

Development of an Instrument to Test Physical Fitness of Mentally Disabled Children

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The physical fitness test is an important factor for mentally disabled children because it is a good indicator of physical fitness level, which is associated with the children's health. Measuring physical fitness needs to be adjusted to the characteristics of student growth and development and the geographical conditions of the environment. This study aims to develop a physical fitness test measure specifically for mentally disabled children aged 10 to 12 years, conducted in five districts in Sulawesi Tengah province. The measuring instrument developed consists of four tests, namely: 1) run 30 meters fast to measure speed; 2) hold the body in a push-up position, feet lifted at shoulder height for 30 seconds to measure strength endurance; 3) sitting reaching forward to measure flexibility; and 4) run 600 meters to measure the endurance of the heart and lungs. Measurements of physical fitness for mentally disabled children provide information about student health that can be used to maintain the lifestyle and health of students. Schools can also apply physical fitness assessments by using the test-measuring instrument that is appropriate to the conditions of students.

Key words: *Development, Measuring Instrument, Physical Fitness, Mentally Disabled Children*

Introduction

Physical fitness tests for children and adolescents provide us with the necessary information that can be used to maintain and improve children's health (Kolimechkov, 2017). Measurement, assessment, and monitoring of physical fitness should be considered as a priority to know the health condition (Cvejić, Pejović, & Ostojić, 2013). Physical fitness is the ability of a person to carry out daily tasks without experiencing meaningful fatigue and still has reserves of energy to carry out other activities. In terms of *physiological fitness*,

physical fitness essentially means the degree of conformity of the dynamic, healthy level possessed by the implementer to the severity of physical tasks that must be carried out (Dorsan, 2014; Giriwijoyo, 2017). Physical activity is mentally disabled individuals don't only improve mental and physical health but also influence social skills such as the capacity to control themselves on their behaviour, as well as receiving instruction from others and the ability to interact cooperatively (Hayakawa & Kobayashi, 2013). Physical activity is mentally disabled children is a means of socializing with the environment (Miguel-Etayo et al., 2014).

Physical fitness can be obtained through physical activity by participating in sports training as well as learning physical sports and health education in schools for school-age children. Through these physical activities, it can help the students to improve cognition and motivation during learning (Dandashi, 2014). Repetition of round ball playing techniques can improve the gross motoric abilities of mild mentally disabled children (Indardi, 2015). Sports and health physical education teachers are expected to be able to find learning models that are fun and easy to do by students (Sumaryanti et al., 2013). Learning Physical, Sports, and Health education through adaptive physical activity is useful for improving children's necessary movement skills in Extraordinary School in mental disability (National Education Standards Agency, 2006). Improving children's physical fitness can have a positive impact on life quality related to health (Gu, Chang & Louisiana, 2016). Westendrop (2012) explains that mild mentally disabled children have a significantly lower score in almost items of motor skills and object control skills when compared to non-mentally disabled peers. The low level of physical fitness and mobility of children with mental disability will be able to affect their health; thus, they are susceptible to disease. To find out the fitness level of students and the success of education can be known through tests and measurements and also evaluations, as Widiastuti (2015) said that tests are tools used to measure performance and to collect the data while measurements are quantitative scores derived from tests.

Children with mental disability have an IQ below the average; further, this condition can affect the child's response to stimuli or instructions given. This can also affect his movement skills. Auxter et al. (2001) explain that mentally disabled children also experience motor delays when standing, walking, etc. It has a negative impact on strengthening their motor and physical. Mentally disabled young people have lower levels of cardiovascular endurance and muscle strength, as well as higher body mass index sizes, compared to their peers (Pitetti & Yarmer, 2002). Children with intellectual disabilities tend to have lower physical fitness levels, are limited to participation, and have a higher obesity rate than their peers who are not disabled (Frey & Chow, 2006). The physical fitness level of children with mental disability is low compared to the health standards set for ordinary students (Meredith & Welk, 2007). Lack of motion and physical fitness can affect sedentary behaviour in mentally disabled children (Okely, Booth, & Chey, 2004). Adaptive physical education is needed for physical activity programs that are suitable for improving the fitness of Extraordinary School students with mental disabilities (Kathryn et al., 2010). Therefore, Physical Education, Sports, and

Health were given to mentally disabled students who need to be adapted according to their growth and development characteristics. The form of exercise for motion activities for mentally disabled children needs to be modified by the movement patterns of mentally disabled children (Kocic et al., 2017).

To evaluate it also needs evaluation tools that have been adapted to the growth and development of mentally disabled students. If the physical extinction of mentally disabled students is tested using the Indonesian Physical Fitness Test. The result is not good because the test result is in the less category; thus, it is a need to develop physical fitness tests specifically for mentally disabled children (Wijayanti et al. 2012). Winnick (2005) in Kathryn, et al. (2010) said that *Fitness Gram* was used as an essential reference in developing *Brockport Physical Fitness Test* (BPFT) for children with disabilities, especially *Intellectual Disabilities* (ID).

Methods

Development Method

The research model used is the development research model (*Research and Development / R & D*). R & D is a research method used to research to produce new products, and then to test the effectiveness of the product (Sugiyono, 2013). The steps of research with the *Research and Development* method are generally explained in Figure 1.

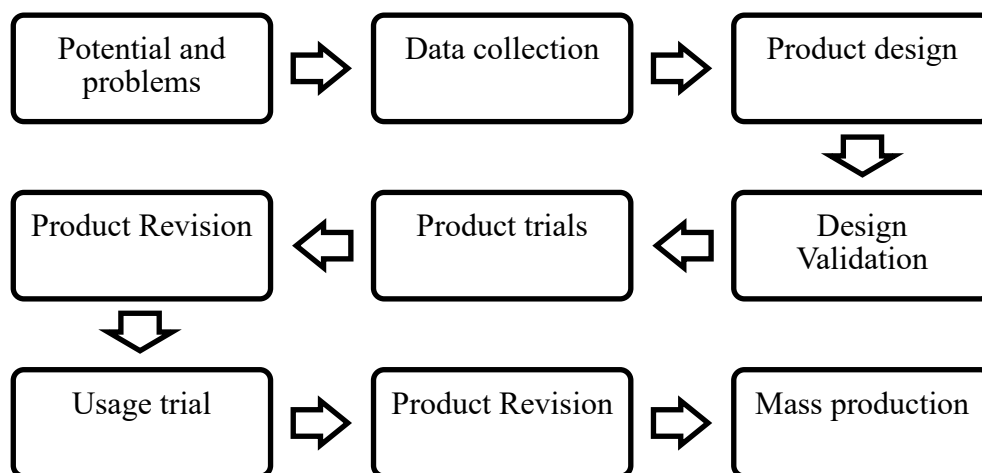


Figure 1. The research steps of the *Research and Development* (R & D) method in general (Sugiyono, 2013)

Instrument Development Procedure

According to Sukmadinata (2010), the steps of developing fitness can be used as follows in Figure 2.

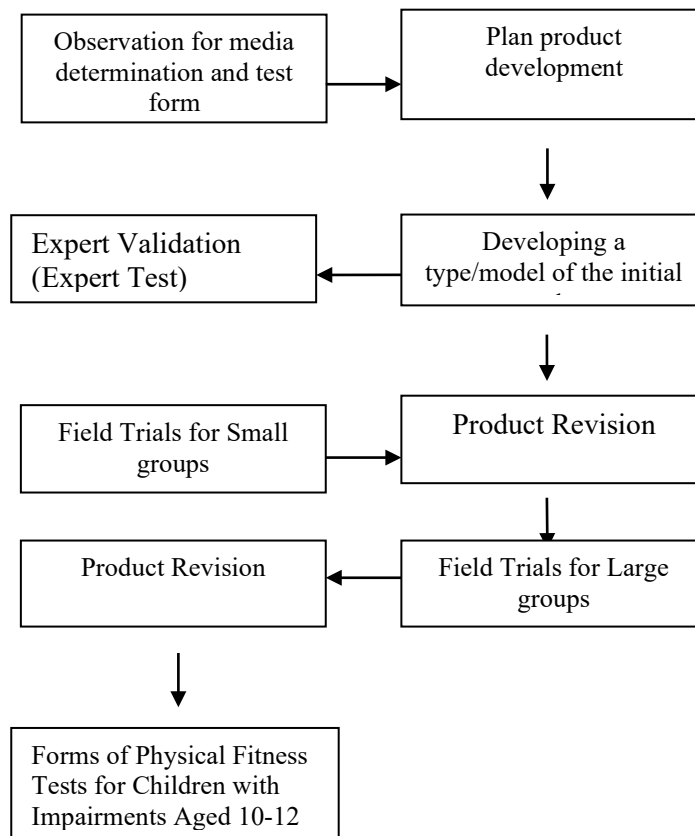


Figure 2. Stage of Development Activities of the Form of Physical Fitness Tests with Mentally Disabled Children

Data Source

The subjects of this study were all Extraordinary Schools in 5 districts in Sulawesi Tengah Province, with the total number of 119 students (male and female mild mentally disabled students). The technique of determining the sample of this study was *Cluster Sampling*. Small groups of 40 students, which were consisted of 25 male students and 15 female students and a large group of 79 students, consisted of 57 male students and 22 female students.

Data Collection Technique

The data collection technique of this study was a qualitative and quantitative data collection technique. The types of qualitative data were data from interviews, field surveys, and inputs from validators. Whereas, quantitative data was a numerical test result from physical fitness

measurement of mentally disabled children at Extraordinary School aged 10 to 12 years, which was a product development study. The trial process of the product development of physical fitness measuring devices was carried out with two levels, namely through small group field trials in two stages with the same sample as a basic description for conducting field trials in large groups. Field trials are carried out after obtaining a revision or not need to be revised based on small group field trials that are then conducted in a large group field test, which will portray the maximum potential of the child.

Results

The development of the form of physical fitness test tools for mentally disabled children aged 10 to 12 years is designed according to the characteristics and level of development of mentally disabled children aged 10 to 12 years. The measuring instrument developed consists of four tests, namely: 1) Run 30 meters fast to measure speed; 2) Hold the body in a push-up position, feet lifted at shoulder height for 30 seconds to measure strength endurance; 3) sitting reaching forward to measure flexibility; and 4) Run 600 meters to measure the endurance of the heart and lungs. Before doing each test item, students warm up first.

Instrument Validation Test

The Instrument Validation Test can be seen in Table 1 and Table 2.

Table 1. Mean and Standard Deviation Data of Male Small Group of Physical Fitness Tests to Mentally Disabled Children in Extraordinary School

Test Item	Mean		Standard Deviation	
	Stage 1	Stage 2	Stage 1	Stage 2
Run 30 meters	8,65	8,07	2,46	1,9
Endurance	18,42	19,32	2,96	2,99
Flexibility	20,48	19,68	6,51	6,97
Run 600 meters	2,61	2,51	0,35	0,31

Table 2. Mean and Standard Deviation Data of Female Small Group of Physical Fitness Test with Mentally Disabled Children in Extraordinary Schools

Test Item	Mean		Standard Deviation	
	Stage 1	Stage 2	Stage 1	Stage 2
Run 30 meters	9,44	17,13	2,49	2,11
Endurance	12,88	13,66	1,46	1,29
Flexibility	23,73	20,20	6,82	5,60
Run 600 meters	2,99	2,71	0,32	0,40

Results of Validity Data from Instrument Trials to Male and Female in Small Groups:

1. Factor Analysis of Male and Female Small Groups in Stage 1

Factor Analysis of Male and Female Small Groups in Stage 1 can be seen in Table 3 and Table 4.

Table 3. Validity Data of Physical Fitness Test for Male Small Group in Stage1

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1,577	39,436	39,436	1,577	39,436	39,436
2	1,152	28,801	68,238	1,152	28,801	68,238
3	,659	16,485	84,723			
4	,611	15,277	100,000			

Table 4. Validity Data of Physical Fitness Test for Female Small Group in Stage 1

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,091	52,276	52,276	2,091	52,276	52,276
2	1,113	27,824	80,101	1,113	27,824	80,101
3	,558	13,954	94,055			
4	,238	5,945	100,000			

2. Factor Analysis of Male and Female Small Groups in Stage 2

Factor Analysis of Male and Female Small Groups in Stage 2 can see in Table 5 and Table 6.

Table 5. Validity Test Data of Physical Fitness Test for Male Small Group in Stage 2

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1,651	41,285	41,285	1,651	41,285	41,285
2	1,094	27,350	68,635	1,094	27,350	68,635
3	,706	17,657	86,292			
4	,548	13,708	100,000			

Table 6. Validity Test Data of Physical Fitness Test for Female Small Group in Stage 2

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1,590	39,745	39,745	1,590	39,745	39,745
2	1,089	27,215	66,960	1,089	27,215	66,960
3	,896	22,395	89,354			
4	,426	10,646	100,000			

Reliability Data Results from Instruments Trial of Physical Fitness Tests to Mentally Disabled Children in Small Groups in Small Group in Stage 1 and 2

Table 7 and Table 8 show the reliability data results from instruments trial of physical fitness tests to mentally disabled children in small groups in a small group in stages 1 and 2.

Table 7. Test-Retest Test Results Data of Trial Reliability in Male Small Group in Stage 1 and 2

Pair	ButirTes (X1 dan X2)	Correlation	Sig.
1	Run 30 meters X 1 & Run 30 meters X 2	.982	.000
2	Endurance X 1 & Endurance X 2	.995	.000
3	Flexibility X 1 & Flexibility X 2	.916	.000
4	Run 600 meters X 1 & Run 600 meters X 2	.939	.000
5	Total T -TKJ 1 & Total T -TKJ 2	.924	.000

Table 8. Test-Retest Test Results Data of Trial Reliability in Female Small Group in Stage 1 and 2

Pair	ButirTes (X1 dan X2)	Correlation	Sig.
1	Run 30 meters X 1 & Run 30 meters X 2	.958	.000
2	Endurance X 1 & Endurance X 2	.962	.000
3	Flexibility X 1 & Flexibility X 2	.900	.000
4	Run 600 meters X 1 & Run 600 meters X 2	.675	.006
5	Total T -TKJ 1 & Total T -TKJ 2	.892	.000

Objectivity Test of Physical Fitness Test Instruments

The objectivity test of physical fitness test instruments can see in Table 9.

Table 9. Data Correlation of Each Test Item in Stage 1 and 2

NO	Test Item	Male		Female		Description
		r ^{-count}	r ^{-table}	r ^{-count}	r ^{-table}	
1	Run 30 meters	0.982	0,396	0.958	0,514	Objective
2	Endurance	0.995		0.962		Objective
3	Flexibility	0.916		0.900		Objective
4	Run 600 meters	0.939		0.675		Objective

Description of Trial Data in Large Group

Table 10 and Table 11 shows the mean and standard deviation test result of the trial instrument in a large group of physical fitness tests with mentally disabled children in extraordinary schools ages 10 to 12 year.

Table 10. Mean and Standard Deviation Data of Male Large Groups for Physical Fitness Tests with Mentally Disabled Children in Extraordinary School Aged 10 To 12 Years

Test Item	Mean		Standard Deviation	
	Stage 1	Stage 2	Stage 1	Stage 2
Run 30 meters	9,33	8,37	2,6	1,96
Endurance	11,94	13,07	3,17	3,78
Flexibility	10,32	11,61	1,53	2,50
Run 600 meters	2,66	2,48	0,35	0,28

Table 11. Mean and Standard Deviation Data of Female Large Groups for Physical Fitness Tests with Mentally Disabled Children in Extraordinary School Aged 10 to 12 Years

Test Item	Mean		Standard Deviation	
	Stage 1	Stage 2	Stage 1	Stage 2
Run 30 meters	10,16	8,94	1,79	1,64
Endurance	11,86	13,63	3,22	3,91
Flexibility	8,46	9,77	1,05	6,65
Run 600 meters	3,1	2,49	0,36	1,19

Standard Improvement as a Final Product

Mean and Standard Deviation Data of Male and Female Large Groups for Physical Fitness Tests with Mentally Disabled Children in Extraordinary School Aged 10 to 12 Years can show in Table 12.

Table 12. Mean and Standard Deviation Data of Male and Female Large Groups for Physical Fitness Tests with Mentally Disabled Children in Extraordinary School Aged 10 to 12 Years

Test Item	N	Mean		Standard Deviation	
		Stage 1	Stage 2	Stage 1	Stage 2
Run 30 meters	59	8,37	8,6	1,5	1,12
Endurance	59	30,57	26,67	3,48	4,41
Flexibility	59	37,63	33,06	1,79	1,72
Run 600 meters	59	2,44	2,41	0,17	0,20

Norms of Assessing Physical Fitness Tests with Male Mentally Disabled Children in Extraordinary Schools at the age of 10 to 12 Years can see in Table 13. Then, Table 14 shows about Norms of Assessing Physical Fitness Tests with Female Mentally Disabled Children in Extraordinary Schools at the age of 10 to 12 Years. And Classification of Categories of Assessment of Physical Fitness Tests in Extraordinary Schools can show in Table 15.

Table 13. Norms of Assessing Physical Fitness Tests with Male Mentally Disabled Children in Extraordinary Schools at the age of 10 to 12 Years

Test Item	Very Good	Good	Enough	Poor	Very Poor
	5	4	3	2	1
Run 30 meters	$X < 6.12$	6.12-7.62	7.63-9.13	9.14-10.64	$X > 10.64$
Endurance	$X > 35.94$	35.94-34.15	3.14-32.35	32.34-30,55	$X < 30,54$
Flexibility	$X > 25.35$	25.35-21.87	21.86-18.38	18.37-14.89	$X < 14.88$
Run 600 meters	$X < 2.19$	2.19-2.36	2.37-2.54	2.55-2.72	$X > 2.73$

Table 14. Norms of Assessing Physical Fitness Tests with Female Mentally Disabled Children in Extraordinary Schools at the age of 10 to 12 Years

Test Item	Very Good	Good	Enough	Poor	Very Poor
	5	4	3	2	1
Run 30 meters	X<6.92	6.92-8.04	8.05-9.17	9.18-10.3	X>10.04
Endurance	X>30.48	30.48-28.76	28.75-27.05	27.02-25.30	X<25.29
Flexibility	X>20.05	20.5-15.64	15.63-11.22	11.21-6.80	X<6.79
Run 600 meters	X<2.71	2.71-2.91	2.92-3.12	3.13-3.33	X>3.34

Table 15. Classification of Categories of Assessment of Physical Fitness Tests in Extraordinary Schools

Category	Score
Very Good	17 – 20
Good	13 – 16
Enough	9 – 12
Poor	5 – 8
Very Poor	1 – 4

Discussion

Based on the results of the study, the forms of physical fitness tests for mentally disabled children aged 10 to 12 years were developed as follows:

1. Run 30 meters to find out the speed of repetitive movements of the body with a range of distances or times as fast as possible. Tests applied to assess motor fitness in children and adolescents are the 50m run test, the flamingo balance test, and the 4x10m shuttle test (Ruiz et al., 2009).
2. Holding for 30 seconds in a push-up position or holding the body with a heel parallel to the head (push-up modification) is done to measure muscle strength to fight the load and do a series of work for a long time.
3. Sitting reaches forward to measure flexibility or the ability of joints to move as widely as possible freely. Matthew Percia (2010) in Ruiz et al. (2009) says, "sitting and reaching tests are tests that can be used to measure the flexibility of the hamstrings, hips, and back. Flexibility as a musculoskeletal component is the ability of muscles or muscle groups to move freely through various movements.
4. Run 600 meters to measure the endurance of the heart and lungs as an effort to circulate blood and oxygen throughout the body, especially the parts of the body that need it.

Cardiorespiratory fitness refers to the ability of the circulatory and respiratory systems to supply sufficient oxygen to the muscles that work during sustained physical activity (American College of Sports Medicine, 2014). The total capacity of the cardiovascular and respiratory systems to supply oxygen during long-term physical activity and reflect the ability to carry out prolonged strenuous exercise (Ruiz et al., 2006). Cardiorespiratory fitness is one of the essential components of physical fitness related to health, and it is a direct indicator of the physiological status of children and adolescents (Cvejić et al., 2013).

The World Health Organization (WHO) recommends that routine testing of physical fitness and physical activity should be considered as public health priority (WHO, 2010). Putra, S., Soegiyanto, and Sulaiman (2017) explained that the average physical fitness of students from Extraordinary School in Aceh Besar District is in the enough and poor category; thus, physical fitness test kits that are appropriate to the characteristics of children need to be developed. Cvejić et al. (2013) describe that Serbia does not have clear provisions and a good definition of how to test physical fitness in children and adolescents. The basic idea is to determine the most common batteries from the test that are adjusted to the conditions in which they are located. Furthermore, it is replaced by a clear concept and how important the tests, the selection of components needed for the test, and how reliable and objective the level of validity in the group of physical fitness tests in children and adolescents.

The results of the validity test of data from mentally disabled children physical fitness tests aged 10 to 12 years in Extraordinary Schools using factor tests from the trial data in small groups in stages 1 and 2 (male and female) obtained the following results: stage 1 of a male is 1,577 and for the female is 2,091. Whereas stage 2 of the male is 1,651, and females are 1,590. According to Sugiyono (2011) that the measuring instrument is said to be valid if it can be used to measure what should be measured. Test results of reliability data of mentally disabled children physical fitness tests aged 10 to 12 years using the retest test for stage 1 and stage 2 (male and female). Correlation test between stages 1 and 2 (male) for each item test is speed with $r^{\text{-count}} = 0,982$, strength endurance with $r^{\text{-count}} = 0,995$, flexibility with $r^{\text{-count}} = 0,916$, endurance of the heart and lung with $r^{\text{-count}} = 0,924$. Meanwhile, stages 1 and 2 (female) is speed with $r\text{-count} = 0,958$, strength endurance with $r\text{-count} = 0,962$, flexibility with $r\text{-count} = 0,900$, endurance of the heart and lung with $r\text{-count} = 0,675$. Following the results obtained, the reliability of the physical fitness test equipment shows that the test equipment is reliable so that it can be trusted or reliable.

The results of the calculation of objectivity with the correlation test between the test stages for the male group obtained results, speed $r\text{-count} = 0.982$, strength endurance $r\text{-count} = 0.995$, flexibility $r\text{-count} = 0.916$, and endurance of the heart and lungs $r = 0.939$. Meanwhile, the female group for the speed test item $r\text{-count} = 0.958$, strength endurance $r\text{-count} = 0.962$, flexibility $r\text{-count} = 0.900$, and endurance of the heart and lungs $r\text{-count} = r 0.675$. The results of objectivity testing are properties that are by the actual situation. Correlation test shows that



all the fitness items in stage 1 and stage 2 have a positive relationship because the male r -table is 0.396, and the female is 0.514, which is smaller than r -count. This shows that the test equipment used is objective and appropriate for measuring the physical fitness level of mentally disabled children aged 10 to 12 years. Iskandar (2008) says that research instruments or data are said to be objective must be able to abandon subjectivism, both subjectivism of researchers and research targets.

Conclusion

Physical fitness measurement results are important information related to the health of mentally disabled students who can be used to maintain their lifestyle and improve their health. The test, which is usually used to measure physical fitness is Indonesian Physical Fitness Tests. It is designed based on the characteristics of normal children. Some studies revealed that the results of physical fitness for mentally disabled children using the Indonesian Physical Fitness Test were in the poor category. Thus, it is necessary to develop physical fitness test instruments specifically for mentally disabled children. The measuring instrument was developed consists of four tests, namely: 1) Run 30 meters fast to measure speed; 2) Hold the body in a push-up position, feet lifted at shoulder height for 30 seconds to measure strength endurance; 3) sitting reaching forward to measure flexibility; and 4) Run 600 meters to measure the endurance of the heart and lungs.

REFERENCES

- American College of Sports Medicine. (2014). *ACSM's Health-Related Physical Fitness Assessment Manual, Fourth Edition*. USA: Lippincott Williams and Wilkins.
- Auxter, D., Pyfer, J, Zittel, L, & Roth, K. (2001). *Principles and Methods of Adapted Physical Education and Recreation*. New York: Mc Graw.Hill.
- Cvejić, D., Pejović, T., & Ostojić, S. (2013). Assessment Of Physical Fitness In Children And Adolescents. *Physical Education and Sport, 11(2)*, 135-145.
- Dandashi, A., Karkar, A.G., Saad, S., Barhoumi, Z., Al-Jaam, J., and Saddik, A. M. E. (2014). Enhancing the Cognitive and Learning Skills of Children with Intellectual Disability through Physical Activity and Edutainment Games. *International Journal of Distributed Sensor Networks, 11(6)*. <https://doi.org/10.1155/2015/165165>
- Dorsan, A. (2014). The Effect of 12 Weeks Dance Education on Physical Fitness Values At Mentally Disabled Children. *International Journal of Science Culture and Sport, Vol. 2*, p. 283. <https://doi.org/10.14486/ijscs200>
- Frey, G. C., & Chow, B. (2006). Relationship between BMI, physical fitness, and motor skills in youth with mild intellectual disabilities. *International Journal of Obesity, 30*. <https://doi.org/10.1038/sj.ijo.0803196>
- Giriwijoyo, H.Y.S.S. (2017). *Fisiologi Kerja Dan Olahraga Fungsi Tubuh Manusia Pada Kerja Dan Olahraga*. Jakarta: Rajawali Perss PT Gaja Grafindo Persada.
- Gu, X., Chang, M., Melinda, A., Louisiana, S. (2016). Physical Activity, Physical Fitness, and Health-Related Quality of Life in School-Aged Children. *Journal of Teaching in Physical Education, 35*. <https://doi.org/10.1123/jtpe.2015-0110>
- Hayakawa, K. & Kobayashi, K. (2013). Effect of a 5-year cognitive motor training program on intellectually disabled youth. *Innovative Teaching, 2(4)*. <https://doi.org/10.2466/02.IT.2.4>
- Indardi, N. (2015). Pengulangan Teknik Permainan Kasti Terhadap Peningkatan Kemampuan Motorik Kasar Anak Tunagrahita Ringan. *Journal Of Physical Education, Health And Sport, 2(1)*.
- Iskandar. (2008). *Metodologi Penelitian Pendidikan dan Sosial (Kuantitatif dan Kualitatif)*. Jakarta: Gaung Persada Press.
- Kathryn, L., et al, (2010). *A Close Look at the Physical Fitness Levels of Elementary Age Students with Intellectual Disabilities*. 10.2478/v10237-011-0015-x
- Kocic, M., Bojić, I., Aleksandrović, M., Ignjatović, A., Radovanović, D. (2017). Is Adapted Basketball Training Adequate Stimulus to Improve Cardiorespiratory Fitness and Sport Skills Performance?. *Acta facultatis medicae Naissensis, 34(2)*. <https://doi.org/10.1515/afmnai-2017-0018>



- Kolimechkov, S. (2017). Physical Fitness Assessment In Children And Adolescents: A Systematic Review. *European Journal Of Physical Education And Sport Science*, 3(4).
- Meredith, M. D., & Welk, G. J. (2007). *Fitnessgram/Activitygram Test Administration Manual*. New York: Cooper Institute.
- Miguel-Etayo, P. D. (2014). Physical Fitness Referenca Standards in European Chindren. *International Journal of Obesity*, 38(136). <https://doi.org/10.1038/ijo.2014.136>
- National Education Standards Agency. (2006). *Materi Sosialisasi TIK, Korikulum KTSP 2006 Standar Kompetensi dan Kompetensi Dasar Mata Pelajaran Pendidikan Jasmani*. Jakarta: BSNP.
- Okely, A. D., Booth, M. L., & Chey, T. (2004). Relationships between body composition and fundamental movement skills among children and adolescents. *Research Quarterly for Exercise and Sport*, 75(3). <https://doi.org/10.1080/02701367.2004.10609157>
- Pitetti, K. H., & Yarmer, D. A. (2002). Lower body strength of children and adolescents with and without mild mental disability: A comparison. *Adapted Physical Activity Quarterly*, 19. <https://doi.org/10.1123/apaq.19.1.68>
- Putra, S., Soegiyanto, K. S. & Sulaiman, (2017). Physical Fitness Analysis Of The High-Grade Primary School Students In The District Of Aceh Besar, The District Of Aceh Besar. *The Journal of Educational Development*, 5(1).
- Ruiz, J, F., Ortega, A., Gutiérrez, et al. (2006). Health-related fitness assessment in childhood and adolescence: a European approach based on the AVENA, EYHS and HELENA studies. *J Public Health*, 14. <https://doi.org/10.1007/s10389-006-0059-z>
- Ruiz J, J., Castro-Pinero, E., Artero, et al. (2009) Predictive validity of health-related fitness in youth: a systematic review. *Br J Sports Med*, 43. <https://doi.org/10.1136/bjism.2008.056499>
- Sugiyono. (2011). *Metode Penelitian Kuantitatif, Kualitatifdan R & D*. Cetakan ke-5. Bandung: CV. Alfabeta.
- Sugiyono. 2013. *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.
- Sukmadinata. 2007 *Metode Penelitian Pendidikan*. Bandung: Remaja Rosdakarya.
- Sumaryanti, Rahayu, T., Amirullah, H., Rahayu, S., Rukmini, D. (2013). Improving Basic Movements And Health Of Mentally Disabled Students Through Adaptive Physical Activities. *The Journal Of Educational Development*, 1(1).
- Westendrop, Marieke, Hartman E., Visseber C. (2012). Are Gross Motor Skill And Sport Participation Related In Children With Intellectual Disabilities. 32(3). <https://doi.org/10.1016/j.ridd.2011.01.009>



- WHO. (2010). *World Health Organization - Global recommendations on physical activity for health*. Geneva: WHO Publications.
- Widiastuti. (2015). *Tes dan Pengukuran Olahraga*. Jakarta: PT. Rajagrafindo Persada.
- Wijayanti, D. G. S., Yuwono, C., & Agus Pujianto, (2012). Survei Tingkat Kebugaran Jasmani pada Siswa-Siswi Tunagrahita SMP Luar Biasa Negeri Kota Salatiga. *Journal of Physical Education, Sport, Health and Recreation*, 1(2). <https://doi.org/10.15294/active.v1i2.430>