

The Effect of Jumping and Hopping Training Models Using Digital Mattress for Children with Intellectual Disabilities

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Abstract The goal of this research is to examine the effect of jumping and hopping training models using digital mattress for intellectually disabled children. This research was conducted at SLBN Pembina Palembang (Indonesia). The sample in this study consisted of 60 intellectually disabled children. The method used is quasi-experimental research, quantitative data analysis technique, and the design of this research is pretest-posttest control group design. The instrument used in this research is the jump and hop test. The significant test to see the effectiveness of this model is the t-test, and the value of $t = 3.827$ and the value of Sig. (2-tailed) or $p\text{-value} = 0.000 < 0.05$. This means that H_0 is declined or there is a difference between the jump and hop training model using a digital mattress and the conventional training model. In brief, the jump and hop training model using a digital mattress is more effective than the conventional training model for intellectually disabled children. Conclusion: The results of the study indicate that: the results of exercise with digital mattress are proven to be effective in developing the basic movement skills of jumping and hopping for intellectually disabled children compared to conventional training models.

Keywords Jump-hop, Digital Mattress, Intellectually Disabled Children

1. Introduction

Tunagrahita or intellectual disabilities according to the World Health Organization (WHO) are children with disabilities that are characterized by significant limitations in intellectual function and adaptive behavior such as conceptual understanding, social and adaptive skills practice. In line with WHO, the American Association for Mental Deficiency (2006) also suggests that intellectually challenged children have a picture of intellectual function below average and at the same time there is also a lack of adaptive behavior that occurs at this stage of development [1].

In Indonesia, intellectual disabilities is called *tunagrahita*. The term previously used was mental retardation (mentally retarded). The word disability is used to describe inability. Thus, intellectual disabilities is the

inability to use mental functions in thinking and reasoning.[2]

Tunagrahita children are also called intellectual disabilities (ID) which is known as mental retardation [3]. According to the American Association on Intellectual and Developmental Disabilities (AAIDD), children with mental retardation imply significant limitations in intellectual functioning and adaptive behavior, as expressed in conceptual, social and practical skills [4].

Intellectual disabilities is not a mental disorder or medical disorder, but rather a term to describe a disorder characterized by significant limitations in intellectual and adaptive functioning that begins before the age of 18 years [5]. From the opinion above, intellectually challenged children imply a disability that is characterized by very significant limitations in intellectual functioning and adaptive behavior, such as conceptual understanding, social and practice adaptive skills.

Children with intellectual disability are those whose intellectual functions are significantly below average with deficiencies in adaptive behavior that occur during their developmental period. Children with intellectual disabilities face many difficulties in learning and, as the result, they need more support on a personal level, both in terms of education, and in terms of social integration. One of the characteristics of this category of children is poor ability to assimilate new or complex information, to acquire new skills and to be independent [6].

Tunagrahita children show symptoms of lack of coordination in movement activities which are shown in movement and muscle responses with low and less varied patterns. Mental retardation has problems in physical and motor development, the physical and motor development of intellectually disabled children is not as fast as the development of normal children [7]. Motor development problems that are often experienced by intellectually disabled children are difficulties in moving such as walking, throwing, jumping, hopping and running.

The development of motor skills is an important aspect in improving the quality of children's movement. Although intellectually disabled children have deficiencies in intelligence or have limited intellectual functions and adaptive behavior, it cannot be denied that intellectually disabled children can also make sports achievements with good training, where intellectually disabled children and other children with special needs can take part in sports activities organized for people with disabilities. This is also supported by the Indonesian government by making regulations whose purpose is not to ignore sports for children with special needs as stated in the Law of the Republic of Indonesia No. 3 of 2005 concerning the National Sports System, namely that sports with disabilities are sports that are specifically done in accordance with conditions of disability. someone's physical or mental [8].

It is the same with sports for children with disabilities at the international level, namely the Special Olympics. Part of

the Special Olympics mission is to develop physical fitness [9]. However, little is known about the fitness level of children with disabilities lower than normal children. Children with disabilities and their parents tend to want the same youth sporting opportunities as children without disabilities, but there are many barriers that stand in the way of those opportunities. Identified barriers include (1) program leader's fear of responsibility/not knowing how to accommodate, (2) lack of trainer knowledge and training, (3) fear of parents and children, and (4) lack of appropriate programs[10].

Based on the opinion above, this coaching program is expected to be a forum for intellectually disabled children to develop abilities in improving basic movements. Intellectually disabled children who participate in locomotor movement exercises can significantly improve their motor skills after repeated training. Mubarak's research illustrates that locomotor movement exercises, which are generally included in coaching programs, can improve children's basic motor skills intellectually disabled children [11]. Locomote is the ability to move in the world"[12]. Locomotor skills involve transporting the body in all directions from one point to another. Examples are: crawling, walking, running, jumping, hopping, running fast, skipping, dodging, and swimming" [13]. Locomotor motion is often referred to as traveling, defined as moving from place to place, such as walking, running, jumping and hopping [14]. This skill is considered the most basic locomotor skill, because it is a skill that develops with development and is more functional. Locomotor skills jump and hop at a glance almost the same but have different definitions. Hopping is a movement to move using one foot as a support while jumping uses two legs as a support.

Based on the background above, the author chose to jump and hop because these basic movements are still an obstacle in physical development for intellectually disabled children. Jumping and hopping are the basic motor skills [15]. Basic motor skills are needed by intellectually disabled children to help physical development and in carrying out daily activities. Basic motor skills in disadvantaged children are essential for healthy physical and social development and performance in activities of daily living. Basic basic motor skills from the basic infant phase to more complex locomotor and manipulative movements serve as building blocks for more complex movements. Specific and functional movement skills may appear before basic movement is achieved; however, it is the basic basic motor skills that help children control their bodies, manipulate their environment, and form the complex skills involved in sports and recreational activities. While optimal development of these skills is important for a developing child, many children fail to achieve basic motor skill competence [16].

The low basic locomotor movement in mild intellectually disabled children is also reflected in the results of researchers' observations at the Special School in Palembang. Intellectually disabled children have characteristics such as

having poor coordination, awkward/less balanced and less controlled movements, as well as difficulties when jumping and hopping, limited thinking power experienced by intellectually disabled children also makes them difficult to control, whether the behavior shown in daily activities reasonable or unreasonable.

Intellectually disabled children who are in SDLB Palembang also still have difficulty in performing basic jump and hop movements. Where hopping is a movement to lift the body from one point to another using two legs as a pedestal, while jumping is a movement to lift the body from one point to another using one leg as a pedestal.

Jumping is a challenging movement for intellectually disabled children, because this movement requires coordination of the arms, legs and body as well as controlling the flight phase when both feet are not in contact with the ground. The jump motion is usually divided into three components: preparation or take-off, flight, and landing”[17]. Based on the data above, jumping skills are challenging for children, because they require arm, leg and body coordination and control the flight phase when both feet do not touch the ground. The jump motion is usually divided into three components: preparation or takeoff, flight, and landing.

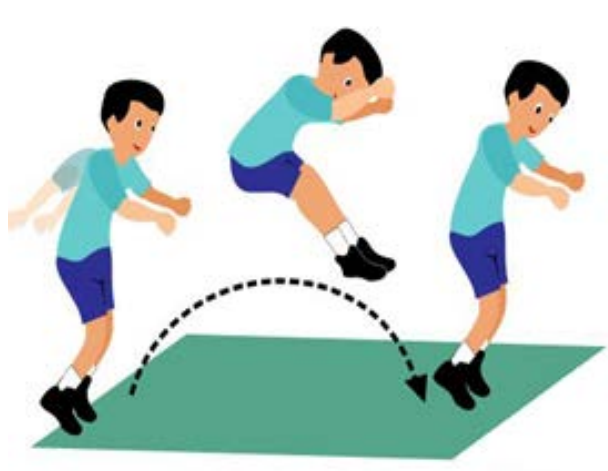


Figure 1. Jumping

The point that needs to be considered in doing a hop movement is the ability to coordinate the movement of the arms and legs. When performing a jump motion it is important to pay attention to landing safely by bending the ankles, knees, and hips [18].

On the other side, hopping is the movement to lift the body from one point to another using one leg as a pedestal. As stated below: a hop is a continuous asymmetric skill and involves taking off and landing on the same foot. Greater leg strength and dynamic balance are required for hopping. Hopping only one leg is used to lift and support the body. This is an important skill to master for safe body management, for example when you are pushed by balance or 'lose your footing'. There are so many sports that use hop movements, including in lay-up basketball games, or various

other forms of hop, everything requires a hop [18].

Hopping involves taking off one foot and landing on the same foot, usually in a continuous, rhythmic motion. Hopping is a challenging skill for many children because it requires balance on a small support base (on one leg), and the ability to control the body for continuous movement. To hop efficiently, the non-hopping side of the body must act as a counterweight while the body is flying. Leg strength is also needed when covering distances [17].

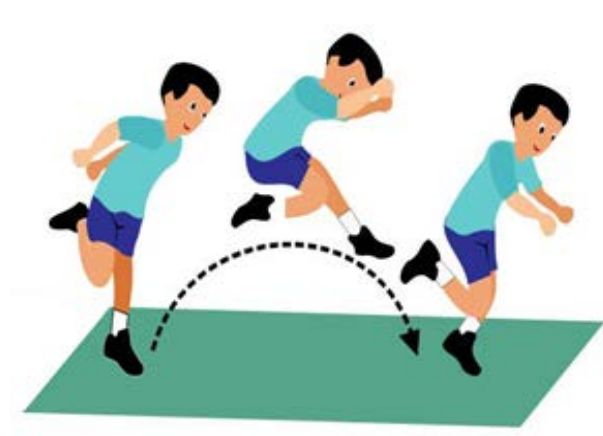


Figure 2. Hopping

Though, in the observation there are still errors in doing both jump and hop. The researcher saw that there was a sense of hesitation and fear in carrying out some movements from the right instruction that created the new and wrong movements. There were children who jump on foot, jump in places that were not on target and children could not hop using one leg, most children did hop movement using 2 legs and children still have low coordination. This can happen because of some of the obstacles that have been stated previously or in terms of the characteristics of children with mild type of intellectual disability.

In accordance with the characteristics that exist in some theories, it shows that children with intellectual disability find it difficult to learn new things related to basic jump and hop movements. However, previous theories also reveal that children with mild mental retardation can still learn and be taught new things compared to the moderate and severe types of intellectual disability in academic contexts, especially sports education. In the sports coaching program for children with special needs, the basic movements jumping and hopping should be mastered by intellectually disabled children. Because not only to help carry out daily activities but the skills of jumping and hopping are basic skill in mastering sports such as athletics, swimming or other game sports.

Intellectually disabled children in the low category include those who are able to educate, namely many of them are able to learn daily life skills, as well as vocational [19]. Individuals with low intellectual limitations often identified when facing increasingly difficult academic tasks [20]. Mild intellectually disabled (ID) children have many learning

difficulties. This group includes children with mild specific learning disabilities. Characteristics of children such as: activity, approach in new situations, acceptance of new individuals, ability to adapt in new circumstances, moods, endurance, mental strength, occur as a result of the interaction between biological and environmental factors [21]. Intellectual disability is a deficit in intellectual function, adaptive function, and this deficit occurs during the developmental period (before the age of eighteen years) [22].

The sports coaching program for children with special needs is coaching that does not focus on one type of specialty, but accommodates children with various special needs and receives coaching according to their specific characteristics. Therefore, sports development for intellectually disabled children becomes a forum for children with intellectual disabilities.

Aspects that are of concern in carrying out intellectual disability children sports coaching and training programs are how to utilize existing facilities and infrastructure such as exploring and maximizing the competence, expertise and knowledge of instructors in maximizing the training model by considering the characteristics of intellectually disabled children and combined with current scientific and technological updates. The right training model must be the main key so that intellectually disabled children can get used to coaching activities. Suitable coaching is for intellectually disabled children. Training and modifications need to be done as behavioral therapy so that later children can be more independent in their daily lives [23]. Training games intended for intellectually disabled children are not just any games, games that can be given to mentally challenged children at least have content, among others, have different therapeutic values and the game figures provided are not too difficult for intellectually disabled children to digest [24]. The use of technology and information can help the learning process of intellectually disabled children by implementing play based learning or learning activities using game media. Play activities can be described as fun activities and make children actively move so that it triggers their fine motor sensors to get better.

Early childhood with disabilities including mental retardation will learn a lot through playing and observing their environment [25]. Through play children can achieve physical, intellectual, emotional and social development. Physical development can be seen while playing. Play is very important for cognitive, physical, social and emotional development in children and adolescents [26]. Playing also offers opportunities for parents to be directly involved in children's activities. Thus, playing can improve physical-psychic development, and can improve their intellectual. Research on interactive educational games based on motion gesture technology shows that children find it easy in this educational game, the games in their research are able to significantly help intellectually disabled children to learn, especially practicing daily activities or skills. [27]. The study of literature began in 2012 with the title: Forms of

Locomotor Basic Movement Exercises (Hop and Jump) Through Games for Children with Disabilities at SMALB-C Level, the results of the research were the development of a guidebook for basic locomotor movement training forms through games for high school students-C Sumber Dharma Malang [28]. In his research, it has similarities with researchers regarding the development of basic movement training models of jumping and hopping in intellectually disabled children, but the subject uses high school mental retardation children instead of elementary school in 2014 the development of mattress products. Product development in the form of a neuron dance pad simulator which has similarities with digital mat in terms of digitization but differs in the purpose of use, where Neuron Dance Pad Simulator as an innovation of portable sports equipment to hone right brain intelligence and prevent obesity risk [29].

Model and technological innovation greatly help human work in general and the advancement of sports coaching and training programs in particular. The emergence of sports equipment that has advanced technology brings us into a better condition, where there are lots of emerging products with the latest innovations at low costs and can help human work [30]. However, there are currently not many sports facilities that have technology for children with special needs; there are still many parties who have not paid attention to sports for children with disabilities, especially children with intellectual disabilities. They have physical limitations in locomotor movements. Based on the data above, it encourages researchers to make updates with current technology by designing a product as a technology-based training model in this case in the form of a digital mattress. The mat itself in the field of sports is a material that is often found, as a base used in training and competitions in several sports. While digital itself is a system that is implemented to build computers and other devices [31].

Previously, there was already a digital-based mattress, namely the *neuron dance pad simulator* as an innovative portable exercise tool to sharpen right brain intelligence and prevent obesity risk [29]. Moreover, there is also a manual mat that is used to train intellectually disabled children to improve basic locomotor movements. The discovery of this digital mat cannot be separated from the problems faced by intellectually disabled children, as the basic movements of jumping and jumping which are still low and not yet optimal. Mats is combined from several basic jump and hop movement training items using touch sensors whose purpose is to carry out an exercise that will be fun and more efficient for intellectually disabled children.

This digital mattress is named D-Mat, D is taken from the abbreviation of the creator's name and Mat stands for mattress. Digital Mattress (D-Mat): It is a mattress designed using a digital system and packaged to develop cognitive and help children with disabilities in physical activities, especially for basic jump and hop movements. Mattress It has an area of 1m x 1m with a height of 5-7 cm. The D-Mat is

made of an aluminum frame and plywood to attach sensors and LED lights, and then covered with rebounded foam and synthetic leather, a flexible mat material with a smooth texture and enough to stick to the floor with minimal risk of slipping or slipping. In addition, the mattress wrapping material is added with a design using letters/numbers to train children's cognitive development or can be adjusted to the child's taste but still contains educational value. Another advantage that is in this digital mattress is equipped with music. The exercise model is designed with a touch of technology that is adapted to the basic movements of jumping and hopping so that it attracts and motivates children to increase physical activity, especially the basic movements of jumping and hopping, related to efforts to improve the ability to jump and hop basic movements through digital-based mats for intellectually disabled children as locomotor activity aids for intellectually disabled children are equipped with additional equipment, including: navigation button box, DC adapter, digital mattress also equipped with music consisting of 3 songs, namely love everything, ride a wagon and my balloon (the song can vary according to the request made) to increase children's enthusiasm for physical activity.

The digital mattress in this study is a type of mattress that uses a digital system to perform basic movement exercises, especially jumping and hopping for intellectually disabled children with sound and light signals. Jump and hop training models will be divided into 40 movements. The form of basic locomotor movement exercises for intellectually disabled children in digital mats only focuses on jumping and hopping movements which consist of several movements, include: (1) jump forward, (2) jump forward with arms at waist, (3) jump forward with arms swinging, (4) jump forward with clapping (5) jump forward with arms outstretched, (6) jump back, (7) jump back with arms on waist, (8) jump back with arms swinging, (9) jump back with clapping, (10) jump back with arms outstretched, (11) jump sideways, (12) side jump with arms at waist, (13) side jump with arms swinging, (14) side jump with clapping, (15) side jump with arms outstretched, (16) combination jump, (17) combination jump with arms on hips, (18) combined jump with arms swinging, (19) combined jump with clapping hands, (20) combined jump with arms outstretched, (21) hop forward, (22) hop forward with hands on the waist, (23) hop forward with swinging hands, (24) hop forward with clapping hands, (25) hop forward with arms outstretched, (26) hop back, (27) hop back with hands on waist, (28) hop back with arms swinging, (29) hop backwards by clapping (30) hop back with arms outstretched (31) hop to the side, (32) hop to the side with arms at the waist, (33) hop to the side with arms swinging, (34) hop to the side with clapping (35) side hop with arms outstretched, (36) combined hop, (37) combined hop with arms on the waist, (38) combined hop with arms swinging, (39) combined hop with clapping (40) combined hop with arms just stretched,



Figure 3. Digital Mattress (D-Mat)

Through the intellectually disabled children's problems that have been described above. The ability of basic locomotor movement as the form of exercise given is still conventional and monotonous for intellectually disabled children. As the result, we need an innovation in coaching through science and technology as an effort to improve basic locomotor movements in mild intellectually disabled children. The training process in basic locomotor movements with digital mats is designed to make it easier for them to practice basic locomotor movements. Therefore, researchers are interested in conducting research on the effect of jumping and hopping exercise models using digital mats for intellectually disabled children. It is expected that with the practice of hopping and jumping using digital mats for intellectually disabled children, it can help children improve their basic skills in jumping and hopping.

2. Research and Methods

The research method used is a quasi-experimental design with One Group Pretest and Posttest Design [32]. This study used a sample of 60 students of *SLBN Pembina Palembang* 2020/2021. The instrument is a jump and hop test. This basic movement instrument has been validated by experts. The jump and hop test is a measuring tool used to determine the basic movement ability of hopping and jumping. This test was developed from the movement of jumping and hopping. The jumping and hopping test instruments have been tested for reliability with a reliability index $r = 0.874$. The jumping and hopping training models in this study were for the experimental group as many as 40. Meanwhile, the control group performed the usual exercise movements that were used, including: (1) Jumping with a play mat, (2) Hopping with a play mat, (3) Jumping with a hulahop, (4) Hopping with hulahop, (5) Jumping with cone, (6) Hopping with cone.

3. Result

The results of this study are based on the assessment of the hop and jump motion tests referring to the truth value of the motion. The assessment is taken from the child's best movement in jumping or hopping, for the basic motion test by giving a score in the form of a True-False form test (True/False), the effectiveness test is done 14 times for

treatment and twice for pretest data collection and posttest in the experimental and control groups. In this effectiveness test using 60 subjects of SLB Pembina Palembang (Indonesia) children consisting of 30 experimental and 30 control groups, raw data from the jump and hop test results are attached (Appendix 5) along with the results of the effectiveness test of the jump and hop training model using a digital mattress for intellectually disabled children:

Table 1. Jumps and Hops Results of Experiment and Control Groups

Group	Mean	N	Std. Deviation	Sum	Minimum	Maximum	Range
Experiment	77.78	30	22.88296	2333.35	25.00	100.00	75.00
Control	53.89	30	25.40258	1616.67	8.33	100.00	91.67

The table above indicates that: The experimental group with 30 research subjects obtained a maximum score of 100, a minimum score of 25, the average value of the experimental group 77.78 and a standard deviation of 22.28, while for the control group with 30 research subjects obtained a maximum score of 100 a minimum of 8.33, the mean value of the control group was 53.89 and the standard deviation was 25.40.

Table 2. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Post Test	Equal variances assumed	.264	.609	3.827	58	.000	23.88933	6.24212	11.39438	36.38429
	Equal variances not assumed			3.827	57.378	.000	23.88933	6.24212	11.39150	36.38717

The following table is a table of independent sample t-test analysis. It can be found that the 2-way (t-tailed) significance value is $0.000 < 0.05$. So there is a significant difference in point scores between the control group and the experimental group. Through the descriptive value, it is proven that the experimental group with the exercise model with a digital mat got a higher score.

4. Discussion

The control and experimental groups both got a pretest result of 0, because they did not yet have the ability to make good and correct jumps and hops. The control group then carried out activities according to the previous habits carried out by the teacher/trainer, while the experimental group was treated with the help of a digital mattress. The two groups, both the control group and the experimental group, each used jump and hop training/learning media. It is just that in the experimental group, using tools/media in the form of a developed product namely digital mats, where digital mats are complete with training models.

In the output of the Independent Samples Test, the value of $t = 3.827$ and the value of Sig. (2-tailed) or p-value = $0.000 < 0.05$ or H_0 is rejected. Thus, there is a difference between the jump and hop training model with a digital mat. Thus, it can be concluded that the jump and hop training model with a digital mat is more meaningful than the conventional training model for children with intellectual disabilities.

The jump and hop training model developed using a digital mat that can be done anywhere on the field or room. The most crucial thing is that there is a source of electric current to operate the digital mattress and the need for assistance from parents/teachers to carry out jump and hop training models for intellectually disabled children. This digital mattress product is a source or training medium that really helps students in improving children's physical activity. The digital mat training model can be a medium for active and fun play because it is equipped with music with children's songs during its implementation.

The advantage of the jump and hop training model using a digital mat for intellectually disabled children is that the mat material is quite flexible with a smooth texture and is sufficiently attached to the floor with the risk of slipping or slipping being minimized. In addition, the digital mattress wrapping material is made of synthetic leather and is designed using letters/numbers to train children's cognitive development or can be adjusted to consumer preferences but still contains educational value. Another advantage is that the digital mattress is equipped with music and has a low electrical power of 24 watts.

5. Conclusions

Based on the data analysis results and discussion, it can be concluded that the training model with a digital mat has a

very significant effect on the ability to jump and hop in intellectually disabled children. It is expected that the training model that has been developed in this study can contribute to trainers/teachers in providing the right training model for intellectually disabled children to improve basic locomotor movements, in this case jumping and hopping.

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