Journal of Positive School Psychology
2022, Vol. 6, No. 3, 4514–4523

The Development of a Physical Activity Model to Enhance Learning of Children with Intellectual Disabilities

Pinyo Sumnuan[1], Nirut Sukdee*[2]

[1,2] Faculty of Education, Thailand National Sports University, Udonthani Campus, Thailand
[1] Jdssk1985@gmail.com, [2] Ter_chula@hotmail.com
**Corresponding Author e-mail: Ter_chula@hotmail.com*

Abstract

The purpose of this research was to develop a physical activity (PA) model to enhance learning of children with intellectual disabilities, (ID). The subjects for this study were eight children with moderate intellectual disabilities (IQ levels 35-49, medical screening form) aged between 6-12 year old, they were selected by purposive sampling. The research instruments consisted of 1) the questionnaire and interview form, 2) observation and note-taking form of learning, 3) The PA model, and 4) Learning tests for children with ID. The PA model was applied to the experimental group for 8 weeks, 3 session per week, and 45 minutes per each. Inferential statistics were One-way ANOVA repeated measures used to compare learning outcome among pre-test, after 4 weeks test and post-test results in 95% confident interval.

The research results were as follows:

1. The PA model consisted of 3 stages: preparation, physical activity and cool down. There were 8 activities including jumping through colored hoop, T-agility, V-shaped stepping, 9-square, ball-dribbling, throw a ball into a box, throwing and catching a ball and shuttle runs, indicated that an index of item objective congruence was 0.94 (IOC=0.94).
2. The PA model was effective in increasing learning of children with ID. in counting, numbers comparison and matching numbers when comparing after the 4-week test and the post-test with the results of the pre-test. Learning outcomes were statistically significantly different at .05. On the other hand, in terms of matching numbers when comparing between pre-test and 4 week test was not statistically different.

Conclusion: These findings suggest that participation in PA model can improve learning outcomes of children with ID. PA model involving mild complexity and moderate intensity appear to have the greatests benefits for children with ID.

Keywords— Physical Activity Model, Learning, Children with Intellectual Disabilities

I. INTRODUCTION

The current situation of people with disabilities reflects the demographic changes of people with disabilities in terms of gender, age, education, distribution, number and type of disability. According to the situation report of people with disabilities in Thailand, it was found that the number of people with disabilities who have a national disability identification card is 1,657,438, accounting for 2.52% of the country's population and is likely to continue increasing. This will lead to economic, social and health problems [1].

Intellectual disability is one of the types of disabilities in terms of development that results in physical, social, language, emotional, functioning and intellectual limitations that are slower than the average person. Characteristics are determined based on intelligence quotient (IQ) level is lower than the threshold and the ability to modify one's own behavior defects in two or more of the ten areas, including

communication, self-care, home living, social/interpersonal skills, functional academic skills, use of community resources, self-direction, work, leisure, health and safety. [2]. The survey of the disabled found that there were 135,085 persons with intellectual disabilities. People with disabilities was in childhood and school age from birth to age 21 made up 29.96% of the total number of people with disabilities at this age and this was increasing. [3]. The number of individuals with intellectual disabilities suggested that the country must prepare to deal with children with intellectual disabilities to receive assistance in maintaining or rehabilitating physical, language, behavior, society and brain to stop the increasing number of disabilities. As a result, these children could be self-reliant and reduce the burden of dependency from family and society.

Physical activity is the movement of the body in various postures caused by the work of skeletal muscles in all parts of the body. The muscle contraction and relaxation process lead to energy metabolism, such as walking, running, jumping, gaming, sports, dancing, and exercise [4]. Physical activity can be divided into two types: 1) Physical activities in daily such as housework, travel and occupation. 2) Physical activity in leisure time such as play, exercise, and sports which are associated with health more than physical activities in daily. [5]. If adequate physical activity is performed, it will have a positive effect on all aspects of health. At the same time, lack of adequate physical activity can have negative effects on health and there is a chance of developing NCDs (Non-communicable diseases). In addition, physical activity also can develop to emotional control, good personality, stress and anxiety reducing. For this reason, physical activity is an important for a good health, quality of life and improve the well-being of people with intellectual disabilities. If they perform physical activities or learn using motor skills, it will stimulate the motor control, sensory neuron, motor neuron and the brain's memory is able to remember information precisely by doing and thinking repeatedly through a variety of motor activities [6][7]. This will stimulates brain function in children with intellectual disabilities to improve motor learning.

According to a study conducted by Inthes et al. [8], the effects of effects of sensory integration training upon learning and health related fitness, it was found that the learning mean of the experimental group was higher than the control group with statistical significantly different at the .05. In addition, with respect to a study on fundamental movement skills training to promote physical activity in children with and without disability conducted by Capio et al [9], it was found that training groups improved in fundamental movement skills whereas control groups did not statistically significantly different in weekday physical activity were found. Increased weekend moderate to vigorous physical activity was found in the experimental group. Moreover, Yamauchi et al. [10] studied motor and cognitive development of children with Down syndrome: the effect of acquisition of walking skills on their cognitive and language abilities, it was found that posture motor developmental age was significantly and positively correlated with both cognitive-adaptive and language-Social in children 1–3 years old. The relationship strengthened with increased age. Acquisition of walking skills had a statistically significant positive effect on the cognitive-adaptive and language-social at the second tests when controlling for the cognitive-adaptive and language-social at the first tests and the second tests. The results indicated that the motor development was correlated with both cognitive and language development in young children with Down syndrome. Additionally, Dandashi et al [11] studied enhancing the cognitive and learning skills of children with intellectual disability through physical activity and edutainment games. The results showed that the system had positive effects on the children in experimental group, in terms of cognition and motivational levels, especially as the children became more physically active in the classrooms. From these research supports that physical activity an important role in promoting the learning of

children with intellectual disabilities. If these children engage in physical activities individually the level of ability and interest of this group of children, they will have positive outcomes in terms of emotional mobility, playfulness, adaptability, communication, understanding the meaning of self-care, interaction with others, maintaining health and safety, and better quality of life. Skills training and basic motor development contribute to improved physical performance, mobility, and perception of children with disabilities. The teaching of active physical activity should start from simple movements to more difficult and continuous movements to achieve the most complete and accurate movement of the body. However, there is no serious study and development of physical activity models to enhance the learning for children with intellectual disabilities in schools to encourage these children to gain physical, language, behavioral, social, and brain rehabilitation to stop the growing disability. Proper and consistent physical activity can help children with intellectual disabilities improve their physical, emotional, social, mental and cognitive performance. As a result, this group of children can help themselves and live happily.

As mentioned above, the problems and the importance have shown significant demographic changes of people with disabilities in Thailand. Most of them are in childhood and adolescence, and their numbers increase. Intellectual disability is a type of person with developmental disabilities that cause physical, social, language, emotional, functioning, and intellectual limitations that are slower than the average person. In the country, children with intellectual disabilities must develop and promote to receive help in maintaining or restoring physical, language, behavioral, social, and cerebral abilities to stop the growing disability, reliance on self-efficacy, and reducing the burden of dependence on family and society. We should do this through physical activities that promote movement, mood, adaptation, and learning. The researchers saw the importance of developing a physical activity model for children with intellectual disabilities using theoretical principles related to physical activity and children with intellectual disabilities to get a physical activity model that is appropriate for the individual, the child's ability, and interest level, leading to the development and restoration of a better quality of life. We will train these children in basic movements such as non-locomotors movement, locomotors movement, and manipulative movement and learning about primary color separation, command practice, directional movements, and numerical learning integrated into the physical activity model. In addition, personnel involved with children with intellectual disabilities can apply the physical activity model in teaching and physical activity to promote their good learning.

II. Research Objectives

The aim of this study was to develop a physical activity (PA) model to enhance learning of children with intellectual disabilities.

III. Research Methods

Population and samples

The population is children with intellectual disabilities aged 6-12 years old who were studying at the special education bureau, Udonthani Province, the Office of Special Education Administration, the Office of the Basic Education Commission, the Ministry of Education, Thailand.

The sample for this study were 8 children with moderate intellectual disabilities (IQ level 35-49) from medical screening form aged between 6-12 year old. They were selected by purposive sampling and there was only one experimental group. This research was approved by the Thailand National Sports University Ethics board. (TNSU 167/2020).

Inclusion criteria are as follows:

1. Children with intellectual disabilities who were aged between 6-12 years and diagnosed by a doctor as having a level of moderate intelligence quotient (IQ=35-49).
2. Children with intellectual disabilities without severe complications and able to an experimental protocol.

3. Children with intellectual disabilities who have not disabilities in mobility, communication, hearing loss and vision problem.
4. Children with intellectual disabilities whose parents allow them to take part in physical activities.

Exclusion criteria are as follows:

1. Children with intellectual disabilities diagnose by medical personnel that it strictly prohibited them from exercising or physical activity.
2. Children with intellectual disabilities and congenital diseases such as heart disease, diabetes, or symptoms resulting from cerebrovascular disease.
3. Children with intellectual disabilities who are immobile or hearing and vision disabilities.

Research tools

1. The standardized questionnaire and interview form of learning outcome of children with intellectual disabilities for teachers and parents.
2. Observation and note-taking form of learning.
3. The physical activity model to enhance the learning of children with intellectual disabilities consisted of 3 major stages: the preparation stage, the physical activity stage, and the cool down stage. There were 8 interesting activities: jumping through colored hoop, T-agility, V-shaped stepping, 9-square, ball-dribbling, throw a ball into a box, throwing and catching a ball and shuttle runs, in each activities performed 45 minute, 3 sessions per weeks for 8 week, indicated that an index of item objective congruence was 0.94 (IOC=0.94).
4. The standardized learning tests for children with intellectual disabilities include counting, numbers comparison and matching numbers.

Quality of research tools

Content validity analysis was determined by using research tools such as questionnaires, interview forms, observation forms, and behavior recording forms. The researcher's physical activity model and learning tests of children with intellectual disabilities presented to five qualified experts to examine the content validity. Then the data analyzed for the Index of item Objective Congruence (IOC), which was equal to 0.94, and the suggestions received to use for further improvements.

Reliability analysis performed by using the research tool in a similar group of 8 people to determine the value using Cronbach's alpha coefficient in the rating scale questionnaire and the value was 0.85. We examined the learning tests of children with intellectual disabilities using the Kuder-Richardson tests [KR (20)] and the confidence value was 0.80. Difficulty index got by choosing a test with a difficulty between .20-.80 and discrimination value got by selecting exams with discrimination greater than .20 or higher.

Data collection

In order to obtain research data, the researcher took the following steps:

1. The researcher studied the principles, theories and content related to physical activity, principles of exercise, development, physical limitations and learning of children with intellectual disabilities.
2. The researcher collected data from questionnaires and interviews with parents, teachers, stakeholders and people related to children with intellectual disabilities by using in-depth interviews and group interviews.
3. We require the sample group to undergo a health check-up with a medical person before participating in this research project.
4. The physical activity model to enhance learning of children with intellectual disabilities is applied to a experimental group for 8 weeks, 3 sessions per week and 45 minutes per each.
5. According to learning tests of children with intellectual disabilities, the experimental group was pre-test, after 4-week test and post-test.
6. The data obtained from the experiment are analyzed, discussion and conclusion of the results.

Data analysis

The process of data analysis in this study is as follow:

1. Content analysis and synthesis determined using the information studied on the principles, theories, and content related to physical

activity, exercise principles, development, physical limitations, and learning of children with intellectual disabilities including information get from in-depth interviews and group interviews of parents, teachers, stakeholders and those related to children with intellectual disabilities.

2. Descriptive statistics were mean and standard deviation foe expression characteristic of simple.

3. Shapiro-Wilk Tests is used to compare with the variables in the study including pre-test, after 4-week test and post-test.

4. One-way ANOVA repeated measures are used to analyze the difference in mean scores on learning of the experimental group obtained from the pre-test, after 4-week test, and post-test.

5. Bonferroni method is used to analyze a pairwise comparison of the mean score on learning of the experimental group obtained from the pre-test, after 4-weeks test, and post-test.

6. The alpha level of p-value less than .05 ($p < .05$) was use for determined significant for all statistical analysis.

IV. Research Results

The research findings are as following:

1. The development of physical activity models to enhance learning for children with intellectual disabilities.

The physical activity model to enhance the learning of children with intellectual disabilities. The researchers developed this model based on the study, analysis, and synthesis of principles, theories, and content related to physical activity, exercise principles, development, physical and learning limitations in children with intellectual disabilities from books, textbooks and academic journals. They analyzed and synthesized with the information get from the context, situation, condition and learning problems of children with intellectual disabilities. In addition, they developed materials and equipment used as a medium to stimulate learning behaviors of children with intellectual disabilities into a physical activity model to enhance learning of children with intellectual disabilities. There were three stages: the preparation stage, the physical activity stage and the cool down stage. There were 8 interesting activities including jumping through colored hoop, T-agility, V-shaped stepping, 9-square, ball-dribbling, throw a ball into a box, throwing and catching a ball, and shuttle runs. All of these were assessed by qualified experts to examine the quality of physical activity models to enhance learning for children with intellectual disabilities. Analysis of the Index of item objective congruence (IOC) from 0.5-1.0 found that, the physical activity model to enhance the learning of children with intellectual disabilities had an index of item objective congruence was 0.94 (IOC=0.94). The recommendations from experts were then revised. This was applied to an experimental group with similar characteristics to the sample group to determine the reliability of the physical activity model to enhance learning of children with intellectual disabilities. The IOC values showed that the physical activity model to enhance the learning of children with intellectual disabilities could be used as a physical activity model for children with intellectual disabilities.

2. The effectiveness of the physical activity model to enhance the learning of children with intellectual disabilities.

The researcher used the data from the learning outcome of the sample group to analyze and present the data as a table and detailed below.

2.1 Eight children with moderate intellectual disabilities had mean of age 9.62 year, ±2.06, height 109.12 cm. ±25.04 and weight of 47.25 kg ±10.31.

2.2 The results of learning outcome of the experimental group by using One-way ANOVA repeated measures.

The used of One-way ANOVA repeated measures assumed the all participants were normal distribution, all the participants variances were equal, all the sample were taken independently of each other and were randomly collected from their populations.

2.2.1 Matching numbers outcome.

The results of mean score learning found that means score learning at post-test ($\bar{x}$=14.50, S.D=4.14) was a statistically significant higher than mean score leaning at pre-test ($\bar{x}$=7.62, S.D=5.57) and after 4 week test ($\bar{x}$=10.62, S.D=3.88) (p<.05). On the other hand, mean score learning at 4 weeks was not significantly different from pre-test (p<.094). (Table1).

Table **1** *Comparison of mean score learning at pre-test, after 4-week test and post-test.*

Source of Variance	df	SS	MS	*F*	*p*
Exam time	2	190.083	95.042	19.214	.000
Error	14	69.250	4.946		
Mauchly's W = .412, Chi-square (2,8) = 5.327, p =.070					
The results of pairwise comparisons were analyzed using the Bonferroni's method					
Post-test > Pre-test (p = .000*, d = 6.87)					
Post-test > After 4-week test (p = .002*, d = 3.857)					
After 4-week test > Pre-test (p = .094, d = 3.00)					

*p < .05

2.2.2 Counting outcome

The results of mean score learning fond that means score learning at post-test ($\bar{x}$=8.25, S.D=1.28) was a statistically significant higher than mean score leaning at pre-test ($\bar{x}$=3.25, S.D=1.48) and after 4 week test ($\bar{x}$=5.87, S.D=1.12) (p<.05). Besides, after 4 weeks test was a statistically significant higher than the pre-test (p<.05). (Table2).

Table **2** *Comparison of mean score learning at pre-test, after 4-week test and post-test.*

Source of Variance	df	SS	MS	*F*	*p*
Exam time	2	100.083	50.042	42.264	.000
Error	14	16.583	1.185		
Mauchly's W = .521, Chi-square (2,8) = 3.910, p =.142					
The results of pairwise comparisons were analyzed using the Bonferroni's method					
Post-test > Pre-test (p = .001*, d = 5.00)					
Post-test > After 4-week test (p = .004*, d = 2.375)					
After 4-week test > Pre-test (p = .001*, d = 2.625)					

*p < .05

2.2.3 Numbers comparison outcome

The results of mean score learning fond that means score learning at post-test ($\bar{x}$=4.75, S.D=.46) was a statistically significant higher than mean score leaning at pre-test ($\bar{x}$=2.62, S.D=1.50) and after 4 week test ($\bar{x}$=3.87, S.D=1.12) (p<.05). Besides, after 4 weeks trail was a statistically significant higher than the pre-test (p<.05). (Table3).

Table 3 Comparison of mean score learning at pre-test, after 4-week test and post-test.

Source of Variance	df	SS	MS	*F*	*p*
Exam time	2	18.250	9.125	16.484	.000
Error	14	7.750	.554		
Mauchly's W = .561, Chi-square (2,8) = 3.473, p =.176					
The results of pairwise comparisons were analyzed using the Bonferroni's method					
Post-test > Pre-test (p = .009*, d = 2.125)					
Post-test > After 4-week test (p = .043*, d = .875)					
After 4-week test > Pre-test (p = .016*, d = 1.25)					

*p < .05

V. Discussions

The results of the research were discussed on key issues as follows:

1. The development of physical activity model to enhance learning of children with intellectual disabilities.

The physical activity model was developed to enhance learning of children with intellectual disabilities by applying the principles and theories of physical activity. The researchers assessed the quality of the tool by quantifying content validity through experts to verify the quality of this model. It was then analyzed to find the index of item objective congruence (IOC) and found that the IOC value was 0.94. The researcher took the recommendations from the experts to improve and change them and used them to experiment with the experimental group with similar characteristics to the sample group. This index of item objective congruence showed that the development of a physical activity model to enhance the learning of children with intellectual disabilities was of outstanding quality and was suitable for use as a model for this group of children. This is because physical activity is a medium to stimulate learning. If someone properly practiced them, they can support children with intellectual disabilities to develop physically, mentally, emotionally, socially, and intellectually. Basic movement activities included picking, carrying, throwing, walking, running, rolling, crawling, jumping, swinging your arms, body rocking, bending, stretching, climbing, hanging, etc. These activities are all the starting points for motivating children in learning to develop their thinking and making appropriate decisions. The development of the

sensory nervous system is very important because the sensory system transmits information to the neuromotor system that controls movement. If they receive information from the movement skill training correctly, clearly, and completely, it affects the learner's ability to learn and perform the movements correctly, quickly, and perfectly [12][13]. The study of this result support the finding of previous study conducted by Giagazoglou et al [14] who study the effects of a trampoline exercise intervention on motor performance and balance ability of children with intellectual disabilities. It was found that trampoline intervention resulted in an experimental group was statistically significant increasing of performance in all motor and balance test and could be an effective intervention for improving functional outcomes. With respect to Dandashi et al [15] who studied the enhancing the cognitive and learning skills of children with intellectual disabilities through physical activity and edutainment games. It was found that after the experiment, the mildly disabled groups achieved best results in terms of scores and coordination, whereas all the observed groups exhibited high motivation levels. With regard Capio et al [16] who studied reduction of errors during facilitates fundamental movement skill learning in children with intellectual disabilities. The result showed that after the experiment, the error reduction program improved movement form, and increased throwing activity during free play to higher extent than the error-strewn programme. Additionally, this findings support the use of movement skills training programmes that constrain practice errors in children with intellectual disabilities. Dealing with a study on motor and cognitive development of children with Down syndrome: The effect of acquisition of walking skills on their cognitive and language abilities conducted by Yamauchi et al [17], it was found that the motor development was correlated with both language development and cognitive in young children with Down syndrome. This finding also recommended that achievement of walking could facilitate later language development and cognitive in children with Down syndrome.

2. The effectiveness of the physical activity model to enhance the learning of children with intellectual disabilities.

Participation in physical activities to enhance the learning of children with intellectual disabilities over 8 weeks showed significant improvement in learning outcomes compared to before and after the experiment. There was a statistically significant difference at the .05 level in terms of cognitive learning to use counting, numbers comparison and matching numbers. These were the starting points for enhancing children's learning motivation to develop thinking and decision-making. The numerical matching test results of the samples during the post-test after 4 weeks test and pre-test were statistically different at the .05 level for all tests. Except for the numerical matching test, only the results of after 4 weeks test versus the pre-test were not significantly different at the .05 level. In the first four weeks, children need to adjust to familiarizing themselves with the equipment used in the activity model, along with the basic adjustments in their posture, so we may observe no significant learning changes. However, after 8 weeks of physical activity, there was a higher change in learning to match numbers. Children could learn from bodily movements and repetitions, which encouraged learning from the functioning of the forebrain. The cerebrum handled the perception of information from external stimuli. Sensory processing learning included vision, language, communication, thinking, learning, and memory in the frontal lobe. The temporal lobe handled the control of speech, movement, thinking, memory, intelligence, and language. The occipital lobe handled auditory control, olfactory, language comprehension, and listening. Consistent with the idea of Eric Jensen [18], the key part of the brain that is directly involved in learning is the cerebrum, where most learning takes place on this part of the brain. The nervous system contains brain cells that are connected to brain cells and learning new things begins with brain cells which have nerve fibers as receptors. There is a

link between the nerve and the dendrite and when stimulated it creates a more networked connection. At the physical activity stage, children have positive emotional responses such as fun, interest, and challenges. The brain secretes dopamine and endorphins through the synaptic gap, making their memory and thinking processes more efficient. Dealing with the idea of Supaviboon and Krabuanrat [19], when a child engages in physical activity or takes part in motor skills, it stimulates the neurons responsible for motor control, sensory neuron, and motor neuron. It also allows the brain's memory to recall information from doing and thinking repeatedly using a variety of motor activities. They should arrange movement activities in steps from simple movements to hard movements. This is to lead to the development of accurate, precise, and perfect skills in learning and retrieving memory information through bodily movements. It is consistent with the study of Hartman et al [20] studied skill-related physical fitness versus aerobic fitness as a predictor of executive functioning in children with intellectual disabilities or borderline intellectual functioning. They found after the trial that skill-related physical fitness was significantly associated with inhibition and both measures of cognitive flexibility, while in the same models did not significant associations between aerobic fitness and executive functioning. In addition, age was significantly related to cognitive flexibility and working memory, favoring the older children. In children with intellectual disabilities, skill-related physical fitness is of higher importance than aerobic fitness in relationship with core domains of executive function. The study results support the finding of previous conducted by Capio et al [21] who studied Fundamental movement skills (FMS) training to promote physical activity in children with and without disability: A pilot study. They found that training groups improved in FMS while control group was not statistically different and no significant changes in weekday physical activity were found. Increased weekend moderate to vigorous physical activity was found in the training groups. With respect to Lotan et al [22] who studied physical fitness and functional ability of children with intellectual disability: effects of a short-term daily treadmill intervention. They found that after the experiment, children with intellectual disabilities had a statistically significant increase in physical fitness at the .05 levels, as measure by resting heart rate and during exercise. The improvement had correlated with statistically significant in functional ability of participant at the .05 levels. As a result, the children taking part in this study showed a statistically significant improvement in their motor skills at the .007 levels. Beside, Sukdee [23] studied the effects of exercise using bosu ball on balance, muscular strength and cardiovascular system of the autistic children, The result revealed that after the trial, children with moderate autism had an average increase in balance, muscular strength, and circulatory abilities (decreased resting heart rate) compared to the pre-test and there was a statistically significant difference at the .05 levels. Moreover, Laohaphaithun and Phothiyen [24] studied teaching by using games to promote the ability to write three-digit numbers of students with intellectual disabilities. They found that after the experiment, children with intellectual disabilities had a higher mean rate of their ability to write three-digit numbers compared to before teaching using game activities.

VI. CONCLUSION

Children with intellectual disabilities are developmental disabilities that limit their intelligence, learning, and adaptation to daily life. Children with moderate intellectual disabilities have an intelligence quotient (IQ) of 35-49 levels. We can see children with intellectual disabilities within 1 year of age and a sign of moderate intellectual disabilities is the delayed speech. They need support at school, home, and society to enable them to take part in society. Physical activity is a tool that can improve the learning of these children. The physical activity characteristics for children with moderate cognitive impairment should be simple, in order from easy to rare, light to hard, and low to high. In addition, repetition of the

practice has a positive effect on learning. After every practice, it is necessary to be rewarded with compliments, applause, and hand touches. The researcher developed a model of 8 physical activities to the promote learning for children with intellectual disabilities. After using the physical activity model to the promote learning, these children showed positive changes in basic physical activity, including picking, throwing, walking, running, rolling, and jumping. These are the starting points for motivating children to learn, leading to the development of thinking, perception, learning, and decision-making, along with encouraging them to be self-reliant and reduce their dependence on family and society.

Application

1. The application of physical activities to promote learning of children with intellectual disabilities should take into account the availability of personnel, location and safety in order to prevent accidents that may occur during the activity.

2. In each physical activity to promote learning of children with intellectual disabilities, teachers, parents or related persons must closely supervise these children.

Suggestions for further study

There should be study of physical activities that can promote children with intellectual disabilities in other skills such as social skills, communication skills, motor skills and physical fitness. These are essential skills in the life of this group of children.

VII. ACKNOWLEDGEMENT

We would like to thank the National Sports University, Udon Thani Campus for supporting the budget for conducting this research. In addition, some experts had guided the conduct of the research, whether teachers, parents, and related parties, for information that is extremely useful in the research, including the samples who cooperated throughout the research process until the research was successful.

REFERENCES

1. Ministry of Social Development and Human Security. (2019). Report on the situation of people with disabilities in Thailand. Retrieved 28 June 2020. http://dep.go.th
2. Government Gazette. (2009). Determination of categories and criteria for educational disabilities in 2009. Volume 126, Special 80 D. (online), Retrieved May 26, 2021 from http://www.mua.go.th.
3. Ministry of Social Development and Human Security. (2019). Report on the situation of people with disabilities in Thailand. Retrieved 28 June 2020. http://dep.go.th
4. Silamat. S. (2014). *Physical Activity for Wellness*. Ed.1. Bangkok: Chulalongkorn University Printing House.
5. Meesomsueb. T. (2004). Exercise in sports. First Edition Bangkok: Mac.
6. Supaviboon. M., & Krabuanrat. C. (2018). *Teaching guide on physical activities for children with intellectual disability (Parent Version)*. First Edition, Bangkok: Office of the Health Promotion Foundation (ThaiHealth Promotion Foundation).
7. Sisurakonrkun. K. (2020). *Improving Mobility: From Principles to Practices. Ed.1. Phitsanulok : Naresuan University Press.*
8. Intes. N., Btharobhas. V., & Samahito., S .(2012). *Effects of Sensory Integration Training Upon Learning and Health Related Fitness.* Journal of Sports Science and Technology The Sports Science Society of Thailand. Vol.12, No.1. (July 2012) pp.155-166.
9. Capio, C. M., Sit, C. H., Eguia, K. F., Abernethy, B., & Masters, R. S. (2015). Fundamental movement skills training to promote physical activity in children with and without disability: A pilot study. *Journal of Sport and Health Science*, *4*(3), 235-243.
10. Yamauchi. Y., Aoki. S., Koike. J., Hanzawa. N., & Hashimoto. K. .(2018) *Motor and cognitive development of*

children with Down syndrome: The effect of acquisition of walking skills on their cognitive and language abilities . Brain Dev. 2019 Apr;41(4):320-326.

11. Dandashi. A., Ghani. A, Saad. S., Barhoumi. Z., Ai-Jaam. J & Saddik. A. (2015). *Enhancing the Cognitive and Learning Skills of Children with Intellectual Disability through Physical Activity and Edutainment Games.* International Juornal of Distributed Sensor Networks. Volume 2015. Article ID May ,26 .165165 for ,2015
12. Supaviboon. M., & Kraruanrat. C. (2018). *Teaching guide on physical activities for children with intellectual disability (Parent Version)*. First Edition, Bangkok: Office of the Health Promotion Foundation (ThaiHealth Promotion Foundation).
13. Sisurakonrkun. K. (2020) .*Improving Mobility:From Principles to Practices. Ed.1. Phitsanulok : Naresuan University Press.*
14. GiagazoglouP ., K o k a r i d a s . D ., . ,.Sidiropoulou. M Patsiaouras. A., .Karra. Ch&Neofotistou. K. (2013) . *Effe of trampoline exercise intrvention on motor performance and balance ability of children with intellectual disabilities*. Reserch in Developmental Disabilities. 34, (2013) 2701-2707.
15. Dandashi. A., Ghani. A, Saad. S., Barhoumi. Z., Ai-Jaam. J & Saddik. A. (2015). *Enhancing the Cognitive and Learning Skills of Children with Intellectual Disability through Physical Activity and Edutainment Games*International Juornal of Distributed . Sensor Networks. Volume 2015. Article ID 165165. 26, May for ,2015
16. Capio, M., Poolton, M., Sit, H., Eguia, F., , & Master, S .(2012*). Reduction of errors during facilitates fundamental movement skill learning in children with intellectual disabilities.* Journal of Intellectual Disability Research. (February 2012)305-295
17. Yamauchi, Y., Aoki, S., Koike, J., Hanzawa, N., & Hashimoto, K. (2019). Motor and cognitive development of children with Down syndrome: The effect of acquisition of walking skills on their cognitive and language abilities. *Brain and Development*, *41*(4), 320-326.
18. Eric Jensen. (2000). *Brain-based learning*. Ed.1. San Diego, CA: The Brain Store.
19. Supaviboon. M., & Krabuanrat. C. (2018). *Teaching guide on physical activities for children with intellectual disability (Parent Version)*. First Edition, Bangkok: Office of the Health Promotion Foundation (ThaiHealth Promotion Foundation).
20. Hartman ,.E., Smith. J., Houwen. S .& .Visscher. Ch (2017). *Skill-related physical fitness versus aerobic fitness as a predictor of executive functioning in children with intellectual disabilities or borderline intellectual functioning.* Research in Developmental Disabilities. 34 (2017) 1-11.
21. Capio, C. M., Sit, C. H., Eguia, K. F., Abernethy, B., & Masters, R. S. (2015). Fundamental movement skills training to promote physical activity in children with and without disability: A pilot study. *Journal of Sport and Health Science*, *4*(3), 235-243.
22. Lotan. M., Isakov. E., Kessel. S., & Merrick. J. (2014). *Physical Fitness and Functional of Children with intellectual Disability: Effects of a Short-Term Daily Treadmill Intervention.* The Scientific World Journal. (2004) 4, 449-457.
23. Sukdee. N. (2015). *Effects of Exercise sing Bosu Ball on Balance, Muscular Strength and Cardiovascula System of the Autistic Chi*ldren. An Online Journal of Education. Vol.10, No.2, 2015, pp.335-349 23.
24. Laohaphaitoon. P., & Bodhiyen. K. (2018). *Improving Writing Ability of 3 Digit Numbers for Students with Intellectual Disabilities by Game Teaching* .Suan Dusit Graduate Academic Journal .Vol.14, No. 2, May – August 2018 (pp. 155-170).