



Web-Based Application to Measure Motoric Development of Early Childhood

Daviq Chairilisyah¹
Universitas Riau, Indonesia

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ABSTRACT: Parents and early childhood educators still find it difficult to find ways to self-identify children's motor development, there needs to be innovation that measures motoric development can be easily used by parents. The purpose of this study is to identify indicators of motor development in early childhood, make measuring instruments, and create a web-based measurement application. This Research and Development methodology uses mix method data analysis. This research is located in Indonesia with a sample of 590 participants. The results of the study show that valid and reliable measurement instruments for motoric development from the results of testing as many as 97 indicators are considered high value. Applications made by Information Technology experts to produce a systematic performance measurement system, making it easier for users, teachers / parents who are famous to get the results of the examination quickly and accurately. The implications of research are expected to be able to build a measuring device with the application of technology that is more developed in aspects of child development in addition to motor development, to become a facility for assessing early childhood development that makes it easier for educators to use it.

Keywords: Early Childhood, Motoric Development, Web Based Application Instrument.

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¹Corresponding Author:
Daviq Chairilisyah
Universitas Riau, Indonesia
Email: daviqch@yahoo.com

1 INTRODUCTION

Hurlock, (1999) states that motoric development is defined as the development of maturity in controlling the movement of the body and brain as the center of motion. Physical development is very closely related to children's motoric development (Rolina & Muhyidin, 2015). Motoric development is a development of elements of maturity and control of body movements that are closely related to the development of motoric centers in the brain (Helmawati, 2015). Motoric development is the development of controlling physical movement through central activity, with coordinated nerves and muscles. Control comes from the reflections development and future activities that existed at birth. Monnas, (2018) revealed the term motoric development refers to the meaning of physical development, where physical development means that children have achieved a number of abilities in controlling their motoric.

Motor development during infancy and childhood depends on the characteristics of the child's growth and maturity and interaction with the environment in which a child is raised. Opportunities and barriers from the environment in children to move or interact with biological growth and maturation determine children's motor performance. Malina, (2003) provide a brief overview of motor development during infancy and children. Critical evaluation for specific movement patterns; important points of dynamic system work; proving genotype of motor development; metabolic and physiological motor development; looking for a relationship between motor development and brain growth, postnatal birth and growth status; and look for the social context of motor development. Motor development and early childhood are preferred over the characteristics and environment of the child. Motorcycle development is a plastic process. Variations in the order, time and tempo of development and level of expertise are related to various biological factors (genotypes, body size and composition, metabolism) and environment (special practices, atmospheric maintenance, maintenance of the atmosphere, playing opportunities and objects) that interact dynamically. Children are also dynamic beings and, in many ways, choose how they want to interact with certain environments even when faced with opportunities or certain environmental stimulation, for example when they are asked to dance. Research findings suggest specific contributions of these factors and their interactions with variations in motor development during infancy and early childhood need to be established in more complex research designs.

According to Richard, (2013) gross motoric is a body movement that uses large or most muscles or all body parts that are affected by the maturity of the child itself. Motoric development is the development of controlling physical movements through the activities of coordinated between the nerve centers, nerves, and muscles. The gross motoric is a physical movement that require balance and coordination between members of the body, using large muscles, part or all of the body. Gross motoric development is the development of body movements that use large or most muscles or all parts of the body that are affected by the maturity of the child itself. Actually, the assumption that motoric development will develop automatically with increasing age is a wrong assumption (Ali, 2012). Motoric development in children needs help from parents and educators in early childhood education institutions, from the side of what is helped, how to help appropriately, how the types of exercises are safe for children in accordance with the stages of age and how enjoyable physical motoric activities for a child (Hasnida, 2014). The ability to carry out movements and physical actions for a child is related to self-confidence and the formation of self-concept (Pendidikan, Kebudayaan, & Indonesia, 2014). Therefore, motoric development is as important as other aspects of development for early childhood (Purna & Kinasih, 2015). The fundamentals of motor skills are an important focus for motoric development of early childhood. Barnett et al., (2016) conducted research on Fundamental Motor Skill (FMS) by using peer-reviewed literature

to support perspectives. The result is defining FMS, discussing the context of what skills can be considered fundamental, discussing how the development of these skills relates to the broader health context of development, and recommends the use of different pedagogical approaches when teaching FMS. Research has concluded that FMS promotion is an important focus in Physical Education (PE) and sports and provides future research questions for investigation.

In order to provide appropriate stimulation, parents and educators of early childhood need to identify early levels of child motoric development so that the stimulation given is appropriate (Carson, Collins, & Carson, 2016). It is still difficult for parents and early childhood educators to self-identify children's motoric development (Suyadi, 2014). There needs to be innovation in motor development measurement tools that can be easily used by parents and early childhood educators.

A study of tool assumptions for early childhood shows that physical activity assessment instruments or tools are needed for preschool years to overcome the gap in physical activity research at an early age. Existing physical activity measures are developed for school-age children (3, 7). Without a physical activity assessment tool for the early years of schoolchildren, researchers relied on steps in motor skills to assess physical activity. This approach fails to assess multi-dimensional aspects and a lifetime of physical activity. Then the researchers developed a Tool for Assessment of Preschool Physical Activity (Pre-PLAy) that must be completed by Early Childhood Educators (PAUD) for children aged 18 months until entering TK (around age 4). Pre-PLAy is designed to measure physical activity that assesses the following domains of physical literacy, consistent with the literature: Competence of movements, coordinated movements, motivation, and enjoyment. Knowledge of the importance of physical activity has also been identified as a domain of physical literacy (Cairney et al., 2018).

Based on the background of the above problems, the objectives of this study are: 1) Identifying indicators of motoric development in early childhood based on ages 0-6 years, 2) Making measuring instruments for motoric development for children aged 0-6 years old, 3) Making applications for early childhood motoric development measurement tools Web-based. The benefits of the research expected from the results of this study can facilitate teachers and parents to identify early levels of motoric development in their children and can become scientific references in measuring motoric development in early childhood.

Based on the background and problems above the researcher was interested in conducting research with the title "Create the Applications to Measure the Motoric Development on Early Childhood Web-Based".

2 METHODS

The type of Research is Design and Development Research. This study is using a qualitative and quantitative data analysis approach. Analysis of the initial data and the validity of the instrument is using a qualitative approach. This study follows the framework of the research process development model of ADDIE (Analysis, Design, Development, Implementation and Evaluation) (Azwar, 2014).

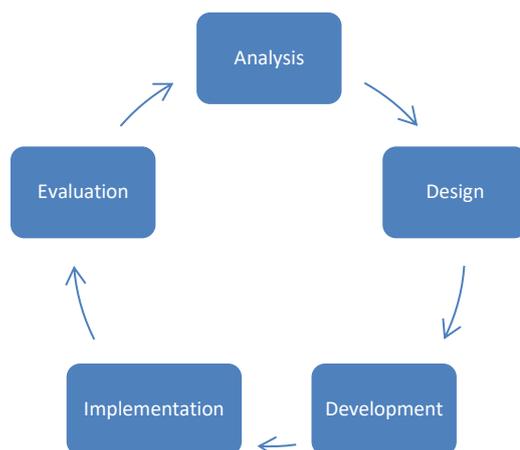
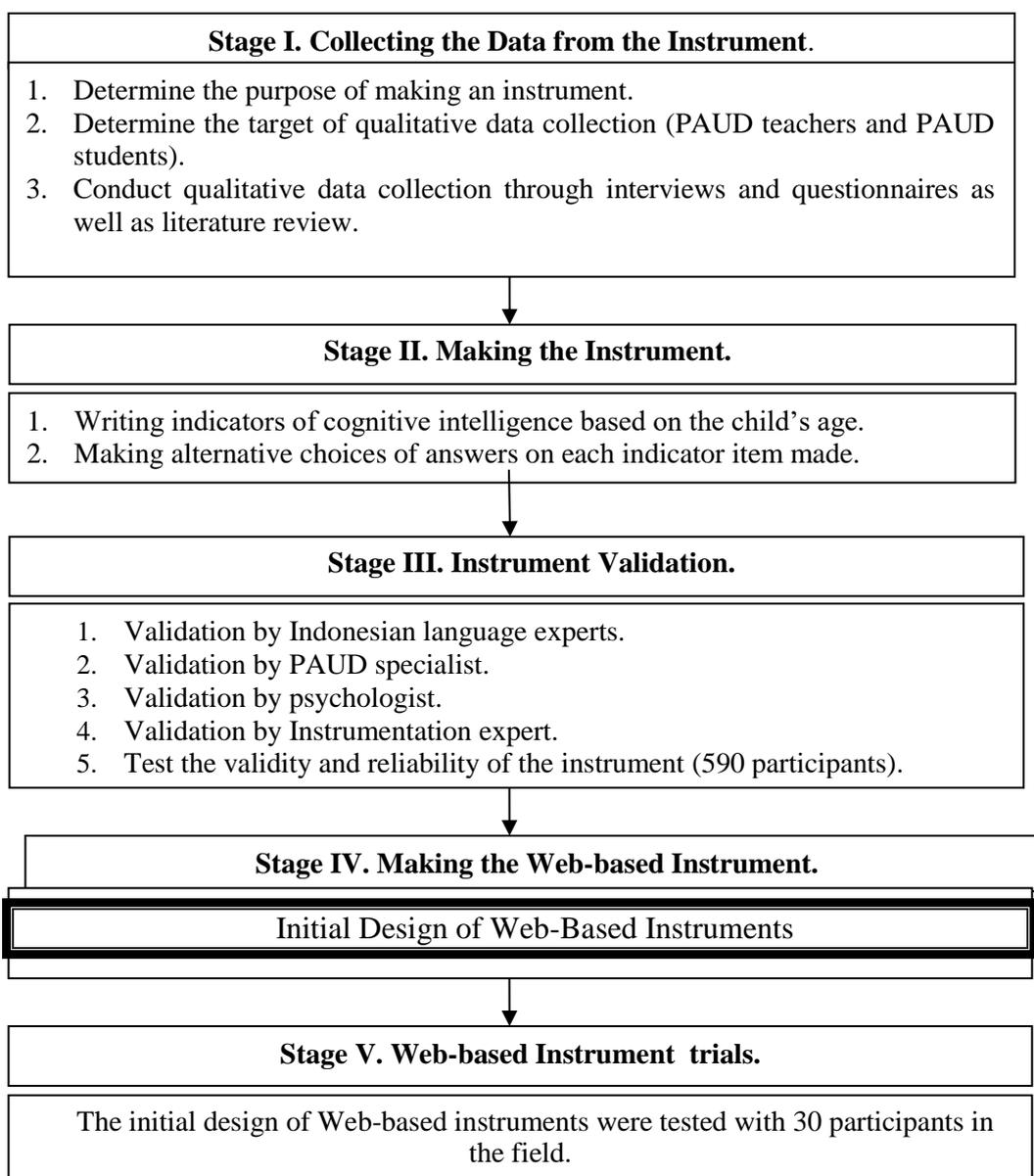


Figure 1. Model framework of the research process for developing the ADDIE model

According to the ADDIE procedure framework model, the procedure of making the motoric development instruments is as follows:



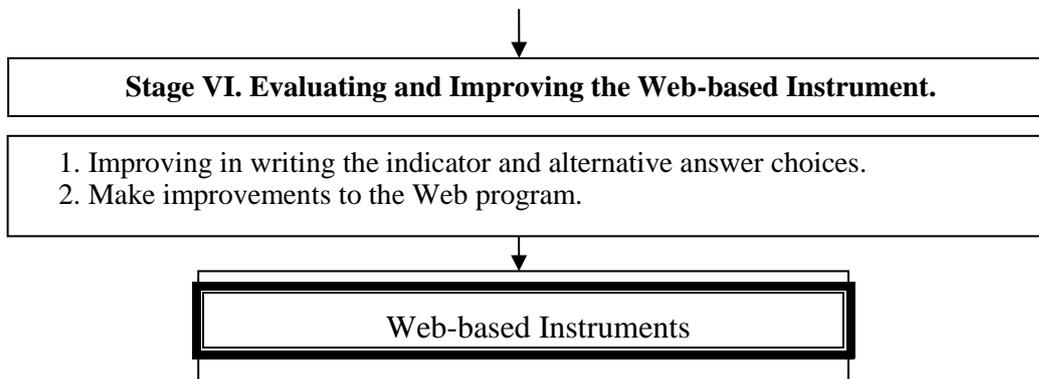


Figure 2. The Framework Process of Making AUD Motoric Development Instrument

The population in this study were all early childhood (Child Care Park, Playgroup, Kindergarten A and Kindergarten B) in Pekanbaru City. The sampling technique uses a quota sampling technique. According to Hiryanto, (2013) quota sampling is a technique for determining samples from populations that have certain characteristics to the desired number (quota). The number of samples of this study is 590 participants.

In order to obtain data in accordance with the subject matter that will be revealed in this research, tools or instruments that reflect the overall indicators to be measured and tested their validity and reliability. Instruments must be well designed to produce empirical data (Sani & Yunus, 2018). To obtain data on indicators of motoric development and the manufacture of motoric development measurement instruments for children aged 0-6 years, the data collection techniques used were observation sheets. Observation is a technique of collecting data with direct observation. Observation is done by observing the motoric development of children aged 0-6 years.

The research instrument was made based on the interval scale with the Likert method. The Likert scale has five alternative answer categories and has interval scores 1-5, but in this study to avoid dubious answers, the values in the middle are omitted so that the intervals are 1-4. The results for the supporting answers from each question were given the highest score, and the results for the answers that did not support were given the lowest score (Santioso, 2016). Then score 1 is given if the motoric development of Undeveloped Children (BB), score 2 is given if the motoric development of Children is Growing (MB), score 3 is given if the child's motoric development develops according to Expectation (BSH), and score 4 is given if the child's motoric development develops the child very well (BSB).

Both qualitative and quantitative data analysis approach were used in this study. Analysis of the initial data and the validity of the instrument is using a qualitative approach. Quantitative statistical approach to measure the validity and reliability of a measuring instrument after being tested on respondents. Explanation of data analysis is as follows:

1. Initial Data Analysis
 - a. Literature Review Analysis.
 - b. Student of Early Childhood Study Program Review Analysis.
 - c. Teacher of Early Childhood Review Analysis.
2. Instrument Validation Analysis
 - a. Validation by Language Expert.
 - b. Validation by PAUD specialist.
 - c. Validation by Psychologist.
 - d. Validation by Instrumentation expert.

e. Statistical Validity and Reliability of the Item.

The Alpha Cronbach formula is used to test the measurements reliability as a whole. To measure the validity of each item and the indicator, Pearson formula is being used.

3 RESULT AND DISCUSSION

Result

3.1 The Procedure of Making AUD Motoric Instruments

- a. Instrument Data Collection Stage.
- b. Instrument Making Stage.
- c. Instrument Validation Stage.

3.2 Valid and Reliable Instrument Result

Table 1. Data Normality Result

	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Motoric Aspect	.034	590	.093	.996	590	.107

Lilliefors Significance Correction

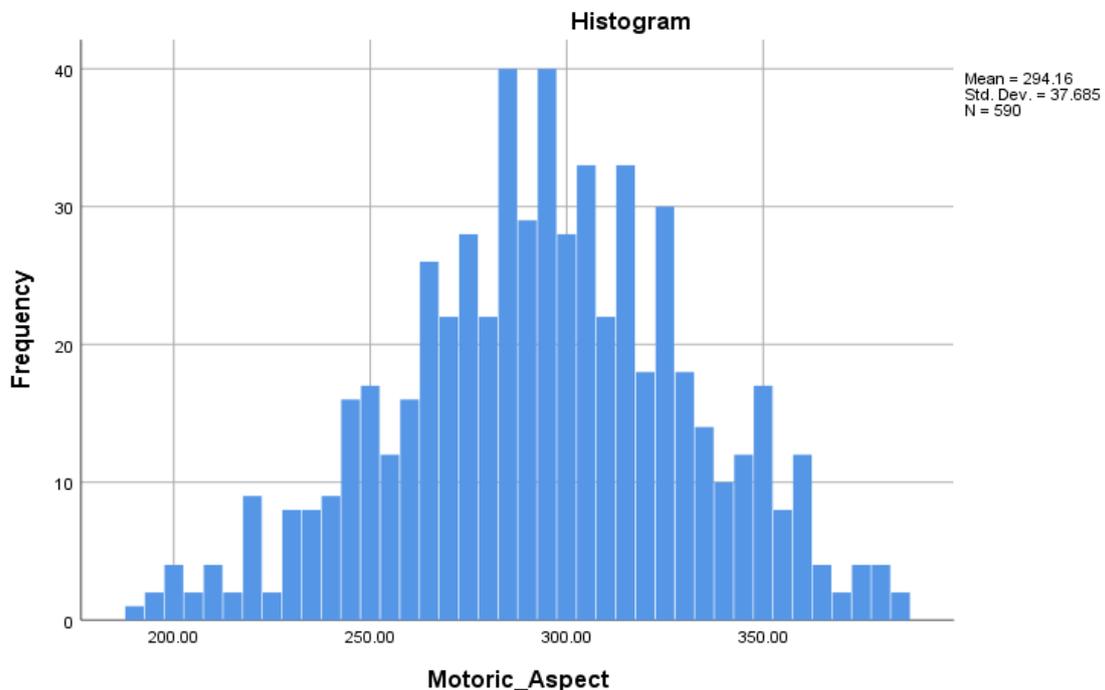


Figure 3. Plot Histogram

From the data normality test result by using Kolmogorov-Smirnov, it was obtained that the variable motoric child development data was in a distribution that had met the normal distribution. Requirements for normal approved data variables in data distribution have a significance > 0.05

(Azwar, 2014). For motor development children have a significance of $0.093 > 0.05$. It can be concluded that the variable children's motoric development comes from the normal population at a significance level of 0.05, so that the variables are statistically distributed normally and deserve to be used as research data.

Then, the measurement of the validity of each question indicator and testing the reliability of the instrument as a whole were carried out. The results of the validity test were obtained based on each indicator item measuring the motoric development of children aged 0-6 years based on the table below.

Table 2. Valid and Reliable Indicators of Motoric Development Instruments on 0-6 years Early Childhood

AGE	INDICATOR	VALIDITY
0-3	Gross Motoric	
Months	1. Try to rise his head when being faced down.	0,57
	2. Look to the right and left.	0,82
	3. Tilt to the right and left.	0,65
	4. Rise and hold his head up.	0,72
	Fine Motoric	
	1. Make a grasping reflex when his hand palm being touched.	0,62
	2. Play hand and foot's fingers.	0,57
	3. Put finger into his mouth.	0,61
	4. Hold things or toys.	0,68
AGE	INDICATOR	VALIDITY
3-6	Gross Motoric	
Months	1. Lay on his stomach with appointed chest and with two hand supported.	0,56
	2. Sit with help.	0,79
	3. Rise both of his feet when being lay down.	0,63
	4. Held his head up while sitting with help.	0,49
	Fine Motoric	
	1. Hold things with his 5 fingers.	0,72
	2. Play things with hand.	0,56
	3. Grab the thing in front of him.	0,71
AGE	INDICATOR	VALIDITY
6-9	Gross Motoric	
Months	1. Lay down back and forth without any help.	0,68
	2. Grab the reachabel thing.	0,76
	3. Hit, throw, or drop things he holds.	0,83
	4. Crawl all over the place.	0,54
	5. Sit without help.	0,61
	6. Stand while being held.	0,74
	Fine Motoric	
	1. Hold thing with his tumb and index finger (pinch).	0,65
	2. Ruple the paper.	0,73
	3. Transfer one thing from one hand to another.	0,82
AGE	INDICATOR	VALIDITY
9-12	Gross Motoric	
Months	1. Stand without being held.	0,53

2. Walk by holding into something..	0,73
3. Walk into some steps with help.	0,65
4. Clap while jump.	0,49
Fine Motoric	
1. Place food he holds into his mouth.	0,72
2. Scratch his head.	0,64
3. Hold small thing and thin (for example: piece of puzzle or paper).	0,75
4. Transfer things from one hand to another.	0,56

AGE	INDICATOR	VALIDITY
12-18 Months	Gross Motoric	
	1. Walk few steps without any help.	0,61
	2. Go up and down the stairs or higher place by crawling.	0,72
	3. Can rise from sitting.	0,87
	4. Do a kick the ball motion.	0,51
	5. Roll all over the place	0,58
	Fine Motoric	
	1. Make free sketch.	0,85
	2. Stack up 3 cubes.	0,69
	3. Hold his glass with 2 hands.	0,84
4. Put things into a container.	0,74	
5. Spill things from the container.	0,49	
AGE	INDICATOR	VALIDITY
18- 24 Months	Gross Motoric	
	1. Walk by his own without fall down.	0,62
	2. Jump in place.	0,79
	3. Go up and down the stairs or higher place with help.	0,74
	4. Walk few steps back.	0,65
	5. Pull and push light things.	0,53
	6. Throw the ball to the front without losing balance.	0,72
	7. Kick the ball to the front.	0,69
	8. Stand with one leg for one or two seconds.	0,76
	9. Do a squat.	0,71
Fine Motoric		
1. Make a vertical and horizontal line.	0,59	
2. Flip the book pages eventhough it's not perfect yet.	0,62	
3. Tear up the paper.	0,63	
AGE	INDICATOR	VALIDITY
2-3 Years	Gross Motoric	
	1. Walk while tiptoeing.	0,67
	2. Jump to the front and back with two legs.	0,53
	3. Throw and catch ball.	0,85
	4. Dance by following the rhyme.	0,61
5. Go up and down the stairs or higher/lower place by holding onto something.	0,75	

Fine Motoric

- | | |
|---|------|
| 1. Rumble the paper or fabric by moving all 5 fingers. | 0,57 |
| 2. Fold fabric/paper eventhough it's not perfect yet. | 0,65 |
| 3. Cut the paper without any pattern. | 0,62 |
| 4. Finger,s coordination is good enough to hold flat things like toothbrush or spoon. | 0,85 |

AGE	INDICATOR	VALIDITY
3-4 Years	Gross Motoric	
	1. Run while brings something light (ball).	0,48
	2. Go up and down the stairs or higher place by using alternately leg.	0,75
	3. Walk on the pretty wide board.	0,63
	4. Jump down from the height less than 20cm (below the height of children's knee).	0,57
	5. Mimick simple calisthenics motions such as tree motion, bunny hopping	0,65
	6. Stand with one leg.	0,62
	Fine Motoric	
	1. Pour water, sand, or seeds into a container (bowl, bucket)	0,79
	2. Put small things into a bottle (stick, pebble, seed).	0,57
	3. Lacing with pretty big thing.	0,63
	4. Cut the paper by following a straight line pattern.	0,68

AGE	INDICATOR	VALIDITY
4-5 Years	Gross Motoric	
	1. Mimick the animal motions, the tree blown away by the wind, airplane.	0,63
	2. Do a hang motion.	0,61
	3. Do a jumping motion, and running coordinately.	0,53
	4. Throw things directedly.	0,51
	5. Catch things precisely.	0,83
	6. Do the anticipation motion.	0,66
	7. Kick something directedly.	0,54
	8. Use toys outside of class.	0,66
	Fine Motoric	
	1. Make a vertical, horizontal, left/right curve, turn left/right and circle.	0,84
	2. Copy a pattern.	0,61
	3. Coordinate between eye and hand to do complicated motion.	0,69
	4. Do a manipulative motion to produce a pattern by using some medias.	0,54
	5. Express himself by doing an art by using some medias.	0,59
	6. Control the hand movement by using fine muscle (pinch, stroke, poke, clench, twist, entwine and squeeze).	0,72

AGE	INDICATOR	VALIDITY
5-6 Years	Gross Motoric	
	1. Do coordinated body movement to train the flexibility, balance and agility.	0,59
	2. Do coordinated eye-feet-hand-head movement in mimicking a dance or calisthenics.	0,58
	3. Do physical game with rule.	0,64

4. Good at doing left or right hand.	0,75
5. Do a self sanitary activity.	0,68
Fine Motoric	
1. Draw according to his idea.	0,79
2. Mimick a pattern.	0,53
3. Do some exploration with various media and activity.	0,71
4. Use stationary and cutlery right.	0,65
5. Cut the paper according to the pattern.	0,58
6. Stick the picture precisely.	0,66
7. Express himself through doing drawing motion precisely.	0,77

3.3 Making Web-based instruments

The research instrument containing indicators of measuring instruments that are valid and reliable from the results of testing directly to 590 participants of early childhood from the age of 0-6 years will be included in the Web program. The Web program is made by Information Technology experts to be able to produce a systematic performance measurement tool, making it easier for users and can make it easier for teachers/parents to get results quickly and accurately. The following are some of the displays of the dialog box in the Web-based motoric measuring instrument that has been created.



Figure 4. The Web Display of the AUD's Motoric

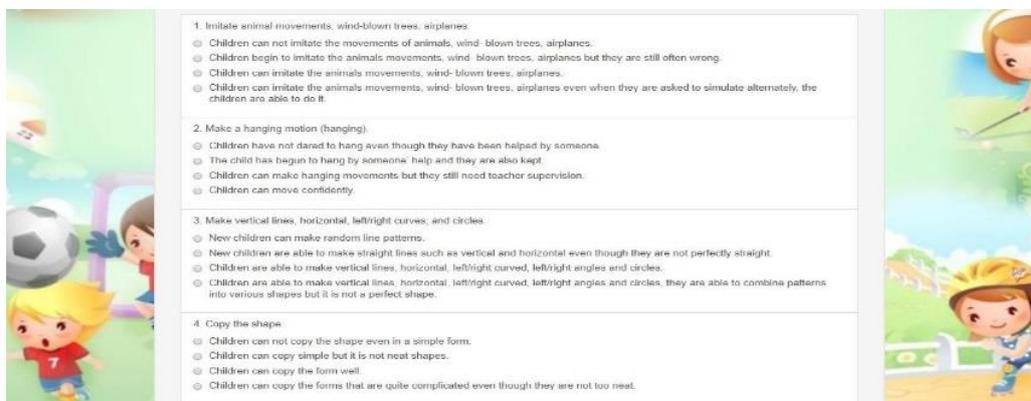


Figure 5. The Web Display of the Motoric Instruments' Test of AUD

Item validation will use the validity for each item and also reliability for the overall measuring instrument. Validation of validity and reliability of this measurement tool was obtained after

researchers conducted a direct trial of children aged 0-6 years from various levels of PAUD education. According to Hiryanto, (2013) quota sampling is a technique for determining samples from populations that have certain characteristics to the desired number (quota) namely: Child Care Park, Play Group, Kindergarten A and Kindergarten B. The results obtained from the trial of the instrument are then measured by using statistical methods to obtain valid items and reliable measuring instruments as a whole. Validity values above 0.44 are considered valid items (Azwar, 2014). While the overall value of the reliability of the measuring instrument is at a value of 0.82, where this value is in the good category for a measuring instrument (Sani & Yunus, 2018). Based on the results of the validity test, the alpha value for each indicator below 0.44 will then be discarded and cannot be used as a valid indicator of measuring instruments. While an alpha value of more than 0.44 will then be validated to be a valid indicator of measuring instruments (Richard, 2013). The results obtained indicate that as many as 150 indicators are considered to have a high value of validity to measure cognitive intelligent of early childhood at the age of 0-6 years. The research instrument containing indicators of measuring instruments that are valid and reliable from the results of testing directly to 590 participants of early childhood from the age of 0-6 years will be included in the Web program. The Web program is made by Information Technology experts to be able to produce a systematic measurement tool for motor skills, making it easier for users and easier for teachers or parents to get measurement results on children's motor skills quickly and accurately.

Discussion

Measuring and assessing aspects of children's motor development is needed to see the target of achieving motoric abilities of children. Application of measurements to assess motoric development of children will be easier if related to technology. The research findings in product validation measuring the motoric development of children is very high, this can be seen from the results obtained indicate that as many as 150 indicators are considered to have high validity values to measure motoric competence of early childhood at the age of 0-6 years.

The findings of this study are supported by research conducted by Rao et al., (2018) that the scale of the East Asia-Pacific Early Childhood Development is the first attempt to create developmental assessment tools based on various cultures and values from various countries in the world region. Scales were given to a representative sample of 7757 children (3869 girls), ranging in age from 36 to 71 months, from Cambodia, China, Mongolia, Timor-Leste, Papua New Guinea, and Vanuatu. The results illustrate similarities and variations in the trajectory of early child development in all contexts. that developmental measurement tools for early childhood are urgently needed including indicators of development that have been validated and appropriate measurement tools and supporting applications to be able to apply measurement of children's abilities easily.

Similarly, research developed by Griffiths, Toovey, Morgan, Spittle, & Pe (2018) aimed at developing a gross motor assessment tool that has an important role in identifying, diagnosing, and evaluating motor difficulties in childhood. The aim of this review is to systematically evaluate psychometric properties and clinical utility of gross motor assessment tools for children aged 2–12 years. Methodological quality varies from poor to very good. The conclusion of the results of the study is that the majority of gross motor assessment for children has excellent validity. The highest test-retest reliability is BOT-2, MABC-2, PDMS-2 and TGMD-2. Bayley-III has the best predictive validity at 2 years of age for later motoric results. There is no assessment tool that shows good evaluative validity. Further research on evaluative gross motor assessment tools is needed.

Another finding in the development of research is data about the development of child motor variables in distributions that have met the requirements as a normal distribution. The motoric development of children has a significance of $0.093 > 0.05$. Based on the results of the validity test as many as 97 indicators are considered to have high value. Valid and reliable instruments of research results from the test results, then included in the Web program. This high validation instrument can be used by early childhood educators to measure the motoric development of children in different, fast and accurate ways given the importance of the accuracy of assessment for early childhood so that it can be used as a reference for evaluating children's motoric development, whether it requires more specific stimulation to overcome problems in children's motoric development. Because the motoric development of children is important for their future physical development.

The following is a Loprinzi, Davis, & Fu (2015) aimed at the effectiveness of physical communication (PA) during childhood needed for a better understanding of roles as adults. The researcher proposes a conceptual model that illustrates the influence of the hypothesis of developing motor skills on physical activity of children and adults, while providing an overview of current empirical research related to this model. The results showed consistent and emerging evidence that showed that adequate motor skills competencies, especially gross motor and motor skills, were associated with increased levels of physical activity during preschool, child and adolescent years, with the development of early motor skills also affecting physical activity. The arrangement of physical education seems to be a suitable environment for the development of motor skills. Applying the right strategies to target the development of motor skills in childhood is very important in helping shape the behavior of children's PA, their experiences related to PA, and maintaining their PA.

The findings in the development of the study found that data on the development of motor child variables in the distribution that had met the normal distribution. The motoric development of children has a significance of $0.093 > 0.05$. Based on the results of the validity test as many as 97 indicators are considered to have high value. Valid and reliable instruments of research results from the test results, then included in the Web program. This high validation instrument can be used by early childhood educators to measure the motoric development of children in different, fast and accurate ways given the importance of the accuracy of assessment for early childhood so that it can be used as a reference for evaluating children's motoric development, whether it requires more specific stimulation to overcome problems in children's motoric development. Because the motoric development of children is important for their future physical development.

4 CONCLUSION

Based on the results of the research that has been done, the conclusions are:

This study succeeded in determining 97 indicators of motor development in early childhood based on ages 0-6 years. At the age of 0-1 years consists of 30 indicators, ages 1-2 years consist of 22 indicators, ages 2-3 years consists of 9 indicators, ages 3-4 years consists of 10 indicators, ages 4-5 years consists of 14 indicators and 5-6 years old consists of 12 indicators. The results of this instrument will be in the form of reports on children's motoric development profiles, children's identity and suggestions for development for children that can be printed out directly through the Web using the internet. This measuring instrument is also equipped with assessment rubrics that are very detailed and based on real behavior in children so that respondents will be easier in choosing answers.

The contribution of this research this measuring instrument is made based on a Web program, so that it is expected that every parent at home or teacher at school can do it, does not need to go to a child expert or Psychology expert directly because it may be constrained by time, distance, personal busyness, or costs.

This motoric development measurement tool uses a scoring system based on the assessment observations by parents or teachers in schools based on the age of the child. Apart from that, this measuring instrument is equipped with suggestions for improvement for children if the child has weakness or lacks normal motor development.

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