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THE DEVELOPMENT OF A SYSTEM INCORPORATING A "MULTI-MODE INSTRUCTION" EXERCISE PROGRAM FOR PROFOUNDLY INTELLECTUALLY DISABLED PERSONS

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Abstract. *This study aimed to develop an instructional system that introduced "multi-mode instruction" (1: Agitate-mode, 2: Animate-mode, and 3: Admire-mode), a method that promotes an interest in moving the body naturally rather than focusing on exercise skill. This system is adopted in order to improve the quality of life (QOL) of those with profound intellectual disabilities. Group A utilized a class-separated instruction method and group B utilized a multi-mode instruction method. Evaluative methods involved the conduction of a behavioral analysis based on observations of videos filmed, and a system evaluation was conducted on exercise technique improvement. A behavior analysis was conducted after one month of exercise instruction and using each instruction method at the participating institutions, the results are as follows: tasks progressed proactively in Group B, which utilized the multi-mode instruction method, and a point which highlights the effectiveness of multi-mode instruction as a method for introducing exercise activities.*

Keywords: Profound intellectual disabilities, Multi-mode instruction, Exercise intervention

1. **Introduction.** Mentally disabled persons, most of whom are non-athletes, are at times left without the opportunity to exercise at all. Exercise and sport environments available to mentally disabled persons are not sufficient by any means. The main reasons include a material (lack of facilities and a trained individual) and environmental (promotion of the working) factors. In addition, in some cases, disability characteristics may make regular exercise difficult. Thus, the inability to establish an exercising habit is also a factor [7]. In particular, it is often extremely difficult for profoundly intellectually disabled persons to communicate. As such, it is thought to be difficult to expect such individuals to actively engage in exercise.

Profoundly intellectually disabled persons (IQ < 20) have an intellect corresponding to that of a child under the age of three. As such, linguistic communication is difficult, and they cannot understand movements/exercises, resulting in issues with motor functions. At times, profoundly intellectually disabled persons have difficulties even with walking [1,6]. Therefore, little research has been performed into exercise intervention for profoundly intellectually disabled persons. That is why providing exercise guidance to profoundly intellectually disabled persons remains difficult for volunteering instructors who have not received specialist training. This results in a high withdrawal rate from the instruction site. However, it is well-known that profoundly intellectually disabled persons are capable

of emotional expression and actively approaching things they are interested in or are curious about.

Therefore, the present study proposes a "multi-mode instruction" approach, which stimulates the participants' emotions before introducing an exercise program. Previous preliminary research results showed that "1. Agitating, 2. Animating, and 3. Admiring" are necessary to instigate the interest of severely intellectually disabled persons (IQ: < 35). Imamura et al. [3] called this the 3A approach. However, training is necessary to enable individuals to carry out this 3A approach alone. Therefore, a "multi-mode instruction" exercise instruction system will be developed with these 3 points as roles expected of the instructor. This system does not aim to enable profoundly intellectually disabled persons to acquire motor skills only; rather, it is an instruction system intended to lead them to hold an interest in moving their bodies spontaneously. This system is adopted in order to improve the quality of life (QOL) of those with profound intellectual disabilities. The results of this study may be expanded and applied to welfare facilities for profoundly intellectually disabled persons as well as regular primary and secondary education systems.

2. **Methods.** The participants in this study were profoundly intellectually disabled persons who had done almost no exercise activities ($n = 12$) in the past. Participants were divided into two groups and the exercise program was conducted (Table 1).

Table 1. Participants' data

	Subject	Gender/Age(y)/DQ IQ*	Height(cm)/Weight(kg)	Diagnosis
Group A	A1	M/41/DQ16	149/69	E/DS
	A2	M/42/DQ13	165/77	E/A
	A3	F/36/IQ34	150/46	DS
	A4	F/42/DQ16	152/46	E/SD
	A5	F/28/†	141/45	VD/SD
	A6	F/46/†	153/64	E/CP
Group B	B1	M/40/DQ13	146/51	E
	B2	M/32/DQ9	162/55	–
	B3	F/28/†	156/46	E/A
	B4	F/41/DQ6	162/47	E
	B5	F/41/IQ6	152/45	E
	B6	F/24/†	164/51	E

Gender: F = female, M = male. Diagnosis: E = Epilepsy, A = Autism, DS = Down's syndrome, SD = Sensorineural deafness, VD = Visual disorder, CP = Cerebral palsy. DQ = Development Quotient, IQ = Intelligence Quotient. †: Unmeasurable.

In Group A, one instructor took charge of two participants (by-class instruction method), and in Group B, three instructors took charge of all six participants (multi-mode instruction method). The multi-mode instruction involved 3 instructors each giving instructions with the specific mode of Ag: Agitate, An: Animate, or Ad: Admire to participants, who engaged in tasks. In contrast, in by-class instruction, exercise instruction was given by one instructor who took charge and performed the three modes (Figure 1). However, two participants fell sick and were not able to participate in more than half of the activities. Therefore, the sample for analysis consisted of ten people. In this study, the contents of the experiment were explained to the Mayor of facilities, a protector and a guardian, and informed consent was obtained prior to the initiation of the study.

The exercise program was conducted twice a week for a month (eight sessions in total). The contents of the exercise program were comprised of six tasks. The exercise tasks adopted for this study were the following tasks consisting of basic exercise with elements of play [2]: 1) walking; 2) striding across obstacles (an elastic cord was wrapped around

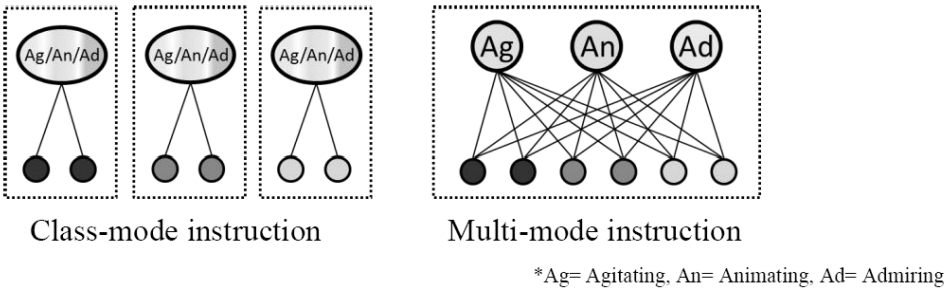

FIGURE 1. Class-mode instruction and multi-mode instruction[1]

two chairs to make an "obstacle"); 3) quadruped walking (going through a hula hoop); 4) stepping up and down (going up and down a box $\sim$ 15 cm in height); 5) throwing motion (a rubber ball with a diameter of 20 cm was used; the person the ball was thrown to was known to the individual, and the ball was thrown using two hands); and 6) catching movement (grabbing a rolling or flying ball using both hands). Imamura et al. [3] have already verified the effectiveness of introducing multi-mode instruction by having severely intellectually disabled persons as participants. The 3) stepping up and down task was introduced from session #5 after the participants were able to perform the walking and striding across obstacles tasks stably, in consideration of the risk of falling. The evaluation of "the improvement of the exercise skill" of the participant was performed by three raters. The rater watched a recorded video and evaluated ten phases of the six exercise tasks. As for the scoring given by the rater, averaging was performed according to an exercise task. The best scoring average of each participant was calculated and the rate of change of the exercise technology of the period was calculated when they performed the exercise task eight times.

3. **Results.** An exercise program was conducted with two groups: Group A, by-class instruction method; and Group B, multi-mode instruction method. Behavior observations related to improvement in motor skills, achievement level, and sociability were conducted.

Figure 2 shows the progress of the mean evaluation score according to each item. All participants were able to perform a walk task (Figure 2-1). No large alterations were observed in the walk movement, and neither group exhibited a significant correlation ($r = 0.50$, n.s, $r = 0.05$, n.s). At the starting point, the striding across obstacles task confounded the participants, although they begun to get used to the task little by little (Figure 2-2). The same situation was observed in the going up and down stairs task (Figure 2-4). In these two tasks, as a result of having performed a correlation analysis, no marked alterations were observed in either group: 2) striding across obstacles ($r = 0.56$, n.s, $r = 0.17$, n.s) and, 4) stepping up and down ($r = -0.36$, n.s, $r = 0.15$, n.s). Four pairs of walk tasks confused the participants. In everyday life, they spend half their time in seated postures, such as in a chair or sofa. Participants refused to complete some tasks the first time and hit a knee and a handle on the floor. However, four pairs of walk tasks were somewhat of a play task when passing through the hula-hoop. The hula-hoop invoked interest in the task. Participants sat down on the floor, and did not seem to find it difficult to pass through the four pairs of hula-hoops and walk from there. A significant difference

[1]Class-mode instruction involves one individual instructing several target individuals. Multi-mode instruction includes two participants that are in charge, meaning that each individual is instructing all target individuals. For example, as for the class mode instruction, one staff member is in charge of two participants. In this case, the 3A (Agitating, Animating, Admiring) method is performed by one staff member. The relationship between the target individuals is limited, too. On the other hand, as for the multi-mode instruction, three staff members are in charge of an individual role of 3A, respectively. Thus, they are in charge of all targeted participants. Therefore, the multi-mode instruction includes many relationships.

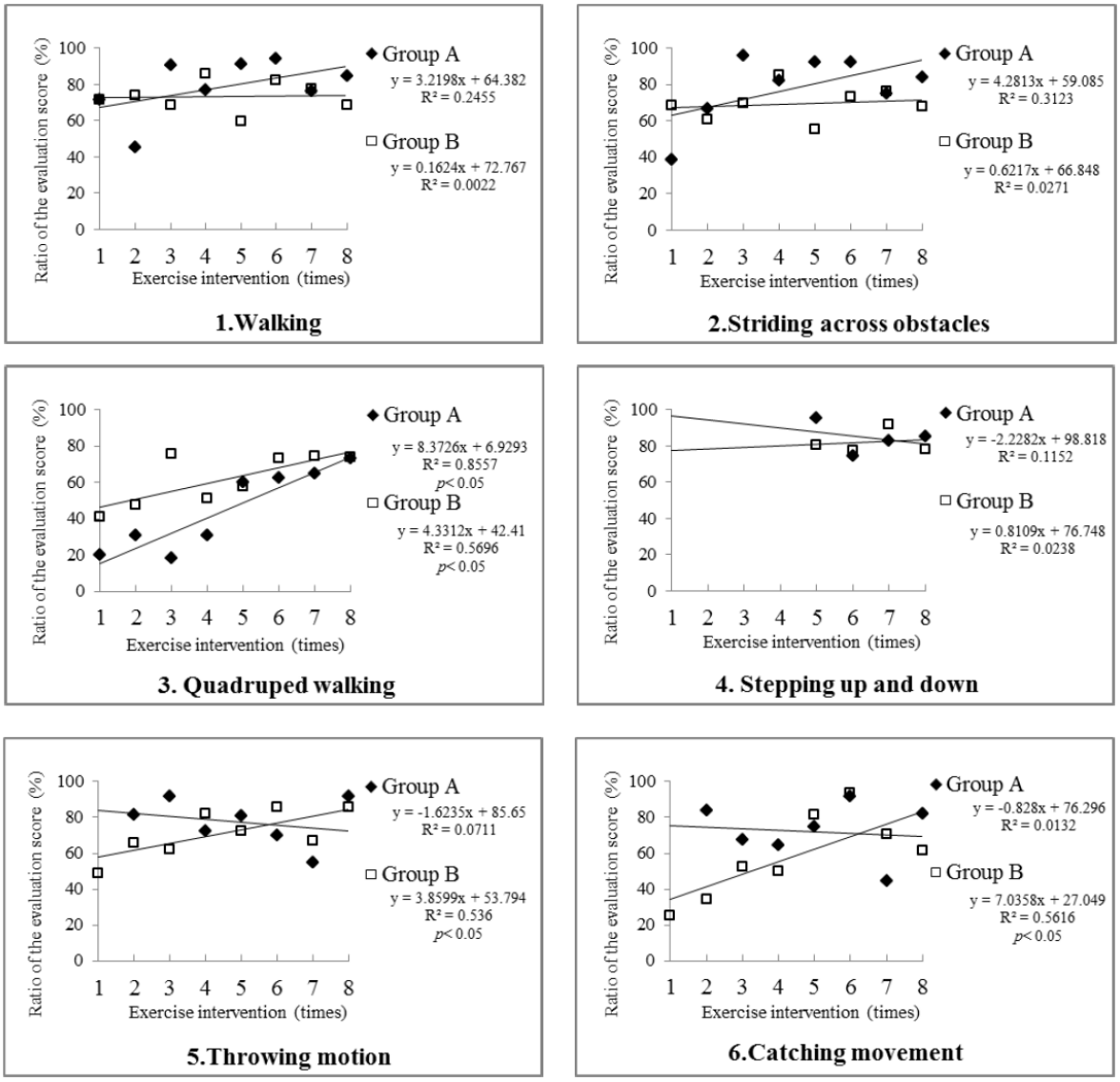

FIGURE 2. Change of the exercise evaluation score[2]

was seen in 3) quadruped walking with both groups ($r = -0.92$, $p < 0.05$, $r = 0.68$, $p < 0.05$) task (Figure 2-3). And participants attempted the ball tasks. Group B became gradually able to perform the throwing movement smoothly ($r = 0.73$, $p < 0.05$). In particular, when moving to catch a ball, participants in Group B chased the ball as they watched it roll with their eyes, and the action to pick up the ball improved ($r = 0.75$, $p < 0.05$). Only Group B improved in the two ball tasks (Figure 2-5, Figure 2-6).

Each time an experiment was completed, an opinion was given by a rater. There were many participants in Group A who had intense changes in their emotions, whereas it was reported that Group B observed others well.

[2]The evaluation method of "the improvement of the exercise technology" of the participant was performed by three raters. The rater watched a recorded video and evaluated ten phases of six exercise tasks, including (1) walking; 2) striding across obstacles; 3) quadruped walking; 4) stepping up and down; 5) throwing motion; and 6) catching movement. As for the score given by the rater, averaging was performed according to an exercise task. The best scoring average of each participant was calculated for 1 and the rate of change of the exercise skill of the period was calculated when the exercise was performed eight times. The vertical axis indicates the mean evaluation score. The cross axle indicates the number of times of the exercise instruction in temporal axes.

4. **Discussion.** For the participants involved in the present study, the walk, striding across obstacles, and stairs walking tasks reflect the basic movements of the everyday life; therefore, changes were not seen in the two groups. However, when faced with the four pairs of walking tasks, they were at a loss at the beginning of the task as they did not have experience of the movement that was in the floor at a hand and a knee. However, they were interested in the hula-hoop, and it is thought that they recognized that the task was easier if they sat down, and subsequently lowered themselves. Afterwards, they were seen to be experiencing a pleasant feeling after having successfully completed the task. As for this, two hypotheses are proposed: 1) the ball task was a defiant task. In addition, ball tasks required participants to be able to control a tool rather than the quadrupled walking task. Furthermore, the ball tasks were the tasks that were higher than a campaign for 1-4 tasks for them; and 2) participants of Group B had an opportunity to utilize all the staff, whereas Group A did not. They performed a task while attracting the attention of all their friends. Therefore, two demands that indicated "I want you to pay attention" and "I want you to praise it" were roused. The multi-mode instruction that 3A was strengthened may induce excellent feelings in the participants. Therefore, it is thought that the acquisition of the skill went ahead through the exercise structure of Group B.

It became clear that, in the future, mimicking movement and a proactive attitude towards engaging in exercise activities are important from the perspective of the participants' sense of achievement and sociability. The results implied that a multi-mode instruction method exercise program may lead to an increase in exercise volume. Furthermore, as proactive behavior shows, instead of participants being "given" the task one-sidedly, having the participants "attain" the task based on their own volition further enforces the action [5]. This indicates that the present study re-affirmed the notion that instigating a voluntary action is at the root of a system that incorporates an exercise program that uses a multi-mode instruction method. Furthermore, observational activities become important when an exercise activity is conducted in a group. This includes participants waiting for their turn while observing other people's activities and watching and praising the performance of others. Kuroki [4] indicated that a gaze from others directed toward you is important because that gaze indicates that others are interested in you.

The multi-mode instruction method has a clear and uniform division of instructors' roles. As such, instructors are able to dedicate more energy to giving guidance, and this reduces their burden. Furthermore, the instructors are able to handle more participants in this method. On the other hand, by-class instruction requires compatibility between the instructors and participants, in addition to having instruction capability. Thus, several issues can be anticipated with this method, including imposing a heavy burden on the instructors. Furthermore, since there are several tasks that the instructor must be responsible for, this method requires various locations and substantial effort. Additionally, comparing the effects is difficult. In the future, exploration into increasing the exercise activity volume in conjunction with the continuation of exercise is believed to be necessary. By conducting several examinations of the system that incorporates this exercise program, we expect this will result in the improvement of the quality of life of profoundly intellectually disabled people. Many facilities adopt class mode instruction. However, exercise instruction involves the carrying out of multi-mode instruction, and the activation of the exercise activity in a person with disability is expected.

5. **Conclusions.** At first, exercise intervention to an individual with an intellectual disability requires exercise tasks and the invention of the tool. In many programs, walking is adopted as exercise in adult intervention. It is a basic movement, and is easy to perform. However, for an individual with an intellectual disability who cannot understand the need for the exercise, pleasure is rarely gained from a walk task. Therefore, it is important to

draw the interest of the target individual via the acquisition of the new movement and the invention of the tool. Many staff members are required to accomplish this, and the 3A principle is clearly important. Although individuals with an intellectual disability have difficulty communicating via words, they are able to express their feelings. Therefore, the multi-mode instruction that is able to emphasize the 3As was demonstrated to be more effective.

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