

Paper:

# **Developing a Disaster Management Education and Training Program for Children with Intellectual Disabilities to Improve “Zest for Life” in the Event of a Disaster – A Case Study on Tochigi Prefectural Imaichi Special School for the Intellectually Disabled –**

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In this study, we first discuss the current status and issues of disaster management education in the context of special support education in Japan, in view of the casualties of those with disabilities during major past earthquakes in Japan. We highlight that there are very few examples of practical implementation of, instructional material for, or previous studies on disaster management education for disabled children, or an established systematic instructional method. As a result, disaster management education tailored to the specific type of disability has been implemented on a school-to-school basis among Special Support Schools for children with disabilities. In many cases, teacher-led evacuation drills have been considered disaster management education. This is an indication that the disaster management education currently practiced in Special Support Schools is inadequate to achieve the goal of “fostering the attitude of acting on one’s initiative” as set forth by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). In view of the situation in Japan, where casualties due to natural disasters continue to occur frequently since the Great East Japan Earthquake, it is urgent that we promote practical disaster management education to foster the Zest for Life among disabled children. This paper is a case study of disaster management education that targets those with intellectual disabilities, which is the largest reported disability type among children enrolled in Special Support Schools in Japan. We applied the ADDIE (Analyze, Design, Develop, Implement, Evaluate) process in instructional design to develop an earthquake disaster management program designed to heighten the capacity of disabled children to foresee and circumvent danger to themselves, so as to protect their lives from large earthquakes which occur frequently in Japan. Specifically, the objective is to apply the earthquake disaster management education program, developed by the authors in a previous study, to children with intellectual disabilities. To this

end, we implemented the program at the target school and verified its educational effect while taking into consideration the degree or condition of disability and the learning characteristics of the intellectually disabled and developed a valid program for intellectually disabled children. The program allows the teachers of Special Support Schools to practice disaster management education in the context of daily classroom study with students without the need to dispatch a disaster management expert to the school each time a program is implemented. Additionally, the program can be customized by the onsite teacher for individual schools, which can lead to a systematic program in disaster management education. In addition, we propose a framework to establish a network of stakeholders, including disaster management experts or organizations and educational institutions to effectively and strategically promote disaster management education. This framework makes it possible to implement the present program the most impactful way, and to maximize the benefits to the schools in Tochigi prefecture.

**Keywords:** intellectual disability, special support education, disaster management education/training program, instructional design (ID), earthquake early warning (EEW)

## **1. Introduction**

### **1.1. Need for Measures for the Disabled Based on Lessons of Large-Scale Earthquakes in the Past**

Japan is an earthquake-prone country. On January 17, 1995, the Nanbu earthquake in Hyogo-prefecture reached a maximum seismic intensity of the first time this level was recorded since it was introduced in the earthquake

intensity scale of the Japan Meteorological Agency. Since its hypocenter was located directly beneath a large metropolis, the earthquake caused immense human suffering, including 6,437 dead (about 90% of which were caused by crushing) or missing persons, and 43,792 injured persons.

Subsequent to the Earthquake, several other intensity-7 earthquakes have occurred and caused extensive casualties, including the October 23, 2004, Chuetsu earthquake (68 dead, 4,805 injured), the March 11, 2011, earthquake off the Pacific coast of Tōhoku (18,434 dead or missing, 6,157 injured), the April 14 and 16, 2016, Kumamoto earthquake (267 dead, 2,804 injured), and the September 6, 2018, Hokkaido Eastern Iburi earthquake (43 dead, 782 injured) [1].

Large-scale earthquakes are often accompanied by tsunamis or landslides in addition to the direct damage caused by the earthquake. Various concerns have surfaced in the response actions of those persons requiring special assistance following earthquakes in the past, such as the inability to protect oneself from sudden danger or to evacuate in time, or the loss of access to items necessary for personal survival.

Following the Great East Japan Earthquake, which was a disaster of unprecedented scale, the Disaster Countermeasures Basic Act (Law No.223, 1961) was amended to strengthen the disaster management skills of persons requiring special assistance, such as the elderly, disabled, and infants. Measures for the disabled include town development to make it more livable for the disabled, and various measures to support the safety and security of the disabled [2]. In response to the government-led measures, manuals on how to support the disabled during disasters have been developed by many local governments and disability support organizations. However, the majority of these manuals focus on the evacuation of or support measures for the disabled following disasters, and lack proposals on concrete educational approaches or training methods that would enable disabled people to recognize the disaster, determine the appropriate response action, or act to protect their physical safety, which tend to be the largest concerns.

Thus, to assess large earthquakes that occurred in the past and to prepare the disabled for future earthquakes, it is necessary to implement “soft” measures so that the disabled can develop the skills and capacity to respond to disasters through the acquisition of knowledge about earthquakes and protect themselves from earthquakes.

## 1.2. Current Status and Issues of Disaster Management Education in Special Support Education

Following the Great East Japan Earthquake, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) adopted, as the direction for disaster management education, “the promotion of disaster management education to heighten the ability to foresee and circumvent danger to self,” based on the Expert Committee on Disaster Management Education and Disaster Man-

agement in response to the Great East Japan Earthquake (Final Report) [3].

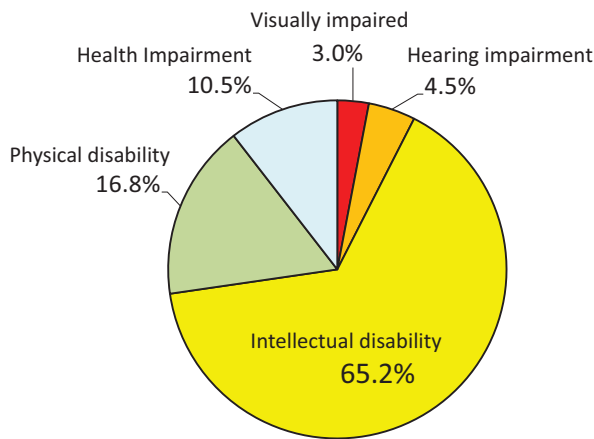
In the “Development of Disaster Management Education to Foster ‘Zest for Life,’” [4] the instructional guideline for disaster management is set forth as, “to provide instruction according to the curriculum for kindergarten, elementary school, junior high school, and senior high school, and depending on the state of disability, development stage, characteristics, and local conditions of individual students.”

Furthermore, the “Safety Education at School to Foster ‘Zest for Life’” [5] also sets forth the guidelines to, “enable the student with disability to foresee and avoid dangerous places and situations themselves and seek assistance when necessary, depending on the state of disability, development stage, characteristics and local conditions of the student,” and calls for disaster management education to foster the Zest for Life of students with disabilities.

Special Support Schools in Japan, which offer education for disabled children, practice their own unique disaster management education according to the type of disability based on MEXT guidelines or manuals.

Special Support Schools are schools established to offer disabled young people “education according to the curriculum for kindergarten, elementary school, junior high school, and senior high school,” and to help them to “overcome learning or living difficulties and develop self-reliance.” They are defined as “having the objective of providing education according to (the standard curricula for) kindergarten, elementary school, junior high school, and senior high school to the visually impaired, hearing impaired, intellectual disabled, physically disabled, and health impaired, and impart to them the necessary knowledge and skills that will enable them to overcome learning or living difficulties and develop self-reliance” (Article 72, Basic Act on Education). According to the figures released by MEXT [6], there are 1,114 Special Support Schools in Japan, with a total enrollment of 137,894 students. Visual impairment represents the smallest portion of the students (3.0%), then hearing impairment (4.5%), intellectual disability (approximately 65.2%), physical disability (16.8%), and health impairment (10.5%). The portion of students with intellectual disability is particularly high, making up over 60% of the total (**Fig. 1**).

Many Special Support Schools conduct earthquake and fire drills each year as part of school events [7] as parts of specific programs conducted for disaster management education, just as in regular schools. In these drills, the students passively engage in initial response actions, such as wearing helmets or protective hoods or crouching under desks as instructed or assisted by the teachers. Emphasis is placed on protecting the students from injury, and quickly and safely leading them to a temporary evacuation center regardless of the type, level, or condition of disability. Through the repetition of such drills, the students develop the passive attitude that “teachers (adults) will always protect us,” which obstructs the achievement of the stated goal of disaster management education that one should act on one’s own initiative. This issue has been



**Fig. 1.** Number of disabled students enrolled in Special Support Schools (MEXT).

raised in many previous studies, some examples of which we will outline below.

Among previous studies on the self-understanding of the disabled, Fujiwara [8] viewed it as a pedagogical issue, noting that “if the student depends on the teacher, the learning experience of making decisions and acting on one’s own with intent is diluted,” and pointed out the need for education that fosters the ability to think, decide, and express on one’s own. In another study, Kojima and Kataoka [9] pointed out the issues of passive education, noting that they ideas “observed from the student’s behavior that they were unable to think, decide and express on their own, waiting for the teacher’s instruction when confronted with new learning material, or engaging in activities by looking at the teacher’s face when they lacked confidence in the activity.” Such studies also support the view that the disaster management education currently practiced in Special Support Schools is inadequate to achieve the disaster management education goal to “foster the attitude to act on one’s initiative.”

As a study on disaster management education for the disabled, Fujii and Matsumoto [10] conducted a questionnaire survey on disaster management education against Special Support Schools. They pointed out the lack of instructional materials or curricula to systematically practice disaster management education, such as teaching guides that target the students’ disability characteristics. In another study, Wada et al. [11] discussed the importance of educational programs on disaster management or disaster management learning in Special Support Schools and pointed out the lack of concrete examples and proposals/research findings to systematize disaster management education.

These issues point to the urgent need for proposals for practical disaster management education in Special Support Education in Japan.

### 1.3. Objective of this Study

This study recognizes the urgency, based on the current status and issues of disaster management education

in Special Support Education, to develop educational programs that helps to foster the Zest for Life among disabled children in order to prepare them for future earthquakes. Therefore, this study proposes a disaster management education program to improve the response capacity of intellectually disabled children to foresee and avoid danger to themselves.

This disaster management education program, which focuses primarily on earthquakes, is designed to impart awareness so that learners can protect them selves from the effects of earthquake tremors or Earthquake Early Warning (EEW) and respond by making decisions and taking appropriate action, without anyone to provide assistance.

To apply this program to intellectually disabled children, it was redesigned using the ADDIE process of Instructional Design, which is a theory known in the fields of education, psychology, and educational technology; it incorporates the characteristics of, and instructional guidelines for, intellectual disability and adopts the learning objective “the awareness to act on one’s own.” The program was then implemented to verify its validity by measuring its effect and having the teachers give their assessments.

One feature of the new developed program is that it allows the teachers of Special Support Schools to practice disaster management education in the context of daily classroom study with students without the need to send a disaster management expert to the school each time a program is implemented. In addition, it can be customized for individual schools by the onsite teacher to meet specific disability levels or conditions, which can lead to future efforts to develop a systematic program in disaster management education.

We also propose a framework to establish a network of stakeholders, including disaster management experts or organizations and educational institutions in order to effectively and strategically promote disaster management education.

## 2. Application of Earthquake Disaster Management Education Program to the Intellectual Disabled

### 2.1. Features of Earthquake Disaster Management Education Program

The earthquake disaster management education program developed and improved by the authors [12, 13] is a set of instructional materials that will help teach students to protect their lives from earthquakes, and has already been put to practical application. The program, which consists of the teacher’s guide, worksheet, drill program for EEW response action, and effect measurement sheets (earthquake questionnaire, drill review questionnaire), allows the onsite teacher to teach students to protect themselves from earthquakes in three steps.

The program was developed based on the ADDIE

process, which is a core theory in Instructional Design (ID) [14].

ID is a learning theory used in education, psychology, and educational technology. It is defined as a “model that incorporates a variety of techniques and research on improving the effects, efficiency, and appeal of educational activities, or their application in processes to realize a learning environment, such as instructional materials or syllabuses” [15].

The five steps of Analyze → Design → Develop → Implement → Evaluate of the ADDIE model can be applied to design or develop effective educational programs.

The basic flow of the process based on the ADDIE model is as follows. (1) Analyze (analysis of the educational needs of intellectually disabled students, selection of program target(s), setting of learning objectives) → (2) Design (design of syllabus applied to the intellectually disabled, discussion of implementation plan for target school, examination of learning method) → (3) Develop (development of teacher’s guide, worksheet, evaluation sheet, and auxiliary teaching material) → (4) Implement (program implementation at school) → (5) Evaluate (students’ self-evaluation, objective evaluation by teachers, review by teachers, effect measurements). The program was evaluated after one cycle, then the issues and problems we identified were fed back to the individual steps to make improvements.

To develop the new program, the ADDIE model was used to evaluate students’ level of attainment and/or difficulty with the various learning methods and instructional materials. This data was then fed back to researchers in order to constantly improve the learning activities through an iterative process. The goal of ID is that learners should not stop at mental understanding of the situation, but should continue on to action, as set out by the learning objectives.

We repeated the steps of Implement (response action drill) and Evaluate (students’ self-evaluation, teachers’ objective evaluation, teachers’ review, effect measurement) in order to evaluate the students’ behavioral changes after the response action drill using the Earthquake Early Warning, and we evaluated the educational effects regarding the degree of learning and behavioral changes of the learner due to program implementation in order to verify the validity of the program.

Work for the individual processes was divided as follows: (1) Analyze was carried out by the authors, (2) Design and (3) Develop jointly by the authors and teachers, (4) Implement by the teachers, and (5) Evaluate by the students, teachers and authors.

## **2.2. Program Applied to the Intellectually Disabled**

In this study, we examined how the earthquake disaster management education program, which had been developed for students without disability, could be adapted to be applied to learning by intellectually disabled students.

The intellectually disabled are defined as “those in whom disorders of the intellectual functions which appeared during the development stage (roughly to age 18)

hinder daily living and place them in a condition in which it is necessary to receive some form of special support” [16].

The learning characteristics of children with intellectual disabilities are such that “the knowledge or skills acquired through learning tend to be fragmented and are difficult to apply to real life situations. Because they have relatively few experiences of success, there is a tendency to insufficiently nurture their will to actively undertake activities” [17]. It is important for the educator to provide instruction according to the actual conditions of the disability in order to develop the abilities of children with intellectual disabilities to think, decide, and express ideas on their own. To achieve this, it is effective to incorporate learning from the viewpoint of active learning into educational activities in a planned, structured manner, and implement them [18]. In order to create a disaster management education program that took into account the general learning characteristics of the intellectual disabled, we iteratively applied the ADDIE process cycle to improve the program.

## **3. Trial Implementation of Earthquake Disaster Management Education Program**

### **3.1. Design, Development, and Implementation of Program**

To effectively educate intellectually disabled children, the teacher must customize the learning method based on the degree or condition of the students’ disability. Since the applicability of the existing earthquake disaster management education program for intellectually disabled children had not been verified, we first implemented the program on a trial basis at a target school to verify its educational effect. The Tochigi prefectural Imaichi Special School, which the authors are supporting, was chosen as the target school. It is a prefectural Special Support School that provides education for students with intellectual disabilities. It consists of a kindergarten, elementary school, junior high school, and senior high school, has an enrollment of 110 students and has a teaching staff of 65.

For program implementation at the target school, the learning objective was set as “to acquire correct knowledge about earthquakes and Earthquake Early Warning systems and to heighten response capacities to foresee and circumvent danger to oneself when an earthquake or Earthquake Early Warning is recognized,” which are the same objectives outlined in the existing program.

For the trial implementation of the existing program, we held a meeting with the target school in which we collaborated with the teachers to organize and analyze the instructional method. From this meeting we defined seven key items for program design. 1) Students who are frightened by the Earthquake Early Warning chime must be instructed carefully so that they will gradually come to accept the sound; 2) Provide instruction by posting the illustration (action to protect self) in the worksheet

	Contents of Programs	Contents	Implementation date
1	Earthquake Questionnaire ①	Effectiveness Measurement 1	September 7, 2017
2	Earthquake Learning ① (Every school year)	Practice of Class①	September 8, 2017
3	Disaster Response Exercise for Earthquake Early Warning ① (announce)	Disaster Response Exercise	September 8, 2017
4	Earthquake Questionnaire ②	Effectiveness Measurement 1	September 8, 2017
5	Training Reflection Questionnaire ①	Effectiveness Measurement 2	September 8, 2017
6	Disaster Response Exercise for Earthquake Early Warning ② (Unannounced)	Disaster Response Exercise	September 19, 2017
7	Earthquake Questionnaire ③	Effectiveness Measurement 1	September 19, 2017
8	Training Reflection Questionnaire ②	Effectiveness Measurement 2	September 19, 2017
9	Disaster Response Exercise for Earthquake Early Warning ③ (Unannounced)	Disaster Response Exercise	October 25, 2017
10	Earthquake Questionnaire ④	Effectiveness Measurement 1	October 25, 2017
11	Training Reflection Questionnaire ③	Effectiveness Measurement 2	October 25, 2017
12	Earthquake Learning ② (Per class)	Practice of Class②	November 30, 2017
13	Disaster Response Exercise for Earthquake Early Warning ④ (Unannounced)	Disaster Response Exercise	November 30, 2017
14	Earthquake Questionnaire ⑤	Effectiveness Measurement 1	November 30, 2017
15	Training Reflection Questionnaire ④	Effectiveness Measurement 2	November 30, 2017
13	Disaster Response Exercise for Earthquake Early Warning ⑤ (Unannounced)	Disaster Response Exercise	January 15, 2018
14	Earthquake Questionnaire ⑥	Effectiveness Measurement 1	January 15, 2018
15	Training Reflection Questionnaire ⑤	Effectiveness Measurement 2	January 15, 2018
16	Disaster Response Exercise for Earthquake Early Warning ⑥ (Unannounced)	Disaster Response Exercise	February 7, 2018
17	Earthquake Questionnaire ⑦	Effectiveness Measurement 1	February 7, 2018
18	Training Reflection Questionnaire ⑥	Effectiveness Measurement 2	February 7, 2018

**Fig. 2.** Dates when programs were implemented at Special Support Schools.

on the blackboard in order to help the students understand the response action; 3) Provide instruction where the teacher demonstrates the response action and have the students mimic the actions; 4) Provide instruction in which the teacher takes his/her class to various locations in the school, where the students are encouraged to think of what kind of response actions to take; 5) Provide instruction in which the students are given opportunities to express their views in the learning situation; 6) In the review session following the response action drill, carefully review the students' behavior to increase the number of success experiences; 7) In the classroom instruction for those with mild disabilities, attempt to deliver instruction according to the existing program.

While observing these key items, the program learning (Earthquake Learning) and response action drill (Earthquake Early Warning Response Action Drill) were carried out on a trial basis, and the educational effects were evaluated from effect measurement 1 (Earthquake questionnaire), which we issued prior to the drill, and effect measurement 2 (Drill review questionnaire), carried out after the drill. The specific implementation contents, objectives and dates are shown in **Fig. 2**, and are described later in detail in Section 4.1.

### 3.2. Method of Evaluation of Program

To evaluate the educational effects of the earthquake disaster management education program, questionnaire sheets were distributed to the students with intellectual disabilities to measure to what extent the learning objectives were achieved based on the students' self-evaluation. To measure the effects of an educational program, R. M. Gagne [19], an ID pioneer, has stated that "program evaluation must be expressed by evaluation of

the learner's performance." In previous studies, the validity of educational programs has been discussed using effect measurements by Shimano et al. [20], Kimura et al. [21], and Nagata and Kimura [13, 22].

We evaluated the efficacy of the program using two quantitative measurements: effect measurement 1 (acquisition of knowledge and skills) and effect measurement 2 (mastering of skills).

In effect measurement 1, we set eight questions that corresponded to the learning objectives of the earthquake disaster management education program, and used these to obtain three-level quantitative self-evaluations of the degree of accomplishment of learning. We used the question sheet (Earthquake Questionnaire), developed for this study. The effects were measured seven times in the process of program implementation and evaluation.

Questions 1–4 evaluate the level of knowledge on earthquake phenomena and Earthquake Early Warning gained through implementation of the program (acquisition of knowledge). The four questions are "1. Do you know what kind of things happen when an earthquake occurs?," "2. Do you know what to do when an earthquake occurs?," "3. Do you know what happens when you hear an Earthquake Early Warning sound?," and "4. Do you know what to do when you hear an Earthquake Early Warning sound?" The learner's self-evaluation is based on three levels: "3. I know, 2. I know a little, and 1. I do not know."

Items 5–8 of the questionnaire survey are statements that evaluate the level of correct understanding of the response actions one should take when an earthquake occurs or when an Earthquake Early Warning is sounded (acquisition of skills). The four statements are "5. It is dangerous. It is better to place this here. This version is clearer

and more concise. when an earthquake occurs;” “6. When an earthquake occurs or one hears an Earthquake Early Warning, one must drop low, cover the head and body, and remain still until the shaking ceases;” “7. One must quickly move to a safe place and protect oneself when one hears an Earthquake Early Warning;” and “8. When one feels the shaking of an earthquake or hears an Earthquake Early Warning, one must think for oneself to protect oneself.” The learner provides a self-evaluation by choosing from three levels: “3. I think so, 2. I think so a little, and 1. I do not think so.” The self-evaluations obtained from these eight questions were used to evaluate the program.

Meanwhile, we analyzed effect measurement 2 by having the students give quantitative self-evaluations about the extent to which they “acquired or mastered the awareness to act on one’s own initiative,” (evaluation of skills) which is the learning objective of the Earthquake Early Warning response action drill after program implementation. We used the question sheet (Drill review questionnaire) developed for this study to evaluate effect measurement. Six measurement sets were taken in the process of program implementation and evaluation.

The questions consisted of three items: “1. Were you able to listen to the Earthquake Early Warning chime or broadcast message quietly?,” “2. Were you able to think about how to act when you heard the chime?,” and “3. Were you able to think and act by yourself to protect yourself from the earthquake?” Reflecting back on the response action drill, the learner gives a self-evaluation by choosing from three levels: “3. I could do it, 2. I could do it a little, and 1. I could not do it.” The self-evaluations obtained from these three questions were used to evaluate the program.

In the authors’ previous study, with students without disability, the effect measurement employed a five-level interval scale of the degree of accomplishment of the learning objective (5. I know well, 4. I know a little, 3. I can not tell either, 2. I slightly do not know, 1. I do not know). In the present study, however, we anticipated that students with intellectual disabilities would find it difficult to make the distinctions between five levels. Based on the request from teachers “to convert the scale to three levels without changing the interval, since intellectually disabled students find it difficult to distinguish between the five levels of the evaluation scale when answering the questions,” levels 4 and 2 were omitted from the five-level scale, and a three-level scale consisting of 5, 3, and 1, without changing the intervals, was adopted to determine the averages.

Furthermore, upon conferring with the target school, we decided to measure the effects on junior and senior high-school students with relatively mild intellectual disabilities, i.e., those with B1 and B2 intellectual disability classifications. The classification of intellectual disability used here is determined from measured IQs, basic lifestyle habits, and problem behaviors, and based on which Disability Certificate Passes are issued. In Tochigi prefecture, where the target school is located, disability is classified into four levels: A1 (most severe, IQ of

roughly 20 or less), A2 (severe, IQ in rough range of 21–35), B1 (moderate, IQ in rough range of 36–50), and B2 (mild, IQ in rough range of 51–70) [23].

### 3.3. Program Implementation and Evaluation

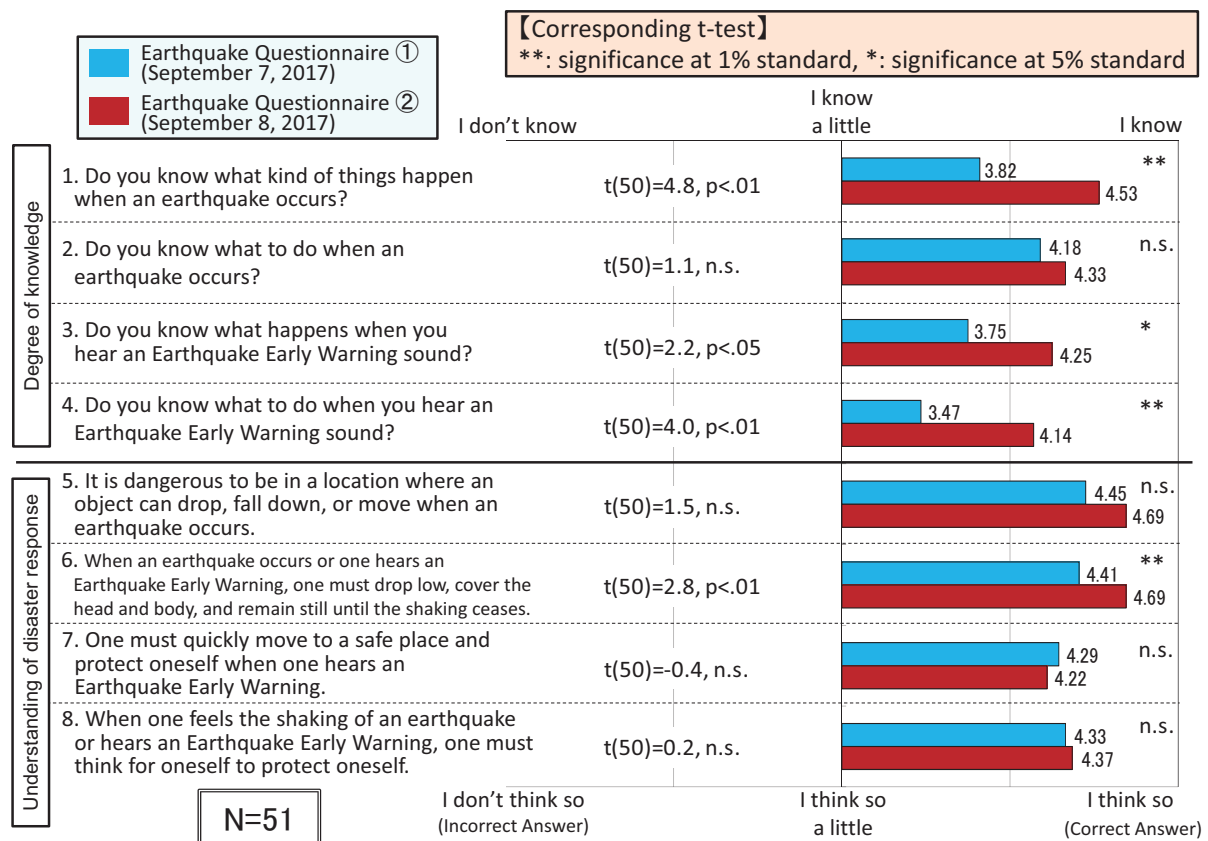
To verify the educational effects of the program, effect measurement 1 (based on the Earthquake Questionnaire) was conducted in advance of the program (September 7, 2017) and following the first response action drill (September 8, 2017), for which prior notification had been given to the students. The paired t test was used for statistical analysis (**Fig. 3**). The junior and senior high-school students with intellectual disability classifications of B1 and B2 were the subjects ( $n = 51$ ) of analysis.

The analysis results for questions 1–4 yielded score changes of 3.82 (before) to 4.53 (after) for “1. Do you know what kind of things happen when an earthquake occurs?” 4.18 to 4.33 for “2. Do you know what to do when an earthquake occurs?” 3.75 to 4.25 for “3. Do you know what happens when you hear an Earthquake Early Warning sound?” and 3.47 to 4.14 for “4. Do you know what to do when you hear an Earthquake Early Warning sound?” The scores were higher after program implementation for all four items, which indicates an increase in the number of those who answered affirmatively (“yes”). Analysis using the paired t test showed that the before and after scores of question items 1 and 4 displayed 1-percent level statistically significant differences while those for question item 3 displayed a 5-percent level difference. Meanwhile, no statistically significant difference was found for those of question item 2.

The analysis results for items 5–8 yielded score changes of 4.45 (before) to 4.69 (after) for “5. It is dangerous to be in a location where an object can drop, fall down, or move when an earthquake occurs;” 4.41 to 4.69 for “6. When an earthquake occurs or one hears an Earthquake Early Warning, one must drop low, cover the head and body, and remain still until the shaking ceases;” 4.29 to 4.22 for “7. One must quickly move to a safe place and protect oneself when one hears an Earthquake Early Warning;” and 4.33 to 4.37 for “8. When one feels the shaking of an earthquake or hears an Earthquake Early Warning, one must think for oneself to protect oneself.” While the pre-implementation scores for these four items were high to begin with, some items displayed further increased scores after implementation. Analysis using the paired t test revealed a statistically significant difference at the 1-percent level between the before and after scores of question item 6, while no significant difference was found for the other three items. Thus, the analysis results of effect measurement 1 found 4.0 or higher scores of the degree of accomplishment of the learning objective for all eight items, which confirmed the enhanced educational effect and program validity with regard to acquisition of knowledge due to program implementation.

Next, to verify the degree of skill mastery due to the response action drill, effect measurement 2 (based on the Drill Review Questionnaire) was conducted after the first





**Fig. 3.** Effectiveness measurement 1 of earthquake disaster management education programs (degree of disability B1 and B2).

and second response action drills (September 8 and 19, 2017, respectively). The paired  $t$  test was used for statistical analysis (**Fig. 4**). The subjects ( $n = 51$ ) were the same as in effect measurement 1.

The analysis results yielded score changes of 4.45 (post first drill) to 4.84 (post second drill) for “1. Were you able to listen to the Earthquake Early Warning chime or broadcast message quietly?,” 3.90 to 4.76 for “2. Were you able to think about how to act when you heard the chime?” and 4.02 to 4.80 for “3. Were you able to think and act by yourself to protect yourself from the earthquake?” Analysis using the paired  $t$  test revealed statistically significant differences at the 1-percent level between the two scores in all items. As shown by the dramatic increase of scores for question items 2 and 3, the results of effect measurement 2 confirm that the “mastery of skills to protect oneself” was enhanced by program implementation.

The results of the two effect measurements demonstrate that the students’ knowledge of earthquakes and Earthquake Early Warning and their understanding of concrete actions to take after an Earthquake Early Warning were improved by implementing this program. Furthermore, they learned through the drills to think for themselves and protect themselves. While the results confirmed the validity of the program, in addition to the fact that the students were given advance notice before the first drill, some scores suggested that there was room for further enhancement of the educational effects. For example, stu-

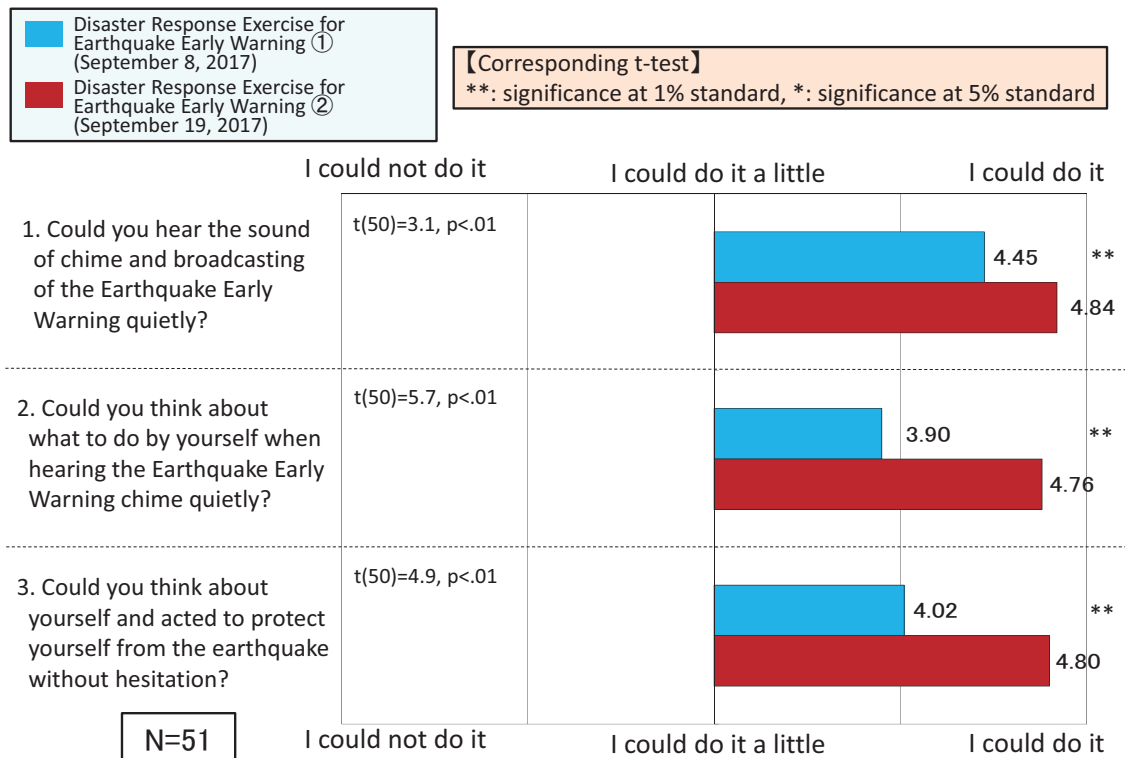
dents did not always understand that the protective actions following an Earthquake Early Warning and those following an actual earthquake were different or that their insufficient understanding of the need to recognize the Earthquake Early Warning and think for themselves to take protective actions was a real danger. Such findings pointed to the need to further improve or adjust the program.

## 4. Development and Implementation of Final Program

### 4.1. Program Improvement and Adjustments

Through trial implementation and verification, we demonstrated that the existing earthquake disaster management education program requires further improvements to enhance the educational effects among intellectually disabled children. To this end, we organized the method of instruction and key points of instruction as follows.

Some key points for elementary school students are: 1) to help them understand the equivalence of an Earthquake Early Warning and earthquake in the learning context of instilling an understanding of the connection between an Earthquake Early Warning chime and an earthquake phenomenon. It will be necessary to gradually acclimate those students who are easily frightened by sound



**Fig. 4.** Effectiveness measurement 2 of earthquake disaster management education programs (degree of disability B1 and B2).

through repetition of the experience. Teachers should use illustrations and video footage or noisily shake desks so that students can have some sense of earthquakes; 2) As part of the learning process to enforce basic response actions when they recognize an Earthquake Early Warning, teachers should provide a setting that allows the students to decide what action to take when they recognize the sound in the classroom. Ingrain the action by having them follow other students' actions, or the teacher who acts with them to demonstrate model behavior; 3) Encourage the students to act on their own even in the absence of the teacher's instruction or assistance; and 4) To enhance understanding during a post-drill review, students should discuss the actions of classmates who were close by and reflect on their own behavior.

While learning based on the existing earthquake disaster management education program was satisfactory for some classes of the junior and senior high-schools, we identified two key items in addition to those for the elementary school students for those classes with greater degrees of disability: 1) In order to ensure that students have an accurate grasp of what can happen during an earthquake, make sure they understand that, in addition to the shaking, objects can drop or fall on them, or move toward them; and 2) Teachers should carry out learning in which the students carefully reflect on their behavior at various physical locations in school and think about whether the actions they took were correct.

While those students with severe intellectual disability will require the same type and level of instruction as the

elementary school, it will be necessary, when the student cannot make decisions on his or her own, to carefully repeat instructions to instill what they are learning based on an awareness and action, such as accepting the teacher's support and acting with the teacher.

Based on these discussions, and the trial implementation and verification at the target school, the final program was developed through the incorporation of improvements and adjustments in the instructional material, which consisted of two types of teacher's guides according to the degree of disability and developmental stage (Fig. 5), worksheets (Fig. 6), slides to assist classroom lectures (Fig. 7), and training videos through which the student can visually learn the response action (Fig. 8).

#### 4.2. Implementation and Evaluation of Improved Program

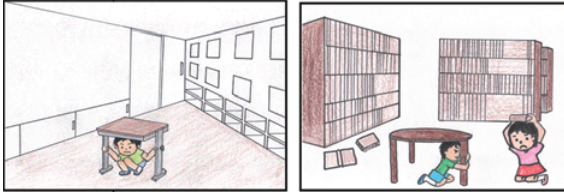

To evaluate the educational effects of the program which had been customized for intellectually disabled students, we carried out effect measurement 1 before the second program learning (November 30, 2017) and after the fourth response action drill (November 30, 2017). The paired *t*-test was used for statistical analysis (Fig. 9). The analysis subjects ( $n = 51$ ) were the same as the targets of the effect measurement carried out in Section 3. The response action drill was carried out without prior notice (surprise drill).

The analysis results of the eight questions yielded score changes of 4.76 (before) to 4.92 (after) for Question 1, 4.69 to 4.84 for Question 2, 4.73 to 4.80 for Question 3,



■Teacher's guide for advance learning (45 min.) «Upper years of elementary school» Imaichi Special School

Title	Let's learn how to act to protect ourselves when we hear an Earthquake Early Warning
Objective (objective of learning)	1. Learn about the dangers of an earthquake, and how to respond when we hear the Earthquake Early Warning 2. To become capable of acting correctly to protect oneself at various places upon hearing an Earthquake Early Warning
Target years	Upper years of elementary school
Subject, event, etc.	Earthquake evacuation drill (advance learning)
Learning format	Elementary School Upper-year block
Preparation	Large display monitor, notebook computer, PowerPoint (projector), cardboard locker, picture cards

Stage	Learning activity	Considerations for instruction and procedure
Introduction (5 min.)	1. Learn about this subject (1) Let's learn about the danger points of various places when an earthquake occurs (2) Let's learn about how to act when we hear an Earthquake Early Warning (3) Let's act to protect ourselves	<ul style="list-style-type: none"> <li>Display the activity using PowerPoint, to provide an overview to the students.</li> <li>Use vocabulary that will reduce the student's fear about earthquakes.</li> </ul>
Program (30 min.)	<p>2. Think about the dangers that accompany earthquakes. Know the three dangers: objects drop, fall, and move ○ Learn about the kind of damage caused by earthquakes. (classroom, corridor, stairs, gym, library, toilet, etc.)</p>  <p>3. Think about how to act to protect oneself when an earthquake occurs. (1) Know about Earthquake Early Warning (2) Learn how to protect oneself in familiar settings based on the three dangers. ① View the training video "Protect your head" and think about how to act to protect oneself at various places (classroom, corridor, stairs, gym, library, toilet) ② Act out the behavior to protect oneself. ○ Assume the "pill bug posture" without the desk.</p> <p>4. Separate into classes and take protective action at various places. (Decide the order of places to visit.) (example: 1. library → 2. corridor → 3. toilet)</p>	<ul style="list-style-type: none"> <li>Show video footage of scenes before and after an earthquake so that the student can easily see the damage of earthquakes. Photos can be used instead.</li> <li>Let the students know that, when a large earthquake occurs, the shaking can cause buildings to collapse or make it impossible for people to remain standing.</li> <li>Use the cardboard locker to show that objects can drop on, fall on, or move toward (3 ways) a person.</li> </ul>  <ul style="list-style-type: none"> <li>Teach the students that certain sounds indicate that earthquake tremors are about to occur.</li> <li>Ask the students whether they have ever heard the sound of an Earthquake Early Warning. Demonstrate two types of Earthquake Early Warning sounds. (NHK broadcast chime, mobile phone)</li> <li>Make it clear to the students that they must use their hands to protect their heads when there is no desk nearby.</li> <li>On the PowerPoint screen, show two possible actions to take when an Earthquake Early Warning is sounded, and ask the students to choose the correct one. Check to see if they know to stay low and protect their head with their hands. Pill bug posture.</li> <li>Ask the students about the potential dangers of an earthquake, and provide hints to draw out their views that "objects can drop on, fall on, or move toward" them.</li> <li>Have the students think of dropping, falling, or moving objects, and ask them to act to protect themselves in various places.</li> </ul>
Summary (10 min.)	5. Review (1) Each class uses picture cards to review the session. (② Protect head from ① Danger) (2) Act out the actual behavior to protect oneself.	<ul style="list-style-type: none"> <li>Present picture cards and check the key points.</li> <li>Let them know that an earthquake can occur any time, and that they are to assume the "pill bug posture" when they hear an Earthquake Early Warning or encounter severe shaking.</li> </ul>

**Fig. 5.** Instructional material depending on the degree of disability and developmental stage (teacher's guide for advance and follow-up learning).


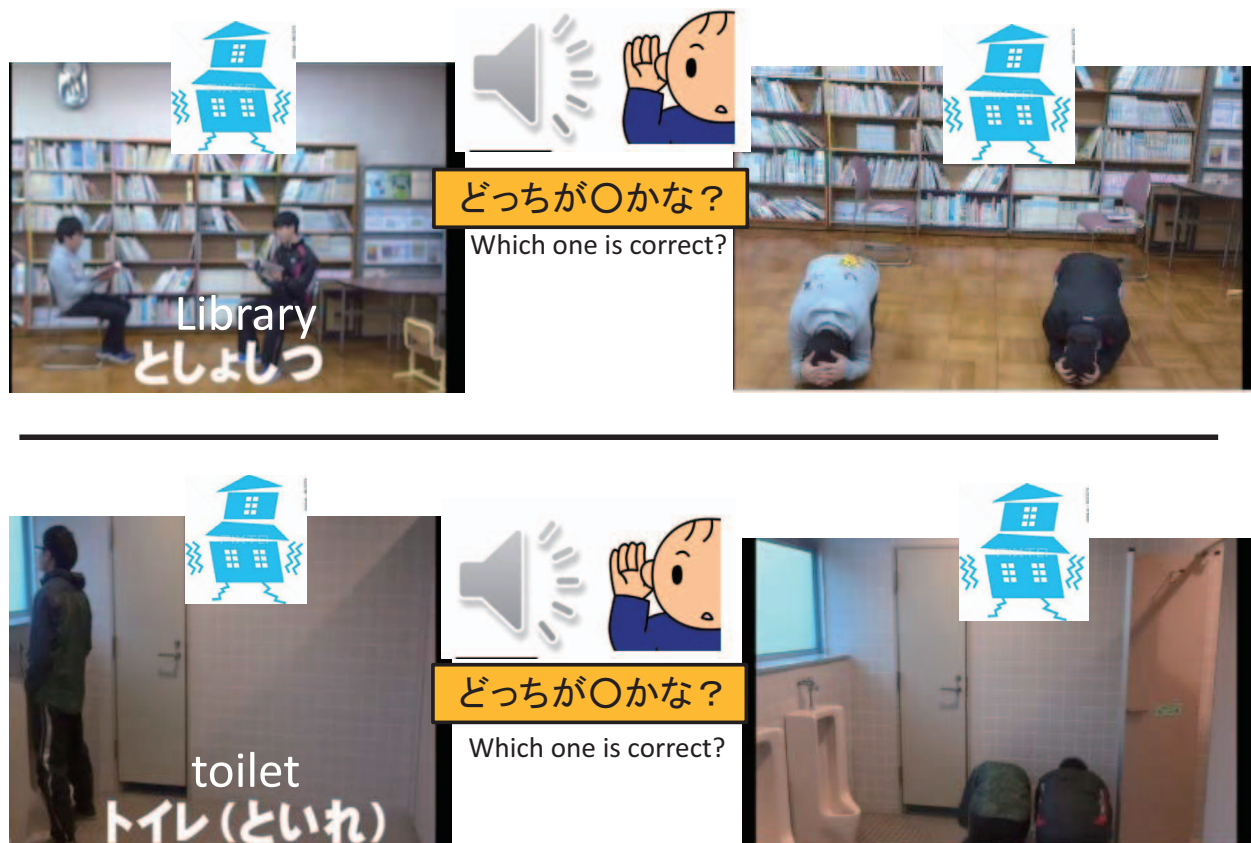
■Teacher's guide for follow-up learning (20 min.) «Elementary, junior and senior high school C» Imaichi Special School		
Title	Let's review how to act to protect ourselves when we hear an Earthquake Early Warning	
Objective (objective of learning)	1. Have the students review their responses in the drill. 2. Confirm the proper action to take when one hears an Earthquake Early Warning 3. Learn the need to protect oneself in an earthquake.	
Target years	Elementary school, junior and senior high school (no entry to worksheet)	
Subject, event, etc.	Response action drill based on Earthquake Early Warning (follow-up learning)	
Learning format	Class	
Preparation	Picture cards on earthquake-related subjects, cardboard locker, whiteboard, felt pens, etc.	
Stage	Learning activity	Considerations for instruction and procedure
Introduction (5 min.)	1. Learn about this subject (1) Review the drill (2) Protective action to take when hearing an Earthquake Early Warning	<ul style="list-style-type: none"> <li>Display picture cards to give an overview to the students.</li> </ul>
Program (12 min.)	2. Review the students' actions during the drill. ○ Have the student recall what actions they took during the drill, and have them act it out.  3. Have the student recall how they responded when they heard the Earthquake Early Warning. (1) Recall that the Earthquake Early Warning is an indication that a large earthquake is coming. ○ Recall how objects can move if an earthquake occurs. Check the three dangers: objects dropping down, falling over, and moving. (2) Know how to protect oneself from danger. ○ View picture cards showing the correct actions to protect oneself at various places. (classroom, corridor, stairs, schoolyard, toilet, etc.) ○ Recall that it is important to protect the head.   “Pill bug”  4. Check the actions to take to protect oneself during an earthquake. ○ Have the students reflect on whether the action they took during the drill was correct. ○ Have them reflect and check the action of getting under the desk or some other object where one can protect the head, or getting low and protecting the head using hands. ○ Confirm that students know that when the shaking has stopped, they must follow the teacher's directions to evacuate.	<ul style="list-style-type: none"> <li>Talk to the students in a manner that encourages them to respond calmly.</li> <li>Prepare and display picture card showing that:</li> <li>Pill bug posture, getting under the desk → Correct behavior</li> <li>Standing, moving about → Incorrect behavior</li> <li>Have the students recall what they have learned so far, to check and see whether their actions today were correct.</li> <li>Use the picture cards used in the advance learning session to remind the students what they learned.</li> <li>Use the cardboard locker or picture cards to demonstrate dangerous behaviors to deepen the students' understanding.</li> <li>Ask the students about their experience so far so that they can think about how to protect themselves the hear hearing an Earthquake Early Warning or when they encounter the strong shaking motions of an earthquake.</li> <li>Ask questions that will induce the students to state that they must protect the head.</li> <li>Prepare picture cards that show how to protect oneself, and make them available so that the students can check them anytime.</li> <li>Note the importance of protecting the head when protecting oneself in an earthquake, and to move under the desk if one is in the classroom.</li> <li>Have the students think about what they can do when there is no desk.</li> <li>Reinforce that the students should assume the pill bug posture, without being told by the teacher, where ever they are when an earthquake strikes.</li> <li>Have the students use catchwords to remember the appropriate action.</li> <li>Have each student reflect on whether the behaviors displayed on the whiteboard are correct or not. Praise those students who acted correctly.</li> <li>With those students who did not act correctly, think together about how to act.</li> <li>Choose words that encourage the student to think about how to act according to the situation.</li> </ul>
Summary (3 min.)	5. Act out the correct behavior to protect oneself ○ Sound an Earthquake Early Warning using a cassette tape, and check the students' actions to protect themselves. ○ Reinforce the importance to protect oneself in an earthquake.	<ul style="list-style-type: none"> <li>Once again, demonstrate the behavior to take when an Earthquake Early Warning is sounded, and make a point that the students must get under the desk or assume the pill bug posture.</li> <li>Use concrete examples to explain to the students that they need to make sure to protect the head and pay attention to safety where ever and with whomever they may be.</li> </ul>

Fig. 5. Continued.



**Fig. 6.** Materials created according to the degree of disability and developmental stage (worksheet/for Junior high and high school students).



**Fig. 7.** Materials created according to the degree of disability and developmental stage (some excerpts).





**Fig. 8.** Teaching materials to learn visually (training video).

4.61 to 4.80 for Question 4, 4.69 to 4.84 for Question 5, 4.69 to 4.96 for Question 6, 4.61 to 4.88 for Question 7, and 4.73 to 5.00 for Question 8. For all eight items, the later scores for the degree of accomplishment of the learning objectives were 4.80 or higher. Analysis using the paired *t* test showed that the before and after scores of question items 6, 7, and 8 displayed 5-percent level statistically significant differences. This suggests that the learning produced a deeper understanding of response actions. The analysis results of effect measurement 1 thus confirm the enhanced educational effect and validity of the improved program.

Next, to verify the degree of skill mastery due to the response action drill, effect measurement 2 was conducted after the third and fourth response action drills (October 25 and November 30, 2017, respectively). The paired *t* test was used for statistical analysis (**Fig. 10**). The subjects ( $n = 51$ ) were the same as in effect measurement 1.

The analysis results yielded score changes of 4.84 (post third drill) to 4.96 (post fourth drill) for Question 1, 4.14 to 4.80 for Question 2, and 4.25 to 4.73 for Question 3. Analysis using the paired *t*-test revealed statistically significant differences at the 1-percent level between the two scores in question item 2, and at the 5-percent level in question item 3. Although the response action drills were carried out without prior notice, high scores were maintained for item 1 while the scores for question items 2 and 3, which were in need of improvement, dramatically increased, indicating that mastery of “skills to protect oneself” was enhanced by program implementation.

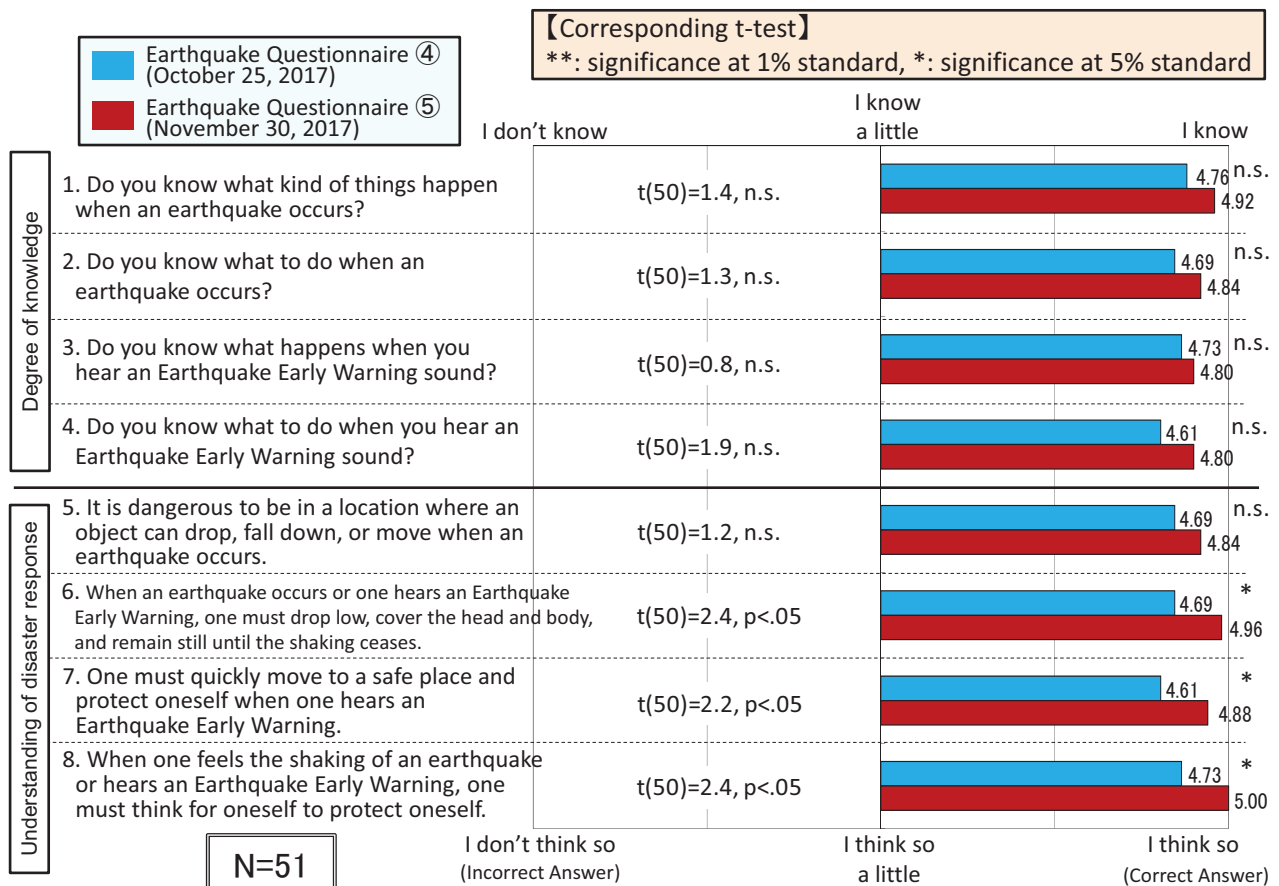
The results of the two effect measurements demonstrate that the students’ knowledge of earthquakes, Earthquake Early Warning, and understanding of concrete actions to take after an Earthquake Early Warning were deepened through the implementation of this program. Furthermore, they learned to think for themselves and to protect themselves as a result of the drills. The results thus confirm the validity of the program.

### 4.3. Retention of Knowledge Acquired, and Skills Improved by Program Implementation

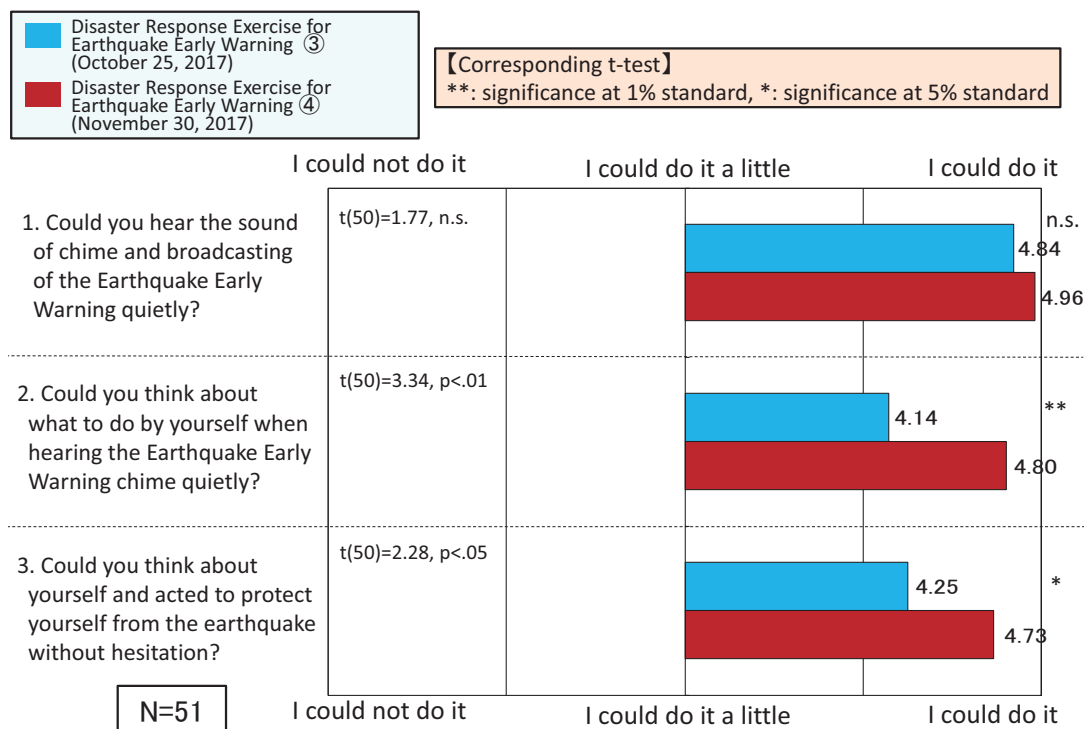
#### 4.3.1. Method of Investigation

The learning characteristics of students with intellectual disabilities are such that the knowledge or skills acquired through learning tend to be fragmented and are difficult to apply to real life situations. Therefore, we investigated whether the proficiency level of the knowledge and skills acquired by implementation of the earthquake disaster management education program and the level of mastery of the skills acquired through the response action drills are respectively retained with the passage of time.

To this end, we used the data obtained by effect measurements 1 and 2, based on program implementation, to examine the changes in the scores that represented the proficiency level of knowledge and skills and the level of mastery of the skills. The single-factor repeated-measures analysis of variance (ANOVA) (paired) was used for statistical analysis. The implementation schedule of the effect measurement used for repeated measurements is shown in **Fig. 2**.



**Fig. 9.** Effectiveness measurement 1 of earthquake disaster management education programs (degree of disability B1 and B2).



**Fig. 10.** Effectiveness measurement 2 of earthquake disaster management education programs (degree of disability B1 and B2).

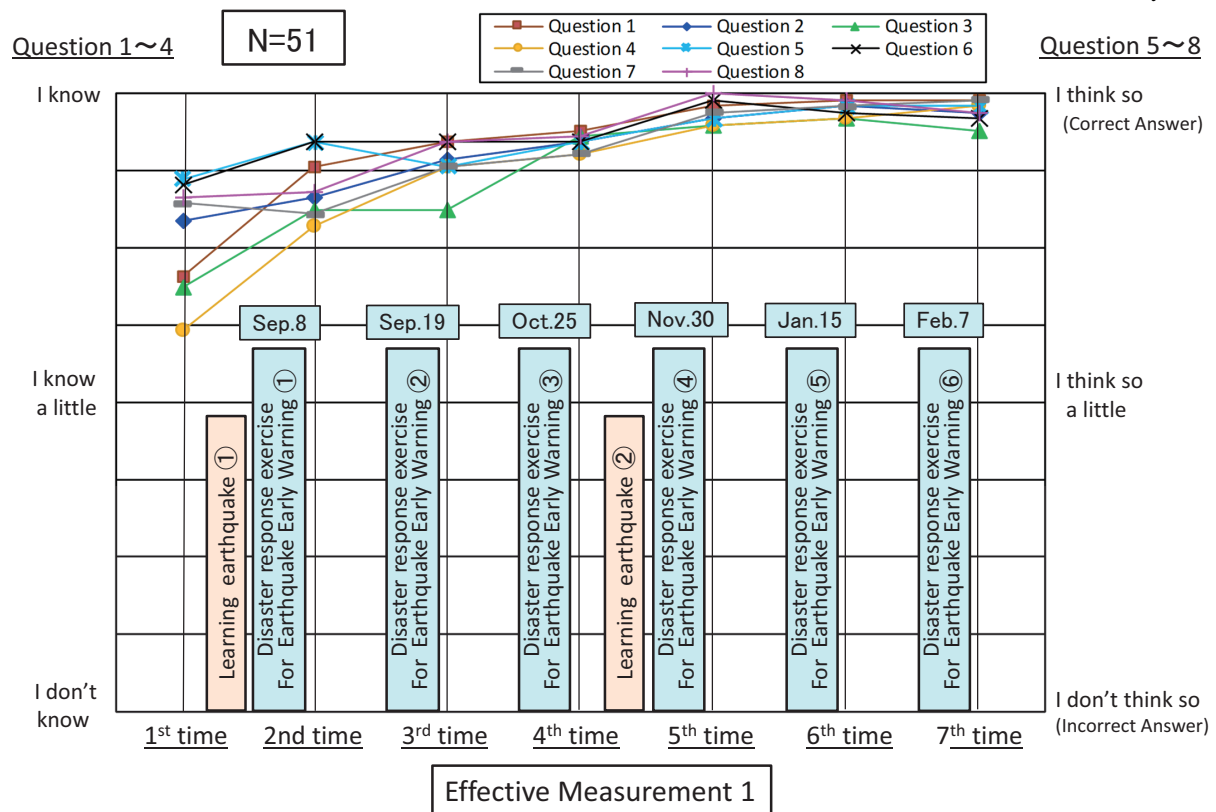


Fig. 11. Repeated measure through earthquake disaster management education programs (degree of disability B1 and B2).

#### 4.3.2. Analysis of Effect Measurement 1 “Earthquake Questionnaire”

The data ( $n = 51$ ) of effect measurement 1 was used to analyze the score changes in the proficiency level of knowledge and skills (Fig. 11). Although local fluctuations exist, the overall scores of the knowledge and skills acquired through program learning ① increase with later events and remain at a high level.

On an event-to-event basis, we found that the scores for all eight items of learning objectives increased between the first effect measurement (September 7, 2017), conducted before program implementation, and the second measurement (September 8, 2017). In the third measurement (September 19, 2017), the scores of two items fell considerably: “3. Do you know what happens when you hear an Earthquake Early Warning sound?” and “5. It is dangerous to be in a location where an object can drop, fall down, or move when an earthquake occurs.” The scores dropped because response action drill ② was a surprise drill without prior notice, and some students felt that they had not acted correctly, resulting in the lower scores. The specific reasons given by the students in a subsequent interview were that, “I didn’t realize that the sound of the Earthquake Early Warning signaled the start of the drill,” “I didn’t know how to protect myself because the drill began suddenly,” and “I was taken by surprise, and it took some time before I could respond.” In the fourth effect measurement (October 25, 2017), while a greater number of students recognized the

Earthquake Questionnaire	Result of One-Factor Analysis of Variance with Correspondence
Question 1	$F(3.6, 179.2)=20.9, p<.01$
Question 2	$F(4.1, 207.6)=10.5, p<.01$
Question 3	$F(3.4, 169.3)=12.3, p<.01$
Question 4	$F(2.5, 126.6)=18.8, p<.01$
Question 5	$F(4.3, 216.6)=3.7, p<.01$
Question 6	$F(3.1, 154.2)=4.3, p<.01$
Question 7	$F(3.5, 175.5)=7.9, p<.01$
Question 8	$F(3.6, 180.6)=7.7, p<.01$
Number of Times	7

Fig. 12. Result of one-factor analysis of variance with correspondence 1 (degree of disability B1 and B2).

sound of the Earthquake Early Warning, the overall scores increased by only a modest amount. Therefore, program learning ② to enhance the proficiency level of knowledge and skill, was carried out with all classes. As a result, the scores of all items rose in the fifth effect measurement (November 30, 2017). Subsequently, high scores were maintained for all items in the sixth and seventh effect measurements (January 15 and February 7, 2018, respectively). The repeated-measures ANOVA yielded statistically significant differences at the 1-percent level for all items (Fig. 12).

The results indicate that enhanced education effects



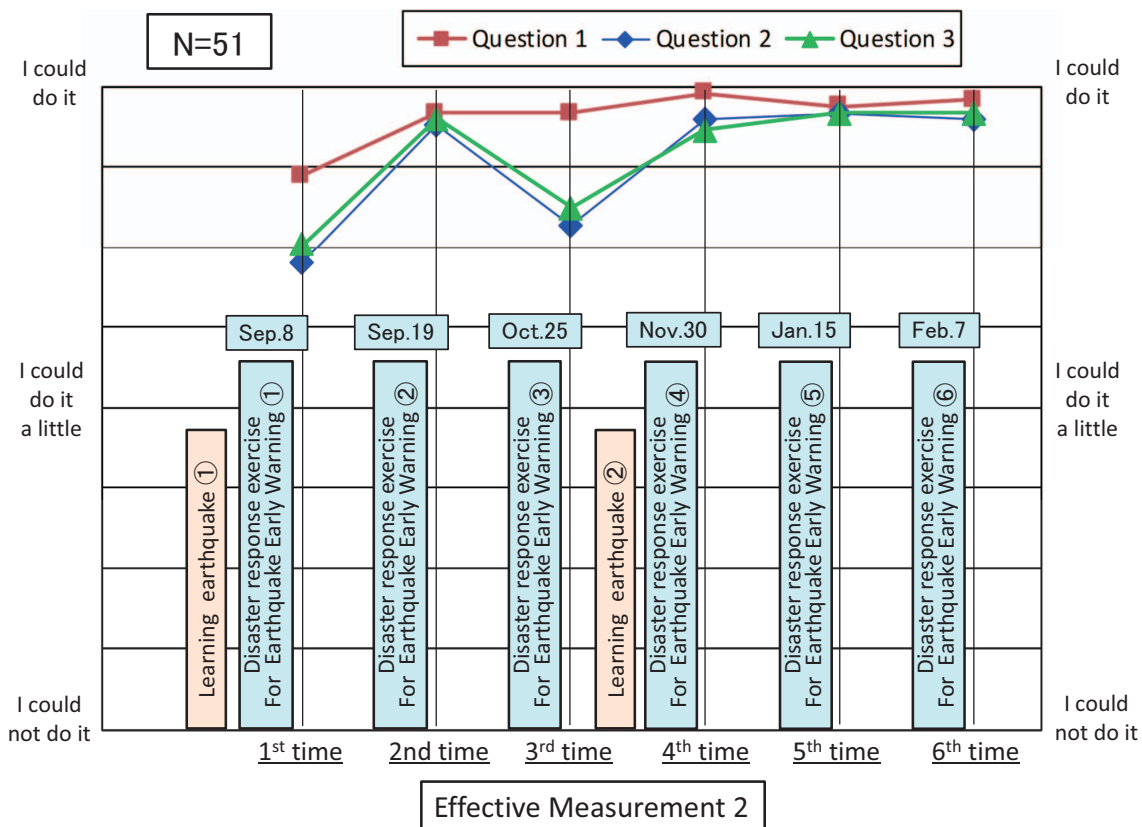


Fig. 13. Repeated measure through earthquake disaster management education programs (degree of disability B1 and B2).

were produced by implementation of earthquake learning ② when adjusted to the degree and condition of the students' disabilities in addition to modification of the response action drill. Furthermore, despite some local fluctuations, the overall trend shows that, through repetition of the response action drill, the proficiency level of the knowledge and skills acquired through learning was retained at a high level with the passage of time.

#### 4.3.3. Analysis of Effect Measurement 2 "Drill Review Questionnaire"

To examine the score changes in the level of mastery of skills acquired through the response action drill, we analyzed the data ( $n = 51$ ) of effect measurement 2 (Fig. 13). The overall trend was similar to that of the results of effect measurement 1.

On an event-to-event basis, we found that the scores of two items increased drastically between the first and second effect measurements (September 8 and 19, 2017, respectively): "2. Were you able to think about how to act when you heard the chime?" and "3. Were you able to think and act by yourself to protect yourself from the earthquake?" However, the same scores fell drastically in the third effect measurement (October 25, 2017). This is because it was a surprise drill without prior notice, as stated for the results of effect measurement 1. These scores rose again in the fourth effect measurement (November 30, 2017). This was the effect of program

Questionnaire for Review on Exercise	Result of One-Factor Analysis of Variance with Correspondence
Question 1	$F(2.4, 120.9)=7.0, p<.01$
Question 2	$F(3.0, 151.4)=12.8, p<.01$
Question 3	$F(3.3, 162.6)=9.9, p<.01$
Number of Times	6

Fig. 14. Result of one-factor analysis of variance with correspondence 2 (degree of disability B1 and B2).

learning (2). Subsequently, students maintained high scores for all items in the fifth and sixth effect measurements (January 15 and February 7, 2018, respectively). The repeated-measures ANOVA yielded statistically significant differences at the 1-percent level for all items (Fig. 14).

These results suggest that, some items which displayed enhanced educational effect by program implementation retained their effect with the passage of time, while others failed to do so when the method of execution was altered, such as in a surprise drill.

The overall trend, however, was similar to that of effect measurement 1, described in the previous section, where the proficiency level of the acquired skills was retained at a high level regardless of the change in the drill method or the passage of time.

#### 4.4. Teacher’s Evaluation of Response Actions and Analysis

While the effect measurements described above were carried out against students with mild intellectual disabilities who are capable of self-evaluation, the program has also been implemented with students who are incapable of self-evaluation. It is necessary to evaluate these students as well in order to verify the educational effects of the instruction that corresponds with the degree or condition of disability, or the need to further improve the program. Therefore, we asked the teachers to evaluate the response actions of all students enrolled in the target school in order to objectively evaluate the proficiency level of the students’ skills acquired through the response action drill.

This consisted of having the teacher evaluate whether the students achieved the learning objective of the response action drill, namely, “to be able to calmly get under the desk on their own initiative to protect themselves,” according to the five levels of “1. Yes,” “2. Yes, by observing other students in the vicinity (or hearing their sound),” “3. The student made some attempt to act,” “4. No,” and “5. Only with the teacher.” The teacher entered their evaluations on the “level-of-accomplishment evaluation sheet,” produced for this study after observing the students’ behavior. The completed sheets were collected by the authors for tabulation and analysis.

The evaluation targets consist of all students ( $n = 110$ ) enrolled in the target school. The students were divided according to the degree of disability into two groups, “B1 and B2,” who were the subjects of analysis in the effect measurement discussed earlier, and “A1 and A2,” and the teacher evaluations of both groups for six response action drills were cross tabulated.

In the tabulation results for the group with degrees of disability B1 and B2, the percentages of students across the six drills who were evaluated as “1. Yes” were 66.2, 76.6, 69.7, 75.0, 87.0, and 92.0%, from the first to sixth drill. Although there were some local fluctuations due to the drill method, the trend overall trend shows that scores increased as the response action drills continued (Fig. 15).

Meanwhile, the share of students who mimicked their classmates changed from 23.4% in the first drill to 4.0% in the sixth drill, thus displaying a falling trend. This suggests that, through repeated participation in the response action drills, these students learned and developed the ability to act according to their own decisions without needing to mimic the behavior of others.

The evaluation results display a trend similar to the analysis results of the students’ self-evaluation, described in Section 3, and suggest an improved proficiency level of skills. We carried out a chi-square test to analyze the relation of the number of response action drills and the teachers’ evaluations. The results yielded a statistically significant difference at the 1-percent level ( $\chi^2(20) = 39.6$ ,  $p < .01$ ).

Next, we analyzed the group with degrees of disability “A1 and A2,” where we found that the percentages of those evaluated as “1. Yes” from the first to sixth drills

were 3.2, 3.2, 10.0, 10.0, 13.3, and 14.8%, respectively. This displays a trend of increasing scores as the response action drill continued (Fig. 16).

It is important to note that the share of students who were unable to act in the drill changed from 16.1% in the first drill to 0% in the fourth and subsequent drills. Meanwhile, the share of students who were able to act with the teacher changed from 54.8% in the first drill to 70.4% in the sixth drill. This indicates that those students had learned and become able to act by following the instruction from their teachers or support of others. When the relation between the number of response action drills and the teachers’ evaluations was subjected to analysis by the chi-square test, no statistically significant difference was found ( $\chi^2(20) = 28.6$ , n.s.)

The objective evaluations by the teachers, who are in daily contact with the students, suggest that, by the time of the final drill, about 70% of the students were able to act to protect themselves on their own, without the teacher’s instruction, as a result of implementing the program.

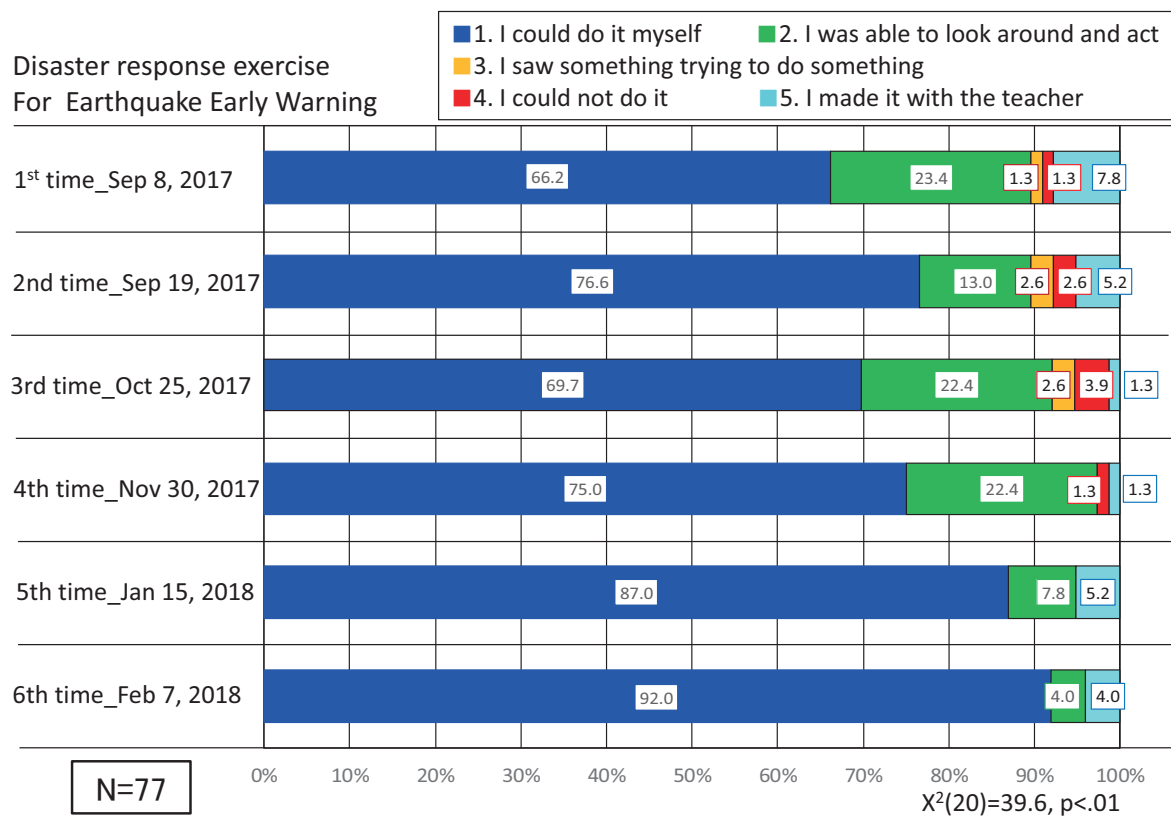
#### 4.5. Effect of Program Implementation (Qualitative Survey with Teachers)

We conducted a qualitative survey with the entire teaching staff of the target school on the changes in students’ specific behaviors and thinking during the response action drills. The survey was conducted after the program was implemented, either in the form of interviews or written statements, which the authors summarized.

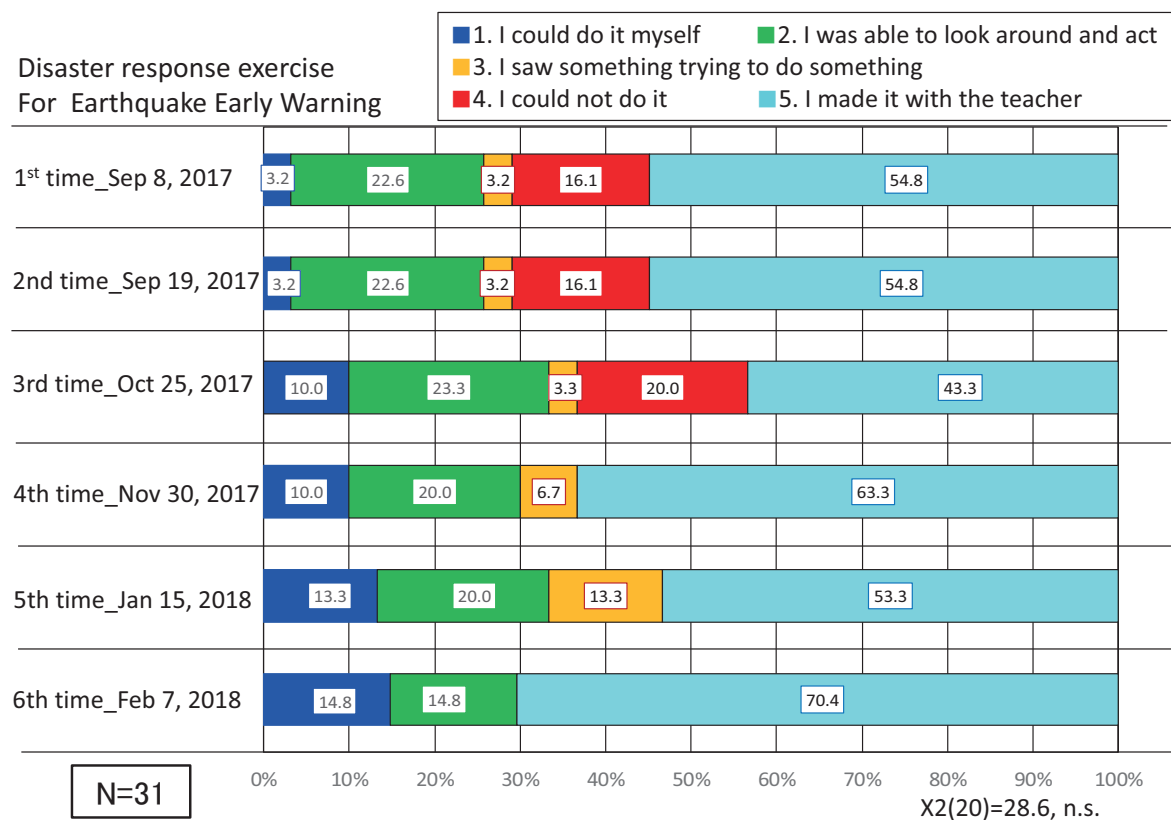
In terms of the changes that took place among the students with mild intellectual disabilities, many teachers reported that the students “were confused and didn’t know how to act,” “acted after receiving instructions from the teacher,” or “were unable to act except with the teacher,” in the early drills, but “became able to act on their own initiative” or “were able to act by observing and following others in the surrounding” with repeated drills (Fig. 17).

When they described the changes that took place among the students with more severe intellectual disabilities, many teachers stated that the students “became frightened and cried out at the sound of the drill,” “panicked and moved about,” “refused to act when instructed by the teacher,” or “showed no response,” in the early drills, but “were able to act when told or supported by the teacher,” “remained quiet though were unable to act,” or “seemed prepared to accept support,” after repeated drills.

Some common observations for all school years were that “an awareness of the need to protect oneself from disasters was created, accompanied by clear changes in the response action, in many students,” or “the attitude changed and the students quietly accepted the teacher’s support even in those students with severe intellectual disability,” suggesting that the teachers felt that implementing the program produced some visible effects.



**Fig. 15.** Cross tabulation of emergency earthquake response action training and teacher evaluation (degree of disability B1 and B2).



**Fig. 16.** Cross tabulation of emergency earthquake response action training and teacher evaluation (degree of disability A1 and A2).

Disaster response exercise  
For Earthquake Early Warning ①



Nothing responds to training cues

Disaster response exercise  
For Earthquake Early Warning ④



In response to the training signal, I also  
crawl under the desk

Fig. 17. Change of child student by response action training (3rd grade elementary school).

## 5. Desirable Ways to Effectively Support and Disseminate Disaster Management Education

In Japan, the general way to support disaster management education in educational institutions is to distribute leaflets or visual aids (DVD) that have been prepared by disaster management experts or the national or local government. However, the teacher must have some specialized knowledge to be able to use this material in classroom lectures. Therefore, the general feeling among teachers is that it is difficult to conduct disaster management education, even when such documents are available.

An alternative method is to invite a disaster management expert to the school as a guest lecturer. This approach, however, tends to be limited to schools with a higher awareness of disaster management and, as a result, the benefits extend to a limited segment of the student population, and is difficult to propagate to other schools.

Another method is to provide training to teachers in collaboration with the local Board of Education. Yet, even if the teacher is equipped with this knowledge, considerable preparation time is needed before a disaster management education can be systematically implemented, and to gain the understanding of the school administration, to reexamine the one-year instructional plan, or to achieve a common understanding among the school staff.

One component of these issues is the hierarchical structure of the schools and Boards of Education, with the prefectural Board of Education at the top, followed by the municipal Board of Education, school, teachers, and students, all of which are independent. There is too much subordination in this sentence, and it is difficult to follow. Consider: “The authors have discussed in a previous study [13] the need for a framework in which the Japan Meteorological Agency would implement disaster management education in partnership with the prefectural

Boards of Education and individual schools.” Kamiya et al. [24] have also pointed out the importance of constructing a network composed of the schools, relevant organizations and groups, and university instructors with expert knowledge. In this study, we renew our proposal for a framework by charting the connection method among stakeholders, consisting of experts or organizations of disaster management and educational institutions, as an effective way to spread disaster management education (Fig. 18). In this study we were able, by tying those stakeholders together, to confirm the validity of this framework by showing that disaster management education can be effectively and strategically implemented and that the benefits of implementation impacted all public schools in Tochigi prefecture.

## 6. Conclusions and Future Prospects

In this study we first discussed the current status and issues of disaster management education in the context of special support education in Japan in view of the casualties of those with disabilities in previous major earthquakes. In Japan, where disaster management education is conducted on a school-to-school basis, there are very few examples of the practical implementation of, instructional material for, or previous studies on disaster management education for disabled children. Neither is there an established systematic instructional method designed to enhance the student’s ability to foresee and avoid danger to self (“Zest for Life”).

Therefore we selected earthquakes, with which intellectually disabled children are familiar, as the subject of this study, and developed a disaster management education program aimed to enhance these students’ response capacity to foresee danger and protect themselves from this danger based on the ADDIE process in Instructional

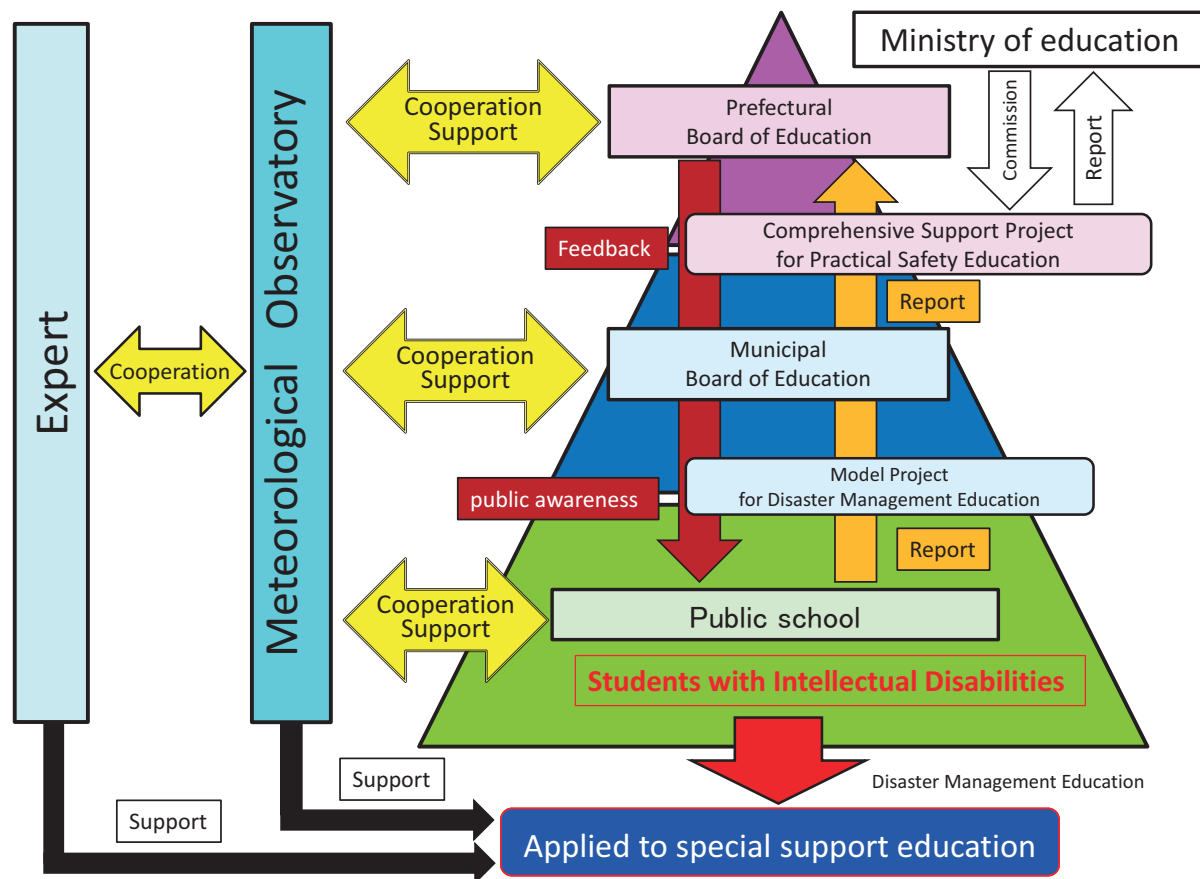


Fig. 18. Framework of disaster prevention education with stakeholder cooperation.

Design (ID).

Specifically, we implemented a program that takes into account the degree or condition of disability and the learning characteristics of intellectual disabilities, by applying the authors' existing earthquake disaster management education program to intellectually disabled children enrolled in the target school.

The Tochigi prefectural Imaichi Special School, which offers education for intellectually disabled students, was selected as the target school where the program was implemented to introduce improvements.

We investigate the program's applicability to intellectually disabled children comprehensively from the effect measurements based on the students' self-evaluations and the teachers' objective evaluations of the students' response actions.

The students' self-evaluations indicated that, although the changes in knowledge acquisition or response actions differed depending on the characteristics of the disability, program implementation accomplished the learning objectives, and continuation of the drills maintained the level of acquired knowledge and skills. Meanwhile, the teachers' evaluations demonstrated that, by the final drill, about 70% of the students were able to decide by themselves to take action to protect themselves without the teacher's instruction.

The effects among the severely disabled students, who

were unable to take response actions on their own, were that they did not begin to panic when they heard the Earthquake Early Warning chime, and displayed greater receptivity to seek support from others, such as entrusting their bodies to others.

Thus, we were able to verify the validity of the newly developed program to increase the response capabilities among intellectually disabled children and their ability foresee danger to themselves and circumvent it. Moreover, the program can be implemented by teachers of Special Support Schools as part of the regular curriculum, making it unnecessary for experts in disaster management to be dispatched to schools to conduct programs. When teachers customize the program according to their needs, it can be used to develop a systematized disaster management education program. While such development requires a network to be constructed among stakeholders, it was possible in the present study to verify that there is a functioning framework for establishing such connections to effectively and strategically promote disaster management education.

Since the present study was limited to implementation within the school environment, it will be necessary in the future to examine learning methods and possible collaborative ties that could expand the sphere of application to non-school situations, such as outdoor learning or home learning involving the parents.

To implement wider dissemination of the program, it will be necessary to carry out a campaign to promote its implementation among a greater number of Special Support Schools. To this end we intend to collaborate with the prefectural Board of Education and other schools in our effort to continue supporting disaster management education. We also plan to develop a disaster management education program that covers actions from the initial response to an earthquake occurrence to tsunami evacuation.

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