines a sample of nursery school teachers in day-care centers, representing the largest group of subjects among those working in preschool facilities in Japan.

In recent years, the demand for childcare facilities has been rapidly increasing due to the increase in number of dual-earner families, and the "Plan for Securing Nursery School Teachers" (launched by the Ministry of Health, Labor and Welfare in 2015) made the securing of nursery school teachers an important issue in Japan. However, there is still an acute shortage of nursery school teachers, and the deteriorating mental health of such teachers has been indicated as the main reason for this shortage. A survey using the Japanese version of the Kessler Screening Scale for Psychological Distress (K6) has been conducted to clarify the mental health of nursery school teachers. The results indicated that 60.0% of nursery school teachers showed a prevalence of psychological distress (K6 score $\geq$ 5) (Yaginuma-Sakurai et al., 2020). In addition, according to Akagawa and Kimura (2019), up to 20% of nursery school teachers are already in a state of burnout (Akagawa and Kimura, 2019).Given this situation, investigating the mental health of nursery school teachers would be helpful in preventing early job turnover. The high prevalence of burnout has also been noted in many countries (Aboagye et al., 2018; Tasic et al., 2020). The poor mental health of nursery school teachers can be considered an issue in many countries around the world.

Further, the number of children with special needs is increasing in Japan. According to a survey conducted in 2018, the percentage of the number of nursery schools that reported having children with special needs was as high as 83.2% (MHLW, 2017). With the Salamanca Declaration, the idea and practice of inclusive education have become a global principle and are becoming more widespread in the country. The United Nations Educational, Scientific and Cultural Organization (UNESCO) defines "special educational needs" to include not only children with disabilities but also gifted children, street children, working children, children from remote areas, nomadic children, and other children living in disadvantaged or remote areas. Children living in remote areas, nomadic children, and other disadvantaged or marginalized children are all in need of support (UNESCO, 1994). In response to this trend, the core curriculum for teaching in Japan, which clarifies the qualities and abilities that should be commonly acquired in teaching programs, has been revised since 2017 to include children with special needs, such as those who have problems with their mother tongue and poverty and have learning and living difficulties and those who need systematic support. In the curriculum, children with special needs include those who have problems with their native language and poverty, learning or living difficulties, or organizational needs (MEXT, 2017).

It has been suggested that caring for children with special needs is a dangerous stressor that can lead to poor mental health in nursery school teachers. Faulkner et al. (2016) explored the work stress of childcare providers through semi-structured interviews. Among the stresses of childcare providers, dedication to the impact of factors, such as poverty and domestic violence on children, was cited. It was also elucidated that identifying problems faced by children and providing support to parents, especially single parents, also contribute to the stress of childcare workers (Faulkner et al.,

2016). However, defining children with special needs is very difficult (Japan Council for Childcare Issues, 2021). Hence, previous studies have limited the scope of children with special needs to children with disabilities (Štemberger and Kiswarday, 2018) or categorized them by the presence or absence of a disability label (Kiso, 2016). Most of the scales employed in previous studies to identify concerns about inclusive education have also been developed with the assumption that children with disabilities would be integrated into general classes (Jobe et al., 1996; Sharma and Desai, 2002). Against this background, stress among nursery school teachers must be investigated considering the diverse and changing perceptions of children with special needs.

It has also been reported that the stress of nursery school teachers is largely influenced by their perceptions and personal characteristics. Finding a relationship between cognitive appraisals and stress in nursery school teachers, Friedman-Krauss et al. (2014) reported that teachers who perceived higher levels of children's behavioral problems also felt higher levels of stress from their work and that this relationship was statistically significant (Friedman-Krauss et al., 2014). An American study on early childhood teachers who teach children from infants to third grade has noted that the impact of inclusive education on their concerns is mediated by their confidence in teaching children with disabilities (Park et al., 2018). In addition, the study has also examined the personal characteristics of caregivers, such as self-efficacy, past childcare experience, whether they have had contact with children with disabilities, gender, age, grade level taught, academic status, and training.

Therefore, the present study focused on assertiveness, which has never been investigated as a personal factor affecting stress. Assertiveness is a method of self-expression that started in the 1970s in the U.S. It refers to communicating appropriately while respecting the other person, rather than stating one's point of view one way or the other. The concept of assertiveness was popularized in Japan by Hiraki (1993). A related study on nurses reported that developing assertive communication allows them to communicate their feelings in an honest and appropriate manner, leading to stress reduction and improved mental health (Daigo et al., 2010). Furthermore, According to Jovanović et al. (2019), teachers who are in charge of children with developmental disabilities have less work-related burnout than teachers with higher levels of assertiveness (Jovanović et al., 2019). According to a survey by the Tokyo Metropolitan Government's Bureau of Social Welfare and Public Health (2018), workplace relationship is the principal reason why nursery school teachers leave their jobs. Since such teachers are expected to communicate with several people, including parents and colleagues, they must have the ability to manage stress related to workplace relationships. Thus, learning assertive communication is expected to help nursery school teachers effectively build healthy workplace relationships and reduce overall stress.

In the current research, the relationship between stressors, mental health, and burnout scales will be clarified to investigate the mental health of nursery school teachers when caring for children with special needs. Yoshikane and Hayashi (2010) explored the relationship between the presence or the absence of a child with developmental characteristics in the classroom and the burnout index. In this study, nursery school teachers were more likely to experience burnout than kindergarten teachers, highlighting that nursery school teachers spend more time with children as a factor (Yoshikane and Hayashi, 2010). Additionally, according to Kiso (2013), as the number of undiagnosed developmentally disabled children increases, nursery school teachers are more likely to suffer from burnout(Kiso, 2013). A study in Turkey also affirmed that having integration students enrolled or not in the current class did not affect the burnout index of preschool teachers (Sahbaz and Kocer, 2017). Comparing these studies is difficult simply because they were conducted in different countries, and

the instruments utilized were distinct from each other. In addition, there have been no studies conducted on nursery school teachers or on whether children with special needs are enrolled in the program, which made us feel the need to investigate this issue.

Furthermore, this study will clarify the relationship between assertiveness and mental health burnout among nursery school teachers. Given that nursery school teachers interact with many people, including children, colleagues, and parents, they must learn how to communicate assertively.

2. Research Methods

In this study, we conducted a questionnaire survey of nursery school teachers. The survey examines whether the stressors of caring for children with special needs affect mental health and burnout and their relationship with assertiveness as a personal factor. An online survey was chosen as the method of data collection because it is more efficient to survey nursery school teachers in a wide range of communities.

2.1 Procedure

The survey was commissioned to an Internet research company (Rakuten Insight) that has roughly 2.2 million registered monitors. According to the 2018 survey, of the 1.54 million registered nursery school teachers, 590,000 are working as nursery school teachers (MHLW, 2020a). The number of registered nursery school teachers is 590,000 out of 1.54 million. We conducted a screening and selected 300 nursery school teachers who are certified as nursery school teachers and are currently working as classroom teachers in childcare centers to complete this survey. Care was taken to make the bias due to region and age as even as possible to prevent bias due to regional differences and age. The survey was sent out on March 12, 2021 and the collection of 300 respondents was completed on March 15, 2021. The valid response rate was 100% as the system was designed so that responses could not be completed in case of incompleteness.

As an ethical consideration, this study was conducted after obtaining approval from the **** Ethical Review Committee (approved November 1, 2020; No. 21). The survey system was initiated only after the research subjects reviewed and agreed to the privacy policy of the Internet Research Company Survey (https://member.insight.rakuten.co.jp/explanation/privacy/). It is clearly stated in the terms of use that the information obtained from the survey and the individual will only be presented in a form that cannot be identified and will not be used for any purpose other than that of the survey.

2.2 Participant

The subjects were 300 nursery school teachers who were qualified and currently working as classroom teachers. As for gender, 14(4.70%) were males, 286(95.3%) were females, 65(21.7%) were in their 20s, 129(43.0%) were in their 30s, 66(22.0%) were in their 40s, and 29(13.3%) were in their 50s or older. As for the type of employment, 222(74.0%) were in standard employment, 18(6.0%) in non-standard employment, and 59(20.0%) in part-time employment, and 1(0.3%) were others. The last educational background of 43(14.4%) students was vocational school, 180(60.0%) were junior college, 75(25.0%) were university, and 2(0.70%) were other. As for the classes they oversaw, 186(62.0%) were in the infant class, 100(33.3%) were in the toddler class, 11(3.7%) were in free charge, and 3(1.0%) were in other classes. With regard to the establishment entities, 88(29.3%) were public, 167(55.7%) were social welfare corporations, 32(10.7%) were stock companies, and 13(4.3%) were others.

In Japan, the Core Curriculum for the Teaching Profession, which clarifies the qualities and abilities that should be commonly acquired in teaching programs, has clearly indicated the understanding and support for children who need special support, such as those who have problems with their mother tongue or poverty, learning or living difficulties, or need systematic support (MEXT, 2017). In the present research, children with special needs were classified into the following seven categories: (1) children diagnosed as having disabilities, (2) children without a diagnosis but having special developmental needs, (3) children experiencing poverty, (4) children having needs for support due to their family environment, (5) children having been abused, (6) children requiring language support due to foreign nationality, and (7) children calling for medical care. For each item, the respondents were asked to answer in three ways: "currently in caring," "have experience in caring," or "have no experience in caring" (Table 1). Regarding whether they have looked after children diagnosed as having disabilities, 62(20.7%) were currently in caring, and 162(54.0%) had experience in caring. In terms of whether they have overseen children without a diagnosis but having special developmental needs, 129(43.0%) are currently in caring of such children, and 133(44.3%) have overseen such children. In regard to whether they have had experience in caring for children who require medical care, 19(6.3%) are currently in charge, and 198(66.0%) had no experience in taking charge, with the largest number of the respondents having no experience in taking caring.

2.3 Measurement method

2.3.1 The Stressor Scale in Inclusive Education

We employed the Scale in Inclusive Education (SSIE), which was developed by the authors. The scale comprises five questions ranging from "I do not feel stress at all" to "I feel very stressed" when assuming stressful situations in inclusive education. The questionnaire consists of 21 items, including "difficulty in dealing with children" (eight items), "human relations with parents and other children in the class" (seven items), "insufficient self-expertise" (two items), "burden of keeping childcare records" (two items), and "insufficient support from colleagues" (two items). This scale has Cronbach's reliability coefficients of α = .84 to .93, which ensures internal consistency, based on a survey of 211 nursery school teachers. On the basis of the results of confirmatory factor analysis, the goodness of

Table 1 Experience in caring for children with special needs

	Experience in caring for children with special needs	Currently in charge		Have experience in caring		No experience in caring	
		N	%	N	%	N	%
(1)	Children diagnosed as having disabilities	62	20.7	162	54.0	76	25.3
(2)	Children without a diagnosis but having special developmental needs	129	43.0	133	44.3	38	12.7
(3)	Children experiencing poverty	32	10.7	99	33.0	169	56.3
(4)	Children with needs for support due to their family environment	72	24.0	149	49.7	79	26.3
(5)	Children having been abused	31	10.3	99	33.0	170	56.7
(6)	Children requiring language support due to foreign nationality	40	13.3	110	36.7	150	50.0
(7)	Children requiring medical care	19	6.3	83	27.7	198	66.0

fit of the model is X^2=384.144, df = 197, GFI = .869, AGFI = .832, CFI = .919, RMSEA = .067, and AIC = 469.144, and the validity can be verified (Shiratori & Kojima, 2022). Nonetheless, as this scale was designed for nursery school teachers in five prefectures, mainly in the Kanto region, out of the 47 prefectures in Japan, it must be verified whether the factor structure can be replicated for nursery school teachers in a wider range of regions.

2.3.2 Burnout scale

The Maslach Burnout Inventory, which was translated into Japanese by Tao and Kubo was utilized (Kubo and Tao, 1992; Maslach and Jackson, 1981). J-MBI has also been studied with nursery school teachers, and its reliability and validity have been verified (Akagawa and Kimura, 2019; Kiso, 2016). The questionnaire consists of 17 items, with three subscales, namely, "emotional exhaustion" (five items), which includes feeling mentally fatigued at work and wanting to quit work, "depersonalization" (six items), which includes avoiding contact with colleagues and children and feeling less meaningful at work, and "decreased sense of personal accomplishment" (six items), which includes feeling joyful, enthusiastic, and satisfied at work. The survey also comprises three subscales. The responses were based on a five-point scale (1–5) ranging from "always" to "never." The total score for "personal accomplishment" was reversed to "decreased personal accomplishment," with a higher total score indicating higher burnout symptoms.

2.3.3 Mental health level

The "WHO-five Well-Being Index Japanese Version (J-WHO-5)" developed by the World Health Organization (WHO) was employed. The responses were based on a six-point scale (0–5) ranging from "never" to "always." A total score of 13 or more points indicates good mental health, and a score of 13 or less indicates poor mental health (Awata et al., 2007). A total score of 13 or higher indicates good mental health, while a score of 13 or lower indicates poor mental health to create a stress scale for nursery school teachers and to examine its reliability and validity.

2.3.4 Assertiveness scale

J-RAS, translated by Suzuki et al. (2004) and completed after a review by several researchers, including a translator from the U.S., was used (Rathus, 1973; Suzuki et al., 2004). Seventeen of the 30 items are reversed items, and the higher the total score after processing the reversed items, the more assertive the respondents. After processing the reversed items, the higher the total score, the more assertive the respondents. The minimum and maximum score ranges are from −90 to +90. In the current study, the nursing students were surveyed, and the mean of the J-RAS total score was −12.0 (±20.2) (Suzuki et al., 2004).

2.4 Analysis method

For SSIE and J-MBI, the appropriateness of the factor structure was confirmed, and confirmatory factor analysis was conducted with each item as the observed variable and the measurement of each item as the latent variable.

For J-MBI, we conducted confirmatory factor analysis with each item as the observed variable and each item as the latent variable. Multiple comparisons (Games–Howell method) were performed. The results of these comparisons were shown only if differences were found.

An analysis of covariance structure was conducted with the factors of SSIE, J-WHO-5, J-MBI, and J-RAS as latent variables and the subscales of each scale as observed variables. Among the paths between the assumed latent variables, those for which no significant path coefficients were obtained were sequentially deleted one by one, starting with those with the smallest path coefficients (standard estimates). Thereafter, the deletion was repeated while checking the significance level of

the other path coefficients, and the process was terminated when all the paths between latent variables became significant. The appropriateness of the model was judged comprehensively from the three indices of goodness of fit index (GFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA).

Statistical analysis was performed using SPSS 27.0 and AMOS 26.0.

3. Results

3.1 Factor structure and total score of SSIE and J-MBI

Table 2 presents the mean values and standard deviations of SSIE and J-MBI. The Cronbach alpha coefficients were calculated to be high, ranging from α = .870 to .917 for SSIE and α = .789 to .879 for J-MBI. The GFI (.823–.859), CFI (.881–.896), and RMSEA (.088–.089). On the basis of a comprehensive review of the results, the factor structure of each scale was judged to be generally appropriate.

3.2 Relationship between the personal attributes of nursery school teachers and SSIE, J-MBI, and J-WHO-5

A t-test, one-way analysis of variance, and multiple comparisons using the Tukey method were conducted to clarify the relationship between the basic attributes of nursery school teachers and SSIE, J-MBI, and J-WHO-5.

Table 3 exhibits the relationship between basic attributes and SSIE. Significant differences were found in the age of nursery school teachers and "insufficient self-expertise" (p = .006–.027). There was a significant difference between SSIE and the two subscales of "human relations with parents and other children in the class" and "burden of keeping childcare records" in terms of the relationship with the establishment of the childcare center (p = .002–.024).

I would like to examine the relationship between J-MBI. There was a significant difference between the age of the nursery school teachers and "emotional exhaustion" and "depersonalization" (p = .004–.048). In "depersonalization," there was a significant difference in the relationship between the type of employment and the establishment entity (p = .006–.013) (Table 4).

For J-WHO-5, the maximum value was 25, the minimum value was 1, and the overall mean value was 12.8 (SD = 5.28). The mental health of the nursery school teachers was below the 13 points that are in good mental health. This value is lower than the results of the study by Akada (2010),

Table 2 Results of the confirmatory factor analysis of SSIE and J-MBI and the mean values of subscales

Scale	Fitness Index	Subscale	*M*	*SD*
SSIE	GFI=. 823	Difficulty in dealing with children (8 items)	25. 85	6. 53
	CFI=. 896	Human relations with parents and other children in the class (7 items)	20. 78	5. 55
	RMSEA=. 089	Insufficient self expertise (2 items)	6. 59	1. 80
		Burden of keeping childcare records (2 items)	6. 72	2. 05
		Insufficient support from colleagues (2 items)	5. 53	2. 05
J-MBI	GFI=. 859	Emotional exhaustion (5 itemes)	13. 48	4. 54
	CFI=. 881	Depersonalization (6 itemes)	21. 35	5. 76
	RMSEA=. 088	Decreased sense of personal accomplishment (6 itemes)	17. 35	4. 51

Table 3 Relationship between the basic attributes of nursery school teachers and J-MBI

				Factor Ⅰ			Factor Ⅱ			Factor Ⅲ			Factor Ⅳ			Factor Ⅴ		
			N(%)	*M*	*SD*	*p*	*M*	*SD*	*p*	*M*	*SD*	*p*	*M*	*SD*	*p*	*M*	*SD*	*p*
Overall			300(100)	25.8	6.53		20.78	5.55		6.59	1.80		6.72	2.05		5.53	2	
Gender	1	Male	14(4.7)	23.50	4.54	n.s.	21.21	2.89	1-2*	6.64	1.95	n.s.	7.50	2.35	n.s.	5.36	2.21	n.s.
	2	Female	286(95.3)	25.96	6.59		20.76	5.65		6.58	1.80		6.68	2.03		5.54	2.04	
Age	1	20s	65(21.7)	27.37	6.14	n.s.	21.57	5.03	n.s.	7.17	1.91	1-2* 1-4**	6.98	1.90	n.s.	5.77	2.01	n.s.
	2	30s	129(43.0)	25.46	6.84		20.57	5.61		6.41	1.82		6.92	2.17		5.57	2.05	
	3	40s	66(22.0)	25.64	6.19		21.27	5.32		6.71	1.51		6.47	2.00		5.26	2.06	
	4	50s and older	40(13.3)	24.98	6.49		19.40	6.36		6.00	1.81		6.05	1.84		5.50	2.11	
Employment status	1	Full-time employment	222(74.0)	26.19	6.69	n.s.	21.22	5.77	n.s.	6.69	1.87	n.s.	6.95	2.03	1-2*	5.66	2.15	n.s.
	2	Part-time employment	18(6.0)	25.56	5.36		19.39	4.13		6.56	1.50		5.94	2.46		5.11	1.81	
	3	Part-time job	59(20.0)	24.53	6.15		19.44	4.76		6.20	1.60		6.10	1.84		5.17	1.65	
	4	Other	0(0.0)	–	–		–	–		–	–		–	–		–	–	
Final educational background	1	Vocational school	43(14.3)	25.47	6.28	n.s.	20.21	4.87	n.s.	6.12	1.73	3-1*	6.58	2.17	n.s.	5.49	2.28	n.s.
	2	Junior college	180(60.0)	25.93	6.54		20.83	5.64		6.52	1.73		6.69	1.99		5.52	1.96	
	3	University	75(25.0)	25.87	6.64		21.15	5.71		7.07	1.93		6.92	2.15		5.64	2.12	
	4	Other	2(0.7)	26.00	12.73		15.00	1.41		5.00	1.41		5.00	1.41		4.00	2.83	
Class in charge	1	Infant class	186(62.0)	25.93	6.52	n.s.	20.47	5.60	n.s.	6.46	1.83	n.s.	6.49	2.09	1-2**	5.54	2.14	n.s.
	2	Toddler class	100(33.3)	25.92	6.30		21.51	5.42		6.87	1.80		7.30	1.87		5.59	1.85	
	3	Free charge	11(3.7)	25.09	8.85		20.18	5.81		6.18	1.40		5.82	2.04		5.27	2.37	
	4	Other	3(1.0)	21.00	6.24		18.33	4.93		6.33	0.58		4.67	1.15		4.33	2.08	
Established	1	Public	88(29.3)	26.19	6.97	n.s.	21.91	4.57	1-4** 2-4*	6.88	1.86	n.s.	7.10	2.01	1-4*	5.30	1.80	n.s.
	2	Social welfare service corporation	167(55.7)	25.64	6.44		20.78	5.81		6.48	1.77		6.59	2.02		5.67	2.11	
	3	Joint-stock companies	32(10.7)	26.78	5.88		19.59	5.78		6.53	1.76		6.91	2.19		5.88	2.24	
	4	Other	13(4.3)	23.85	6.16		16.15	5.06		6.15	1.86		5.38	1.89		4.54	2.11	

Note:Factor Ⅰ Difficulty in dealing with children, Factor Ⅱ Human relations with parents and other children in the class, Factor Ⅲ Insufficient self expertise, Factor Ⅳ Burden of keeping childcare records, Factor Ⅴ Insufficient support from colleagues. Gender was subjected to t-test. Other items were subjected to one-way analysis of variance followed by the Tukey method as a subsequent test. * $p<.05$, ** $p<.01$.

Table 4 Basic attributes of nursery school teachers and their relationship to SSIE

			Factor Ⅰ			Factor Ⅱ			Factor Ⅲ		
			M	*SD*	*p*	*M*	*SD*	*p*	*M*	*SD*	*p*
Overall			13.50	4.54		21.35	5.76		17.35	4.51	
Gender	1	Male	13.00	3.04	n. s.	20.50	4.07	n. s.	18.36	3.32	n. s.
	2	Female	13.51	4.60		21.39	5.83		17.30	4.56	
Age	1	20s	12.32	4.20	3–1* 4–2* 4–1**	19.85	5.12	3–1* 4–1*	17.06	4.11	n. s.
	2	30s	12.95	4.65		21.14	5.95		17.19	4.71	
	3	40s	14.52	4.14		22.35	5.89		17.70	4.59	
	4	50s and older	15.38	4.56		22.83	5.42		17.80	4.44	
Employment status	1	Full-time employment	12.96	4.53	3–1**	20.75	5.88	3–1*	17.21	4.63	n. s.
	2	Part-time employment	14.33	4.77		22.94	6.01		18.56	3.93	
	3	Part-time job	15.31	4.00		23.25	4.69		17.59	4.22	
	4	Other	–	–		–	–		–	–	
Final educational background	1	Vocational school	14.44	5.06	n. s.	23.07	5.61	n. s.	17.19	4.57	n. s.
	2	Junior college	13.36	4.49		21.41	5.82		17.09	4.35	
	3	University	13.13	4.15		20.27	5.40		18.13	4.77	
	4	Other	17.50	10.61		20.00	12.73		15.00	8.49	
Class in charge	1	Infant class	13.39	4.72	n. s.	21.40	5.99	n. s.	17.43	4.82	n. s.
	2	Toddler class	13.44	4.20		21.18	5.37		16.90	3.86	
	3	Free charge	15.09	4.83		22.18	5.62		18.91	3.67	
	4	Other	15.00	3.00		20.67	7.02		22.00	5.29	
Established	1	Public	13.33	4.72	n. s.	21.17	5.59	4–1* 4–2**	16.82	4.69	n. s.
	2	Social welfare service corporation	13.41	4.53		20.89	5.79		17.69	4.38	
	3	Joint-stock companies	13.28	3.70		22.25	5.96		16.66	4.79	
	4	Other	15.92	5.14		26.31	3.43		18.38	4.11	

Note:Factor Ⅰ emotional exhaustion, Factor Ⅱ depersonalization, Factor Ⅲ Decreased sense of personal accomplishment. Gender was subjected to t-test. Other items were subjected to one-way analysis of variance followed by the Tukey method as a subsequent test. * $p<.05$, ** $p<.01$.

which revealed that the mental health status of nursery school teachers is deteriorating. The best mental health status was found in the free charge category, with a score of 17.64. By contrast, the worst mental health status was 11.71 for male nursery school teachers. Although there was a significant difference in mental health status depending on the class they were in charge of (p = .009–.023), there was no significant difference between the other basic attributes and J-WHO-5.

Finally, the relationship between J-RAS and the basic attributes: the maximum total score of J-RAS was 42, and the minimum was −63, with an overall mean of −3.49 (SD = 16.41). Compared with a study conducted on nurses in Japan, −6.6 (SD = 19.7) for managerial nurses and −12.4 (SD =

Table 5 Relationship between the basic attributes of nursery school teachers and J-WHO-5 and J-RAS

			J-WHO-5			J-MBI			J-RAS		
			M	*SD*	*p*	*M*	*SD*	*p*	*M*	*SD*	*p*
Overall			12.82	5.28		49.01	9.61		-3.49	16.41	
Gender	1	Male	11.71	4.25	n. s.	48.57	6.80	n. s.	0.50	19.65	n. s.
	2	Female	12.88	5.32		49.03	9.74		-3.69	16.25	
Age	1	20s	12.38	4.60	n. s.	46.49	7.71	3-1* 4-1*	-7.86	17.13	n. s.
	2	30s	12.74	5.51		48.28	10.54		-3.01	17.36	
	3	40s	13.02	5.30		50.86	8.87		-3.18	12.18	
	4	50s and older	13.50	5.60		52.43	9.19		1.53	17.01	
Employment status	1	Full-time employment	12.41	5.16	3-1*	47.88	9.80	3-1**	-3.58	16.71	n. s.
	2	Part-time employment	13.00	4.89		51.94	10.26		-3.71	16.13	
	3	Part-time job	14.32	5.63		52.33	7.72		-0.09	17.14	
	4	Other	–	–		–	–		–	–	
Final educational background	1	Vocational school	12.44	5.75	n. s.	51.47	9.30	n. s.	-4.14	20.56	n. s.
	2	Junior college	13.01	5.28		48.68	9.77		-2.57	15.39	
	3	University	12.65	4.93		48.39	8.95		-5.79	16.05	
	4	Other	11.00	11.31		50.00	25.46		13.50	13.44	
Class in charge	1	Infant class	12.51	5.33	3-1** 3-2*	49.08	10.11	n. s.	-4.14	20.56	n. s.
	2	Toddler class	12.89	5.15		48.52	8.69		-2.57	15.39	
	3	Free charge	17.64	3.91		51.55	8.66		-5.79	16.05	
	4	Other	12.67	3.51		52.33	13.01		13.50	13.44	
Established	1	Public	12.56	5.35	n. s.	48.19	10.25	n. s.	-4.36	18.66	n. s.
	2	Social welfare service corporation	13.21	5.22		48.90	9.22		-2.71	15.50	
	3	Joint-stock companies	11.84	4.95		48.94	9.48		-5.09	15.25	
		Other	12.08	6.40		56.15	8.40		-3.77	15.60	

Gender was subjected to t-test. Other items were subjected to one-way analysis of variance followed by the Tukey method as a subsequent test. $^{*}p<.05$, $^{**}p<.01$.

20.8) for new nurses (Suzuki et al., 2017), the assertiveness level of nursery school teachers was found to be higher than that of nurses (Table 5).

Finally, all the groups with very low J-RAS scores were in the J-WHO-5 low group. There was also a significant difference in J-WHO-5 high and low groups with low or slightly low J-RAS scores ($p < .001$) (Figure 1).

3.3 Relationship between experience in caring for children with special needs and SSIE, J-MBI, and J-WHO-5

A one-way analysis of variance was conducted to determine if there was a difference between SSIE and SSIE according to experience in caring for children with special needs. After the analysis of variance, the Tukey method was used for the multiple comparisons of equal variances, the Games-Howell method was employed for unequal variances, and significant differences were found only between those with and without experiences in caring for children with medical care needs and SSIE. For the SSIE subscale "human relations with parents and other children in the class," there was a significant difference ($p = .010$) between the SSIE subscale "human relations with parents and other children in the class" and SSIE. For the SSIE subscale "insufficient self-expertise," there was a significant difference between "have experience in caring childcare teachers" compared with "no experience as a caring childcare teacher" ($p = .031$) (Table 6).

Subsequently, a one-way analysis of variance was conducted to determine if there was a difference between J-BMI and experience in caring for children with special needs. As there were

Table 6 Relationship between SCIE and the childcare experiences of children requiring medical care

		SSIE		*M*	*SD*	*df*	*F*	*p*	Multiple comparison
Children requiring medical care	Factor Ⅰ	1	Currently in caring	3.3	0.9	2.0	0.25	0.818	n. s.
		2	Have experience in caring	3.1	0.8				
		3	No experience in caring	3.2	0.8				
	Factor Ⅱ	1	Currently in caring	3.3	0.5	2.0	3.01	0.011	1-2** 1-3*
		2	Have experience in caring	2.9	0.9				
		3	No experience in caring	3.0	0.7				
	Factor Ⅲ	1	Currently in caring	3.5	1.0	2.0	3.61	0.034	2-3*
		2	Have experience in caring	3.1	0.9				
		3	No experience in caring	3.4	0.9				
	Factor Ⅳ	1	Currently in caring	3.7	0.7	2.0	1.89	0.070	n. s.
		2	Have experience in caring	3.2	1.0				
		3	No experience in caring	3.4	1.1				
	Factor Ⅴ	1	Currently in caring	2.9	0.8	2.0	0.12	0.829	n. s.
		2	Have experience in caring	2.7	1.0				
		3	No experience in caring	2.8	1.1				

Note:Factor Ⅰ Difficulty in dealing with children, Factor Ⅱ Human relations with parents and other children in the class, Factor Ⅲ Insufficient self expertise, Factor Ⅳ Burden of keeping childcare records, Factor Ⅴ Insufficient support from colleagues.
After one-way analysis of variance, multiple comparison (Games-Howell) was used. *p<. 05, **p<. 01.

Table 7 Relationship between J-MBI and children requiring language support due to foreign nationality

		J-BMI Factor		*M*	*SD*	*df*	*F*	*P*	Multiple comparison
Children requiring language support due to foreign nationality	Ⅰ	1	Currently in caring	13.3	4.9	2.0	0.31	0.734	n.s.
		2	Have experience in caring	13.8	4.7				
		3	No experience in caring	13.3	4.4				
	Ⅱ	1	Currently in caring	13.8	4.7	2.0	0.05	0.949	n.s.
		2	Have experience in caring	21.2	5.8				
		3	No experience in caring	17.6	4.7				
	Ⅲ	1	Currently in caring	13.5	4.5	2.0	3.78	0.024	1-3*
		2	Have experience in caring	21.4	5.8				
		3	No experience in caring	17.4	4.5				

Note:Factor Ⅰ Emotional exhaustion , Factor Ⅱ Depersonalization , Factor Ⅲ Decreased sense of personal accomplishment. After one-way analysis of variance, multiple comparison (Tukey) was used. $^{*}p<.05$, $^{**}p<.01$.

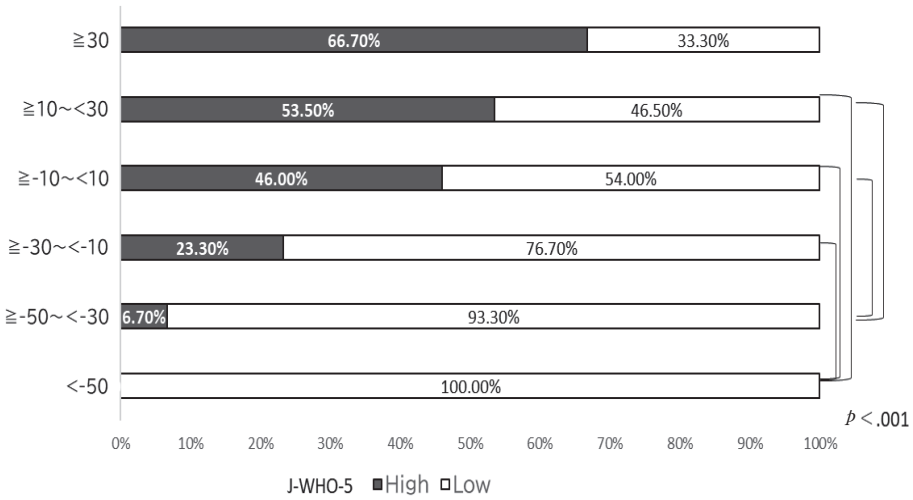

Figure 1 Distribution of J-RAS score in J-WHO-5 high and low groups

equal variances, the analysis of variance was followed by multiple comparisons (Tukey), and the results confirmed that nursery school teachers who had experience with "children requiring language support due to foreign nationality" were more likely to have "decreased sense of personal accomplishment" than their current counterparts (p = .026) (Table 7).

Finally, a t-test was conducted to determine if there was a difference between the 181(60.3%) children with good mental health status and the 119(39.7%) ones with poor mental health status in J-WHO-5 and experience in caring for children with special needs. Consequently, no significant differences were found in any of the items.

3.4 Examination of the model by covariance structure analysis

The SSIE, J-MBI, J-WHO-5, and J-RAS factors were used as latent variables, and the subscales of each factor were employed as observables. For J-RAS, the total score was calculated and utilized

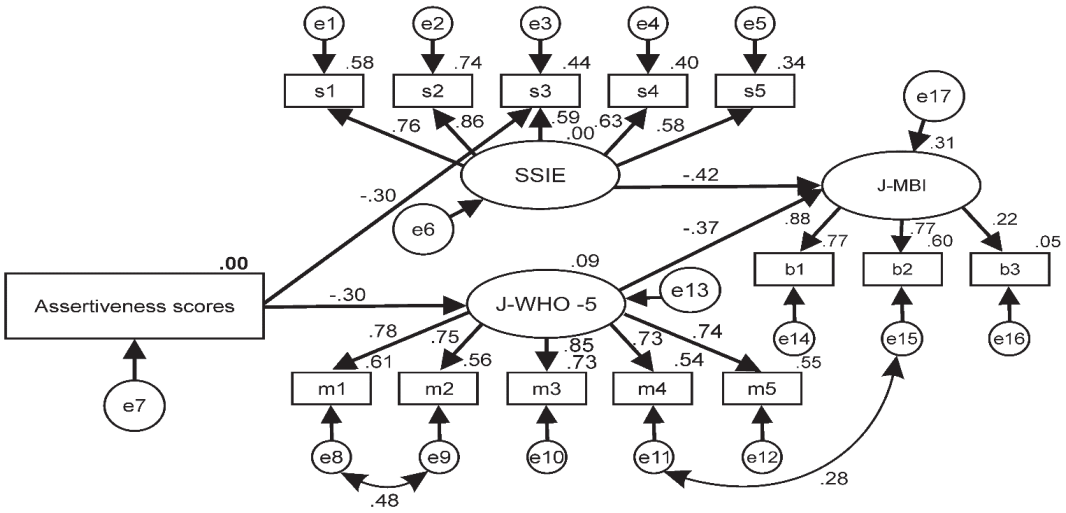

Figure 2 Model diagram of SSIE, J-MBI, J-WHO-5, and J-RAS

as an observational variable. According to previous studies, a model with a GFI of .94 or higher, an AGFI of .90 or higher, and an RMSEA of less than .01 is considered to have a good fit (Takagi and Tanaka, 2003). During the creation of the model, the corrections were made repeatedly by introducing error correlations based on correction indices. Consequently, the goodness of fit indices of the model that specified the interrelationships among the four scales showed acceptable fit values (X^2 = 184.973, df = 72, GFI = .919, AGFI = .882, CFI = .937, RMSEA = .072, and AIC = 250.973). Figure 2 illustrates that the path coefficients of the model demonstrated a direct effect from SSIE to J-MBI, but no path from SSIE to J-WHO-5. The J-RAS total score was significant for the SSIE subscale, insufficient self-expertise, and the direct effect to J-WHO-5.

4. Discussion

4.1 Relationship between the childcare experience of children with special needs and the SSIE, J-MBI, and J-WHO-5 of nursery school teachers

Children with special needs were categorized into seven items, and the relationship between their childcare experience and stress-related factors was clarified. The results validated that there was no significant difference between SSIE, J-MBI, and J-WHO-5 for the items other than (6) children requiring language support due to foreign nationality and (7) children requiring medical care. There was no significant difference between SSIE, J-MBI, and J-WHO-5. This result was partially directed by the results of Sahbaz and Kocer (2017), who affirmed that the presence of children with special needs did not affect the burnout level of caregivers. Conversely, the results were different from those of Kiso (2013) and Yoshikane and Hayashi (2010) and other studies conducted in Japan, which argued that burnout was affected when caring for developmentally disabled children or children with developmental tendencies (Kiso, 2013; Yoshikane and Hayashi, 2010). In Japan, it has been reported that approximately 80% of nursery schools have children with special needs (MHLW, 2019b), and it is expected that children with disabilities and developmental disabilities, even among those with special needs, are now expected to spend time together in regular classes. Since the Salamanca Declaration, there has been a change in the awareness of nursery school

teachers toward inclusive education and research on the practice in Japan (Hori, 2017). We believe that this may be because nursery school teachers have accumulated knowledge about disabilities and childcare practices that are no longer directly connected to SSIE and J-MBI.

Contrarily, there was a significant difference between the SSIE subscales "human relations with parents and other children in the class" and "insufficient self-expertise" and the experience of caring for children with medical care needs. In Japan, since Act for Eliminating Discrimination against Persons with Disabilities in 2016, the Child Welfare Law has been amended, and the number of children requiring medical care in nursery schools has increased dramatically (MHLW, 2020b). According to a case study on children with medical care who use nursery schools, the inclusion of children with medical care needs, children with disabilities, and healthy children in a class brings out diverse needs and increases the number of difficult situations for day-care practices (Ueda et al., 2020). In addition, according to a questionnaire survey of nurses at nursery school caring for children who require medical care, training for nursery school teachers is necessary because nursery school teachers are currently providing medical care together with nurses (Sorata, 2014). The burden and risk of providing safe and secure medical care in a non-medical nursery school is great, and the importance of supporting nursery school teachers in dealing with tension and accidents is required (Ueda et al., 2020). As revealed in the results of the present research, there are many nursery school teachers who have no experience with the need for medical care in nursery schools, and childcare practices and issues involving children with medical care have not been sufficiently accumulated (Matsumoto et al., 2019). Thus, the entire preschool must establish a system to prevent the burden from becoming too great only on the nursery school teachers who oversee children with medical care, to accumulate childcare practices, and to improve the skills of nursery school teachers by enhancing training. It has also been elucidated that there is a chronic shortage of nurses in nursery schools and that they do not adequately accept children who require medical care (Sorata, 2014). Deciding for the placement of not only nursery school teachers but also nurses is crucial.

Similarly, there was a significant difference between the childcare experience of children requiring language support due to foreign nationality and J-MBI's "decreased sense of personal accomplishment." Hayashi (2021) affirmed that in caring for children who need language support due to their foreign nationality, understanding the difficulties of communication with children and parents and their culture is necessary. This is not a problem that can be solved by simply communicating in the language, but it is expected that the inability to communicate due to differences in the mother tongue leads to a decrease in the sense of personal accomplishment of the nursery school teachers. There are some reports that translation and dissemination applications are used to supplement linguistic communication with parents, but there is a large disparity in the dispatch of interpreters among local governments, and the actual situation is that it is left to the efforts of the nursery school teachers to respond (Hayashi, 2021). In a national survey report, the following issues were also identified as challenges in caring for children with foreign nationality: "It is difficult to communicate the detailed nuances of concerns to parents" and "It is difficult to understand the specific problems and needs of children with foreign roots and their parents" (MHLW, 2019a). This suggests that it is not a problem that can be solved simply by being able to communicate in a language, but that the inability to communicate due to differences in native languages leads to a decline in the personal sense of accomplishment of nursery school teachers. In the future, utilizing foreign nursery school teachers who understand multicultural childcare, accumulating practical experience in the childcare field, and training nursery school teachers in multicultural understanding and communication will be essential.

According to Fukushima and Shimizu (2017), who examined knowledge about developmental disabilities and the factors that influence burnout among nursery school teachers, it was noted that the level of knowledge about developmental disabilities depends on whether nursery school teachers are aware of it or not. In this study, the importance of the balance between personal knowledge and social support is highlighted as stress is higher when nursery school teachers' knowledge of inclusive education is high but social support from colleagues in the workplace is low(Fukushima and Shimizu, 2017). The importance of balancing personal knowledge and social support is affirmed. In addition, Friedman-Krauss et al. (2014) asserted that teachers who reported higher levels of child behavior problems also reported higher levels of stress from their work and that this relationship was statistically significant. This relationship is statistically significant (Friedman-Krauss et al, 2014). Therefore, future research should focus on nursery school teachers who feel strongly about SSIE and additionally investigate the reasons for this and their working environment.

4.2 Related models of SSIE, J-MBI, J-WHO-5, and J-RAS

The relationship between SSIE, which is a stressor in caring for children with special needs, J-MBI and J-WHO-5, which are stress responses, and J-RAS, which is a personal factor, was analyzed by covariance structure analysis. Additionally, the relationship between SSIE, a stressor in caring for children with special needs, the stress responses, J-MBI and J-WHO-5, and the personal factor, J-RAS, was analyzed by covariance structure analysis. The results confirmed that although SSIE directly affected burnout, there was no direct path between SSIE and J-WHO-5. In addition, a direct path was found from J-RAS to the stressors insufficient self-expertise and mental health. This suggests that an increase in the assertiveness total score may reduce the stressor, increase mental health, and reduce burnout tendencies. This result supported a study by Jovanović et al. (2019), which examined the special needs of teachers working with children with developmental disabilities, and the assertiveness level is a stressor and stress response to burnout and mental health. It was found to be one of the personal factors that influence (Jovanović et al, 2019).

4.3 Mental health and assertiveness of nursery school teachers

It is worth noting that 181(60.33%) of the nursery school teachers were considered to have poor mental health, with an overall mean of 12.82 (SD = 5.28) in J-WHO-5. In Japan, there is a serious problem of early turnover and shortage of nursery school teachers (Kiso, 2018). Stress and burnout among nursery school teachers are problems in many countries (Grant et al., 2019; Lim and Kim, 2014), and efforts to reduce the burden on nursery school teachers and create a comfortable work environment are required. In addition, according to a study conducted by the OECD in 2020, nursery school teachers are more likely to feel stressed when the percentage of children with special needs exceeds 11% of the class (OECD, 2020). The results of the present study corroborated that employment condition part-time employees are more likely to suffer from emotional exhaustion on the burnout scale compared with full-time employees. These hard aspects, such as the number of children, working conditions, and environment, cannot be improved by individual nursery school teachers. Efforts to improve mental health should not be left to the efforts of individual nursery school teachers but should include a preschool-wide support system, training initiatives, working conditions, and class sizes.

I would also like to discuss the assertiveness scores of nursery school teachers. The mean assertiveness score of the nursery school teachers was −3.49 (SD: 0.97). The higher the J-RAS score, the higher was the value of mental health. Conversely, a study of nurses indicated that a J-RAS

score of −10 to +10 was unlikely to lead to burnout, and that too high a score can also lead to burnout (Suzuki et al., 2006). Suzuki et al. (2007), who investigated the relationship between assertiveness and burnout among new nurses, argued that a J-RAS score of 10 to +10 was less likely to lead to burnout (Suzuki et al., 2007). Nevertheless, it has been highlighted that nurses have very low assertiveness scores because they are required to act as a mediator between doctors and patients and because they are in a profession where medical accidents directly affect human lives (Suzuki et al., 2017). Accordingly, comparing the assertiveness scores of nurses and nursery school teachers is difficult. As there have been very few studies on assertiveness in nursery school teachers (Shiratori et al., 2021), a comparative study on mental health and burnout is an area for future investigation.

4.4 Limitations of this study and future issues

It is good to note that by using an online questionnaire, we were able to obtain responses from all 47 prefectures, covering all nursery school teachers. However, a certain amount of bias must be considered as the target audience was users registered as monitors with the research company. Since it has been pointed out that it is very difficult to accurately grasp the concerns in promoting inclusive childcare (Park et al., 2018), cross-sectional surveys have their limitations. It is important to conduct additional research, such as interviews, on the relationship between stress among nursery school teachers and caring for children with special needs and stress among nursery school teachers.

Let us talk about future issues. Assertiveness is strongly associated with self-trust, self-disclosure, etc., and is deeply related to stress in interpersonal relationships (Hiraki, 1993). According to Park et al. (2018), early childhood teachers' concerns about inclusive education are mediated by teachers' background variable "confidence," and training to improve confidence is of paramount importance(Park et al., 2018). This is the most important factor. The acquisition of assertive communication is expected to lead to self-belief and self-confidence, which, in turn, will improve the mental health of nursery school teachers. Assertion training for nursery school teachers in the future must be developed as there have been no research reports on assertion training for nursery school teachers in Japan.

Statements and declarations

Competing interests

The authors have no relevant financial or nonfinancial interests to disclose.

Funding

Funding was provided by the Mitsubishi Foundation.

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[Paper]

Relationship between Contingencies of Self-Worth, Contentment of Sources of Self-Worth, and Subjective Well-Being of Japanese People with Autism Spectrum Disorder

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Abstract

The study examined the relationship between contingencies of self-worth, contentment of sources of self-worth, and subjective well-being of Japanese adults with autism spectrum disorder (ASD), through a comparison with adults in the same age group. For this purpose, a questionnaire survey was administered to a sample of 19 adults with ASD and 50 adults in the same age group (the control group). The results showed that "friendships" and "enthusiastic activity" of the participants with ASD were higher than those of the control group in terms of contingencies of self-worth and contentment of sources of self-worth. In addition, no significant correlations were found for the sub-factors of contingencies of self-worth and subjective well-being among the adults with ASD. The higher contentment of sources of self-worth, "athletic competence," and "friendships," the higher subjective well-being of the adults with ASD. The implication of the findings is that enhancing "athletic competence" and "friendships" in contentment of sources of self-worth may be effective for improving subjective well-being of adults with ASD.

Keywords: Autism spectrum disorder, Contingencies of self-worth, Contentment of sources of self-worth, Self-esteem, Subjective well-being

1. Introduction

Self-esteem has been defined as the positivity of overall evaluative feelings toward oneself (Endo, 2013). The perspectives from which self-esteem can be analyzed include contingencies of self-worth (CSW) and contentment of sources of self-worth (CSSW). The former refers to the concept of what domains take self-esteem and the estimates of one's own worth (Crocker et al., 2002; Crocker et al., 2003; Uchida, 2008). As for the latter, [*1] it has been defined as an indicator of how satisfied the sources of self-esteem are (Ito et al., 2013).

Previous research has shown that CSW are related to motivation (Ohtani, 2012). Since people are more likely to be motivated toward objects with high CSW, they will actively engage in them, resulting in a higher CSSW. For example, those for whom athletic competence is a source of self-esteem (i.e., CSW in athletic competence are high) will actively engage in exercise. They will tend to be more athletic (i.e., CSSW in athletic competence is high), and self-esteem is likely to increase. However, those for whom athletic competence is not a source of self-esteem (i.e., CSW in athletic

competence are low) will not actively engage in exercise. They will not tend to be more athletic, and self-esteem is not likely to increase. In this regard, self-esteem can be clarified by not only considering it in terms of high and low self-esteem, but also by focusing on CSW and CSSW.

As for the relationship between self-esteem and various constructs, one construct with a particularly strong relationship is subjective well-being. Previous research has defined subjective well-being as "a broad category of phenomena that includes people's emotional responses, domain satisfactions, and global judgments of life satisfaction" (Diener et al., 1999). Subjective well-being can also be divided into two domains: cognitive and affective (Diener et al., 1999). The cognitive aspect refers to the degree of satisfaction with one's life (Ito et al., 2003) and is the core concept of subjective well-being (Gilman and Huebner, 2006). On the other hand, the affective aspect consists of both positive and negative emotions such as enjoyment and sadness (Ito et al., 2003).

Baumeister et al. (2003) found a strong relationship between subjective well-being and self-esteem, with higher self-esteem leading to higher subjective well-being. Ito and Kodama (2005) considered that a dispositional cognitive style that views aspects in a positive light can result in a positive perception of both the present self and life.

Autism spectrum disorder (ASD) is a disorder related to social communication. Due to its negative psychological aspects, a number of people with ASD have been diagnosed with depressive symptoms or mental disorders in adolescence and adulthood (Kikuchi, 2010). Recent research has begun to examine the positive psychological aspects of subjective well-being among people with ASD, rather than the negative ones. For instance, Scheeren et al. (2022) conducted a longitudinal study of subjective well-being of 917 individuals with ASD over a six-year period. They found that the higher the objective psychosocial functioning is, such as employment, independent living, and friendship ratings, the higher subjective well-being is.

Studies of subjective well-being have also begun to be conducted on Japanese individuals with ASD. For example, Kojima (2018) compared the high and low subjective well-being of 27 students/working adults with ASD and 60 people in the same age group, and found little difference. They also found that the higher self-esteem of those with ASD, the higher their subjective well-being. This indicates the effectiveness of self-esteem support for enhancing subjective well-being of individuals with ASD.

Although self-esteem of adults with ASD has been reported to be lower or similar than that of typically developing adults, the findings have been inconsistent (e.g., Maras and Bowler, 2012; Nguyen et al., 2020). The reason may be due to individual differences among people with ASD (Kojima and Noutomi, 2013). Given the possibility that self-esteem of adults with ASD is lower or similar to that of typically developing adults, and the possibility of individual differences, it is likely that there are a number of adults with ASD who need self-esteem support. However, it is unclear how to provide such support. Previous research (Kojima, 2018) on self-esteem and subjective well-being of individuals with ASD has only examined the relationship between these two aspects, leaving this issue open to discussion. Thus, it is important to clarify CSW and CSSW, which are two perspectives from which self-esteem can be analyzed in more detail.

In previous studies on CSW, they used developmentally appropriate scales. For example, studies conducted on adolescents (Ohtani and Nakaya, 2010) used the CSW Scale for adolescents, while those for adults (Crocker et al., 2003; Uchida, 2008) used the CSW Scale for adults. In the present study, we only target adults with ASD who may have lower or similar self-esteem than typically developing adults.

By examining the relationship between CSW, CSSW, and subjective well-being, we can clarify

the relationship between self-esteem and subjective well-being among adults with ASD. We hope to gain insight into how to help such adults lead more fulfilling lives through self-esteem support. Therefore, this study examined the relationship between CSW, CSSW, and subjective well-being of Japanese adults with ASD, through a comparison with adults in the same age group.

2. Method

2.1 Subjects

In order to recruit a sample of adults with ASD, requests were made to 13 parent associations of children and persons with developmental disabilities in Japan, after which cooperation was obtained from eight such associations. For each association, we asked the person in charge to send a letter containing the URL and QR code of the questionnaire to their members via e-mail. While answering the questionnaire, we basically asked the respondents to assume what they would answer in person. Overall, we received 30 responses. After excluding the data with missing values, the number of respondents with ASD (without intellectual disabilities) was 19 (18 males; 1 female). Among them, 5 had coexisting ADHD and 2 had coexisting ADHD and LD. Their ages ranged from 20 to 57 years, with a mean age of 27.2 years (SD = 8.2).

For the control group, which consisted of a sample of adults in the same age range, an online survey was conducted by Cross Marketing Inc. The ages of the 50 adults (45 males; 5 females) ranged from 19 to 57 years, with a mean age of 25.5 years (SD = 6.2). A t-test was also performed on the ages of the adults with ASD and the control group, after which no significant differences were found (t (67) = 0.95, p > .05). Thus, the ages of the adults with ASD and those of the adults in the control group were similar.

2.2 Survey period

This research was conducted from June 2022 to September 2022.

2.3 Questionnaire

2.3.1 Information sheet

For the adults with ASD, they were asked to state their gender, age, occupation, and diagnosis. For the control group, they were asked to provide their gender, age, and occupation.

2.3.2 CSW and CSSW

In this study, the self-developed CSW Scale and CSSW Scale for adults were used. Both scales, which have shown reliability and validity, consist of five factors: athletic competence, enthusiastic activity, friendships, prosocial behavior, and appearance. Both scales were also created in correspondence with one another. For example, the item "I am satisfied with myself when I can treat people with compassion" on the CSW Scale corresponds to "I think I treat people with compassion" on the CSSW Scale (Table 1). The responses to the CSW Scale were based on a six-point scale ranging from 1 (not applicable at all) to 6 (very applicable), while the answers to the CSSW Scale were based on a five-point scale ranging from 1 (not applicable at all) to 5 (very applicable). Before developing the scales for adults with ASD, one representative of the association of parents of children and persons with developmental disabilities was asked to evaluate the contents, after which the questionnaire items were modified based on the opinions.

2.3.3 Subjective well-being

This study also used the Subjective Well-Being Scale (Ito et al., 2003), based on the World Health

Table 1 The Contingencies of Self-Worth Scale and the Contentment of Sources of Self-Worth Scale

The Contingencies of Self-Worth Scale	The Contentment of Sources of Self-Worth Scale
Athletic competence	Athletic competence
8 Have good motor skills is important to me	8 I think I have good motor skills
11 I get depressed when I don't achieve good results in sports	11 I think I achieve good results in sports
14 Being good at sports makes me confident	14 I think I am good at sports
Enthusiastic activity	Enthusiastic activity
4 It is important for me to work on things that interest me	4 I think I am working on something I am interested in
7 I am satisfied with myself because I have something to devote myself to	7 I think I have something to devote myself to
15 I feel confident when I am enthusiastic about something I like	15 I think I am enthusiastic about what I like
Friendships	Friendships
2 If I don't have friends I can talk to about anything, I don't feel confident about myself	2 I have friends with whom I can talk about anything
5 I don't mind if I don't have good friends*	5 I don't think I have any good friends*
13 It is important for me to have friends whom I can trust	13 I think I have friends I can trust
Prosocial behavior	Prosocial behavior
1 I feel confident when I can be kind to others	1 I think I am kind to people
3 I am satisfied with myself when I can treat people with compassion	3 I think I treat people with compassion
10 Doing things for others is important to me	10 I think I do things for others
Appearance	Appearance
6 Good looks is important to me	6 I think I have good looks
9 I lose self-confidence if I feel I have a bad body figure (style)	9 I think have a good figure (style)
12 I am satisfied with myself if I think I have a cool (beautiful) face	12 I think I have a cool (or beautiful) face

Note. *Item was reversed scoring.

Organization's Subjective Well-Being Inventory (Sell and Nagpal, 1992). The adult version of this scale consisted of one factor and 12 items, with demonstrated reliability and validity (Ito et al., 2003). The answers were based on a four-point scale, with higher scores indicating a higher subjective well-being.

2.4 Ethical considerations

For the adults with ASD, this study was conducted with the consent of the representative of the parent association and that of the individual. For the control group, we obtained the consent of each participant. When conducting the survey, the author explained (in writing) that the survey would be conducted based on the free will of the survey respondents, that there would be no disadvantage if they did not respond, and that privacy protection would be ensured. In addition, the research was

Table 2 Contingencies of self-worth, contentment of sources of self-worth, and subjective well-being of adults with ASD and control group

	Adults with ASD	Control group	*p*	*r*
	Median (interquartile range)	Median (interquartile range)		
Contingencies of self-worth				
Athletic competence	3.33 (1.33)	3.67 (1.42)	0.74	0.04
Enthusiastic activity	5.00 (1.67)	4.00 (1.75)	0.02*	0.29
Friendships	4.33 (1.67)	3.67 (0.75)	0.02*	0.29
Prosocial behavior	4.67 (1.67)	4.00 (2.00)	0.44	0.09
Appearance	3.67 (1.33)	4.00 (1.08)	0.78	0.03
Contentment of sources of self-worth				
Athletic competence	2.33 (1.00)	2.33 (1.67)	0.25	0.14
Enthusiastic activity	4.00 (1.00)	3.33 (1.08)	0.01**	0.32
Friendships	3.67 (1.67)	3.00 (1.42)	0.05†	0.24
Prosocial behavior	3.33 (1.67)	3.33 (1.42)	0.82	0.03
Appearance	2.33 (1.67)	2.50 (1.33)	0.19	0.16
Subjective well-being	2.42 (0.83)	2.67 (0.75)	0.53	0.08

**$p < .01$, *$p < .05$, † $p < .10$.

Table 3 Spearman's rank correlation coefficients for the sub-factors of contingencies of self-worth and subjective well-being

		Contingencies of self-worth				
		Athletic competence	Enthusiastic activity	Friendships	Prosocial behavior	Appearance
Adults with ASD	Subjective well-being	−.35	−.03	.08	.14	−.17
Control group		.05	.48**	.01	.33*	.06

**$p < .01$, *$p < .05$.

conducted with the consent of the research ethics committee of the graduate school to which the author belongs (2022-71A; June 9, 2022).

2.5 Analysis

SPSS (version 28) and Excel programs were used to analyze the statistics.

3. Results

3.1 Basic statistics for each scale and the results of the Mann-Whitney U test

The Mann-Whitney U test was conducted on the scores of each scale for the adults with ASD and the control group (Table 2). According to the results, the scores for "enthusiastic activity" ($p < .05$) and "friendships" ($p < .05$) in CSW were significantly higher for the adults with ASD than for the control group. CSSW was also significantly higher for the adults with ASD than the control group in "enthusiastic activity" ($p < .01$). In addition, there was a significant trend in the score for "friendships" ($p < .10$) in CSSW and no significant difference in subjective well-being.

Table 4 Spearman's rank correlation coefficients for the sub-factors of contentment of sources of self-worth and subjective well-being

		Contentment of sources of self-worth				
		Athletic competence	Enthusiastic activity	Friendships	Prosocial behavior	Appearance
Adults with ASD	Subjective well-being	.46*	.24	.49*	.34	.36
Control group		.16	.48**	.36*	.40**	.17

**$p < .01$, *$p < .05$.

Table 5 Spearman's rank correlation coefficients for the sub-factors of contingencies of self-worth and contentment of sources of self-worth

	Athletic competence	Enthusiastic activity	Friendships	Prosocial behavior	Appearance
Adults with ASD	−.05	.70**	.49*	.37	−.07
Control group	.74**	.57**	.52**	.73**	.25

**$p < .01$, *$p < .05$.

3.2 Relationship between CSW, CSSW, and subjective well-being

Spearman's rank correlation coefficients were calculated for the sub-factors of CSW and subjective well-being for the adults with ASD and the control group (Table 3). No significant correlations were found for the sub-factors of CSW among the adults with ASD. However, significant correlations were found for "enthusiastic activity" ($r = .48$, $p < .01$) and "prosocial behavior" ($r = .33$, $p < .05$) in the control group.

Spearman's rank correlation coefficients were also calculated for the sub-factors of CSSW and subjective well-being for the adults with ASD and the control group (Table 4). Significant correlations were found for "athletic competence" ($r = .46$, $p < .05$) and "friendships" ($r = .49$, $p < .05$) in CSSW among the adults with ASD. Meanwhile, significant correlations were found for "enthusiastic activity" ($r = .48$, $p < .01$), "friendships" ($r = .36$, $p < .05$), and "prosocial behavior" ($r = .40$, $p < .01$) in CSSW for the control group.

Finally, Spearman's rank correlation coefficients were calculated between the corresponding sub-factors of CSW and CSSW (Table 5). According to the results, there were significant correlations for "enthusiastic activity" ($r = .70$, $p < .01$) and "friendships" ($r = .49$, $p < .05$) among the adults with ASD. Significant correlations were found in "athletic competence" ($r = .74$, $p < .01$), "enthusiastic activity" ($r = .57$, $p < .01$), "friendships" ($r = .52$, $p < .01$), and "prosocial behavior" ($r = .73$, $p < .01$) in the control group.

3.3 Distribution of the scores for CSW, CSSW, and subjective well-being

Figure 1 presents scatter plots for the sub-factors of CSW and subjective well-being for the adults with ASD and the control group. Specifically, the scores for "enthusiastic activity" in CSW ranged from 3 to 6 for the adults with ASD, whereas those for the control group ranged from 1 to 6.

The scatter plots of the sub-factors of CSSW and subjective well-being for the adults with ASD and the control group are shown in Figure 2. For "athletic competence" in CSSW, the scores ranged from 1 to 3 for the adults with ASD, whereas the scores ranged from 1 to 5 for the control group.

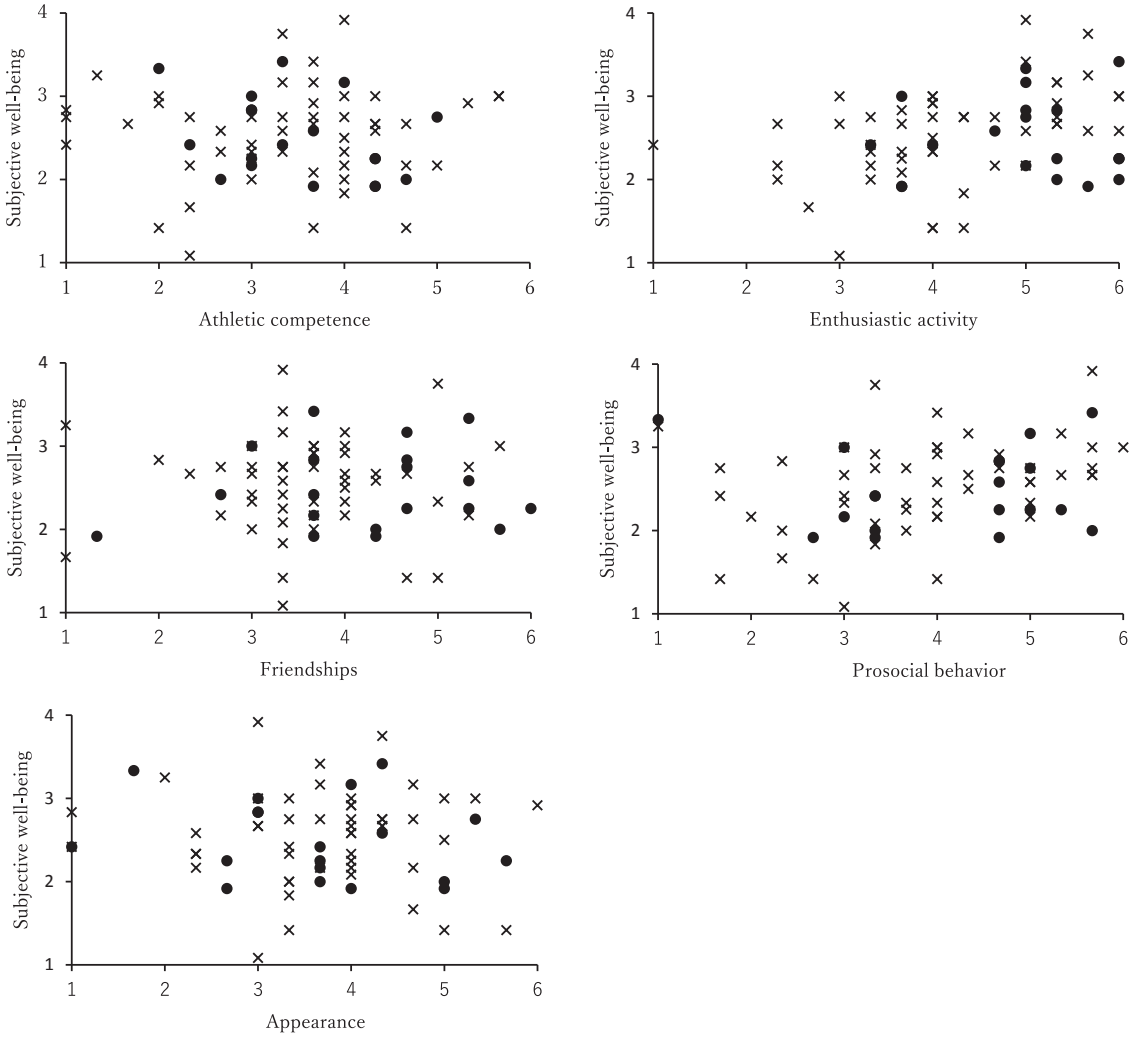

Figure 1 Scatter plots for the sub-factors of contingencies of self-worth and subjective well-being
●Adults with ASD ×Control group

4. Discussion

In order to clarify the relationship between CSW, CSSW, and subjective well-being of the adults with ASD, we first examined the relationship between CSW and CSSW (Table 5). Next, we focused on the relationship between subjective well-being and CSSW, by comparing the adults with ASD and the control group. Moreover, we examined the relationship between subjective well-being and CSSW in more detail by focusing on CSW.

4.1 Relationship between CSW and CSSW

Upon examining the correlations between the factors in the CSW Scale and the CSSW Scale, there were significant correlations between "enthusiastic activity" and "friendships" in the adults with ASD. However, no significant correlations were found for "athletic competence," "prosocial behavior," and "appearance" among them. In the control group, except for "appearance," there were

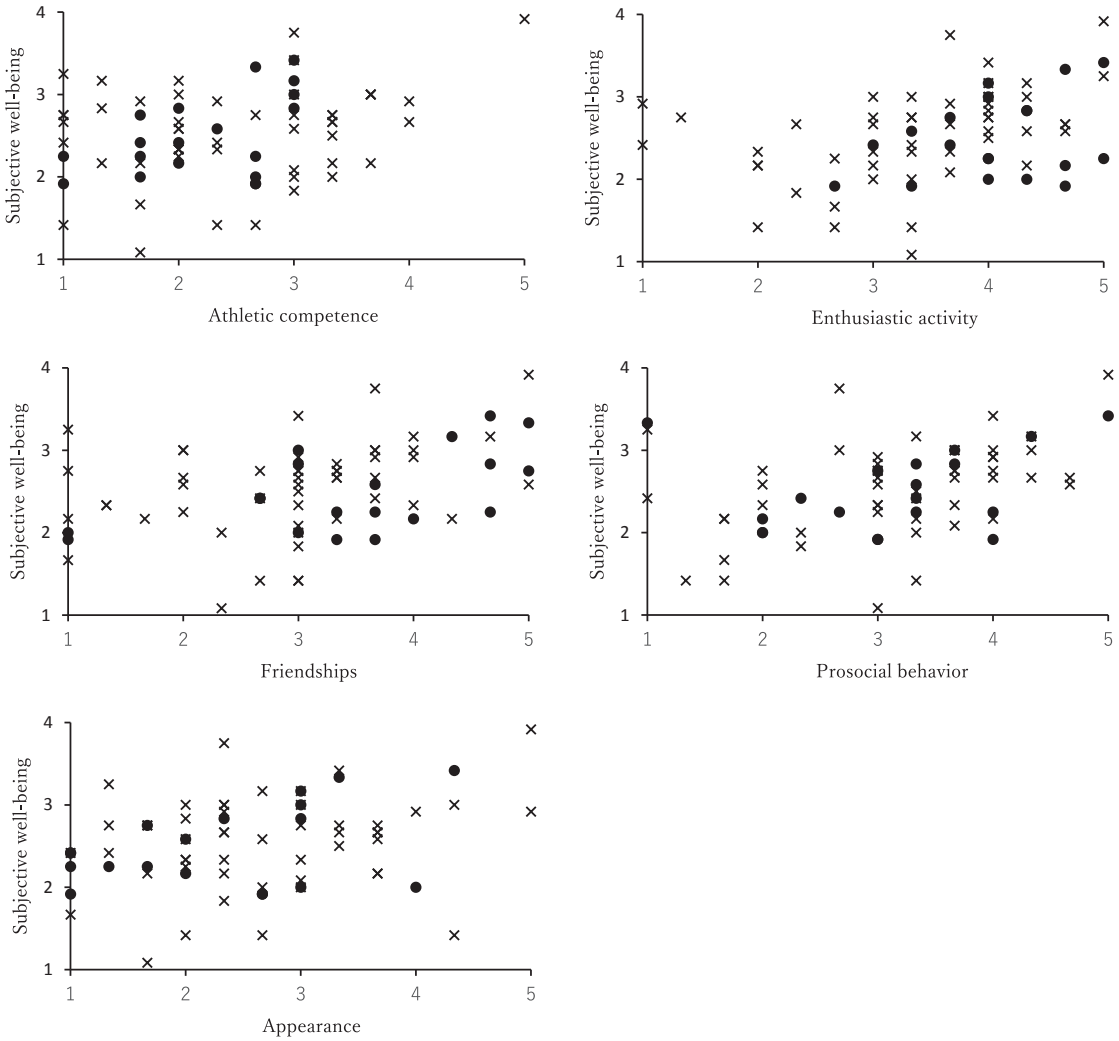

Figure 2 Scatter Plots for the sub-factors of contentment of sources of self-worth and subjective well-being
●Adults with ASD ×Control group

significant correlations between CSW and CSSW for "athletic competence," "enthusiastic activity," "friendships," and "prosocial behavior."

Given that CSW are related to motivation (Ohtani, 2012), it is thought that people are motivated toward objects with high CSW. Thus, CSSW toward objects with high CSW may be higher. In this regard, Ito et al. (2013) found that the correlation coefficients of the sub-factors of CSW and CSSW ranged from .20 to .57, showing a weak to moderately significant correlation. In the present study, moderately significant correlations were found between CSW and CSSW for "enthusiastic activity" and "friendships" among adults with ASD, which is similar to the findings of previous research (Ito et al., 2013).

Conversely, the reason why almost no correlation was found for "athletic competence" and "appearance" in the sub-factors of CSW and CSSW among the adults with ASD may be due to the difficulty of increasing CSSW for "athletic competence" and "appearance." Even if some people with ASD have high "athletic competence" in CSW, and although they engage in physical activity, it may

not necessarily increase "athletic competence." In particular, adults with ASD have been noted to have physical clumsiness. For example, in their meta-analysis, Kimberly et al. (2010) noted that impaired coordinated movement is a characteristic of ASD. The difficulty of individuals with ASD in exercising may be one of the reasons for no correlation between the corresponding factor "athletic competence" of CSW and CSSW. Similarly, it may be that even if adults with ASD attempt to improve their appearance when CSW is high, it does not necessarily lead to an increase in their "appearance." This may be the reason why no correlation was found in "appearance" between the sub-factors of CSW and CSSW.

4.2 The relationship between CSW, CSSW, and subjective well-being: A comparison of high and low

4.2.1 Athletic competence

The results of the correlation analysis showed that there is almost no relationship between "athletic competence" in CSW and subjective well-being among the adults with ASD. However, the higher the "athletic competence" in CSSW is, the higher subjective well-being is. In the control group, there was almost no relationship between CSW and CSSW in "athletic competence" and subjective well-being. In terms of "athletic competence" in the CSSW Scale, the better the adults with ASD were at sports/athletics, the higher their subjective well-being.

Benson et al. (2019) compared the time spent on physical activities among 15 adults with ASD, whose mean age was 22.8 years. Based on their findings, the adults with ASD spent less time on medium- and high-intensity physical activities. These results suggest that adults with ASD tend to spend less than half as much time on medium- and high-intensity physical activities, compared to typically developing adults, and that such exercise may enhance their subjective well-being. Hamm and Yun (2018) also investigated the relationship between physical activities and self-determination theory among 143 adults with ASD, whose mean age was 25 years. As for self-determination theory, humans have three basic psychological needs: 1) the need for competence; 2) the need for autonomy; and 3) the need for relatedness (Ito, 2021). The results revealed that the higher the satisfaction of three basic psychological needs in humans, the higher motivation for physical activity in adults with ASD was (Hamm and Yun, 2018). Hence, when considering support for adults with ASD, it is important to make decisions according to these three aspects.

Furthermore, as individuals with ASD have been reported to have difficulties with exercise (Watahiki et al, 2020), some may not necessarily be motivated to exercise. Therefore, while providing support to individuals with ASD in exercise, it may be necessary to consider their motivation for exercise and ensure that they are not compelled to exercise against their will.

4.2.2 Enthusiastic activity

Based on the results of the Mann-Whitney U test, the adults with ASD had higher "enthusiastic activity" in terms of CSW and CSSW, compared to the control group. In terms of this sub-factor in the CSW Scale, adults with ASD stated that it was important for them to be enthusiastic about their interests and felt confident when they engaged in something they liked. Such beliefs were higher than those of the control group.

The results of the correlation analysis also showed that there was a minimal relationship between "enthusiastic activity" and subjective well-being in CSW among the adults with ASD. On the other hand, in the control group, the higher "enthusiastic activity" of CSW was, the higher subjective well-being was. Moreover, the higher "enthusiastic activity" of CSSW was, the higher subjective well-being was.

Kojima (2020) interviewed a sample of individuals with ASD, whose mean age was 19.8 years, and asked about the source of their subjective well-being. According to the findings, hobbies were the source. In a related study, Grove et al. (2018) also investigated the actual situation of special interests, and the relationship between special interests and a range of quality of life measures among 687 adults with ASD, whose mean age was 42.4 years. Note that Grove et al. (2018) define special interests in the following way: "people on the autism spectrum often have extraordinary intense or specific interests, this is what we refer to as a special interest in a topic." Their results showed that computers and music were relatively common interests for adults with ASD. Furthermore, adults with ASD with specific interests had higher life satisfaction of leisure activities than those without such interests. However, although the effect sizes were not large, it was found that the more time spent in specific interests, the lower subjective well-being.

Furthermore, Grove et al. (2018) investigated the relationship between special interest motivation and subjective well-being of individuals with ASD with an average age of 42.4 years. Results revealed that there was motivation for special interest that led to the subjective well-being of individuals with ASD as well as motivation for special interest that did not lead to the subjective well-being. The higher the two factors of "personal life values and goals" and "engagement and flow," the higher the subjective well-being of participants with ASD tended to be.

The "personal life values and goals" factor included statements such as "I chose this special interest because it allows me to reach my life goals" and "because it is a good way to learn lots of things that could be useful in other areas of my life" (Grove et al., 2016). The "engagement and flow" factor was "for the sense of sheer enjoyment I experience doing my special interest," "because I like the feeling of being totally immersed in my special interest," etc. (Grove et al., 2016).

In light of the above, one possible background factor for the lack of a significant relationship between subjective well-being and "enthusiastic activity" in CSSW for individuals with ASD may be the presence of motivation to engage in things that are interesting to them. It is possible that "personal life values and goals" and "engagement and flow" were not very high in motivating individuals with ASD, who are targeted in this study to engage in activities that they are interested in. When providing support for the "enthusiastic activity" in CSSW for individuals with ASD, it may be effective to provide support based on the motivations of the particular interests of individuals with ASD.

4.2.3 Friendships

Based on the results of the Mann-Whitney U test, "friendships" were higher among the adults with ASD, compared to the control group. Based on "friendships" in the CSW Scale, the adults with ASD believed that having a trusted friend is important and that they felt more confident in themselves by having a friend they could talk to about anything, compared to the control group. In addition, adults with ASD felt that they had trusted friends, compared to the control group.

In related research, Baron-Cohen and Simon (2003) conducted a direct-response questionnaire survey of the friendships among 68 people with ASD (without intellectual disabilities) and typically developing people, with a mean age of 34.3 years. Their results showed that the friendships of adults with ASD were negative than those of typically developing people. The results showed that the friendships of people with ASD were significantly lower than the control group, which is at variance with the results of the present study. Although the present study did not identify a clear reason for this discrepancy, one possible reason is the individual differences in the friendships among the adults with ASD. Their study also indicated that the higher the autism spectrum index, the worse the friendships (Baron-Cohen and Simon, 2003), which is, again, possibly due to the individual differences

in such friendships.

The results of the correlation analysis indicated that there is a minimal relationship between "friendships" in CSW and subjective well-being among adults with ASD. However, the greater "friendships" in CSSW are, the higher subjective well-being is. Kojima (2020) interviewed a sample of people with ASD, whose mean age was 19.8 years, and asked about the source of their subjective well-being. Based on the findings, a number of adults with ASD indicated that the source of their subjective well-being was friends. Specifically, responses such as "I feel happy when I am talking to my friends" were found, supporting the results of this study.

Conversely, some adults with ASD reported a minimal relationship between friends and subjective well-being. In this regard, Mazurek (2014) investigated the relationship between the number and quality of friends and subjective well-being among adults with ASD aged 18 to 62 years (mean age: 32.4 years), and found that there was a minimal relationship between the number and quality of friends and subjective well-being.

Possible reasons for this contradictory result can be discussed in terms of the age in life and the influence of the scale. First, regarding the age in life, the ages of the 19 adults with ASD in this study ranged from 20 to 57 years, with a mean age of 27.2 years (SD = 8.2). In Mazurek's (2014) study, the adults with ASD ranged in age from 18 to 62 years, with a mean age of 32.4 years (SD = 12.5). Since this was not significantly different from our study's sample, age was not a factor.

As for the influence of the scale used in Mazurek's (2014) study, i.e., the Unidimensional Relationship Closeness Scale (Dibble et al., 2011), it measures the degree of intimacy between the self and a specific attribute such as "friends" or "families." In this regard, Mazurek (2014) placed "friends" for the question item in the scale (Dibble et al., 2011) to measure the quality of friends and the degree of intimacy between friends and the self. There are several questions about how they perceive friends in various situations in the Unidimensional Relationship Closeness Scale. Conversely, the "friendships" questions in this study were relatively simple and did not specifically ask how one perceives friends in various situations/settings. Thus, it is possible that the difference in the content of the question items regarding friends was one of the reasons for the inconsistent result.

The PEERS® (Program for Education and Enrichment of Relational Skills) is a program that can be used as a reference for individuals with ASD in enhancing "friendships" in CSSW. PEERS®, developed at the University of California in Los Angeles, is a program for making friends tailored to the characteristics of ASD (Tanaka & Yamada, 2020). The PEERS® has already been implemented in more than 125 countries (Itani et al., 2022), and there have been significant improvements in communication (Yamada et al., 2020) and increased self-esteem (Schiltz et al., 2018). In other words, PEERS® may be effective in increasing self-esteem by enhancing the "friendships" of individuals with ASD in CSSW, and consequently, in increasing their subjective well-being.

4.2.4 Prosocial behavior

According to the results of the correlation analysis, there was no significant difference between "prosocial behavior" and subjective well-being in CSW among the adults with ASD, nor was there a significant difference between "prosocial behavior" and subjective well-being in CSSW. Feng and Zhang (2021) examined 1,106 adults aged 30 to 60 years, with a mean age of 37.06 years. They found that "prosocial behavior" had a positive effect on subjective well-being, supporting the results of the control group in the present study. Hence, it can be concluded that the higher "prosocial behavior," the higher subjective well-being of the control group.

Regarding the correlation coefficient between "prosocial behavior" and subjective well-being in terms of effect size, the coefficient of CSSW was .40 for the control group, while the coefficient was

.34 for the adults with ASD. Therefore, there was no major difference in effect size, and that the relationship between "prosocial behavior" in CSSW and subjective well-being of both the adults with ASD and the control group were generally comparable.

4.2.5 Appearance

The results of the correlational analysis showed that there was a minimal relationship between "appearance" in CSW and CSSW and subjective well-being, for adults with ASD. These aspects were similar to those of the control group. Diener et al. (1995) examined the relationship between subjective physical attractiveness and subjective well-being among 221 college students and found a significant weak correlation of .29. In the present study, the correlation coefficient between "appearance" and subjective well-being in CSSW for the adults with ASD was not significant, but remained weak at .36. This suggests that this relationship was generally comparable to that of the control group.

5. Limitation and future research recommendations

One limitation of this study is that the adults with ASD were those whose parents/guardians belonged to parent associations for children and youth with developmental disabilities. It is assumed that such parents are more motivated to obtain information on childrearing. Therefore, it is possible that many of the adults with ASD were more likely to receive the necessary social support, thus having fewer challenges in everyday life.

Note

[*1] Although Ito et al. (2011). used the term "contentment of sources of self-esteem," we used the term "contentment of sources of self-worth" to correspond with the term "contingencies of self-worth," which is commonly used as an academic term in Japan and abroad. Additionally, the term "self-worth" is used synonymously with the definition of "self-esteem" (Endo, 2013).

Acknowledgments

I would like to express my deepest gratitude to people for their cooperation in this survey.

Funding

This study was supported by the Grant-in-Aid for the Japan Society for the Promotion of Science Fellows (JP22J10309).

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[Paper]

The "Sense of Difficulty" Related to Developmental Disorders in Japanese High School Students: A Case Study of a *Yogo* Teacher's Experience

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Abstract

This study examines the relationship between the severity of developmental disorder-related difficulties (sense of difficulty: SOD) of students who use the health room, the seriousness of their problems, and their need for assistance. Five hundred *Yogo* teachers working at high schools in the Tokyo metropolitan area are surveyed. They are asked to name one student with high support needs and one with low support needs among the students they teach and to rate these students on a checklist of developmental disorder-related difficulties. Factor and cluster analyses are conducted to examine the relationship between the clusters obtained and the level of the students' support needs. The means and standard deviations of each item on the checklist are calculated for each cluster, and each support needs level. The analysis results suggest that many students who use the health room had difficulties related to developmental disorders and that the greater the difficulties, the more likely they are to develop serious problems. We found that the greater the sense of difficulty for both ASD and ADHD disorders, the greater the risk factor for more serious problems. We suggest it is necessary to respond to students who visit the health room with mental health problems from the perspective of "developmental disorder SOD," regardless of whether they have a diagnosis.

Keywords: Sense of difficulty, developmental disorders, Japanese high schools, *Yogo* teacher, School adaptation

1. Introduction

According to the Basic School Survey for FY2020 (MEXT, 2021), Japan's high school enrollment rate is over 98.8%. Non-attendance and school maladjustment among high school students remain serious problems. It has been reported that "apathy/anxiety" was the most common reason for non-attendance, at 36.8%, followed by "disruption of daily rhythm, play, and delinquency" (12.4%), "problems surrounding friendships except bullying" (10.5%), and "maladjustment upon entering or

transferring to school or promotion" (10.5%) (MEXT, 2022). Although the number of high school dropouts has decreased over the past ten years, it has remained at the high level of 39,000 (about 1.2% of the total), which is still not ideal. Psychological factors, such as stress and emotional control, are believed to aggravate these problems (Okada, 2002). Therefore, capturing and examining the psychological aspects of students will help in responding to these problems. It has been pointed out that people with developmental disorders often face various stresses due to their characteristics and are prone to maladjustment to the environment because they do not have appropriate methods of accepting and coping with stress (Hayashi et al., 2015). Yamashita (2015) also stated the necessity of examining the possibility that developmental disorders, such as autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD), exist behind mental health problems in children. Furthermore, high school is a time when students experience major changes, both mentally and physically. It has been pointed out that students with developmental disorders, especially during this period, may become emotionally unstable with low self-esteem, which may develop into secondary disorders such as truancy, school maladjustment, and problematic behaviors (MEXT, 2010). However, a survey conducted in high schools in the Tokyo metropolitan area reported that 24.6% of the students had mild developmental disorders, and the number of students requiring special support education has been increasing annually (Tobe et al., 2013). Furthermore, the results of a recent large-scale epidemiological study (Kamio et al., 2012) on a population of elementary and junior high school students in Japan revealed that many children do not have a diagnosis of ASD but have many autistic behavioral characteristics at the subthreshold level. Moriwaki and Kamio (2013) reported significant emotional and conduct problems in approximately 10% to 20% of children with many subthreshold autistic behavioral characteristics. Considering this situation, there is an even greater need for an attitude of support that captures the "Komarikan (sense of difficulty; SOD)" that students with developmental disorders tend to have, regardless of whether they have a diagnosis. Sato (2007) describes "Komarikan" as "the feeling that a person has when they have a bad or painful experience but is unable to solve it on their own and does not know what to do. This is the feeling that a person has when he or she is in such a state of distress." In addition, he also stated that "there are cases in which the individual does not feel a sense of distress, even though they are in such a state. There are cases in which it is fully expected that the individual will fall into such a state in the future, even if no problem arises at present. Still, from the perspective of providing educational support to the individual, it is desirable to judge that a 'Komarikan' exists in these cases as well." (Sato, 2007). Takahashi (2012) pointed out that, in supporting university students with developmental disorders, it is easier to provide support by assessing the "Komarikan" caused by the characteristics of the developmental disorders rather than by identifying the characteristics of the students' developmental disorders. Furthermore, he proposed support methods that focus on university student's "Komarikan" by developing the "ASD Komarikan Questionnaire" (Yamamoto and Takahashi, 2009), "ADHD Komarikan Questionnaire" (Iwabuchi and Takahashi, 2011), and "Integrated Komarikan Questionnaire" (Takahashi, 2012). However, in Japan, there are almost no studies investigating the difficulty high school students with developmental disorders such as ASD and ADHD tend to feel. This study defines this feeling as "developmental disorder SOD" or "SOD."

A health room is where students with such mental health problems can be identified. In Japan, health room are staffed by a faculty member called a *Yogo* teacher. A "*Yogo* teacher" is a special licenced educator who supports children's growth and development through health education and health services on the basis of principles of health promotion in all areas of educational activities in school (Japanese Association of *Yogo* Teacher Education, 2003). *Yogo* teachers accurately grasp the

condition of students' health needs and environmental health and guide students with mental and physical health problems (MEXT, 2015). Therefore, it is important to make efforts for early detection and responses to these problems through health consultations (MEXT, 2017). According to the report on the survey of the status of health room use in 2016 (Japan School Health Association, 2018), the most common background factor for students who used the health room in high schools was "mainly psychological problems" at 41.6%. The percentage of *Yogo* teachers who experienced continuous support within approximately one year was 91.4%. A survey conducted on *Yogo* teachers in high schools also pointed out that many *Yogo* teachers deal with students who complain of mental and behavioral disorders (Nakano et al., 2018). Hence, there may be many students with developmental problems among those involved with *Yogo* teachers in the health room.

Therefore, this study aims to provide information to support high school students with mental health problems in Japan from the viewpoint of "developmental disorder SOD" by examining the relationship between the severity of the students' problems and their need for support ("support needs"). This study aims to provide materials for supporting high school students with mental health problems in Japan from the viewpoint of "developmental disorder SOD."

2. Method

2.1 Survey targets and methods

A questionnaire survey was conducted on 500 *Yogo* teachers enrolled in national, public, and private high schools in the Metropolitan area (Tokyo, Saitama Pref., Chiba Pref., Kanagawa Pref., Yamanashi Pref., and Gunma Pref.). The 1161 targeted schools were divided into three categories: co-educational schools, boys' schools, and girls' schools, and each school was numbered. Thereafter, a simple random sampling was conducted using a random number table, and 500 schools were selected. The following questionnaire was mailed to the selected 500 schools; the teachers were asked to answer the questionnaire and return it directly. The 204 respondents were included in the analysis (response rate: 40.8%). The survey period was from July to August 2019.

The purpose and procedure of the survey were explained in writing to school principals and *Yogo* teachers (respondents); ethical considerations were explained in writing, such as the freedom to respond, the fact that responses obtained would be statistically processed, that anonymity would be ensured when the results were published, and that consent was obtained by responding. In addition, from the viewpoint of privacy protection, the respondents were asked to provide sufficient consideration to individual cases so they would not be identified. This study was approved by the Research Ethics Committee of the Institution to which the first author belongs.

2.2 Investigation details

The questionnaire items consisted of three parts: (1) a face sheet, (2) a questionnaire about the SOD of students who use the health room and have high support needs, and (3) a questionnaire about the SOD of students who use the health room and have low support needs.

2.2.1 Face sheet

The subjects were asked to indicate the location of the school where they worked and their years of teaching experience.

2.2.2 Mental health of students with high support needs

"Please think of one of the students you were involved with in the health room who had been 'excessively absent or tardy, expelled or retained from school, or punished for student guidance

problems' and whose background was thought to contain psychological factors such as stress." Thereafter, they were asked how much the student had trouble with each item on the checklist. These were evaluated on a 5-point scale: 1, not troubled at all; 2, not very troubled; 3, undecided; 4, troubled; and 5, very troubled. This checklist consists of 12 items, 6 from the "ASD Komarikan Questionnaire" (Yamamoto et al., 2009) and 6 from the "ADHD Komarikan Questionnaire" (Iwabuchi et al., 2011), with some modifications. This checklist was designed for university students, but since a similar checklist for high school students does not exist, the authors decided to use some of the items from this checklist with changes in wording that they believe are applicable to high school students in this study. The authors also gave each item an "Item Names" that they considered appropriate.

2.2.3 Mental health of pupils with low support needs

The students were asked to complete the same checklist as in 2.2.2, "Please think of one student whom you have been involved with in the health room who does not fall into the category 2.2.2, and about whom you are particularly concerned, such as frequent use of the health room." Thereafter, they were asked about the degree to which the student had trouble with each item on the checklist, as in 2.2.2.

2.3 Analysis method

The responses to the face sheet were tabulated. Next, factor and cluster analyses were conducted on the responses to checklists 2.2.2 and 2.2.3, and the relationship between the obtained clusters and the level of support needs was examined. The mean and standard deviation of each item in the checklist were calculated for each cluster. The above analyses were conducted on the scores of 373 students (182 students with high support needs and 191 students with low support needs) whose answers were not incomplete, such as through missing values.

3. Results

Of the 204 schools that responded, 63 (30.9%) were in Tokyo, 36 (17. 7%) in Saitama Pref., 57 (27.9%) in Chiba Pref., 22 (10.8%) in Kanagawa Pref., 10 (4.9%) in Yamanashi Pref., and 16 (7.8%) in Gunma Pref.. The average teaching experience of respondents was 18.2 years (SD = 11.7).

3.1 Factor structure of the checklist

An exploratory factor analysis (maximum likelihood method, Promax rotation) was conducted on the 12 items of the SOD checklist based on the scores of 373 subjects included in the analysis. The number of factors was set to two by considering the decay pattern of eigenvalues (3.260, 2.058, 0.993, etc.) and the interpretability of the factors. However, two items had factor loadings of less than.35, so these items were excluded, and factor analysis was conducted again. The final factor pattern after rotation is shown in Table 1. Factor 1 was named the "ASD SOD factor" because high loadings were found for items related to ASD, such as "making friends," "conversation," "group," "isolation," and "others' viewpoints." Factor 2 was named the "ADHD SOD factor" because it loaded highly on items related to ADHD, such as "inattention," "multiple tasks," "impulsivity," "life rhythm," and "emotional control." To examine internal consistency, alpha coefficients were calculated for each factor, with alpha = .851 for the "ASD SOD" factor and alpha = .650 for the "ADHD SOD" factor. The correlation between the factors was .1 25. The average scores of the items included in each factor were defined as the "ASD SOD score" and the "ADHD SOD score," and the sum of the "ASD SOD score" and "ADHD SOD score" was defined as the "Developmental disorder SOD score."

Table 1 Results of the factor analysis for the SOD checklist

Item Names	Items	I	II	Commonality
Making Friends	I'm not good at making new friends	**.834**	-.019	.692
Conversation	I can't talk well with my friends	**.802**	.054	.657
Group	I feel uncomfortable in group activities	**.767**	-.035	.583
Isolation	I sometimes feel isolated	**.737**	.027	.549
Others' Viewpoints	I'm not good at imagining other people's thoughts	**.518**	-.013	.267
Inattention	I often forget things and forget promises	-.066	**.779**	.599
Multiple Tasks	I can't handle multiple tasks well	.067	**.646**	.433
Impulsivity	I sometimes act impulsively	.081	**.415**	.187
Life Rhythm	I have an irregular life rhythm	-.130	**.398**	.162
Emotional Control	I get angry easily	.065	**.340**	.125
* The authors gave each item an "Item Names" that they considered appropriate.	Factor contribution	2.800	1.522	
	Contribution rate	28.0%	15.2%	
	Interfactor correlation	.125		

3.2 Classification by SOD

Using the "ASD SOD score" and "ADHD SOD score," we conducted cluster analysis using the Ward method to obtain four clusters (Figure 1). The first included 101 subjects, the second included 111 subjects, the third included 56 subjects, and the fourth included 105 subjects.

Next, one-factor analysis of variance was conducted using the four clusters as independent variables and the "ASD SOD score" and "ADHD DOD score" as dependent variables. The results showed that there were significant differences between the clusters (ASD SOD score: $F(3, 369) = 252.42$, ADHD SOD score: $F(3, 369) = 227.00$, both $p < .001$), and multiple comparisons using Holm's method (1% level) revealed that the "ASD SOD score" was significantly higher in the first and third clusters than in the second and fourth clusters. There was also a significant difference in the "ADHD SOD score," with the result of the third cluster > second cluster > first cluster > fourth cluster. The first cluster was designated as the "ASD SOD group" because its "ASD SOD score" was high and its "ADHD SOD score" was low. The second cluster was defined as the "ADHD SOD group" because the "ADHD SOD score" was high and the "ASD SOD score" was low. The third cluster was defined as the "ASD & ADHD SOD group" because both "ASD SOD scores" and "ADHD SOD scores" tended

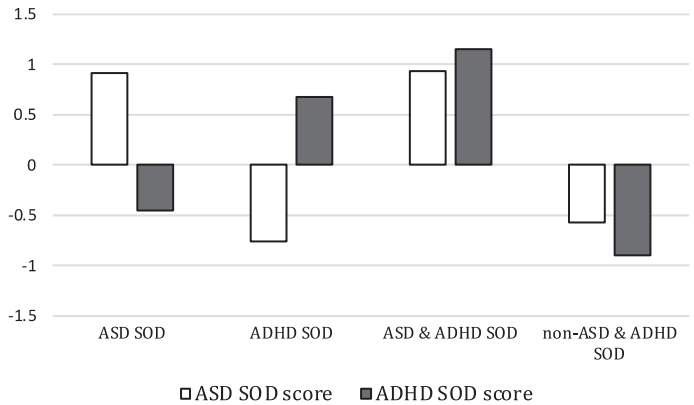

Figure 1 Standardized scores for SOD for each cluster

to be high. The fourth cluster was defined as the "non-ASD & ADHD SOD group" because both "ASD SOD scores" and "ADHD SOD scores" tended to be low (Table 2).

3.3 Relationship with the level of support needs

To examine the relationship between the degree of support needs and developmental disorder SOD, an uncorrelated t-test was conducted with the degree of support needs as the independent variable and developmental disorder SOD score as the dependent variable. The results showed a significant difference between conditions (t (371) = 5.43, $p < .001$), indicating that students with high support needs had higher developmental disorder SOD scores.

Next, to examine the relationship between the level of support needs and each cluster, each of the four clusters were divided into eight groups (high and low support needs groups), and a chi-square test was conducted on the number of people in each group; a significant relationship was found (χ^2 (3, N = 373) = 16.40, $p < .001$) The results of the chi-square test showed a significant association (Table 1). The number of students with high support needs in the "ASD & ADHD SOD group" was significantly higher, and the number of students with low support needs in the "non-ASD & ADHD SOD group" was significantly higher (Table 3).

Finally, each group's mean and standard deviation were calculated for each of the items in the checklist (Table 4).

4. Discussion

The factor analysis results for the SOD checklist showed that the checklist had a two-factor structure, namely the "ASD SOD factor" and "ADHD SOD factor," as shown in Table 1. This confirmed the validity of the checklist in capturing the sense of the difficulty of students with ASD and ADHD. However, the value of the alpha coefficient for the ADHD SOD factor was rather low at 0.650. Further refinement is needed in the future.

Cluster analysis was conducted based on these scores, and the results were divided into four clusters: "ASD SOD group," "ADHD SOD group," "ASD & ADHD SOD group," and "Non-ASD & ADHD SOD group," as shown in Figure 1. DSM-5 (American Psychiatric Association, 2013) allows for the simultaneous diagnosis of ASD and ADHD; it is possible that some of the students in the "ASD & ADHD SOD group" have both ASD and ADHD. On the other hand, the "Non-ASD & ADHD SOD group" had low scores in both the "ASD SOD score" and "ADHD SOD score," suggesting that they include students who have mental health problems without developmental

Table 2 Mean scores for each group

		ASD SOD	ADHD SOD	ASD & ADHD SOD	Non- ASD & ADHD SOD
ASD SOD Score	Average	4.49	2.72	4.51	2.92
	(SD)	(0.07)	(0.06)	(0.09)	(0.06)
ADHD SOD Score	Average	2.75	3.73	4.13	2.37
	(SD)	(0.05)	(0.05)	(0.07)	(0.05)

Table 3 Number of people belonging to each group

Variable		Cluster				
		ASD SOD	ADHD SOD	ASD & ADHD SOD	Non- ASD & ADHD SOD	Total
Support Needs	High Support Needs	50 (13.4%)	59 (15.8%)	△37 (**9.9%**)	▼ **36** (**9.7%**)	182 (48.8%)
	Low Support Needs	51 (13.7%)	52 (13.9%)	▼19 (**5.1%**)	△ 69 (**18.5%**)	191 (51.2%)
	Total	101 (27.1%)	111 (29.8%)	56 (15.0%)	105 (28.2%)	373 (100.0%)

※Regardless of the presence or absence of a diagnosis, they were divided into 4 groups. △ : Significantly more / ▼ : Significantly less

Table 4 Mean and standard deviation for each item in the checklist

		ASD SOD		ADHD SOD		ASD & ADHD SOD		non-ASD & ADHD SOD	
		High Support Needs	Low Support Needs	High Support Needs	Low Support Needs	High Support Needs	Low Support Needs	High Support Needs	Low Support Needs
ASD SOD Score	Making Friends	4.58 (0.14)	4.55 (0.14)	2.53 (0.13)	2.77 (0.14)	4.65 (0.16)	4.53 (0.23)	3.14 (0.16)	2.78 (0.12)
	Conversation	4.30 (0.14)	4.31 (0.14)	2.37 (0.13)	2.46 (0.14)	4.35 (0.17)	4.11 (0.23)	2.58 (0.17)	2.49 (0.12)
	Group	4.42 (0.14)	**4.67** (0.14)	2.56 (0.13)	2.85 (0.14)	**4.68** (0.17)	4.58 (0.23)	3.06 (0.17)	3.03 (0.12)
	Isolation	**4.74** (0.14)	4.55 (0.14)	2.92 (0.13)	3.02 (0.14)	**4.81** (0.17)	4.37 (0.23)	3.44 (0.17)	2.80 (0.12)
	Others' Viewpoints	4.44 (0.17)	4.35 (0.16)	2.97 (0.15)	2.81 (0.16)	4.30 (0.19)	4.53 (0.27)	**3.47** (0.2)	2.93 (0.14)
ADHD SOD Score	Inattention	2.12 (0.15)	1.86 (0.15)	3.03 (0.14)	2.88 (0.14)	3.49 (0.17)	3.74 (0.24)	1.72 (0.17)	1.67 (0.13)
	Multiple Tasks	3.24 (0.17)	2.78 (0.16)	3.69 (0.15)	3.77 (0.16)	4.14 (0.19)	4.26 (0.27)	2.19 (0.2)	2.13 (0.14)
	Impulsivity	3.08 (0.16)	2.31 (0.15)	3.66 (0.14)	3.56 (0.15)	3.95 (0.18)	4.11 (0.25)	2.92 (0.18)	1.99 (0.13)
	Life Rhythm	3.08 (0.16)	2.20 (0.16)	**4.36** (0.15)	**4.15** (0.16)	4.41 (0.19)	4.32 (0.26)	**3.50** (0.19)	2.23 (0.14)
	Emotional Control	3.26 (0.16)	3.63 (0.16)	4.02 (0.15)	4.12 (0.16)	4.62 (0.19)	4.37 (0.27)	3.00 (0.19)	3.03 (0.14)

※1 Numbers in parentheses are standard deviations

disorders in their background.

It was also suggested that students with high support needs had more difficulties with developmental disorders. This study defined these students as "students who were disciplined for excessive absences and tardiness, expulsion, retention, and student guidance problems, and whose background was thought to be one of stress or other psychological factors." The results suggest that the high level of SOD that was unique to students with developmental disorders, such as ASD and ADHD, may be one of the risk factors for developing such serious problems. However, according to the report of the 2016 survey on the use of the health room (Japan School Health Association, 2018), only 5.4% of *Yogo* teachers cited developmental disorders as a background factor for high school students who used the health room. This indicates that high school *Yogo* teacher teachers do not place as much importance on the perspective of "developmental disorder" as they do on other factors. Considering the results of this study, we believe that supporting students with the perspective of "developmental disorder SOD" as the background of the problems they face may help to prevent the problems from becoming more serious. Furthermore, as shown in Table 3, there were many students with high support needs in the "ASD & ADHD SOD group" whose ASD SOD score and ADHD SOD score were both high, and many students with low support needs in the "Non-ASD & ADHD SOD group" where both scores were low. However, there was no bias in the number of students in the "ASD SOD group" and "ADHD SOD group." Based on these results, it can be inferred that students with both ASD and ADHD SOD tended to be more likely to develop serious problems, such as school maladjustment (truancy, dropouts, etc.) and student guidance disciplinary actions.

The mean scores of each item in the checklist for each group in Table 4 suggest that students in the group with high ASD SOD scores may feel uncomfortable in group activities and isolated in the group. In recent years, improving classes by actively incorporating group activities has been promoted to realize independent, interactive, and deep learning in high schools. This trend may have a considerable influence on their adaptation to school life. This issue needs to be discussed in detail in the future. In addition, it was suggested that many students in the "ADHD SOD group" had high "life rhythm" scores. In addition, there was a large difference in the "life rhythm" scores of the "non-ASD & ADHD SOD group." High school students are at an age when they are more likely to develop

autonomic nervous system problems and sleep disorders (Kametaka et al., 2000; Ikeda et al., 2015); it has been pointed out that many students who are absent have these problems. Furthermore, it has been reported that 25%–50% of ADHD is complicated by sleep disorders (Konofal, Lecendreux, Cortese, 2010); we believe that the results of this study may reflect this reality. In high schools, the number of days absent and tardiness are very strictly regulated as requirements for promotion and graduation; there are many cases in which the disruption of the daily rhythm directly leads to transfer or expulsion from school. It is necessary to examine the student's situation and develop support for them at an early stage in cooperation with medical institutions.

5. Conclusion

As described above, many students with developmental disorder SOD use the health room, and it is suggested that the greater the SOD, the more likely it is to develop into a serious problem. We suggest that the students who come to the health room with mental health problems may be able to prevent these problems from becoming more serious if they are treated from the viewpoint of "developmental disorder SOD." In this way, *Yogo* teachers will be required to recognize the problem as soon as possible and provide appropriate support by connecting students to school counselors and medical institutions in cooperation with teachers and staff.

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[Paper]

Effects of Sub-Threshold Neurodevelopmental Traits on the Adjustment of Female Students to High School: A Study Focused on Premenstrual Dysphoric Mood

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Abstract

The purpose of this study was to determine the impact of the adjustment to high school on female students with sub-threshold neurodevelopmental disabilities traits by monitoring premenstrual discomfort. A questionnaire survey was conducted on a group of 500 high school seniors and on first- and second-year college students, using the sub-threshold neurodevelopmental disabilities traits scale, the PMDD rating scale, and the school adjustment questionnaire. To test the accuracy of each of the scales used, we analyzed them using item response theory. To determine whether sub-threshold ASD and ADHD traits influenced school adjustment, the analysis was conducted by monitoring PMDD. The results of this analysis determined that female high school students with sub-threshold ASD traits have difficulties with school life and study performance. In the case of female high school students with sub-threshold ADHD traits, PMDD was found to interfere with school relationships. In particular, female high school students with sub-threshold ASD traits were more likely than female high school students with sub-threshold ADHD traits to experience depressed or hopeless moods and to have higher levels of anxiety and tension. These results suggest that there is an urgent need to develop classroom-based support techniques that allow for good communication between female high school students with sub-threshold neurodevelopmental disabilities traits and their peers.

Keywords: Female High School Students, Sub-Threshold Neurodevelopmental Disabilities Traits, PMDD, School Adjustment

1. Introduction

In clinical practice, it is often observed that in women symptoms of psychiatric disorders such as depression, panic disorder, mood dysphoria, and personality disorders, as well as physical disorders such as asthma, allergic diseases, and epilepsy tend to worsen over time and are poorly controlled before menstruation (Egawa, 2020). The most severe form of these disorders, in which psychiatric symptoms are so severe that daily life and interpersonal relationships are severely impaired, is called premenstrual dysphoric disorder (PMDD). In the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) (American Psychiatric Association, 2013), PMDD is classified as a depressive disorder.

In Japan, the prevalence of moderate to severe PMDD and premenstrual syndrome (PMS) among female high school students was found to be higher than among adult females (Takeda et al., 2010). A survey of a total of 1,431 female high school students was used to determine the relationship between PMDD and PMS dysmenorrhea, and found that 3.2% of the cases qualified as PMDD. In addition, the prevalence of PMDD and moderate to severe PMS increased with the severity of dysmenorrhea, indicating a correlation between PMS and PMDD severity and dysmenorrhea in adolescents (Kitamura et al., 2012). PMDD can interfere with the daily lives of female high school students and can have serious consequences.

Furthermore, women with intellectual or developmental disabilities are more likely to have menstrual abnormalities (Yada (Hashimoto) et al. 2017). To determine the prevalence of PMS in women with autism, we compared a group of women with autism and learning disabilities (n = 26) with a group of women without autism and learning disabilities (n = 36). Results showed that a 30% or greater increase in premenstrual DSM-IV symptoms was an evidence of fulfillment of the diagnostic criteria. The prevalence of PMS was 92% in the autistic group compared to 11% in the control group. This difference was highly significant. Susceptibility to premenstrual syndrome has been shown to be significantly increased in women with autism (Obaydi and Puri, 2008).

Based on the above previous studies, support for women with developmental disabilities should take into account the impact of women's unique hormonal fluctuations on their everyday lives (Noda et al., 2021). In addition, it is assumed that providing appropriate support, especially during the adolescent period of female high school students, will lead to an improvement in mental health during adolescence. However, there have been no studies demonstrating an association between sub-threshold neurodevelopmental disabilities traits and mood disturbance in PMDD and its impact on school adjustment among female high school students.

In this study, we clarify the effects of sub-threshold neurodevelopmental disabilities traits on school adjustment mediated by discomfort in PMDD among female high school students. The objective of this study is to gain, through the analysis of the results, a perspective on how to better support female students with sub-threshold neurodevelopmental disabilities traits.

2. Method

2.1 Survey subjects

A total of 500 people were surveyed: 257 high school senior students (120 males and 137 females) and 243 first- and second-year college students (138 males and 105 females).

2.2 Survey timing and means of implementation

The survey was conducted in March 2021. The survey was conducted online through the research contractor Rakuten Insight. The parents or guardians of the subjects and the subjects themselves were asked to consent to the online study in advance, and only the subjects were asked to complete the questionnaire. The study was approved by the Ethical Review Committee of Tokyo University of Agriculture and Technology (Approval No. 210203-0270).

2.3 Survey Items

2.3.1 Sub-threshold neurodevelopmental disabilities traits scale

From the questionnaires developed by Takahashi et al. (2015) and Shinoda et al. (2017), seven items were selected from the sub-threshold Attention-Deficit/Hyperactivity Disorder (ADHD) traits

questionnaire short version and the sub-threshold autism spectrum disorder (ASD) traits questionnaire, respectively. The representative of the questionnaire creator had confirmed that the questionnaire could be used by high school students. A five-point scale was used, ranging from "very troubled (5 points)" to "not troubled at all (1 point)".

2.3.2 PMDD rating scale

The 12 items of the PMDD Rating Scale developed by Miyoka et al. (2009) were used to evaluate PMDD, which is defined as symptoms mainly consisting of recurrent mood changes before menstruation. A five-point scale ranging from "very strongly (5 points)" to "no change (1 point)" was used.

2.3.3 School adjustment questionnaire

Two items related to poor adjustment to school, "It interfered with my efficiency in school life and studies" and "It interfered with my relationships with people at school" (Miyoka et al., 2009), were selected for female high school students who had one or more symptoms of the PMDD Rating Scale (all applicable). A five-point scale was used, ranging from "very strongly (5 points)" to no change maybe "no change? Instead of just NOT (1 point)."

2.4 Method of analysis

2.4.1 Validation of scale accuracy

To verify the accuracy of the scale used in this study, we decided to analyze the results using Item Response Theory (IRT). The IRT is a method of inferring measurable abilities from the results of a questionnaire using responses to items (response status) when the characteristics of the items (difficulty and discrimination) are known. In other words, it is an analytical method that allows detailed confirmation of measurement accuracy. In addition, since the nature of the population of survey participants does not affect the analysis process, the scale can be used in a variety of school settings. As shown in (1) to (3) below, the analytical procedure for this study was adapted from Eguchi (2011) and Uragami and Wakita (2016). Easy Estimation Ver. 2.1.5 by Kumagaya (2009) was used for the analysis.

(1) Confirmation of unidimensionality of the scale

For each item of the scale used in this study, a factor analysis of the inter-item correlation matrix using tetrachoric correlation coefficients was performed. The eigenvalues are then plotted on a graph (scree plot) to confirm the unidimensionality of the scale.

(2) Estimation of item parameters

Since the five-item method was used in this study, the Graded Response Model (GRM) was employed to estimate the item parameters. Then, the discrimination parameter (a) and the difficulty parameter (b) for each item were calculated by the marginal maximum likelihood estimation method. In this study, the five-case method was used to obtain responses, so four difficulty parameters (b) were estimated for each item (Iwabuchi and Kato, 2018). This analysis yielded an Item Response Category Characteristic curve (IRCCC) for each item. The IRCCC represents the probability that respondents with a particular latent characteristic scale value (θ) will select each choice branch. The position and slope of this curve provide a visual indication of the characteristics of the item in question.

The parameter (a), which represents the item's discriminative power, is an indicator of the extent to which it can identify the respondent's latent characteristics. A high value implies a high degree of contribution to the estimation of latent characteristic values (θ). The item difficulty parameter (b) is an index of item difficulty. It represents the position of the item on the latent

characteristics scale. The larger this value is, the more the position of the curve is to the right, and the smaller it is, the more it is to the left. Therefore, a large value of b expresses that the item cannot be answered correctly unless the ability value (θ) is high, indicating that it determines the difficulty of the item. In this study, the level of the discrimination ability parameter (*a*) was set to $a > 0.75$ (Ironson et al., 1989). The level of the difficulty parameter (*b*) was set to $4.00 > b > -4.00$ (Kijima, 1999).

(3) Estimation of reliability

To examine measurement accuracy, Cronbach's alpha coefficient was obtained as an estimate of the reliability coefficient. Generally, when α is 0.7 to 0.8 or higher, it is considered an indication that a certain level of reliability is ensured. The free statistical software HAD by Shimizu (2016) was used for the analysis.

2.4.2 Characteristics of female high-school students with sub-threshold neurodevelopmental disabilities traits

The sub-threshold ASD and ADHD traits scores of female high school students were compared with those of male high school students and female college students using an unpaired t-test.

2.4.3 Characteristics of PMDD among female high school students

We compared scores for premenstrual unpleasant mood in the group with high scores of sub-threshold ASD and ADHD traits using an unpaired t-test with female college students. In addition, scores are compared between the group with high scores of sub-threshold ASD and ADHD traits and the group with overlapping sense of distress in female high school students and the group with stereotyped developmental students using a one-way ANOVA.

2.4.4 Effects of characteristics related to sub-threshold neurodevelopmental disabilities traits on school adjustment among female high school students

A mediation analysis was conducted to see if characteristics of sub-threshold ASD and ADHD traits influenced school adjustment by mediating PMDD.

3. Results

3.1 Confirmation of the accuracy of each scale

The accuracy of each scale was confirmed by IRT. First, the inter-item correlation matrix with tetrachoric correlation coefficients was factor analyzed to check its eigenvalues. The first three eigenvalues were 4.87, 0.60, 0.41, ... for the sub-threshold ASD traits questionnaire; the ratio of the first eigenvalue to the second eigenvalue was 4.27, which is large, indicating that the unidimensionality aspect of the scale was satisfied. Next, for the sub-threshold ADHD traits questionnaire, the scores were 3.99, 0.86, 0.58, ..., and the ratio of the first eigenvalue to the second eigenvalue is 3.13, which indicated that the unidimensionality of the scale was satisfied. Finally, the PMDD rating scale was 7.81, 0.94, 0.64, ..., and the ratio of the first eigenvalue to the second eigenvalue was 6.87, which is large, and the unidimensionality of the scale was judged to be satisfying. Next, the GRM was employed in this study to estimate the item parameters by calculating the discrimination parameter (*a*) and the difficulty parameter (*b*) for each item using the marginal maximum likelihood estimation method. The value of the discrimination parameter (*a*) was determined to satisfy the range $a > 0.75$. The sub-threshold ASD traits questionnaire was $1.97 > a$, the sub-threshold ADHD traits questionnaire was $1.42 > a$, and the PMDD rating scale was $1.50 > a$, meeting the $a > 0.75$ level of Ironson et al. (1989). The value of the difficulty parameter (*b*) was determined to satisfy the range $4.00 > b > -4.00$ for all items. The sub-threshold ASD traits

questionnaire was $2.75 > b > -1.56$, the sub-threshold ADHD trait questionnaire was $3.26 > b > -1.86$, and the PMDD rating scale was $2.92 > b > -1.15$, meeting the Kijima (1999) level of $4.00 > b > -4.00$. Finally, Cronbach's alpha coefficient was determined for each scale as an estimate of the reliability coefficient. As a result, a value of $\alpha = 0.91$ was calculated for the sub-threshold ASD traits questionnaire, $\alpha = 0.84$ for the sub-threshold ADHD traits questionnaire, and $\alpha = 0.93$ for the PMDD rating scale. The values were determined to be sufficiently internally consistent (Tables 1, 2, and 3). The English translations of all items of each scale were prepared independently by the authors after examining their content validity.

3.2 Extraction of female high school students with high scores on each scale

Twenty-three female high school students (16.8% of the female students) had high scores (mean

Table 1 Parameter estimates for each model (sub-threshold ASD traits questionnaire)

Item	Slope Parameters *1		Location Parameters *2 *3							
			1		2		3		4	
	a	Standard Error	*b*	Standard Error	*b*	Standard Error	*b*	Standard Error	*b*	Standard Error
1. Past experiences come back to life as if they are happening in the present, and feelings become unstable	1.97	0.13	−1.25	0.08	0.19	0.06	1.52	0.09	2.75	0.19
2. Cannot talk as well as other people	3.26	0.19	−1.03	0.07	0.06	0.04	1.06	0.07	2.25	0.15
3. Have trouble feeling that they are different from the usual person	3.00	0.18	−0.94	0.06	0.23	0.04	1.43	0.09	2.64	0.20
4. Have trouble feeling comfortable in group activities	3.00	0.18	−1.06	0.07	0.12	0.04	1.24	0.08	2.46	0.17
5. Feelings are easily hurt	2.62	0.16	−1.39	0.09	−0.09	0.05	1.18	0.07	2.25	0.14
6. I am not good at making new friends when I go to school or change classes	2.20	0.13	−1.56	0.10	−0.34	0.05	0.80	0.06	2.05	0.12
7. I think other people see me as being out of place all the time	2.76	0.17	−1.14	0.08	0.21	0.05	1.91	0.12	2.72	0.21
M	2.69		−1.19		0.05		1.31		2.45	
SD	0.47		0.22		0.20		0.36		0.27	

*1 Parameter (*a*): an indicator of the extent to which the respondent's latent characteristics can be identified (characteristic value proportional to the slope of the item characteristic curve at ability value (θ) = *b*)

*2 Parameter (*b*): Indicator of item difficulty (characteristic value representing the position of the item characteristic curve)

*3 In this study, the GRM was employed and responses were requested using the five-case method, so four difficulty parameters (*b*) were estimated for each item (Iwabuchi and Kato, 2018).

+1 SD or higher) on the sub-threshold ASD traits questionnaire. There were 16 female high school students (11.7% of the female students) with high scores (mean +1 SD or higher) on the sub-threshold ADHD traits questionnaire. In addition, 13 female high school students (9.49% of the female students) had high scores on both the sub-threshold ASD traits questionnaire and the sub-threshold ADHD traits questionnaire. Twelve female high school students (8.8% of the female students) had high scores only on the sub-threshold ASD traits questionnaire, and four female high school students (2.9% of the female students) had high scores only on the sub-threshold ADHD traits questionnaire. Twenty-five female high school students (18.3% of the female students) had high scores (mean +1 SD or higher) on the PMDD rating scale.

3.3 Gender Comparison on sub-threshold ASD and ADHD traits questionnaire

To begin, an unpaired t-test was conducted on the sub-threshold ASD traits questionnaire scores of female and male high school students. The results showed no significant difference between

Table 2 Parameter estimates for each model (sub-threshold ADHD traits questionnaire)

Item	Slope Parameters *1		Location Parameters *2 *3							
			1		2		3		4	
	a	Standard Error	*b*	Standard Error	*b*	Standard Error	*b*	Standard Error	*b*	Standard Error
1. I have trouble remembering things	1.64	0.12	−0.87	0.08	0.70	0.07	1.73	0.11	3.26	0.25
2. I have trouble with irregularity in my life	1.67	0.12	−1.27	0.09	0.11	0.06	1.25	0.08	2.64	0.17
3. I have trouble with my room being so messy that I can't invite people over	1.42	0.11	−1.14	0.09	0.11	0.07	1.37	0.10	2.78	0.18
4. I cannot do well when there are multiple things that need to be done	3.60	0.21	−1.34	0.09	−0.13	0.04	0.94	0.06	1.97	0.13
5. I am always busy with things that need to be done and have no time to spare	2.67	0.16	−1.44	0.09	−0.08	0.05	1.12	0.07	2.27	0.15
6. I get irritated easily	1.94	0.13	−1.19	0.08	0.25	0.06	1.57	0.10	2.76	0.19
7. I work hard, but the results are not as expected	2.02	0.13	−1.86	0.12	−0.41	0.06	1.00	0.07	2.47	0.16
M	2.14		−1.30		0.08		1.28		2.59	
SD	0.76		0.31		0.35		0.29		0.41	

*1 Parameter (*a*): an indicator of the extent to which the respondent's latent characteristics can be identified (characteristic value proportional to the slope of the item characteristic curve at ability value (θ) = *b*)

*2 Parameter (*b*): Indicator of item difficulty (characteristic value representing the position of the item characteristic curve)

*3 In this study, the GRM was employed and responses were requested using the five-case method, so four difficulty parameters (*b*) were estimated for each item (Iwabuchi and Kato, 2018).

conditions (t (244.12) = 0.09, p = 0.93). Similarly, sub-threshold ADHD traits questionnaire scores (t (251.75) = 0.15, p = 0.88) did not differ significantly by gender.

3.4 Comparison of scores on the sub-threshold ASD and ADHD traits questionnaire by age

To begin, an unpaired t-test was conducted on the sub-threshold ASD traits questionnaire

Table 3 Parameter estimates for each model (PMDD Rating Scale)

Item	Slope Parameters *1		Location Parameters *2 *3							
			1		2		3		4	
	a	Standard Error	*b*	Standard Error	*b*	Standard Error	*b*	Standard Error	*b*	Standard Error
1. feeling depressed or hopeless	4.09	0.38	0.08	0.05	0.54	0.07	1.40	0.13	2.35	0.24
2. feeling anxious or nervous	3.89	0.34	−0.23	0.06	0.53	0.07	1.26	0.11	2.16	0.20
3. tearfulness or sudden sadness	2.72	0.27	0.21	0.07	0.57	0.08	1.52	0.14	2.20	0.21
4. Becoming angry or irritable or hitting others	2.52	0.22	−0.42	0.08	0.55	0.08	1.21	0.11	2.20	0.20
5. Loss of interest (in school, hobbies, etc.)	3.37	0.31	0.04	0.06	0.54	0.07	1.51	0.13	1.97	0.18
6. difficulty concentrating	2.81	0.25	−0.69	0.08	0.66	0.08	1.24	0.11	2.34	0.22
7. Tiredness or loss of energy	2.43	0.22	−0.77	0.09	0.55	0.08	1.12	0.10	2.13	0.19
8. Increased appetite or cravings for certain foods (e.g., sweets, etc.)	1.75	0.17	−0.65	0.10	0.21	0.09	1.02	0.11	2.24	0.19
9. Sleeps more than usual	1.50	0.15	−1.15	0.13	0.00	0.10	0.90	0.11	2.19	0.19
10. Sleeps less than usual	1.94	0.21	0.21	0.09	0.53	0.09	1.87	0.17	2.92	0.31
11. Feeling out of control	3.44	0.32	0.05	0.06	0.37	0.06	1.54	0.14	2.18	0.21
12. Any of the following physical symptoms (breast pain or tightness, abdominal tightness, abdominal pain, headache, joint pain, muscle pain, feeling swollen, weight gain, constipation)	1.84	0.18	−0.64	0.10	0.36	0.09	1.23	0.12	2.03	0.17
M	2.69		−0.33		0.45		1.32		2.24	
SD	0.86		0.45		0.19		0.26		0.24	

*1 Parameter (*a*): an indicator of the extent to which the respondent's latent characteristics can be identified (characteristic value proportional to the slope of the item characteristic curve at ability value (θ) = *b*)

*2 Parameter (*b*): Indicator of item difficulty (characteristic value representing the position of the item characteristic curve)

*3 In this study, the GRM was employed and responses were requested using the five-case method, so four difficulty parameters (*b*) were estimated for each item (Iwabuchi and Kato, 2018).

scores of female high school and college students. The results showed no significant differences between conditions (t (232.36) = 0.20, p = 0.84). Similarly, there was no significant difference in scores on the sub-threshold ADHD traits questionnaire (t (222.87) = 0.42, p = 0.67) due to age.

3.5 Comparison by age on PMDD rating scale scores (group with higher scores on sub-threshold ASD and ADHD traits questionnaire)

Unpaired t-tests were conducted on PMDD rating scale scores for the groups with higher scores on the sub-threshold ASD traits questionnaire for female high school students and female college students. The results showed a trend toward significant differences between conditions (t (28.51) = 1.95, p = 0.06). That is, female high school students with higher scores on the sub-threshold ASD traits questionnaire (M = 35.13, SD = 9.56) were more likely to feel uncomfortable before menstruation than female college students (M = 28.67, SD = 10.27). Similarly, an unpaired t-test was conducted on PMDD rating scale scores for the group with higher scores on the sub-threshold ADHD traits questionnaire. The results showed a significant difference between conditions (t (27.87) = 2.10, p = 0.05). That is, female high school students (M = 36.250, SD = 11.02) with higher scores on the sub-threshold ADHD traits questionnaire were more uncomfortable before menstruation than female college students (M = 29.00, SD = 8.30).

3.6 Comparison of PMDD assessment scores among high-scoring groups of female high school students on the sub-threshold ASD and ADHD traits questionnaire

A one-way ANOVA was conducted on the PMDD scores of female high school students in the groups on the sub-threshold ASD-only (12 students) and on the sub-threshold ADHD-only (4 students) and on students who fell within the overlap of both the sub-threshold of ASD and ADHD (13 students), as well as on randomly selected typically developing students (29 students). The results showed a significant main effect for female high school students with sub-threshold neurodevelopmental disabilities traits with respect to the overall PMDD scores (F (3,54) = 40.72, p = 0.00). The results of multiple comparisons (Holm method) showed that the with overlapping on the sub-threshold ASD and ADHD groups (sub-threshold ASD: M = 31.92, SD = 7.93, sub-threshold ADHD: M = 27.25, SD = 9.95, overlapping: M = 39.08, SD = 9.57) scored significantly higher on PMDD than did typically developing students (M = 17.24, SD = 1.55) (sub-threshold ASD: t (54) = 6.77, $Padj$ = 0.00, sub-threshold ADHD: t (54) = 2.97, $Padj$ = 0.01, duplicate: t (54) = 10.34, $Padj$ = 0.00). Note that there was no significant difference between the on the sub-threshold ASD-only group and the on the sub-threshold ADHD-only group for overall PMDD scores (t (54) = 1.28, $n.s.$). Therefore, a one-factor analysis of variance was conducted for each item of the PMDD scale, and the main effect of scores on the sub-threshold neurodevelopmental disabilities traits was found to be significant for the item "feeling depressed or hopeless" (F (3,54) = 23.68, p = 0.00). In addition, a significant main effect of sub-threshold neurodevelopmental disabilities traits scores was found for the item "feeling anxious or nervous" (F (3,54) = 22.64, p = 0.00). Multiple comparisons (Holm method) showed that the on-the-subthreshold ASD-only group (M = 3.17, SD = 1.27) scored significantly higher on PMDD than the on-the-subthreshold ADHD-only group (M = 1.50, SD = 1.00) (t (54) = 3.36, $Padj$ = 0.04).

3.7 Sub-threshold neurodevelopmental disabilities traits scores predict premenstrual unpleasant mood and problems with school adjustment

A mediation analysis was conducted to prove whether PMDD is mediated by the assumption that sub-threshold neurodevelopmental disabilities traits affect school adjustment in female high

school students. First, multiple regression analysis were conducted using scores on the school adjustment item "It interfered with my efficiency in school life and studies" as the objective variable, and with scores on sub-threshold ASD as the explanatory variable. The results showed that sub-threshold ASD scores significantly predicted "It interfered with my efficiency in school life and studies" (b = 0.10, SE = 0.02, t (135) = 5.37, p = 0.00). Furthermore, when PMDD scores were added as explanatory variables, PMDD significantly predicted "It interfered with my efficiency in school life and studies" (b = 0.07, SE = 0.01, t (134) = 9.59, p = 0.00), while sub-threshold ASD effect became non-significant (b = 0.02, SE = 0.02, t (134) = 1.50, p = 0.14). The results of the indirect effect test (Bootstrap method, 2000 runs) showed that the 95% confidence interval ([0.05,0.10]) did not include 0, indicating significant mediation of PMDD.

Next, multiple regression analysis was conducted using sub-threshold ADHD scores as the explanatory variable. The results showed that sub-threshold ADHD scores significantly predicted "It interfered with my efficiency in school life and studies" (b = 0.12, SE = 0.02, t (135) = 6.78, p = 0.00). Furthermore, when PMDD was added as an explanatory variable, PMDD significantly predicted "It interfered with my efficiency in school life and studies" (b = 0.07, SE = 0.01, t (134) = 8.67, p = 0.00). The effect of sub-threshold ADHD scores was also significant but smaller (b = 0.04, SE = 0.02, t (134) = 2.29, p = 0.02).

Similarly, multiple regression analysis was conducted using the school adjustment item "It interfered with my relationships with people at school" as the objective variable and sub-threshold ASD scores as the explanatory variable. The results showed that sub-threshold ASD scores significantly predicted "It interfered with my relationships with people at school" (b = 0.10, SE = 0.01, t (135) = 7.17, p = 0.00). Furthermore, when PMDD scores were added as an explanatory variable, PMDD significantly predicted "It interfered with my relationships with people at school" (b = 0.05, SE = 0.01, t (134) = 6.88, p = 0.00). The effect of sub-threshold ASD scores was also significant, but the effect was smaller (b = 0.06, SE = 0.01, t (134) = 4.00, p = 0.00).

Next, multiple regression analysis were conducted using sub-threshold ADHD scores as the explanatory variable. The results showed that sub-threshold ADHD scores significantly predicted "It interfered with my relationships with people at school" (b = 0.08, SE = 0.02, t (135) = 4.93, p = 0.00). Furthermore, when PMDD scores were added as explanatory variables, PMDD significantly predicted "It interfered with my relationships with people at school" (b = 0.06, SE = 0.01, t (134) = 7.51, p = 0.00), while sub-threshold ADHD scores effect became non-significant (b = 0.01, SE = 0.02, t (134) = 0.77, p = 0.45). The results of the indirect effect test (Bootstrap method, 2000 times) showed that the 95% confidence interval ([0.04,0.10]) did not include 0, indicating significant mediation of PMDD.

4. Discussion

The analysis in this study showed, first, that female high school students with sub-threshold ASD and ADHD were not significantly different from both male high school students and female college students. Second, that female high school students with sub-threshold neurodevelopmental disabilities traits were more uncomfortable before menstruation than female college students or female high school students with typical development. In particular, female high school students with sub-threshold ASD traits were more likely than female high school students with sub-threshold ADHD traits to experience depressed or hopeless moods and to have higher levels of anxiety and tension. Since the results of this study indicate that four female high school students had sub-

threshold ADHD traits, it is desirable to survey a larger number of subjects in the future.

The results showed that sub-threshold ASD scores among female high school students were associated with PMDD, summarized as "it interfered with my efficiency in school life and studies". Women with ASD experienced heightened sensory sensitivity and severe premenstrual symptoms before menstruation, which have been proven to be related to the difficulty of living in ASD women (Noda et al., 2021). In addition, more than 75% of women with ASD who are aware of PMS symptoms, tend to become hypersensitive due to changes in themselves, becoming aware of mental symptoms like lethargy, difficulty concentrating, and crying before menstruation. In addition, there is evidence of premenstrual changes in lifestyle behaviors such as poor performance, forgetfulness, and increased compulsive behaviors (Kyrkou, 2005).

In addition, in the case of female high school students with sub-threshold ADHD traits, it was demonstrated that PMDD caused them to respond "It interfered with my relationships with people at school". The prevalence of PMDD has been shown to be higher in women with ADHD compared to the general female population (Dorani et al., 2021). In addition, prevalence differences for ADHD-related mental disorders have also been demonstrated to be significantly greater in women than in men for anxiety, depression, bipolar disorder, and personality disorders (Solberg et al.,2017).

Adolescence is a unique period in human development, both psychologically and physiologically. In addition, it is a critical and vulnerable period between childhood and adulthood (Takeda et al.,2010). Many female high school students experience stress in their daily lives, and with little accurate information on reproductive health, they may experience significant stress related to menstruation. It has also been noted that when PMS and other symptoms occur, these females may have negative thoughts that further reinforce premenstrual symptoms (Kitamura et al., 2012).

A woman with sub-threshold neurodevelopmental disabilities traits experience a state of help-seeking, which is noted when she expresses her difficulty in talking to others about her menstruation, while seeking understanding from those around her (Noda et al.,2021). In order to promote adjustment of female high school students with sub-threshold neurodevelopmental disabilities traits to the school environment, reproductive health education should be actively provided in a standard classroom accounting for sub-threshold neurodevelopmental disabilities traits. Furthermore, it is expected that female students with sub-threshold neurodevelopmental disabilities traits will gain understanding of their own difficulties from the female high school students around them, and will develop supportive techniques that facilitate good communication experiences with them.

Acknowledgments

We thank Dr. Anna Di Gregorio, Dr. Yutaka Nibu, and Ms. Marianna Nibu for editing the text and critically reading the manuscript.

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Journal of Developmental Disabilities Research〔JDDR〕
Vol. 1 October 2023

Edited and published by
Japanese Association for the Study of Developmental Disabilities
President/Shinya Miyamoto
Chief Editor/ Soichi Hashimoto　Vice Chief Editor/ Takahiro Watanabe

DATA CREATION
SHINNIHON PRINTING INC

MANAGING EDITORS
R. Kumagai　D. Saito　S. Tanaka

JAPANESE ASSOCIATION FOR STUDY OF DEVELOPMENTAL DISABILITIES
1-9-10-402 , Paredoru Rikugien Kita, Nakazato, Kita-ku, Tokyo 114-0015, Japan

Journal of Developmental Disabilities Research
Vol. 1　October 2023

Chief Editor: Soichi Hashimoto
President: Shinya Miyamoto
Publisher: Japanese Association for the Study of Developmental Disabilities,
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Production: