Pilot Study: Characterizing Successful Beginning Reading in Indonesian

Harwintha Yuhria Anjarningsih[1]

Department of Linguistics, University of Indonesia, Depok, Indonesia

Center for Language and Cognition Groningen, Faculty of Arts, University of Groningen, Groningen, the Netherlands

Abstract

The investigation reported in this article aims to point out how the lexical and sub-lexical route are employed in normal beginning reading in Bahasa Indonesia (Indonesian) and to identify reading performance that may suggest the occurrence of impaired reading in Bahasa Indonesia which is possibly displayed by the children with the lowest reading performance. Ten typical developing third-grade students participated in the study. Error patterns of those ten students are analysed for the error analysis and for the analysis on the relationship between psycholinguistic variables and reading performance. Five of those students were recorded during the reading part and the data were used in the latency analysis. The preliminary findings reported here seem to show that beginning reading in Bahasa Indonesia is characterised by the utilization of the sub-lexical route and more skilled reading by lexical route. The development of the lexical route depends on the development of the sub-lexical route which is influenced by the complexity of the Grapheme Phoneme Correspondence. The lexical route for words with simple graphemes is developed first, the lexical route for words with consonant clusters are developed later. The last to be developed is the lexical route for words with digraphs. Furthermore, Late AoA, imageability, syllable number, and resemblance to words influence the lexical processing of the stimuli in the test. Impaired reading seems to be characterised by less developed sub-lexical route as evidenced by difficulties with words containing consonant clusters and digraphs and longer latencies for reading aloud words and pseudowords.

Keywords:
psycholinguistics, reading performance

[1] The work reported here is a part of the master thesis of the author completed in 2006 in the European Masters in Clinical Linguistics program. The work was under the supervision of Prof. Dr. Ria de Bleser of the Department of Patholinguistics, Faculty of Human Sciences, University of Potsdam, Germany

1. Introduction

The national and official language of the multilingual Republic of Indonesia, Bahasa Indonesia is very transparent orthographically. Below is the list of letters in the Indonesian orthography and their corresponding phonemes:

A	B	C	D	E	F	G	H	I	J	K	L	M	N
/a/	/b/	/c/	/d/	/e/ & /ə/	/f/	/g/	/h/	/i/	/dʒ/	/k/	/l/	/m/	/n/

O	P	Q	R	S	T	U	V	W	X	Y	Z
/o/	/p/	/k/	/r/	/s/	/t/	/u/	/f/	/w/	/ks/	/j/	/z/

(Source: Alwi et al., 2003)

Besides the aforementioned graphemes, Indonesian also has 4 digraphs: KH /x/, NY /ñ/, NG /ŋ/, and SY /š/. In addition, there are 3 diphthongs in Indonesian: AU /aw/, OI /oy/, and AI /ay/. It can be seen that graphemes in Bahasa Indonesia, alone or in combination, map in one to one correspondence to the phonemes of the language, excepting for E that maps to 2 phonemes /e/ and /ə/, K and Q that map to /k/, and F and V that map to /f/. The writing of /k/ into K or Q and /f/ into F or V seems to be dictated by the origins of the words. Q is used only when the words come from Arabic (qurban, Qur'an, qunut, etc.). However, there is a tendency that nowadays people prefer to write those words from Arabic with K. Furthermore, V is used only when the words have European roots (*vital*, *vitamin*, *vokal*, etc.).

In teaching beginning reading, in general Indonesian teachers, including the participating students' teachers, use a kind of phonics approach. The teachers train students to memorise the name of letters in the Indonesian alphabet and to combine consonants and vowels into syllables. For example, in presenting the word "bola" (ball) for first graders, the teachers would write the following on the board (taken from *Bina Bahasa dan Sastra Indonesia untuk Sekolah Dasar Kelas 1*, Tim Bina Karya Guru, 2004):

bola

bo la

b o l a

bo la

bola

The students then would read together with the teacher starting from the complete word, the two syllables, the four letters, the two syllables again, and the complete word to finish. The way they read the syllables is by naming the two letters in the first syllable, combining them into a syllable, then doing the same steps for the second syllable, and finally they read the whole word (/be/ /o/ /bo/ pause /el/ /a/ /la/ pause /bola/). After about two months (half of the first semester of first grade) the next step is to read simple sentences, first with support and then without. One example of support is presented below.

Figure 1. An example of support for beginning readers.

ini ban mobil										
i	.....	i	.....	.....	n	m	o	.....	.....	l
.....	n	.....	b	.....	.....	.....	.....	b	i	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	i	l

In reading the sentence (this is a car's tyre) the students can resort to letters and the corresponding sounds in each of the syllables. This is reinforced by the writing of the corresponding letters.

The present investigation is based on the dual-route model of reading. According to this account, fluent readers utilize two routes when they read. The lexical route enables them to match whole words and the sub-lexical route permits them to identify words by means of grapheme-phoneme correspondence rules. GPC rules are rules which specify the relationship between a written letter and the phoneme which it conventionally represents (Field, 2004). The following diagram is dual-route model based on the work of Ellis and Young, 1988 (downloaded

from http://www.smithsrisca.demon.co.uk/ PSYellisyoung1988.html). The route employed for reading aloud starts from the right-hand side and ends at the bottom left-hand side.

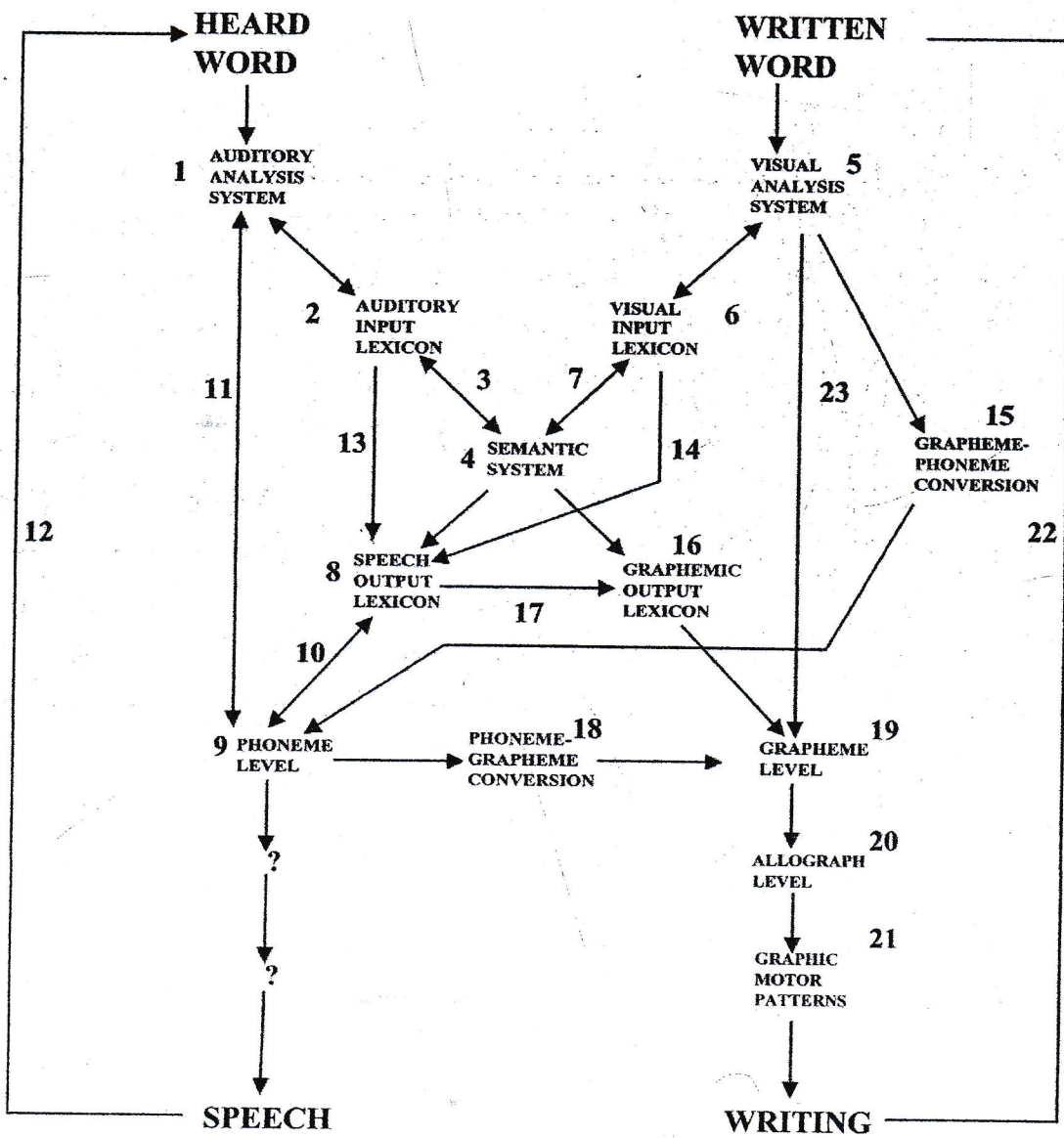

Figure 2. Dual-route model according to Ellis and Young, 1988 (taken from http://www.smithsrisca.demon.co.uk/PSYellisyoung1988.html)

Reading impairments affecting once-fluent-reading adults (acquired dyslexia) are the first cases explained by the dual-route model. The dual-route model differentiates three types of acquired dyslexia: surface, phonological, and deep. The lexical route (written word, visual analysis system, visual input lexicon, semantic system, speech output lexicon, phoneme level, speech) and the sub-

lexical route (written word, visual analysis system, grapheme phoneme conversion (GPC), phoneme level, speech) can be selectively impaired. According to the dual-route model, surface dyslexia arises because of damage to the lexical route and the sparing of the sub-lexical route. On the other hand, phonological dyslexia is caused by damaged sub-lexical route while the lexical route is relatively intact. Thus, the dual-route model can account for the surface dyslexics' better performance when reading aloud regular words and non-words compared to their reading aloud irregular (exception) words and the phonological dyslexics' better performance in reading words (both regular and irregular) when compared to their reading non-words. The account of dual-route model for developmental dyslexia is because some children have difficulties acquiring one or more of the modules needed for skilled reading (for discussions in shallow orthography see, among others, Defior et al., 1996; Zoccolotti et al., 1999). The children having difficulties acquiring the grapheme-phoneme rule system are called developmental phonological dyslexics; those having difficulties acquiring the lexical procedure for reading are called developmental surface dyslexics (Coltheart et al., 1993).

Based on the afore-mentioned background, the following research goals were set:

1. to point out how the lexical and sub-lexical route is employed in normal reading in Bahasa Indonesia;
2. to identify reading performance that may suggest the occurrence of impaired reading in Bahasa Indonesia which is possibly displayed by the children with the lowest reading performance.

2. Method

2.1. Participants

Ten normally developing third grade students from a state elementary school in Jakarta participated in the study (mean age 8 years old and 3 months). They are chosen by their teachers by means of a questionnaire. Five of those ten students were recorded during reading and hence their data are used for the latencies analysis.

2.2. Materials

Items for the reading test is based on rating by native speakers. Thirty adult speakers of Bahasa Indonesia participated in Age of Acquisition Rating, thirty two in the Imageability Rating, and thirty in the Verb Frequency Rating. Data then are cross-analysed to provide items for the following tasks:

Reading Test 1: Late Age of Acquisition concrete nouns-1 syllable n=10

Reading Test 2: Late Age of Acquisition abstract nouns- 1 syllable n=14

Reading Test 3: Early Age of Acquisition concrete nouns- 1 syllable n=16

Reading Test 4: Early Age of Acquisition abstract nouns- 1 syllable

Reading Test 5: Early Age of Acquisition concrete nouns- 2 syllables n= 12, 4 irreg.

Reading Test 6: Early Age of Acquisition abstract nouns- 2 syllables

Reading Test 7: Early Age of Acquisition verbs n=16, 5 irreg.

Reading Test 8: Late Age of Acquisition concrete nouns- 2 syllables n=8, 4 irreg.

Reading Test 9: Late Age of Acquisition abstract nouns- 2 syllables n=6, 5 irreg.

Reading Test 10: Late Age of Acquisition verbs n=4, 3 irreg.

Reading Test 11: *irregular nouns, Early Age of Acquisition*

Reading Test 12: *irregular nouns, Late Age of Acquisition*

The underlined tasks are those intended tasks whose items could not be provided by the cross-analysis of the rating results. The italicized tasks are those whose items could not be generated in enough number by the cross-analysis. Therefore, they are incorporated in the other tasks as indicated by the abbreviation irreg. In addition, two tasks consisting of pseudowords are also constructed.

Reading Test 13: pseudowords not resembling words

Reading Test 14: pseudowords resembling words

According to the dual-route model, some attributes of words influence their processing during reading. These are considered during the item pooling process. The first of these is spelling regularity. Irregular words are stored in the readers' lexicon; they know how to read the words because there is already association between the print and pronunciation. If the readers' lexical route is impaired and

they are forced to read through the sub-lexical route, there is chance that the irregular words are not read correctly since they do not follow the rules mapping orthography and phonology. As in Bahasa Indonesia there is no irregular word, irregular words in the current research are defined as words containing one of the digraphs NG, NY, KH, or SY which have been mentioned by adult Bahasa Indonesia readers as presenting problems when they started learning reading and during their first and second grade in elementary school. This especially happens when the digraphs are in the middle of the word with the pattern CVCV (e.g. *bu-nga*, *mo-nyet*) because the first letter of the digraphs can wrongly be read as belonging to the first syllable and the second letter to the second syllable.

The second attribute considered is imageability. Some acquired phonological dyslexics are worse at reading abstract words than concrete words (Coltheart, 1996; Iribarren et al., 1999) and the poorer readers (average 9 years old and 10 months) in the sample of Coltheart et al. (1988) read words with high imageability better than words with low imageability. Thus, in light of this finding, the items incorporated in the present research also reflects the concrete-abstract distinction. The imageability rating incorporated a 1-7 scale with the following description:

1. very abstract
2. not too abstract
3. in between abstract and concrete
4. not too concrete
5. concrete
6. very concrete

Due to the result of the rating, concrete nouns are those receiving the rating of 7 given by 20 or more raters (n ≥20 out of 32 raters) and abstract nouns are those receiving the rating of 1 given by 10 or more raters (n 1 ≥0 out of 32 raters with mean age 26.97).

The third attribute also considered is Age of Acquisition (the age at which words are first learned in their spoken or written form (Bonin et. al., 2004 quoting Carroll and White, 1973 and Gilhooly, 1984)). Compared to frequency, AoA is a more reliable index in accounting for reading aloud speed (Morrison and Ellis,

1995, 2000). Controlling frequency, Morrison and Ellis (1995, 2000) find AoA as a major determinant in word naming and lexical decision speed; the effect of AoA in the former task is of special interest for the present study. Rated AoA is used in the present study due to its high correlation with objective AoA drawn from study with children (Morrison and Ellis, 2000). However, some researchers (e.g. Zevin and Seidenberg, 2002 in Bonin et al., 2004) have argued that frequency trajectory (calculated by the difference between z-scores of 'child' and 'adult' frequency corpora) is a better indices than AoA in predicting response latencies in lexical tasks, including reading. Responding to this, there are two reasons why in the present research (rated) AoA is used. First, Bonin at al. (2004) in their attempts to develop issues raised by Zevin and Seidenberg (2002) still found affects of AoA, but not frequency trajectory, after including cumulative frequency (derived from adult and child frequency counts) in their regression equation. Second, (rated) AoA for words in Bahasa Indonesia is more possible to be obtained than frequency trajectory under the time constraint posed to this research; no such frequency corpora of words in Bahasa Indonesia exists yet and developing it would need technology and time not currently available.

The AoA rating both for nouns and verbs used the following scale:

1. 1-2 years old
2. 3 years old
3. 4 years old
4. 5 years old
5. 6 years old
6. 7 years old
7. 8 years old and older

Due to the result obtained, the following criteria were used to select the words rated by 30 raters:

For nouns →

1. Early AoA : rating 1-2, 3, or 4 given by 10 or more raters, or by fewer by 10 raters but the highest for the corresponding items.
2. Late AoA : rating 8 and older given by 10 or more raters

For verbs →

1. Early AoA : rating 1-2 or 3 given by 20 or more raters
2. Late AoA : rating 6, 7, or 8 and older given by 20 or more raters

The fourth attribute considered is the grammatical class of the words (verb and noun). Deep dyslexics are more successful in reading aloud nouns, as compared to adjectives and verbs (Funnel, 2000 in Funnel (ed.)). As it has been argued that deep dyslexia and phonological dyslexia are endpoints of some continuum (Gloser and Friedman, 1990 in Coltheart, 1996), this grammatical class effect is also seen in phonological dyslexia. As for surface dyslexics, it has also been observed that they have problems with grammatical class so that nouns are read better than adjectives which in turn are read better than verbs (De Bleser, EMCL 2005-2006 class lecture document 1dyslexia1.pdf). Hence, among the content words, nouns are the easiest to process and verbs are the most difficult. This "endpoint" positions of nouns and verbs lead to their inclusion in the test so as to enable a clear picture if the grammatical category of the words does play a role. As a whole, grammatical class of the words are considered along with the three other attributes to select the words included in the previously mentioned reading tasks.

The fifth attribute considered is resemblance to words. Two kinds of pseudowords are used in the test: pseudowords resembling words and pseudowords not resembling words. In decoding pseudowords, children must access and integrate multiple phonological code. Therefore, the decoding speed for pseudowords is particularly sensitive to difficulties in phonological coding of visual stimuli (Wagner and Torgesen, 1987). Although not as unfamiliar as nonwords, pseudowords not resembling words should be more difficult to process than pseudowords resembling words. If a significant difference is found in the reading performance of the two kinds of pseudowords, it can be attributed to the familiarity of pseudowords resembling words to the children. The pseudowords not resembling words all follow the phonotactics of Bahasa Indonesia as outlined in *Tata Bahasa Baku Bahasa Indonesia*--Standard Grammar of Bahasa Indonesia-- by Alwi et al., 2003). The pseudowords resembling words all have their stressed vowels changed. As Bahasa Indonesia has consistent stress that falls on the penultimate syllable and all the words used are bisyllabic, this means the vowel in

the first syllable is changed. Thus, all but one grapheme in the pseudowords resembling words are familiar to the participants, whereas in the case of pseudowords not resembling words the combinations of graphemes, although legal in the language, have not been encountered before. The higher familiarity to the pseudowords resembling words may be attributed to the partial recruitment of the lexical route or to the establishment of their grapheme sequences in the participants' sight words.

The sixth or last psycholinguistic attribute considered is number of syllables. As discussed by Defior et al. (1996), differential performance was seen in the ease of reading words with four levels of syllable number. The easiest ones read were the words with one syllable and the most difficult were words with four syllables. In the present investigation, only two levels of syllable number are employed: words with one syllable and words with two syllables. In the analyses the interaction between syllable number and other psycholinguistic variables can be seen. It remains to be seen if the result of Defior et al. (1996) is replicated since imageability, AoA, grammatical class, and regularity were not taken into account in their investigation.

2.3. Procedure

In general, the administered test was a paper-and-pencil administration. The ten participants came one by one to the classroom already prepared by the school. In the test, the participants and experimenter had one copy of the test material, one task per page. The participants' reading performance was recorded on a digital voice recorder to be used in the latencies analysis. Before starting reading items on a page (a task), the participants were required to say "mulai" (begin) in order to mark start time for the latencies analysis. When the participants misread items on the test, the experimenter wrote down the exact response above the corresponding items. This note would be used for the error analysis.

2.4. Analyses

Quantitative and qualitative analyses are employed. The errors made by the children are grouped under some headings in accordance with the dual-route

model of reading. The error headings for words and their definitions are as follows:

1. no response
2. letter by letter reading
3. regularisation (irregular words read as regular words e.g. *bu-nga* read as *bun-ga* or *syal* read as *sal* or *yal*)
4. semantic errors (the production of a word that shares a semantic relationship with the stimulus e.g. reading *bunga* as *kembang* which also means flower)
5. visual errors (the production of a response which shares at least 50 percent of the letters of the stimulus that may result in another word or a nonword)
6. substitution (the production of a response totally different from the stimulus which can be another word or a nonword)
7. derivational errors (the production of a response that contains the stimulus plus one or more derivational morpheme)
8. inflectional errors (the production of a response that contains the stimulus plus one or more inflectional morpheme)
9. other

The error headings for pseudowords and their definitions are as follows:

1. no response
2. letter by letter reading
3. lexicalization (the production of a word as a response)
4. visual errors (the production of a response which shares at least 50 percent of the letters of the stimulus that may result in a word or another nonword)
5. substitution (the production of a response totally different from the stimulus which can be another word or a nonword)
6. other

Percentage of errors in each of the headings is calculated and the results are correlated statistically by means of the software R with the nature of the stimuli (imageability, Age of Acquisition, regularity of the spelling, grammatical category, and resemblance to words). This can point to how psycholinguistic

variables influence the processing of the items in the reading test. Also, the composition of errors is investigated to enable an identification of how the sub-lexical and lexical routes are used in reading in Bahasa Indonesia. Furthermore, latencies of each of the children's answers are analysed to find out how long they need to utter them. As shown by Paulesu et al. (2001) in Italian, a language with shallow orthography, the dyslexics read more accurately than French or English dyslexics although the Italian dyslexics showed the same degree of impairment on reading latencies and reading-related phonological tasks relative to their controls. Since Bahasa Indonesia is also a transparent language, there is a need to record and analyse latencies as well.

3. Results

3.1. Reading performance

Table 1. Reading Test Result

Tasks / *Participants*	*1*	*2*	*3*	*5*	*7*	*8*	*9*	*10*	*13*	*14*	*Mean*	*Range*
I	100	100	93.75	100	100	100	100	100	95	100	98.88	93.75-100 (6.25)
II	100	92.86	93.75	100	100	100	100	100	85	85	95.66	85-100 (15)
III	70	85.71	100	100	100	62.50	66.67	75	80	90	82.99	62.50-100 (37.50)
IV	90	100	100	100	100	87.50	33.33	100	95	90	89.59	33.33-100 (66.67)
V	100	100	100	100	100	100	66.67	100	95	100	96.17	66.67-100 (33.33)
VI	70	85.71	87.50	91.67	81.25	87.50	33.33	100	65	80	78.20	33.33-100 (66.67)
VII	100	92.86	100	100	100	100	66.67	100	90	100	94.96	66.67-100 (33.33)
VIII	90	85.71	100	100	75	100	50	100	85	95	88.07	50-100 (50)
IX	90	100	93.75	100	93.75	87.50	83.33	75	75	100	89.83	75-100 (25)
X	50	71.43	87.50	91.67	100	75	50	75	70	75	74.56	50-100 (50)
Mean	81	91.43	95.625	98.33	95	90	65	92.50	83.50	91.5		
Range	50-100 (50)	85.71-100 (14.29)	87.50-100 (12,50)	91.67-100 (8.33)	75-100 (25)	62.50-100 (37.50)	50-100 (50)	75-100 (25)	65-95 (30)	75-100 (25)		

The following result was obtained for the ten tasks, from the most difficult to the easiest:

1. Task 9 (Late AoA abstract nouns, 2 syllables) mean percentage of correct answers= 65%
2. Task 1 (Late AoA concrete nouns, 1 syllable) mean percentage of correct answers= 81%
3. Task 13 (Pseudowords not resembling words) mean percentage of correct answers= 83.50%
4. Task 8 (Late AoA concrete nouns, 2 syllables) mean percentage of correct answers= 90%
5. Task 2 (Late AoA abstract nouns, 1 syllable) mean percentage of correct answers= 91.43%
6. Task 14 (Pseudowords resembling words) mean percentage of correct answers= 91.50%
7. Task 10 (Late AoA verbs) mean percentage of correct answers= 92.50%
8. Task 7 (Early AoA verbs) mean percentage of correct answers= 95%
9. Task 3 (Early AoA concrete nouns, 1 syllable) mean percentage of correct answers= 95.63%
10. Task 5 (Early AoA concrete noun, 2 syllables) mean percentage of correct answers= 98.33%

When nouns were matched on Late AoA, syllable number affected reading performance only for abstract nouns (Welch Two Sample t-test). In a 95% confidence interval, there was no significant difference between the scores for Late AoA concrete nouns 1 syllable and 2 syllables.

1. Late AoA abstract → 2 syllable nouns & 1 syllable nouns (p-value = 0.007542)
2. Late AoA concrete →1 syllable nouns & 2 syllable nouns (p-value = 0.5632)

This non-significant difference was also found between Early AoA concrete nouns 1 syllable and 2 syllables. However, since the rating activity could not generate items for Early AoA abstract nouns, the observed pattern for Early AoA

concrete nouns cannot be indicated for the abstract items by the present investigation.

4. Early AoA concrete →1 syllable nouns & 2 syllable nouns (p-value = 0.1882)

For Late AoA concrete nouns 1 syllable, imageability did not seem to make a difference in reading performance. However, for Late AoA concrete nouns 2 syllables, imageability did play a role. Late AoA abstract 2 syllable nouns were significantly more difficult to read than their concrete counterparts.

5. Late AoA 1 syllable →concrete & abstract (p-value = 0.3945)
6. Late AoA 2 syllables →abstract & concrete (p-value = 0.01213)

For verbs, AoA was not seen to affect reading performance. Late AoA verbs were not significantly more difficult to read than early AoA verbs (p-value = 0.6097). Yet, since in the test all verbs were bisyllabic, no effect of syllable number could be observed. In addition, for the pseudowords differential performance was seen between reading pseudowords not resembling words and reading pseudowords resembling words. Although only marginally significant, pseudowords not resembling words were more difficult to read than pseudowords resembling words (p-value = 0.09136).

It should be noted that the participants with the two lowest scores are in the second and third groups (see grouping based on Reading error analysis under 3.2 below). There is a discussion with the conclusion that the most developed lexical route was that of the participants in the first group. That of the second and third was still developing as their sub-lexical route is still not fully developed and as the full development of the sub-lexical route seems to predate that of the lexical route. This finding regarding the two lowest scores seems to support the conclusion of 3.2. The more developed one's lexical route, the lesser the influence of Late AoA, imageability, and syllable number on reading success.

Yet, one thing that needs to be borne in mind regarding the non-significant, significant or marginal difference found is how many irregular words are in the tasks. To illustrate, the most significant difference or the smallest p-value was found between Late AoA abstract nouns 2 syllables and Late AoA abstract nouns 1 syllable. Looked at more carefully, the number of the words

falling under Late AoA abstract nouns 2 syllables is six and five of which are irregulars. On the other hand, the number of words falling under Late AoA abstract nouns 1 syllable is fourteen without any irregulars. The second highest significance is between Late AoA abstract nouns 2 syllables and Late AoA concrete nouns 2 syllables. The number of items in the former task is six with one irregular while the latter has eight words with four irregulars. For the marginal significance between pseudowords resembling words and pseudowords not resembling words, the number of irregulars in each of the tasks is almost equal: three in the former and four in the latter. Therefore, at this point this result regarding the effects of psycholinguistic variables on lexical access and reading performance in Bahasa Indonesia is still suggestive at best.

3.2. Reading error analysis

From the average reading scores of the ten participants, three groups can be delineated. The first group consists of the participants whose average scores are 90% or higher, the second group includes those with average scores of 80% to 89.99%, and the third group consists of participants with average reading scores of lower than 80%. The following table gives information on the participants in each of the groups along with their average scores.

Table 2. Three Groups of Readers Based on Average Reading Scores

Group	*Participants*	*Average Reading Score (%)*	*Age (years;months)*
1	I	98.88	8;3
	II	95.66	8;1
	V	96.17	8;8
	VII	94.96	8;5
2	III	82.99	7;10
	IV	89.59	8;8
	VIII	87.45	8;5

Group	*Participants*	*Average Reading Score (%)*	*Age (years;months)*
	IX	89.59	7;7
3	VI	78.20	8;11
	X	74.56	8;1

The delineation of these three groups is important as they show different error patterns. The first group made errors on six words, six pseudowords not resembling words, and three pseudowords resembling words. Some of the errors were regularisation and the rest were visual.

Figure 3. Reading Errors of the First Group.

Task 1
0

Task 2
gir → gair, syak → sak

Task 3
ban → bang, nol → tol

Task 5
0

Task 7
0

Task 8
0

Task 9
khamar → kamar, khitah → kitah

Task 10
0

Task 13
kirna → kiran, lato → loto, rafun → ratun, sungo → sunggo, sungo → sugo, cafu → kafu, misybo → misibo

Task 14
mukam → pukam, ontan → otan, sebda → semda

One interesting finding was found for irregular words (words containing one of the digraphs KH, NY, NG, and SY). The digraphs in the words in red were read by leaving out one of the letters composing the digraphs (regularisation). Thus, SY in "syak" and "misybo" was read as "S," KH in "khamar" and "khitah" was read as "K," and NG in "sungo" was read as "G." However, for the words in blue the opposite of regularisation seemed to happen. "N" in "ban" was read as

"NG," and "NG" in "sungo" was added with "G." The rest of the errors committed by the participants in the first group were all visual.

Next, the second group made errors on twenty nine words, thirteen pseudowords not resembling words, and three pseudowords resembling words. The errors were predominantly regularisation and visual errors.

Figure 4. Reading Errors of the Second Group

Task 1

kru → ruk, stres → tres, skrup → skup, skrup → akrus, syal → sial

Task 2

saf → tas, kruk → kru, saf → kaf, syak → siak

Task 3

cat → kat

Task 5

0

Task 7

makan → makanan, minum → minuman, lempar → lempet, pakai → pakaian, tendang → tendang /e/

Task 8

janur → jamnur, bacang → bacam, dalang → dalam, konflik → kaflik, konflik → komflik

Task 9

frater → fater, syura → nyayura, frater → frauter, khamar → kamar, khitah → khitam, syura → seyura, frater → fete, khitah → kitah

Task 10

tuai → tu-ai, tuai → tunai

Task 13

miktet → miktex (mikteks), kilus→ tilus, kour → kor, sungo → sunggo, peya → penya, miktet → mikter, misybo → misibo, rafun → ratus, aplon → aflon, misybo → misbo, maklir → mak-hir, vublit → vubit, rafun → warun

Task 14

sebda → seda, banyi → bayi, tout → tour

For the regularisation errors, as was observed in the first group, the second group also made regularisation errors (red) and addition of sound to the words with digraphs or resulting in digraphs (blue). However, unlike the first group, the second group also regularised digraphs resulting in a completely different consonant (green).

A pattern of visual errors that was also found in the second group but not in the first group was simplification of consonant clusters. The words in purple contain consonant clusters that form the onset of a syllable. The finding was that the consonant clusters containing two consonants were often reduced into one consonant ("frater" read as "fater") and those containing three consonants were often reduced into two consonants ("skrup" read as "skup").

Besides regularisation and visual errors, two other kinds of errors were also identified from the second group. Derivational errors were observed affecting three words in task 7 ("makan", "minum," and "pakai"). The addition of the suffix -an to these words which are verbs turns them into nouns. The other kind of errors found was other. This includes the errors committed to the word "tendang" in task 7, the word "tuai" in task 10, and the pseudoword "maklir" in task 13. The error made on the word "tendang" is important to raise. As mentioned in Chapter 1 the graph E can be read as /e/ or /ə/. In standard Bahasa Indonesia, the two phonemes are in contrastive distribution. If a child reads E as /e/ and does not correct herself although in that particular word E should be pronounced as /ə/, this can point to an over-reliance on sub-lexical route. In task 7, the correct pronunciation of the graph E in the word "tendang" is /ə/. However, in some dialects of Bahasa Indonesia (most notably in a dialect spoken in North Sumatra province) it is perfectly acceptable to pronounce the E as /e/. The lack of other items with this feature (E with the correct pronunciation as /ə/) in the test makes it difficult to make a comparison and to draw a conclusion whether this error was due to the child's dialect or to her over-reliance on the sub-lexical route. Nevertheless, this finding regarding the graph E can suggest its utilization in later versions of the test to find out the existence of over-reliance on sub-lexical route.

For the third group, the majority of the errors were also regularisation and visual errors. As was observed in the first and second groups, regularisation of digraphs (red) and addition of digraphs (blue) were observed.

Figure 5. Reading Errors of the Third Group.

Task 1

syal → sal, kru → kruk, stres → stret, boks → buks, syal → sail, kru → ruk, stres → res, skrup → rup

Task 2

jab → jat, kruk → kuk, sak → pak, saf → syau, bong → bung, syak → sain

Task 3

pot → bot, ban → dan, dot → dok, teh → te

Task 5

kalung → keluarga, bunga → buaya

Task 7

makan → makanan, banting → benting, kunyah → kuyah

Task 8

konflik → kulflik, combro → jom-ro, konflik → koflik

Task 9

nyiru → nyaru, khitah → khatah, syura → sayur, tasyrik → jarik, frater → rater, khamar → kamar, khitah → hiktah

Task 10

tuai → tul

Task 13

lonya → loya, miktet → miktek, puwat → puyat, kilus→ kulus, lato → mato, kour → kor, jasme → jame, raum → rau, misybo → misybong, pulsar → polsar, vublit → vulbit, jasme → jugle, sungo → jun-go, jasme → jugle

Task 14

putak → pukat, sebda → sebada, sihu → sihut, tout → tuo, lofal → lufal, numpan → numpah, miut → miun, banyi → bangnyi, tout → tiut

However, unlike the first and second groups, the regularisations made by the third group seemed to affect not only the digraphs but also the vowels following them. For example, "syak" was read as "sain" and "syura" was read as "sayur." This suggests that simple graphemes also gave them problems.

For the visual errors, simplification of consonant clusters was also observed (purple). One simplification error out of the six made incorporated a simplification of a three-graphemed consonant cluster into only one consonant (skrup → rup). Although not very prevalent, this phenomenon was not observed in the other two groups.

One derivation error was found in the third group. The verb "makan" in task 7 was read as the noun "makanan." Furthermore, substitution errors were observed; making this kind of error a plausible marker of this group of readers. Two words in task 5, "kalung" and "bunga," were read as "keluarga" and "buaya" respectively and a non-word in task 13 ("jasme") was read as another nonword, "jugle." It can be seen that the two children were presumably trying to avoid the digraph NG in the case of the two words but in the case of the non-word, the child was presumably only able to figure out the GPC correspondence of the first and

last graphemes and hence supplied totally different sounds for the graphemes in between.

Regarding substitution, some of the regularisation and visual errors of the three groups can also be seen as producing other words or non-words. However, they were not considered as substitutions as they happened to digraphs or still fulfilled the 50% similarity requirement mentioned in Analysis section. The errors are reproduced below.

Table 3. The Three Groups' Regularisation and Visual Errors Resembling Substitution

Groups	*Errors*
1	syak →sak, ban → bang, nol →tol, khamar →kamar
2	saf →tas, kruk →kru, dalang →dalam, khamar →kamar, tuai →tunai, banyi →bayi
3	kru →kruk, sak →pak, bong →bung, pot →bot, ban →dan, dot →dok, syura →sayur, khamar →kamar, putak →pukat, jasme → jugle

Under this analysis, the third group made more of this substitution-like errors compared to the other two groups. As this kind of error (substitution) shows that what plays a role in the response is not only the Grapheme Phoneme Correspondence (GPC) but also the (other) words in the children's lexicon, it can be observed that the children in the third group were more prone to adopting words in their lexicon than to provide responses based on partial Grapheme Phoneme Correspondence. The errors presented in Table 4 along with the finding discussed in the previous paragraph seem to point out that substitutions are unique to the third group.

The following table gives the summary of the number of each kind of errors described previously for each group. Hence, any difference in error composition among the three groups can be observed.

Table 4. Summary of Errors Made by the Three Groups in Reading the One Hundred Twenty Six Items in the test

ror	Regularisation			Visual			Derivational	Substitution	Other
Group	pure	with addition of digraphs	with indication of substitution	pure	with simplification of consonant clusters	with indication of substitution			
1	3	1	3 syak →sak, khamar →kamar, *ban* → *bang*	8	-	1 nol →tol	-	-	-
2	7	3	3 dalang →dalam, khamar →kamar, banyi →bayi	16	8	3 saf →tas, kruk →kru, tuai →tunai	3	-	3
3	8	3	2 syura →sayur, khamar →kamar	25	7	7 kru →kruk, sak →pak, bong →bung, pot	1	3	-

ror	Regularisation			Visual			Derivational	Substitution	Other
Group	pure	with addition of digraphs	with indication of substitution	pure	with simplification of consonant clusters	with indication of substitution			
						→bot, ban →dan, dot →dok, putak →pukat			

Table 4. Summary of Errors Made by the Three Groups in Reading the One Hundred Twenty Six Items in the test

(The underlined words for regularisation of digraphs, the italicized words for addition of digraphs contra-regularisation), black for pure visual errors, and green for simplification of digraphs with another consonant)

For regularisation with simplification of digraphs, the second and third group made more of this kind of errors than did the first group. For the other two sub-headings under regularisation, the three groups made similar number of errors. The third group made the largest number of pure visual errors and the smallest number of this kind of error was made by the first group. For visual errors with simplification of consonant clusters, the second and third groups were not much different and the first group did not make any of this kind of errors. The third group made more visual errors that were suspect to substitution compared to those made by the first and second group ($1^{st}<2^{nd}<3^{rd}$). The first group did not make any derivational errors and the second group made more of this kind of errors than the third group. Lastly, substitution errors were made by only the third group.

3.3. Reading Latencies Analysis

Due to technical difficulties, the voice recording of only five participants is available for the latencies analysis. One is in the first group (participant VII), two in the second group (participants VIII and IX), and two in the third group (participants VI and X). The time needed to finish each task was recorded for the five participants. Measuring started when each child said "mulai" which means "start" before reading the first item in each task and ended when the child finished reading aloud the last item in the tasks. Before presenting the finding from the latencies analysis, I would like to present again the ten reading tasks and their details.

Reading Test 1: Late Age of Acquisition concrete nouns-1 syllable n=10

Reading Test 2: Late Age of Acquisition abstract nouns- 1 syllable n=14

Reading Test 3: Early Age of Acquisition concrete nouns- 1 syllable n=16

Reading Test 5: Early Age of Acquisition concrete nouns- 2 syllables n= 12, 4 irreg.

Reading Test 7: Early Age of Acquisition verbs n=16, 5 irreg.

Reading Test 8: Late Age of Acquisition concrete nouns- 2 syllables n=8, 4 irreg.

Reading Test 9: Late Age of Acquisition abstract nouns- 2 syllables n=6, 5 irreg.

Reading Test 10: Late Age of Acquisition verbs n=4, 3 irreg.

Reading Test 13: pseudowords not resembling words

Reading Test 14: pseudowords resembling words

Furthermore, significant difference was only found in the reading aloud of Late AoA nouns. For Late AoA abstract nouns, those with 2 syllables were significantly more difficult to read than those with 1 syllable. For Late AoA 2 syllable nouns, those abstract were more difficult to read than the concrete ones. Marginal significance was found between the reading aloud of pseudowords not resembling words and that of pseudowords resembling words with pseudowords not resembling words being more difficult to read.

Below is the summary of the finding from the latencies analysis (in seconds).

Table 5. Latencies analysis result

Tasks / *Participant*	*1*	*2*	*3*	*5*	*7*	*8*	*9*	*10*	*13*	*14*	*Mean*
VII	9.32	12.35	11.49	8.28	9.94	6.93	5.23	4.19	14.7	15.22	
	0.932	0.88	0.718	0.69	0.621	0.866	0.872	1.048	0.735	0.761	0.8123
VIII	14.18	19.44	10.8	9.03	15.3	14.34	9.3	5.87	33.3	30.21	
	1.418	1.389	0.675	0.753	0.956	1.793	1.55	1.468	1.665	1.511	1.318
IX	14.07	18.26	15.03	12.97	19.33	15.56	16.7	8.36	45.74	36.57	
	1.407	1.304	0.939	1.080	1.208	1.945	2.783	2.09	2.287	1.829	1.687
VI	13.74	17.55	21.3	13.75	26.78	20.56	15.6	8.48	43.45	40	
	1.374	1.253	1.331	1.146	1.674	2.57	2.6	2.12	2.173	2	1.824
X	37.35	22.16	17.64	14.54	24.45	26.67	19.36	8.17	43.45	49.04	
	3.735	1.582	1.103	1.212	1.528	3.334	3.227	2.043	2.173	2.452	2.239
Mean	17.732	17.952	15.252	11.714	19.16	16.812	13.238	7.014	18.064	34.208	
	1.7732	1.2816	0.9532	0.9762	1.1974	2.102	2.201	1.754	1.81	1.711	

(black shows duration for the whole tasks and green shows averages for individual items)

From the above table, we can see that there was a suggestion of a relationship between the participants' error rates and their mean duration for individual items (see right-hand-side mean). This individual mean duration was obtained from adding up the average time needed for a word in each task (green

number under each task) and dividing the result by 10. The ordering of the participants was based on the percentage of errors in the reading test (see Table 3), starting from the one with the highest percentage of correct answers. The individual mean duration also shows this pattern. The more errors the participants made, the longer the time they needed for reading aloud items in the test.

In the analysis based on psycholinguistic variables manipulated in the tasks, some tasks were found to be significantly or marginally more difficult to carry out than other tasks. The result is reproduced below.

1. Late AoA abstract → 2 syllable nouns significantly more difficult than 1 syllable nouns (p-value = 0.007542)
2. Late AoA 2 syllables →abstract nouns significantly more difficult than concrete nouns (p-value = 0.01213)
3. Pseudowords not resembling words marginally more difficult than pseudowords resembling words (p-value = 0.09136).

As there was a suggestion that error patterns may resemble those of latencies, t-tests were run to check whether the significant and marginal difference mentioned above was also true for latencies. Marginal difference was only found between the latencies for Late AoA, abstract nouns, 2 syllables and the latencies for Late AoA, abstract nouns, 1 syllable and between the latencies for Late AoA Verbs and the latencies for Early AoA Verbs (see below). None of the differences among the other tests reached significance.

Welch Two Sample t-test
data: LatLA2Syll and LatLA1Syll
t = 2.0667, df = 4.563, p-value = 0.09901
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.2594701 2.1090701
sample estimates:
mean of x mean of y
2.2064 1.2816

Welch Two Sample t-test

data: LatLAV and LatEAV
t = 1.9444, df = 7.901, p-value = 0.0882
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.1049157 1.2177157
sample estimates:
mean of x mean of y
1.7538 1.1974

This failure to find significant difference for the the other tasks employing nouns and pseudowords may have been caused by the very small number of data. Further investigations of reading latencies in Bahasa Indonesia need to incorporate bigger samples. In this way, it can be found out whether or not correlations found in reading performance analysis are different from those found in latencies analysis. At best, this failure to find significant difference for the other tasks employing nouns and pseudowords suggests that correlation patterns found in reading performance analysis may not always be the same as those in latencies analysis.

4. Discussion

Reading success in Bahasa Indonesia and its dependence on lexical or sub-lexical route seem to be closely related to the grouping of reading performance mentioned in the results section. In general, Grapheme Phoneme Conversion which lies at the heart of the sub-lexical route is a very important component of successful reading in Bahasa Indonesia and reading success seems to depend on how much GPC has developed. Compared to the other two groups, for the first group (i.e., the one with the highest percentage of correct answers) GPC for single graphemes and consonant clusters seemed to be no longer a problem. However, decoding of digraphs was still a problem for the children in this group as they still made errors when reading the irregular words. The errors pattern was not erratic but it showed that the participants already had partial understanding in how the digraphs sound based on how they look like. For example, SY was read S and KH

was read K. For the second group, GPC was still developing as shown by their digraph substitution errors (NG read as M) and simplification of consonant clusters. The second group's digraph substitution errors suggested a partial knowledge of the sound of the digraphs that did not seem to be related to how the digraphs look like. This partial knowledge seems to be purely phonological as NG and M share the same manner of articulation (nasal). The third group is still developing the GPC and the level of the developed GPC so far was still lower than that seen for the second group. The readers in the third group still exhibited cue reading (Ehri and Wilce, 1987) as shown by their substitution errors. Reading the words "kalung" as "keluarga" and "bunga" as "buaya" (meanings respectively necklace, family, flower, and crocodile) and the pseudoword "jasme" as "jugle" shows that there was a kind of guessing involved. Wild as it may seem, the response seems to show the participants' untilization of some distinctive visual aspect of the spelling and associating it with the word's pronunciation and meaning (Ehri and Wilce, 1987) but as shown by the two participants while their resulting responses do share some phonemes with the stimuli, the meanings do not. Summing up, the GPC in the third group was the one least developed among the three groups and their reading success was the lowest.

If irregular words in Bahasa Indonesia is defined as those containing one (or more) of the digraphs KH, NY, NG, and SY as defined in the present research, they do seem to present problems in the first years of learning to read. Digraphs are more problematic than consonant clusters for beginning readers. Following the dual-route research literature in saying that irregular words are read by the lexical route, in Bahasa Indonesia it seems that the lexical route is available after the sub-lexical route reaches its maturity. Lexical route for words with simple graphemes is available before that for those with consonant clusters. The last one to emerge is lexical route for words containing digraphs. As a tentative answer to the second research question, I would like to propose that for beginning reading in Bahasa Indonesia success depends on sub-lexical route (in line with Wagner and Torgesen, 1987 p. 192 and Wimmer and Goswami, 1994) but for fluent reading the lexical route is more influential.

Another evidence that seems to point to the proposed answer to the second research question is the error regarding E committed by a child in the second group as discussed previously. Although not a very strong one, it does suggest the tendency that the participants in the second group still over-relied on the sub-lexical route according to which E can be read as /e/ or /ə/. This is to add to the errors in reading aloud words with digraphs and consonant clusters.

Moreover, psycholinguistic variables that seem to play a role in reading or word naming in Bahasa Indonesia are Late AoA, imageability, number of syllables, and resemblance to words. Late AoA abstract nouns with two syllables were significantly more difficult to read than their counterparts with one syllable. Late AoA two syllables abstract were significantly more difficult to read than their concrete counterparts. For pseudowords, resemblance to words was marginally significant in influencing their processing during reading. Pseudowords not resembling words were marginally more difficult to read than those resembling words. For reading latencies, Late AoA, abstract nouns, 2 syllables needed longer time to be read that their 1 syllable counterparts. This marginal difference in reading latencies is not due to difference in syllable number as other task pairs contrasting 1 syllable and 2 syllables did not show the same result (i.e., Late AoA concrete nouns and Early AoA concrete nouns). Marginally significant latencies difference was also found between Late AoA verbs and Early AoA verbs. Although still a very preliminary finding and biased by irregularity, this result is a good start in encouraging further investigations into the effects of psycholinguistic variables in reading or word naming. Investigations on subtypes of dyslexia in Bahasa Indonesia can make use of this finding.

Regarding the third research question, the reading errors may help to provide an answer. The errors found in the present study (see Table 5) were only of five kinds: regularisation, visual, derivational, substitution, and other. While pure visual errors by themselves only point to a kind of confusion experienced by the participants that led to their substituting one simple grapheme for another, their proportion to other errors can reveal something. It shows that the poorer the participants' performance is, the more prone they are to pure visual errors. A problem at this very basic GPC may suggest reading impairment or at least delay.

Consonant cluster and digraph simplification or substitution may constitute another marker of reading problems. If compared to same age peers with similar IQ, a child exhibits considerably more problems in a longer time span with consonant clusters and digraphs, a dyslexia suspicion needs to be raised. A special note can be expressed about participant VI who was the oldest participant and in group 3 (see Table 3). If her schooling experience and IQ are comparable to those of the others but her problems with consonant clusters and digraphs persist, it is best to test her further for developmental dyslexia. In the absence of norms regarding reading performance and problems in Bahasa Indonesia, this comparison is a sensible thing to do. However, as noted by Wimmer (1996) in German phonological dyslexics, early difficulties with accurate phonological coding and phonemic segmentation were no longer found at the end of grade four. The children he investigated then read very slowly and had poor spelling. For Bahasa Indonesia, a longitudinal study needs to be carried out with children like those in the third group who showed problems with phonological coding to find out whether they only suffer a reading delay or reading impairment. Slow reading without phonological coding and phonemic segmentation problems may point out that the latter is true.

Yet, even at the beginning of third grade, reading latencies may serve to differentiate good from poor readers. As shown in Table 6, the poorer the reading performance of the participants is, the more time they needed to read aloud the test items. Although this statement is based only on the data of five of the ten participants, the suggestion that sub-lexical route development in comparison with that of the lexical route can be observed in reading latencies seems to be well grounded. Once the sub-lexical route for words with simple graphemes, consonant clusters, and digraphs are well established, lexical reading for those words are established and this shortens the time needed to read them. This fast and automatic sight word process of reading (Ehri, 1995) seems to characterize the performance of the participants in the first group. It remains to be seen with larger sample of beginning readers whether reading latencies in Bahasa Indonesia indeed correlates with reading success. A longitudinal study can also be carried out to see

the stability of the grouping and the comparison of reading latencies among the groups.

This longitudinal study is needed also to check how much the performance of the readers has improved since Defior et al. (1996) found out that poorer readers in their study improved slower and needed more time (up to the fourth school grade) but still with only 70% correct response rate compared to 90% of the good readers. As mentioned by the class teachers of the participating students in a personal interview, over the years children come to elementary school with different levels of reading. The majority (about 80%), who went to kindergarten, already have good letter knowledge and can read simple words at the beginning of first grade. On the other hand, the remaining 20% are real novice. Perhaps the aforementioned characteristics of the third group have something to do with this late start. If the children just need more time for mastering GPC and developing their lexical route, by fourth grade those difficulties should have been overcome.

However, there are still some loose threads emerging from this research. The first is regarding rime level phoneme awareness. Younger, preliterate children need to be investigated to find out the universality of the rime level phoneme awareness as discussed by Goswami and Bryant, 1990. Perhaps the absence of a correlation between rime level phoneme awareness in the present investigation is due to the teaching methods used in Indonesian elementary schools which somehow alters the rime level phoneme awareness. The second is the question of identifying subtypes of dyslexia in Bahasa Indonesia. While there are some indications of developmental phonological dyslexia observed in this sample of beginning readers, the indications of developmental surface dyslexia are still not clear. This may have been due to the fact that tasks containing irregular words could not be presented in the present investigation. The third is the question regarding psycholinguistic variables and their influence on the lexical access in Bahasa Indonesia. The fact that the reading tasks arranged according to syllable number and imageability also contained irregular words seems to blur the t-test results. It cannot be made certain that the significant difference found was due to the psycholinguistic variables controlled in those tasks or due to irregularity. However, it may be the case that the psycholinguistic variables (e.g. Late Age of

Acquisition) are actually due to the sound structure of the words and hence the inclusion of irregular words in a task controlling for Late AoA is unavoidable. For example, in Task 9. Late AoA abstract nouns 2 syllables, five of the six nouns contain digraph. Perhaps, those nouns are late to be acquired due to their more complex sound structure. Hence, irregularity and other linguistic variables need to be teased apart in future administration of this dyslexia screening-test. The fourth loose thread is related to phonological awareness and reading success. If syllable level phonological awareness is correlated with reading success in Bahasa Indonesia, why was significant correlation failed to be found between reading scores and Syllable Detection scores and between reading scores and Reversing Syllable in Nonwords scores? Replication with another, bigger sample of third graders may shed light into this question. All the aforementioned loose threads are future work to be done to improve the dyslexia screening-test and add to the knowledge about reading in Bahasa Indonesia.

5. Conclusion

From the present research, some points can be concluded. They are the following.

1. At the beginning, reading success in Bahasa Indonesia depends on sub-lexical route, but later on skilled reading seems to depend on lexical route. The lexical route progresses selectively in that the one for simple graphemes is developed before that for consonant clusters and the last lexical route to be developed is that for digraphs. This development of the lexical route seems to depend on the development of the sub-lexical route that is influenced by the complexity of the Grapheme Phoneme Correspondence (GPC for simple graphemes is less complex than that for consonant clusters which in turn is less complex than that for digraphs). This GPC complexity leads to the consonant clusters and digraphs simplification that are perhaps just visually driven, phonologically driven, or are suspect to word or pseudoword substitutions. In addition, Late AoA, imageability, syllable number, and resemblance to words influence the processing of the stimuli in the test.
2. Based on the findings, impaired reading in Bahasa Indonesia may be

characterized by delay in the development of the sub-lexical route. The reading errors of the at-risk children are not constrained by the visual similarity between what is read and their response giving rise to totally different-looking letter substitutions (e.g. M for NG) and word or pseudoword substitutions (e.g. "keluarga" for "kalung"). As also found in other languages with shallow orthography, the performance of children with specific reading impairment in Bahasa Indonesia may also be characterized by considerably longer reading latencies when compared with that of other children with comparable IQ and age.

REFERENCES

Alwi, H., S. Dardjowidjojo, H. Lapoliwa & A.M. Moeliono. (2003) *Tata Bahasa Baku Bahasa Indonesia* (third edition). Jakarta: Balai Pustaka.

Barry, C. & S. Gerhand. (2003) Both concreteness and age-of-acquisition affect reading accuracy but only concreteness affects comprehension in a deep dyslexic patient. *Brain and Language, 84*, 84-104.

Beaton, A.A. (2004) *Dyslexia, Reading, and the Brain: A Sourcebook of Psychological and Biological Research.* Hove: Psychology Press.

Bonin, P., C. Barry, A. Méot, & M. Chalard. (2004) The influence of age of acquisition in word reading and other tasks: A never ending story? *Journal of Memory and Language, 50*, 456-476.

Coltheart, M. (1996) Phonological Dyslexia: Past and Future Issues. *Cognitive Neuropsychology, 13*(6), 749-762.

Coltheart, M., B. Curtis, P. Atkins, & M. Haller. (1993) Models of reading aloud: Dual-route and parallel-distributed-processing approaches. *Psychological Review, 100*, No. 4, 589-608.

Coltheart, V. (1988) Effects of word imageability and age of acquisition on children's reading. *British Journal of Psychology, 79*,1.

De Bleser, R. 1dyslexia1.pdf. EMCL 2005-2006 Developmental and Acquired Dyslexia and Dysgraphia class lecture document, University of Potsdam, Germany.

De Bleser, R. & R. Keim. (2002) "Südtiroler Lesetest (1st Beta Version)". Autonomous Province of Bolzano.

Defior, S., F. Justicia, F.J. Martos. (1996) The influence of lexical and sublexical variables in normal and poor Spanish readers. *Reading and Writing: An Interdisciplinary Journal, 8*, 487-497.

Ehri, L.C. (1995) Phases of development in learning to read words by sight. *Journal of Research in Reading, 18* (2), 116-125.

Ehri, L.C. & L.S. Wilce. (1987) Cipher versus cue reading: An experiment in decoding acquisition. *Journal of Educational Psychology, 79* (1), 3-13.

Fawcett, A.J. & R.I. Nicolson. (1995) Persistence of phonological awareness deficits in older children with dyslexia. *Reading and Writing: An Interdisciplinary Journal, 7*, 361-376.

Field, John. *Psycholingistics: The Key Concepts*. London:Routledge.

Funnel, E. (2000) Deep dyslexia. In E. Funnel (ed.) *Case Studies in the Neuropsychology of Reading*. Hove: Psychology Press Ltd.

Gerhand, S. & C. Barry. (2000) When does a deep dyslexic make a semantic error? The roles of age of acquisition, concreteness, and frequency. *Brain and Language, 74*, 26-47.

Goswami, U. & P. Bryant. (1990) *Phonological Skills and Learning to Read*. Hove: Lawrence Erlbaum Associates Ltd.

Harm, M.W. & M.S. Seidenberg. (1999) Phonology, reading acquisition, and dyslexia: Insights from connectionist models. *Psychological Review, 106* (3), 491-528.

Hynd, George W. (1983). *Dyslexia: Neuropsychological theory, research, and clinical differentiation*. New York: Grune & Stratton.

Iribarren, C., G. Jarema, & A.R. Lecours. (1999) Lexical reading in Spanish: Two cases of phonological dyslexia. *Applied Psycholinguistics, 20*, 407-428.

Liberman, I.Y., D. Shankweiler, F.W. Fischer, B. Carter (1974). Explicit syllable and phoneme segmentation in the young child. *Journal of Experimental Child Psychology, 18*, 201-212.

Lindgren, S.D., E. de Renzi, L.C. Richman (1985) Cross-national comparisons of developmental dyslexia in Italy and the United States. *Child Development, 56* (6), 1404-1417.

Masterson, Jackie. (2000). Developmental surface dyslexia. In Elaine Funnel (ed.). *Case Studies in the Neuropsychology of Reading* (pp. 123-148). Hove: Psychology Press Ltd, Publishers.

Morrison, C. & A. Ellis (1995) Roles of word frequency and age of acquisition on word naming and lexical decision. *Journal of Experimental Psychology, Learning, Memory, and Cognition, 21*, (1), 116-133.

Morrison, C. & A. Ellis (2000) Real age of acquisition effect in word naming and lexical decision. *British Journal of Psychology, 91*, 167-180.

Nopola-Hemmi, Jaanamarja. (2002) *Familial Dyslexia: Genetic and Neuropsychological Findings*. Online material, Helsinki University Biomedical Dissertation.

Paulesu, E., J. -F. Demonet, F. Fazio, E. McCrory, V. Chanoine, N. Brunswick, S.F. Cappa, G.Cossu, M. Habib, C.D. Frith, U. Frith. (2001) Dyslexia:

Cultural diversity and biological unity. *Journal of the Simplified Spelling Society, 29*, 14-18.

Plaut. D.C. (1999) A connectionist approach to acquired word reading and acquired dyslexia: Extension to sequential processing. *Cognitive Science, 23* (4), 543-568.

R Development Core Team (2005). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R- project.org.

Rack, J.P., M.J. Snowling, & R.K. Olsen. (1992) The nonword reading deficit in developmental dyslexia: A review. *Reading Research Quarterly, 27* (1), 28-53.

Riccio, C.A. & G.W. Hynd. (1995) Contributions of neuropsychology to our understanding of developmental reading problems. *School Psychology Review, 24* (3).

Seidenberg, M.S. (1993) A connectionist modelling approach to word recognition and dyslexia. *Psychological Science, 4* (5), 299-304.

Siegel, L.S. (1992) An evaluation of the discrepancy definition of dyslexia. *Journal of Learning Disabilities, 25* (10). 618-629.

Siegel, L.S. (1998) Phonological Processing Deficits and Reading Disabilities. In J.M. Metsala & L.C. Ehri (eds.) *Word Recognition in Beginning Literacy.* Mahwah: Lawrence Erlbaum.

Snowling, Margaret J. (2000). *Dyslexia.* Malden: Blackwell Publishing.

Stanovich, K.E. (1980) Toward an interactive-compensatory model of individual differences in the development of reading fluency. *Reading Research Quarterly, 16* (1), 32-71.

Tim Bina Karya Guru. (2004) *Bina Bahasa dan Sastra Indonesia untuk Sekolah Dasar Kelas 1.* Jakarta: Penerbit Erlangga

Treiman, R. Onsets and rimes as units of spoken syllables: Evidence from children. *Journal of Experimental Child Psychology, 39*, 161-181.

von Euler, K., Ingvar Lundberg, & Gunnar Lennerstrand (eds.). (1989) *Brain and Reading: Structural and Functional Anomalies in Developmental Dyslexia with Special Reference to Hemispheric Interactions, Memory Functions, Linguistic Processes and Visual Analysis in Reading.* Hampshire: The Macmillan Press Ltd.

Wagner, R.K. & J.K. Torgesen. (1987) The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin, 101* (2), 192-212.

Wimmer, H. & U. Goswami. (1994) The influence of orthographic consistency on reading development: word recognition in English and German children. *Cognition, 51*, 91-103.

Zoccolotti, P., M. De Luca, E. Di Pace, A. Judica, M. Orlandi, & D. Spinelli. (1999) Markers of developmental surface dyslexia in a language (Italian) with high grapheme-phoneme correspondence. *Applied Psycholinguistics, 20*, 191-216.

(http://www.smithsrisca.demon.co.uk/PSYellisyoung1988.html)