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Development of visual perception test for children aged 3-8 years

Desenvolvimento de teste de percepção visual para crianças de 3-8 anos

Desarrollo de la prueba de percepción visual para niños de 3 a 8 años

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Abstract

Eyesight is an essential sense. The eyes are responsible for 80% of the information we receive about the world around us. The ability to perceive visual stimuli should therefore be considered the most effective ability when compared to other senses. Furthermore, it predisposes all developmental and growth issues in children. Impairment in visual perception leads to several problems, such as learning disorders, behavioral disorders, emotional problems and social disorders. Visual perception impairment is also often comorbid with other disabilities. Using the Frostig test, the examination of visual perception has begun to be carried out by several health workers, such as psychologists and occupational therapists. Although the Frostig test has been used in Indonesia, some of its aspects need to be reviewed. Indonesia's visual perception tests are limited, and infrequently inspected. This study aims to modify the Frostig test into a testing instrument that is appropriate to the culture of child development in Indonesia and to be a child-friendly instrument, especially for children aged three-to-eight years. Modifications that will be made include the amendment of item content, additional dimensions, items and response options. The measurement of content validity involved 20 participants, a trial test of 30 participants, a visual attention test of 111 participants and a test for validity and reliability in 219 participants. The exploratory factor

analysis confirmed six sub-tests, consisting of 38 items, with composite reliabilities ranging from 0.648-0.823.

Keywords: Visual perception; Test; Children; Development; Measurement.

Resumo

A visão é um sentido essencial. Os olhos são responsáveis por 80% das informações que recebemos sobre o mundo que nos rodeia. A habilidade de perceber estímulos visuais deve, portanto, ser considerada a habilidade mais eficaz quando comparada a outros sentidos. Além disso, predispõe todos os problemas de desenvolvimento e crescimento em crianças. A deficiência na percepção visual leva a vários problemas, como distúrbios de aprendizagem, distúrbios de comportamento, problemas emocionais e distúrbios sociais. A deficiência da percepção visual também costuma ser comórbida com outras deficiências. Com o teste de Frostig, o exame de percepção visual passou a ser realizado por diversos profissionais de saúde, como psicólogos e terapeutas ocupacionais. Embora o teste Frostig tenha sido usado na Indonésia, alguns de seus aspectos precisam ser revistos. Os testes de percepção visual da Indonésia são limitados e raramente inspecionados. Este estudo tem como objetivo transformar o teste Frostig em um instrumento de teste adequado à cultura do desenvolvimento infantil na Indonésia e um instrumento amigo da criança, especialmente para crianças de três a oito anos. As modificações que serão feitas incluem a alteração do conteúdo do item, dimensões adicionais, itens e opções de resposta. A medição da validade de conteúdo envolveu 20 participantes, um teste experimental de 30 participantes, um teste de atenção visual de 111 participantes e um teste de validade e confiabilidade em 219 participantes. A análise fatorial exploratória confirmou seis subtestes, compostos por 38 itens, com confiabilidade composta variando de 0,648-0,823.

Palavras-chave: Percepção visual; Teste; Crianças; Desenvolvimento; Medição.

Resumen

La vista es un sentido esencial. Los ojos son responsables del 80% de la información que recibimos sobre el mundo que nos rodea. Por tanto, la capacidad de percibir estímulos visuales debería considerarse la capacidad más eficaz en comparación con otros sentidos. Además, predispone a todos los problemas de desarrollo y crecimiento en los niños. El deterioro de la percepción visual conduce a varios problemas, como trastornos del aprendizaje, trastornos del comportamiento, problemas emocionales y trastornos sociales. El deterioro de la percepción visual también suele ser comórbido con otras discapacidades. Con

la prueba de Frostig, el examen de la percepción visual ha comenzado a ser realizado por varios trabajadores de la salud, como psicólogos y terapeutas ocupacionales. Aunque la prueba Frostig se ha utilizado en Indonesia, es necesario revisar algunos de sus aspectos. Las pruebas de percepción visual de Indonesia son limitadas y se inspeccionan con poca frecuencia. Este estudio tiene como objetivo modificar la prueba Frostig en un instrumento de prueba que sea apropiado para la cultura del desarrollo infantil en Indonesia y que sea un instrumento amigable para los niños, especialmente para niños de tres a ocho años. Las modificaciones que se realizarán incluyen la enmienda del contenido del elemento, dimensiones adicionales, elementos y opciones de respuesta. La medición de la validez de contenido involucró a 20 participantes, una prueba de prueba de 30 participantes, una prueba de atención visual de 111 participantes y una prueba de validez y confiabilidad en 219 participantes. El análisis factorial exploratorio confirmó seis subpruebas, que constan de 38 ítems, con confiabilidades compuestas que van desde 0,648-0,823.

Palabras clave: Percepción visual; Prueba; Niños; Desarrollo; Medición.

1. Introduction

Vision is a prominent sense. Eyes capture 80% of the information presented by the environment (Kaplan, 2006; Önder, etc 2019). It can also be said that visual perception is the most effective of all the other senses (Önder, etc 2019). This was also confirmed by Kaplan (Kaplan, 2006), who stated that vision plays an important role in children's development. Visual perception and other visual abilities affect all issues of child development, including the physical, intellectual, emotional, and behavioral, while also impacting academic performance and social competence. Visual perception is understood as a cognitive component that will perform an interpretation of visual stimuli, or the ability to understand what is seen. It is a method of the nervous system through the eye, providing contact with the outside world (Brown et al., 2012).

Vision issues do not only explain healthy eyes and good acuity, but also clarify eye efficiency. How the eyes function will affect the perception and performance of children in various activities; those with learning disorders, emotional and behavioral disturbances have a tendency to show deviant behavior as a result of disturbed visual perception. Visual perception causes difficulty in reading and in interpreting symbols, tables, and charts; it can also cause problems in orientation and motor coordination. In addition, impaired visual perception can make children appear clumsy, lazy or disrespectful, and explain their refusal to

read or engage in certain rituals. Children with impaired visual perception show extreme behaviors, such as self-injury, various compulsive behaviors (Evans et al., 2001), emotional reactions, psychiatric disorders and even suicide attempts (Daniels, L. E., & Ryley, 1991; Kaplan, 2006; Kurtz, 2006). These extreme behaviors are the result of severe visual perception disturbances that cause difficulty in recognizing where an object is, where the body is located, where the body ends and also the difficulty maintaining stable vision in one eye. Deviant behaviors in children can even affect language, communication and social abilities (Ahmetoglu, Aral & Butun Ayhan, 2008; Kaplan, 2006; Kurtz, 2006). In addition, visual perception is also believed to influence children's behavior in cases of developmental delay and disabilities, such as ADHD (Jung et al., 2014), autism (Behrmann et al., 2006) and cerebral palsy (Cho et al., 2015; James et al., 2015).

Visual perception disorder is a subtle condition. As a consequence, its diagnosis is often ignored (Kurtz, 2006). Parents, pediatricians and teachers are seldom aware of the correlation between learning difficulties and problems with vision (Rosen, 2016). The ability to see effectively isn’t considered a crucial problem (Gallaway & Mitchell, 2010) and the onset of various behavioral issuesis rarely attributed to visual problems. In the west, teachers, psychologists and occupational therapists are just beginning to understand the importance of examining visual perception (Brown et al., 2012); some researchers emphasize the importance of early detection in visual disorders, stating that early intervention can reduce the severity of the disorder (Marr et al., Turan,Yukay-Yuksel&Yurtsever-Kılıçgün,in (Önder, A., Balaban Dagal, Küsmüş, Bilici, Özdemir, 2019). Johnson (2011) also mentions that operations under the age of three can bring optimal results (Johnson, 2011).

The examination of visual perception disorder is recommended and should become a standard assessment in clinical psychology. Clinical psychologists need to know whether visual perception disorder contributes to the severity of emotional, social and cognitive disorders in some cases. For example, anxiety and schizophrenia are known to be associated with abnormalities in visual perception (Daniels & Ryley, 1991). Some clinical psychologists use VMI (Visual-Motor Integration) and Bender Gestalt to examine visual abilities in children. However, the use of VMI tests in several countries with different cultural backgrounds is beginning to be questioned. VMI is referred to as a culture-free assessment tool (Goyen & Duff, Overvelde & Hulstijn, Parush et al., van Hoorn, Maathuis, Peters, & Hadders-Algrain (Coallier et al., 2014), although the results of other studies show differences in patterns of motor visual ability due to different cultural backgrounds. Thus, the argument

for rejecting the concept of culture-free is strengthened, as there is evidence that cultural variables will affect children's performance and motor visual abilities (Coallier et al., 2014).

In addition to visual-motor integration, in their research, (Köster et al., 2018) state that humans with different cultural backgrounds will have different cognitive processes. Köster and colleagues associate this with the development of attention processes with cultural differences in children aged one to four years (Köster et al., 2018; Önder, Balaban Dagal, Küsmüş, Bilici, Özdemir, 2019). It can also be concluded that the tendencies of human visual perception differ between cultural backgrounds and place of origin. Therefore, the preparation of visual perception tests that are adjusted to the cultural background is highly necessary and recommended (Köster et al., 2018). The same issue is proven by research conducted by (Gal et al., 2010). The results of their research and several other studies indicate that standardized assessment tools will be rendered invalid if used to examine people from different cultural backgrounds. The translation of these tests should not be permitted by those that use them (Josman et al., 2006).

The problem that arises at this time is the availability of the test, appropriate to Indonesian culture. In Indonesia, Frostig and TVPS are used to measure visual perception in children. First developed in 1963 by Marianne Frostig, the Frostig test consists of five sub-tests (Kelly, 1983), all of which are still applied in Indonesia. There are no available publications relating to norm adjustment and standardization of the Frostig test in Indonesia. Nevertheless, results of the validity test for the Frostig test in Indonesia still exhibit some shortcomings. In the first, third and fourth sub-tests there were more than 20 items that needed to be reviewed (Widyana, 2009).

The limited number of studies regarding the ability of visual perception in Indonesia is also the reason for this research. Several countries such as the USA, the United Kingdom and Germany have used visual perception tests as a standard assessment for developmental problems in children. A number of these tests have been revised several times. In fact, the USA already offers visual perception tests for adults, such as Developmental Test of Visual Perception - Adolescent and Adult (DTVP-A), Motor-Free Visual Perception Test - third edition (MVPT-3) and Test of Visual Perceptual Skills (non-motorized) - third edition (TVPs-3) (Brown et al., 2012).

The purpose of this study is to modify the Frostig visual perception test (Frostigs Entwicklungstest der visuellen Wahrnehmung). The modification intends to construct a testing instrument that is suitable for the culture of child development in Indonesia and can be a child-friendly instrument, especially for children aged three-to-eight years. Adaptations that

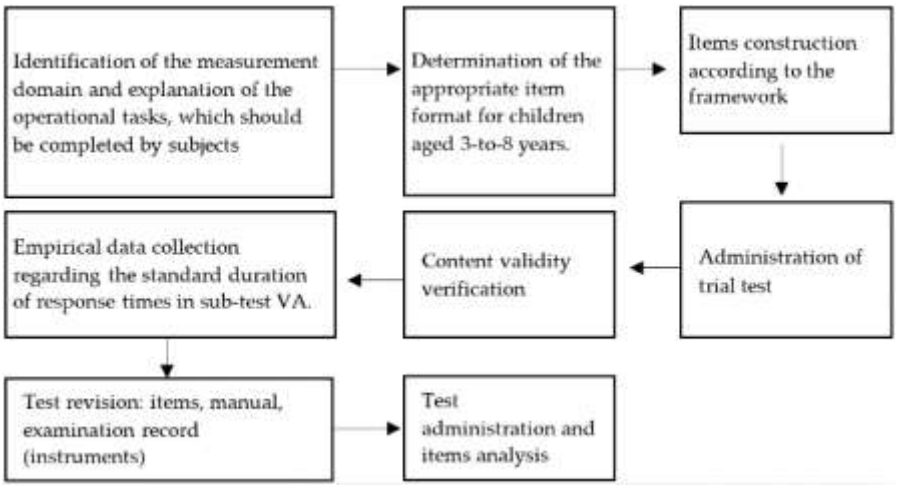
will be achieved in this study include revising the contents of the item, adding dimensions and modifying response options. In addition, the modification of the items will be highly adapted to the needs and interests of children, so that changes in the context are also considered in this study. Modification of the context is done by modifying the instructions and tasks that will be used in the testing process (Stewart et al., 2012).

The dimensions in this study are based on visual perception disorders proposed by (Kurtz, 2006), namely visual attention (VA), visual closure (VC), visual form constancy (VFC), visual discrimination (VD), visual figure-ground differences (VFGD), visual-motor integration (VMI), and visual-spatial perception (VSP). (Kurtz, 2006) offers eight dimensions of visual perception problems. In this design, only seven problems of visual perception will be used as a sub-test, because visual discrimination is already represented by other sub-tests, namely visual figure-ground discrimination and visual form constancy (Stern & Lombard, 1968).

2. Methodology

This study is conducted in accordance with the stages of preparation and measuring instruments suggested by Azwar (2016). Figure 1 shows a sequence of the modification procedure (S. Azwar, 2016).

Figure 1. Stages on measuring the instrument.



Source: Sa Azwar (2016).

Based on the figure above, it can be seen the sequence of modification procedure begin with identification continue to determination and item construction. The next procedure

is administration of trial test which continue to validity verification, empirical data collection, test revision and the last is test administration and items analysis.

Participant of this study involved several groups, such as participants for the trial of instruction content, consisting of 30 children aged 3-8 years. Participants for content validity verification, consist of 20 people. Participants for determining response time, consisting of 111 participants, aged 3-8 years. Participants for reliability and construct validity examination, consisting of 219 children aged 3-8 years.

The data collection process takes three months' time. Data was collected in Temanggung, Yogyakarta and South Tangerang, in schools that were willing to work together, assisting in the process of collecting data. Informed consent forms were distributed to the school and signed by the school principal.

Judgment recruitment was done by contacting participants. Participants consisted of lecturers in psychology, clinical or education professionals and Master's students who were in the fifth semester and had already completed developmental subjects, including psycho-diagnostic and psychometrics courses. The testers were Master's students in clinical psychology, who had experience in psychological testing. There were 11 testers in total, from whom the data was collected. The tester group was divided into several data collection sessions. Each data collection session consisted of three or four testers. Before conducting the test, the tester was given a briefing on test administration.

3. Result

Items construction

The test kits consist of test books, test manuals, VMI and VSP answer sheets, along with scoring sheets. A total of 112 items were constructed and were divided into seven sub-tests. Table 1 shows the item proportions in each sub-test.

From the Table 1, it can be seen that four sub-tests contain two types of question, while visual attention and visual closure sub-tests contain one type of question. These items are then trialed. After a trial of 30 children aged 3-8 years, there followed a review and rearrangement of items, preparation of manuals, preparation of instructions, and scoring sheets.

Table 1. Item proportions in each sub-test.

Number	Sub-test	Task	Item proportion
A.	Visual attention	Choose the relevant stimulus with the correct time	13.39%
B.	Visual closure	Stimulus identification	14.28%
C.	Visual form constancy	1. Pair images of objects with basic shapes 2. Categorize objects with basic shapes	19.09%
D.	Visual figure ground discrimination	1. Find objects that are obscured 2. Find a number of objects that are obscured	14.28%
E.	Visual Memory	1. Select objects that were previously seen, in accordance with the order and color 2. Mention as many previously seen objects as possible and Pointing to the location of objects that were previously seen	12.5%
F.	Visual Motor Integration	Connecting dashed lines and points Draw a line according to the pattern	13.39%
G.	Visual Spatial Perception	1. Finding objects 2. Connect the points according to the sample image	13.39%
		Total proportion	**100%**

Data Analysis.

3.1. Content validity

Content validity was analyzed using the content validity ratio (CVR) (S. Azwar, 2016). There were 20 data sets collected from a subject matter expert (SME) or panelist and 112 items. The following is the CVR formula Azwar 2016:

$$CVR = \frac{2ne}{n} - 1 \qquad (1)$$

ne = numbers of SME rate items as essential

n = numbers of total SME

CVR numbers range from -1.00 to +1.00. When CVR is > 0.00, it means 50% or more of SMEs in the panel rated an item as essential. The greater the value of CVR from zero, the more important and the higher the validity of the content. All CVRs that are negative or equal to zero will be eliminated, while items in which CVR is positive will be interpreted as having validity of content at certain rates (S. Azwar, 2016). The CVR results show a range of values

from 0.7 to 1.00. This indicates that the whole item has good content validity, and can be presented in a test.

3.2. Response time sub-test Visual attention

A total of 111 children aged 3-8 years were included for response time testing on the visual attention sub-test. The determination of standard time was done by calculating the frequency of response time. The most common response time was one second for each item. Therefore, the expected response for correct answers is that participants are able to point the right stimulus within one second.

3.3. Items Analysis

Analysis of item discrimination is obtained by calculating the item correlation with the total score. The item correlations ranged from -0.026 to 0.500. According to item discrimination with a number below 0.200 is considered to be unfavorable. Items are good if they have a value of 0.200 to 0.300. Therefore, items with a value of less than 0.200 were eliminated. In the VMI sub-test, all items can be used. A total of 30 from 112 items should be eliminated. The remaining items composed of visual memory consisting 12 items, visual closure eight items, visual form constancy 13, visual figure-ground discrimination 14 items, visual attention 11 items, visual-motor integration 15 items, and visual-spatial 10 items. The total remain items are 82.

3.4. Construct Validity

The construct validity test is carried out by an exploratory test of factor analysis. Exploratory tests are commonly used to bring together inter-related variables and reduce the actual dimensions of space, so as to produce a new interpretation of dimensions (Rietveld, T., & Hout, 1993). Testing the construct validity by using exploratory factor analysis is commonly used in the early stages of instrument development to identify correlations within a group of variables that make up a construct. Factor analysis was determined to be seven factors, based on scree plot observations, using a factor loading cut off of 0.40. The results are seen in Table 2.

Table 2 shows that the seventh factor contained only four loading factors, and spreading in the VSP and VA sub-tests. Thus, it can be concluded that one sub-test cannot be categorized as the seventh factor. The construct validity test results confirm only six factors with a strong loading factor in VMI, VSP, VFGD, VM, VFC, and VA sub-tests. The VC sub-test cannot be categorized as the seventh factor, because it has a low spearing loading factor into other factors.

The analysis was continued and resumed using six factors. Items with loading factors less than 0.40 are removed. From the results of the second exploratory factor analysis, cumulative sums of squared loadings were 41.191%. This shows that the six factors obtained from the visual perception test explained 41.19% of the variations of the construct of visual perception.

Table 2. Factor analysis result.

	Component						
	1	2	3	4	5	6	7
VM.1.1							
VM.1.3				.457			
VM.1.4							
VM.1.5		.518					
VM.1.6							
VM.1.7					.407		
VM.2.1				.527			
VM.2.2				.473			
VM.2.3				.576			
VM.3.1				.625			
VM.3.2				.549			
VM.3.3				.578			
VC.4							
VC.5							
VC.7							

	Component						
	1	2	3	4	5	6	7
VC.8							
VC.11							
VC.13							
VC.14							
VC.16							
VFC.1.2					.408		
VFC.1.8					.467		
VFC.1.9					.447		
VFC.1.10							
VFC.2.1							
VFC.2.2							
VFC.2.4					.467		
VFC.2.5					.406		
VFC.2.6					.458		
VFC.2.7							
VFC.2.9							
VFC.2.10					.547		
VFC.2.11							
VFGD.1.1							
VFGD.1.2			.532				
VFGD.1.3			.405				
VFGD.1.4							
VFGD.1.5			.444				
VFGD.1.8			.530				
VFGD.2.1							

	Component						
	1	2	3	4	5	6	7
VFGD.2.2							
VFGD.2.3							
VFGD.2.4			.572				
VFGD.2.5							
VFGD.2.6							
VFGD.2.7			.566				
VFGD.2.8			.456				
VA1							
VA2							.453
VA3						.437	.438
VA4							
VA5						.527	
VA7						.641	
VA8						.571	
VA10						.594	
VA11						.552	
VA14							
VA15							
VMI.1.1							
VMI.1.2							
VMI.1.3	.400						
VMI.1.4	.548						
VMI.1.5							
VMI.1.6	.489						
VMI.2.1	.433						

	Component						
	1	2	3	4	5	6	7
VMI.2.2	.492						
VMI.2.3	.514						
VMI.2.4	.588						
VMI.2.5	.638						
VMI.2.6	.597						
VMI.2.7	.625						
VMI.2.8	.504						
VMI.2.9	.511						
VSP.1.4							.579
VSP.1.5							.456
VSP.1.7							
VSP.2.1							
VSP.2.2		.579					
VSP.2.4		.527					
VSP.2.5		.480					
VSP.2.6		.552					
VSP.2.7		.452					

Source: Own study.

Table 3 shows the number of remaining items. Six items are in the VM sub-test, with four in VFC, seven in VFGD, six in VA, and 10 in VMI items and VSP. Thus, it can be concluded that these six factors are visual perception models that are acceptable and in accordance with the existing population, and it consist of 38 items.

Table 3. [Resume of six factors].

Number of items	Factor 1 VMI	Factor 2 VSP	Factor 3 VFGD	Factor 4 VM	Factor 5 VFC	Factor 6 VA
1.	0.460	0.623	0.547	0.546	0.595	0.470
2.	0.409	0.579	0.466	0.522	0.544	0.598
3.	0.479	0.707	0.506	0.628	0.498	0.640
4.	0.521	0.721	0.580	0.660	0.485	0.659
5.	0.553	0.480	0.616	0.601		0.635
6.	0.677		0.638	0.633		0.544
7.	0.661		0.479			
8.	0.661					
9.	0.572					
10.	0.618					

Source: Own study.

3.5. Estimation of reliability

The estimation of reliabilities is obtained by calculating the reliability of the composite per sub-test. The results of the reliability calculation can be seen in Table 8. The estimated reliability figures have a range from 0.648 to 0.823. In Cronbach's alpha, the reliability value of 0.600 is still accepted in exploratory testing (Hair, 2014). (McCowan & McCowan, 1999) states that reliability around 0.50 is a satisfactory reliability level for tests that have items between 10-15 (Mc Cowan & Mc Cowan, 1999). (Bagozzi & Yi, 1988) in his research stated: "For composite reliability, values greater than about .6 are desirable" (Bagozzi & Yi, 1988). The composite reliability value of the six sub-tests is listed below.

Table 8. Estimation of reliability.

Sub-test	n item	Composite reliability
VM	6	0.707
VFC	4	0.650
VFGD	7	0.702
VA	6	0.727
VMI	10	0.823
VSP	5	0.648

Source: Own study.

The following formula is used to calculate the estimated reliability:

$$CR = \frac{(\Sigma \lambda i)^2}{(\Sigma \lambda i)^2 + (\Sigma \epsilon i)} \quad (2)$$

λ = standard loading factor for item i.

ε = respective error variance for item i.

With:

$$\epsilon = 1 - \lambda_i^2 \quad (3)$$

4. Discussion

The main purpose of this study is to modify the Frostig visual perception test, including measurement of its validity and reliability as part of the modification process. This research succeeded in determining a new construct of the test. The modified visual perception test consists of six sub-items, out of a proposed seven sub-tests, with a total of 38 items. The number of sub-test and items is acceptable and meets the standard, compared to another visual perception tests. In Motor-Free Visual Perception Tests (MFVPT), there are five sub-tests, with a total of 45 items (Brown, 2008). With a sufficient number of items, the practitioner can still measure the visual perceptual performance, without the long duration of administration tests, and still can get the best child concentration span. Research by (Moyer, 1954) suggested that a concentration span of children aged 2-7 years playing with toys varied from 28.5 to 39.7 minutes (Moyer, 1954).

The test results show that one sub-test has been dropped, namely the visual closure sub-test. In this sub-test, the level of difficulty for each item is not easy to be constructed. Between an item (image) in which 20% is covered, and an item (image) in which 55% of the whole picture is covered, there were almost no differences in the level of difficulty. The level of difficulty cannot be determined by the percentage. When an image (item) is blocked in black and then 20% of the image is covered, the item is not easy to be identified. The limited literature regarding visual closure is considered to be the cause of poor construction. Moreover, (Brown & Murdolo, 2015) states that in the DTVP test, the visual closure sub-test has a high level of difficulty for children aged five years, and among children of certain races (Brown & Murdolo, 2015).

The estimated reliability of the visual perception test does not differ greatly from the reliability of the visual perception test, which has been used four times, revised and used in the USA. The Test of Visual Perception (the fourth revised skill) (TVPS-4) still has a sub-test with crobach alpha ranging from 0.68 to 0.81 (Brown & Peres, 2018). The study of Brown supports this finding, that modification of the visual perception test is worthwhile and appropriate for use.

Each sub-test is comprised of two-to-three types of questions, except for the visual closure and visual attention sub-test. The results show that the first type of question in VM and VSP sub-tests are all dropped. This means that the type of questions is still inappropriate for the existing population. In the first type of VM sub-test, a series of stimuli is shown to the subject with certain exposure duration, and the tester asks the subject to remember the shape/ figure of each stimulus, along with its color and location. Then, subjects were asked to choose a series of stimuli in accordance with the series shown previously.

The number of stimuli will increase in line with the item number, starting from three to six stimuli. For three stimuli, subjects were asked to choose one series of stimuli, which matches the series previously presented. In the four stimuli, there were four series choices. Distractors were shown to increase along with the number of stimuli. Distractors are varied in order, color, and amount of stimulus and answer choices. This shows that there is more than one variation of distractors.

Although the distraction process cannot be fully proven in this study, some researchers have stated that the number of distractors can affect one's memory. Unlike the results of previous studies, which have shown that attention plays a role in suppressing distractors, the number of distractors is not related to participant performance. (Nussenbaum et al., 2017) proves that memory sensitivity in one distractor is better than in three distractors Nussenbaum

et al 2017. Thus, it can be concluded that the more distractors used in an item, the poorer the sensitivity of memory and the higher the probability of a subject choosing the wrong answer.

The first type of question does not only appear in the VM sub-test, but also in the VSP sub-test. In this type of question, the subject is asked to follow the directions of the tester. In the testing process, children tend to be in a hurry, paying less attention to direction and instructions, and often guessing immediately after the instruction. Accordingly, mistakes occur frequently. The VSP sub-test is the final part of the test. The total duration of the test is 60-75 minutes, while the child's (2-7 years) ability to concentrate ranges from 28-39 minutes (Moyer, 1954). It is plausible, therefore, that the long duration of test administration could affect the performance of the children, because the ability to concentrate decreased. Furthermore, in this population, recognition of left-right direction remains relatively poor. The ability to reproduce direction and orientation is also affected by cultural differences (Kershner, 1972).

Although the age range in this item contributes significant variation to the measurement, the basis of the test has been established for children aged 3-8 years. This means that, in terms of utility, this test can be considered valuable because it has a relatively large target age range. In addition, with the reduction of items, the utility value in terms of time saving also increases (Swerdelik, 1976).

This research not only involves the process of measurement and items construction, but also involves the process of making pictures, manuals and other test details. The scope of this study is very broad. It is both necessary and highly recommended that an umbrella research model be designed for further study, so that a better visual perception test can ultimately be realized.

In this study, a modification of the visual perception test was successfully carried out by adding one sub-test from the Frostig test to six visual perception sub-tests. Reliabilities of visual perception tests were proved to be good and acceptable. This research will be the basis for further development of visual perception tests.

5. Conclusion

This study has successfully modified the Frostig test. The Frostig test has five factors, and this study proposed seven factors to measure visual perception. The analysis results confirmed six factors from the seven factors proposed, with a reliability range of 0.650 -

0.823. Of the 112 items that were tested, 38 items were considered feasible to measure Indonesian children's visual perception test.

Implication

Indonesia already has a visual perception measurement tool that has been adjusted to the needs of Indonesian children's culture. This test only consists of 38 items. Besides the more simple process of assessing visual perception disorders, the test's duration is appropriate to children's needs because children's ability to concentrate is also limited.

Further research would be necessary to design umbrella research for determining the norm based on ages and research with atypical development child participants, and also to design a visual perceptual test for ages above 8 years.

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