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Clinical Assessment of Phonological Awareness: Psychometric Properties

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Abstract

Purpose: The purpose of this study is to identify psychometric properties (item difficulty, item discrimination, reliability, and construct validity) in the Clinical Assessment of Phonological Awareness (CAPA) for Standard Indonesian.

Method: Participants in this study were 106 children. All participants were assessed using the Clinical Assessment of Phonological Awareness (CAPA). The assessment was administered by the teachers who have been trained to administer CAPA.

Result: After completing item analysis, it was found that some items have a low discrimination index (<0.3), so these items must be eliminated. After the items are eliminated, syllable blending has four items, syllable segmentation has eight items, phoneme blending has eight items, and phoneme segmentation has six items. Then, each subtest has varying item difficulty, ranging from medium to difficult/hard. In the split-half reliability test, it was identified that all subtests in CAPA have a sound reliability coefficient of .80 - .97.

Conclusion: This study reveals that CAPA has good quality items and has a good level of reliability.

Keywords: phonological awareness, dyslexia, speech therapist, Indonesia, Norm-referenced test

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INTRODUCTION

Using valid and reliable measuring instruments in clinical practice is very crucial and important for speech therapists in clinical decision-making. If clinical decision-making is based on invalid and unreliable measuring instrument, the clinical decision cannot be trusted (Urbina, 2004). Despite the high awareness of Indonesian speech therapists, and related institution and association including Indonesian Speech Therapist Association (ISTA) towards the importance of using a valid and reliable measuring instrument, nevertheless the standard test instrument to determine the phonological awareness of children suspected of having dyslexia have not been available thus far.

According to the International Dyslexia Association (Lyon, Shaywitch, & Shaywitz, 2003), dyslexia is characterized by problems with accurate and/or fluent word recognition, and poor spelling or decoding abilities. These difficulties are often "unexpected" in view of the child's other cognitive abilities and exist despite the provision of adequate formal classroom instruction. At the explanatory level, dyslexia typically results from a deficit in the phonological component of language (Lyon et al., 2003).

Based on IDA's definition, it is important to assess the ability of phonological awareness to establish the diagnosis of dyslexia, and phonological awareness deficit has been the consensus as a marker (or proximal cause) of dyslexia (Shaywitz, 2003; Snowling, 2000; Uhry, 2005). The purpose of this study is to identify psychometric properties (item difficulty, item discrimination, reliability, and construct validity) from Clinical Assessment of Phonological Awareness (CAPA).

PHONOLOGICAL AWARENESS AND READING

Previous studies have undoubtedly found a causal relationship between phonological awareness (or phonological sensitivity) and reading ability. Firstly, many children with dyslexia have phonological awareness problems before they learn to read (Hulme & Snowling, 2009). Secondly, phonological awareness becomes a powerful predictor for reading disorder at the preschool age (Bryant, MacLean, Bradley, & Crossland, 1990; Lundberg, Frost, & Petersen, 1988; Muter, Hulme, Snowling, & Taylor, 1998; Scanlon & Vellutino, 1996; Wagner et al., 1997). Thirdly, phonological awareness (or sensitivity) intervention can improve reading ability (NRP, 2000) in terms of accuracy

Indonesian Phonology

Indonesian (bahasa Indonesia [baˈhasa indoˈnesia]) is the official language of Indonesia. Most formal education is conducted in Indonesian. As verbal communication, language is a universal system. All languages in the world have phonemes (vocal, diphthong, consonant). Indonesian has five pure vowels (a, e, i, o, and u) and only three diphthongs written as "ai," "au," "oi" and few consonant clusters (Moeliono &

Dardjowidjojo, 1988; Pusat Bahasa Departemen Pendidikan Nasional, 2003).

In the pronunciation of phoneme consonants, one phoneme can have several pronunciations (for example, phoneme [b]). The sound [b] would change to sound [p] if it placed as the last sound of the word. On the other hand, the sound [g] would also change to sound [k] or [ʔ] (depending on the dialect) if placed at the end.

Example:

sebab [səbap] – cause
tabib [tabip] – traditional doctor
kebab [kəbap] – kebab (Turkey food)
gudeg [gudək/gudəʔ] – gudeg (Yogyakarta's famous food)

Dyslexia and Phonological Awareness in Indonesia

Dyslexia has been a concern of many researchers and practitioners. Findings from many studies contain information with very important implications for our understanding of the importance of assessing phonological processing ability (phonological awareness, phonological memory, and rapid automatized naming) to identify children, as early as possible, who are at risk of reading disorders. In a study by Winksel and Widjaja, (2007) a positive correlation was identified between phonological awareness (rhyme detection, phoneme deletion, syllable deletion) with word reading, nonword reading, and letter knowledge in children in Indonesia.

More recently, the development of a reading assessment battery (Jap, Borleffs, & Maassen, 2017), had a significant positive impact on the management of children with dyslexia in Indonesia. According to Jap et al., (2017), the development of a reading assessment battery is a crucial first step in the management of reading problems in Indonesia as knowledge and awareness of dyslexia in Indonesia are dependent on the accurate identification and treatment of individuals with or at risk of dyslexia in Standard Indonesian (SI). Amongst the tests used in the study were phoneme deletion and rapid automatized naming (digit, letter, colour).

The study identified that there was a significant difference in the ability of phoneme deletion and rapid automatized naming between typical children and children at risk of dyslexia (Jap et al., 2017). In addition, there were no significant differences between phonological memory ability (forward digit span and backward digit span) in typical children compared to children at risk of dyslexia in Indonesia. By contrast, the research of Taruna and Syaf (2018) it was identified that children with dyslexia in Indonesia had problems on forward digit span

Clinical Assessment of Phonological Awareness

Asesmen Klinis Kesadaran Fonologi ('Clinical Assessment of Phonological Awareness') (Taruna, 2019) is the first measuring instrument in Indonesia that aims to identify the precursors of phonological coding which is one of the bases of fluent-print word recognition skill (Pennington, 2009).

The theoretical basis used for CAPA construction was the theory of Pennington (2009) and Rathvon (2004). According to Pennington (2009), phonological awareness is the precursor of phonological coding that forms the basis of the development of fluent-print word recognition skills.

Furthermore, according to Rathvon (2004), phonological awareness measures can be classified into one of two broad categories, depending on the linguistic unit involved:

(1) Non-phonemic tasks, which measure global aspects of phonological awareness, such as syllable sensitivity; and

(2) phonemic awareness tasks, which measure the ability of blending or segmenting phonemes. Based on these theories, CAPA has four subtests, namely syllable blending, syllable segmentation, phoneme blending, and phoneme segmentation (Table 1).

Each subtest has 10 items. Items that are responded correctly will be given a score of 1, while the items that are responded incorrectly will be given a score of 0. All subtests in CAPA are Indonesian language items.

Table 1. Description of CAPA (Pre Item Analysis)

TEST	SUBTEST	ITEM TOTAL
Phonological Awareness	Syllable blending	10
	Syllable segmentation	10
	Phoneme blending	10
	Phoneme segmentation	10
	Total	40

Table 2. Description of Phonological Awareness Task

CAPA	SUBTEST	DESCRIPTION
Phonological Awareness	Syllable blending	The child listens to segments of orally presented words and blends the syllable together to form a word. **Example:** I'm going to say some syllable. When I'm finished, you say the word that the syllable make. kal/ku/la/tor What's the word? *Kalkulator* ('calculator')
	Syllable segmentation	Syllable segmentation tasks require the child to indicate the number of syllables in spoken words, such as clapping or tapping. **Example:** "Clap to show me how many syllables you hear in *matahari* ('sun') (The child claps four times)
	Phoneme blending	The child listens to segments of orally presented words and blends the sounds together to form a word. **Example:** I'm going to say some sounds. When I'm finished, you say the word that the sounds make. s/u/s/u What's the word? *Susu* ('milk')
	Phoneme segmentation	The child indicates the number of phonemes in spoken or pictured words by drawing marks, clapping, or tapping. **Example:** "Clap to show me how many sounds you hear in *ibu* ('mother') (The child claps three times)

METHODS

Participants

Participants in this study were 106 children. The characteristics of the sample in this study are presented as follows:

1. Male and female
2. Ages 5 years 0 months to 6 years 11 months
3. Studying in Pekanbaru Kindergarten.

Materials and Procedures

All participants were assessed using the Clinical Assessment of Phonological Awareness (CAPA). The assessment was administered by the teachers who have been trained to administer CAPA. After all the participants were assessed using CAPA, item analysis was then carried out to eliminate the items that were poor in quality. Furthermore, a reliability test (split-half reliability) was carried out on items that had a good index of item discrimination (>0.3). Finally, factor analysis was conducted to determine the construct validity.

Item Analysis

Item analysis is a process which examines student responses to individual test items in order to assess the quality of those items and of the test as a whole. Item analysis is especially valuable in improving items which will be used again in later tests, but it can also be used to eliminate ambiguous or misleading items in single test administration. Two principal measures used in item analysis are item difficulty and item discrimination. The difficulty of an item in a test is the percentage of the sample taking the test that answers that question correctly (Domino & Domino, 2006). Item discrimination refers to the ability of an item to correctly "discriminate" between those who are higher on the variable in question and those who are lower (Domino & Domino, 2006).

Reliability Test

Reliability refers to the consistency of the data or the results obtained (Domino & Domino, 2006). Any measuring instrument must first of all yield consistent measurements; the actual measurement should not change unless what we are measuring changes (Domino & Domino, 2006).

Factor Analysis

One way to deal with the huge number of constructs tapped by existing tests—and with the unwieldy number of correlations that can be obtained from their global scores, their subtest scores, and their item scores—is through a series of statistical procedures known collectively as factor analysis (FA) (Urbina, 2004). The principal goal of factor analysis is

to reduce the number of dimensions needed to describe data derived from a large number of measures (Urbina, 2004). It is accomplished by a series of mathematical calculations, based on matrix algebra, designed to extract patterns of intercorrelation among a set of variables (Urbina, 2004).

RESULTS

Based on the item analysis, the results of item difficulty and item discrimination from syllable blending, syllable segmentation, phoneme blending, and phoneme segmentation were obtained. The items in each subtest which have a good discrimination index (> 0.3) will be used as the final item. Then, after the final item was determined, split-half reliability test was conducted to identify the reliability coefficient and factor analysis was conducted to determine the construct validity of CAPA.

Table 3. Characteristics of Participants

	AGE		
	4.0-4.11	**5.0-5.11**	**6.0-6.11**
Male	3	20	30
Female	3	23	27
Total	6	43	57

Item analysis results

Based on the item analysis, items 1, 2, 3, 4, 5, and 6 in the syllable blending subtest have a low discrimination index (<0.3) (Table 4). Therefore, 4 out of 10 items that were part of the syllable blending subtest (pre-item analysis) were determined as final items (post item analysis).

In the syllable segmentation subtest, there are eight items that have a good discrimination index (3, 4, 5, 6, 7, 8, 9, 10) (Table 6). Furthermore, in the phoneme blending, there are eight items that have a good discrimination index (1, 2, 3, 4, 5, 6, 7, 8) (Table 6). Lastly, in the phoneme segmentation, there are six items that have a good discrimination index (1, 2, 3, 5, 6, 7) (Table 7).

Table 4. Item analysis of syllable blending

DISCRIMINATION	DIFFICULTY		
	HARD (0-50)	MEDIUM (51-85)	EASY (86-100)
Poor (<0.01)			1,2,3,5
Fair (0.1 – 0.3)			4,6
Good (>0.3)		7,8,9,10*	

*Final item: 7,8,9,10

Table 5. Item analysis of syllable segmentation

DISCRIMINATION	DIFFICULTY		
	HARD (0-50)	MEDIUM (51-85)	EASY (86-100)
Poor (<0.01)			
Fair (0.1 – 0.3)			1,2
Good (>0.3)	10*	3,4,5,6,7,8,9*	

*Final item: 3,4,5,6,7,8,9,10

Table 6. Item analysis of phoneme blending

DISCRIMINATION	DIFFICULTY		
	HARD (0-50)	MEDIUM (51-85)	EASY (86-100)
Poor (<0.01)			
Fair (0.1 – 0.3)	9,10		
Good (>0.3)	3,4,5,6,7,8*	1,2*	

*Final item: 1,2,3,4,5,6,7,8

Table 7. Item analysis of phoneme segmentation

DISCRIMINATION	DIFFICULTY		
	HARD (0-50)	MEDIUM (51-85)	EASY (86-100)
Poor (<0.01)			
Fair (0.1 – 0.3)	4,8,9,10		
Good (>0.3)	1,2,3,5,6,7*		

*Final item: 1,2,3,5,6,7

Split-half reliability results

Based on the split-half reliability test, it has been identified that all CAPA subtests (syllable blending, syllable segmentation, phoneme blending, phoneme segmentation) have a reliability coefficient range from .80 - .97.

Table 8. Reliability Coefficient of CAPA

NO	SUBTEST	RELIABILITY COEFFICIENT
1	Syllable blending	.80
2	Syllable segmentation	.94
3	Phoneme blending	.97
4	Phoneme segmentation	.96

Factor analysis results

Based on the factor analysis, it is known that the CAPA has one factor (one-factor solution), which consists of syllable blending, syllable segmentation, phoneme blending, and phoneme segmentation (Table 9).

Table 9. Component Matrix of CAPA

	COMPONENT
	1
Syllable blending	.86
Syllable segmentation	.91
Phoneme blending	.93
Phoneme segmentation	.82

DISCUSSION

This study aimed to identify the psychometric properties of the Clinical Assessment of Phonological Awareness (CAPA). CAPA is a measuring instrument designed by Rexsy Taruna (first author). The aim of CAPA construction is to identify the phonological awareness ability of children in Indonesia.

The presence of CAPA in Indonesia can help speech therapists to:

(1) identify the performance level of phonological awareness ability, and

(2) identify children at risk of reading disorders. During the initial CAPA construction, there are four subtests that consist of syllable blending, syllable segmentation, phoneme blending, and phoneme segmentation. Each subtest has 10 items, with a total of 40 items.

After performing item analysis, it was found that some items have a low discrimination index (<0.3), so these items must be eliminated. After the items were eliminated, syllable blending has four items, syllable segmentation has eight items, phoneme blending has eight items, and phoneme segmentation has six items. Moreover, each subtest has varying item difficulty, ranging from medium to difficult hard.

In the split-half reliability test, it was identified that all subtests in CAPA has a reliability coefficient of .80 - .97. Any measuring instrument must produce consistent measurements; the actual measurement must not change unless what we measure change. By convention, a correlation coefficient that reflects reliability should reach the value of .70 or above, so that the test can be considered as reliable (Domino & Domino, 2006).

According to Nunnally and Bernstein (1994), a reliability coefficient that is greater than .90 is a very good reliability to be used as the basis for decision making at the individual level. After performing the split-half reliability test, factor analysis is undertaken afterwards. Based on the factor analysis results, it has been identified that CAPA has one factor. Each subtest correlates, forming a factor called phonological awareness.

LIMITATIONS AND DIRECTIONS FOR FURTHER RESEARCH

Based on the results obtained, there is evidence that CAPA is a measuring instrument that has items with good quality. Moreover, the highest level of reliability makes CAPA a candidate that can be used as the standard test instrument which can be used in Indonesia. It should be noted that the current study has limitations in terms of the sample size which is not representative of the typical child population in Indonesia. Therefore, a representative sample which can represent the typical child population in Indonesia would be needed for further study in order to generalize these results.

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APPENDIX A

Gender : _____ Date of Birth : _____

Examiner : _____ Chronological Age : _____

SYLLABLE BLENDING—AGE: 4.0 – 6.11

NO	ITEM	RESPONSE	SCORING	
			CORRECT	INCORRECT
1	Ha – di – ah (*pres – ent*)		1	0
2	Kal – ku – la – tor (*cal – cu – la – tor*)		1	0
3	Per – sa – ma – an (*sim – i – lar – i – ty*)		1	0
4	Or – ga – ni – sa – si (*or – gan – i – za – tion*)		1	0
Total				

SYLLABLE SEGMENTATION—AGE: 4.0 – 6.11 TAHUN

NO	ITEM	RESPONSE	SCORING	
			CORRECT	INCORRECT
1	Lemari ('*cupboard*')		1	0
2	Misteri ('*mystery*')		1	0
3	Makanan ('*food;*)		1	0
4	Matahari ('*sun*')		1	0
5	Perbedaan ('*difference*')		1	0
6	Selamanya ('*forever*')		1	0
7	Diantara ('*between*')		1	0
8	Mempermasalahkan ('*problematic*')		1	0
Total				

PHONEME BLENDING—AGE: 4.0 – 6.11

NO	ITEM	RESPONSE	SCORING	
			CORRECT	INCORRECT
1	/m/ /a/ (*m-a*)*		1	0
2	/s/ /i/ (*s-i*)*		1	0
3	/b/ /au/ (*b-au*)*		1	0
4	/k/ /ai/ (*k-ai*)*		1	0
5	/a/ /p/ /i/ (*f-i-r-e*)		1	0
6	/s/ /u/ /s/ /u/ (*m-i-l-k*)		1	0
7	/m/ /a/ /t/ /a/ (*e-y-e*)		1	0
8	/l/ /a/ /m/ /p/ /u/ (*l-a-m-p*)		1	0
Total				

PHONEME SEGMENTATION—AGE: 4.0 – 6.11

NO	ITEM	RESPONSE	SCORING	
			CORRECT	INCORRECT
1	Api ('*fire*')		1	0
2	Ibu ('*mother*')		1	0
3	Apa ('*what*')		1	0
4	Suka ('*like*')		1	0
5	Ayam ('*chicken*')		1	0
6	Botol ('*bottle*')		1	0
Total				