

PHONOLOGICAL DEVIATIONS PRODUCED BY DYSLEXIC ADOLESCENTS IN INDONESIAN LANGUAGE

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Abstract

Despite Indonesian's transparent orthography and frequent reading exposure, dyslexic students continue to experience reading impairments into adolescence. This study aimed to analyse the phonological deviations observed during dyslexic adolescents' reading activities in an inclusive school in Surabaya. This qualitative study involved face-to-face reading tests using a corpus-informed instrument comprising 180 phonologically selected keywords arranged into 55 sentences, administered to two adolescent participants with dyslexia. Of 55 total errors, 33 were phonological; most outputs were non-words (20/33). Feature-changing was the predominant process (16/33), typically preserving at least one feature (often place of articulation), consistent with subtle but systematic sub-lexical grapheme–phoneme mapping weaknesses. Vulnerabilities clustered around velar segments (/k, g, ŋ, x/) and high-load contexts—consonant clusters (e.g., /st/, /tr/), digraphs (<ng>, <kh>), and vowel/consonant sequences—often managed via epenthesis (e.g., schwa insertion in /st/, /ŋ/→/ŋg/) or deletion (e.g., coda /k/). Some patterns (e.g., /v/→/f/, /ʃ/→/s/, schwa in /st/) aligned with Javanese phonotactics, while others (e.g., certain velar substitutions) were not L1-explainable, underscoring a core phonological-decoding deficit. Findings indicate that, even after years of literacy exposure, phonological decoding remains the major handicap for Indonesian-speaking dyslexic adolescents; assessments and interventions should therefore target sub-lexical mapping in clusters, digraphs, codas, and velars, while accounting for local phonotactic influences.

Keywords: adolescent, dyslexia, Indonesian language, literacy skills, phonological deviation.

INTRODUCTION

The ability to read is required in academic life. It is a crucial skill that students need to acquire during the school period, as most of the knowledge they encounter comes from written sources, such as books or academic articles. Experts agree that reading is a very complex ability which involves a lot of different constituent processes that operate in parallel (de Groot, 2013; McNamara & Kendeou, 2017), such as the process of decoding and accessing lexical entries (Field, 2003). Individuals with good reading ability encounter no significant problems in converting written form into speech form and then obtaining the meaning (Field, 2003). However, for individuals with reading disability, the process is not easily done. The difficulties experienced by them often cause errors in reading and even failure in comprehending the meaning of the text. This impairment in reading is called dyslexia. This, unfortunately, affects their achievement at school.

Demonet (2004)(2004) defined dyslexia as an unexpected, specific, and persistent failure to acquire efficient reading skills despite conventional instruction, adequate intelligence, and sociocultural opportunity. It means that, even though dyslexics are highly intelligent (Beaton, 2004), this impairment makes them fail to acquire reading ability which makes them disable to identify certain written words, thus makes them read incorrectly. Thus, at school, where most activities involve reading and writing, these children hardly catch up their same-age friends in understanding the lesson since they often have difficulty to understand the written language. This, unfortunately, may affect their academic performance and later in their lives may affect their achievements if the impairment is not immediately treated. In Surabaya, there are quite many students that suffer from dyslexia. Nawangsari and Suprpti (2008) recorded that 19,8% elementary school students suffer from dyslexia. People might have been aware about dyslexia and the effect on the academic period of children as well as in adolescence. This is proven by the increasing numbers of inclusive schools that concerns with therapies for students with dyslexia, Nevertheless, there are quite a few studies, particularly in Indonesia, that discuss the disorder in linguistic point of view even though it affect the reading ability which involve linguistics aspect (Jap et al., 2017)

There are quite many claims about which aspect in the lower level reading process that influences this impairment (Bellocchi et al., 2013; Lallier et al., 2014; Sanders, 2001; Valdois et al., 2014). Yet, among the many skills that are involved in lower level of reading, phonological awareness becomes the skill that highly contributes in the accuracy of reading (Bonifacci & Tobia, 2016). Furthermore, the impaired visual span, which also affect reading performance of the dyslexic readers, only contributes to the speed of reading (Lallier et al., 2014; Valdois et al., 2014). In addition, Bose, Colangelo, & Buchanan (2011) examined how the complexity of the words influences the reading accuracy in children with dyslexia. They found that the more complex the word that is read, the less likely those readers will read correctly.

Nevertheless, in treating the students with dyslexia, it is important to understand the process of reading to find out which reading ability is impaired in order to make the treatment more effective and efficient since there are processes occurred in reading and sometimes, not every dyslexic students suffer from all of it. One of the characteristics of dyslexic reader is their poor reading ability compared to their same age peers in terms of reading accuracy and comprehension, (Anjarningsih, 2011). The lack of accuracy is caused by the neurological impairment which results dyslexics to suffer deficiency in phonological awareness (Sanders, 2001). This makes them difficult to identify the graphemic patterns of written symbols with associated sound (identifying the orthography principals), thus appear as inaccuracy in reading. The deficiency in this aspect also gives them hard times in differentiating similar words. They also tend to insert or delete particular sounds in a word and or skip one or two words in reading a full sentence. The difficulties in identifying the orthography principals also appear even in language with transparent orthograpy like Indonesian language. Eliza (2016) found on her seven Indonesian dyslexic participants showed low accuracy in reading 40 vocabularies prepared in her istrument. However, among the vocabularies used, there was none consonant cluster that was tested.

The mentioned studies illustrate how the various causes of the deviation and the effects that appear in dyslexic children during their reading activity. Sometimes, the variety of the deviation is not determined by the child's age. In a school for students with special needs in Surabaya, Galuh Handayani, some of the dyslexic students in elementary class show better reading performance than their dyslexic senior who are already in high school even though both of them are undergoing treatment with their therapist with the same frequency. The symptoms appear in each student are also varied, even though in some phonological

environment that involves certain phoneme, such as /ŋ/ which is symbolized by two consonant letters <ng>, most of them show similar patterns of deviation.

Numerous studies confirmed that the possibilities of the impairment persist until adolescence. Shaywitz, et al. (1999) found that their data indicated that deficits in phonological coding continue to characterize dyslexic readers even in adolescence. Another similar result was indicated in a longitudinal research conducted by Undheim (2009). She found that, by the age 16, the participants performed less well in English than their counterparts, but showed similar results in their mother tongue language (Norwegian). However, at age 23 they all showed lower decoding abilities, reading and writing skills than their cohort. Nevertheless, their educational level is not much lower than their cohort as young adults. Chung, et al. (2010) also found that the participants with dyslexia were significantly weaker than controls in the five cognitive measures: RAN, verbal STM, visual-orthographic knowledge, morphological and phonological awareness. Considering the explanation given above, this study aims at analysing the patterns of the phonological deviations occurred in reading activity of dyslexic adolescents in Surabaya.

This qualitative study asks how and in what ways adolescent dyslexic readers produce phonological deviations during Indonesian reading-aloud, and how they make sense of these deviations in practice. It seeks to characterize the patterns that emerge, and to understand the conditions under which they arise. It further explores participants' own accounts and strategies, attends to the role of linguistic background in shaping or differentiating these patterns, and interprets moments where deviations yield non-words versus real-word substitutions as windows into sub-lexical grapheme–phoneme mapping.

Method

The present study was designed as a qualitative study as the data collection was conducted in natural setting, which is one of the characteristics of qualitative approach (Creswell, 2014). The data were collected during the reading activity of the participants. Moreover, the data collection was also conducted only by observing the participants' reading process and was done in face-to-face interaction. In order to obtain the data, an instrument, texts to read, were presented. The instrument was made by the researchers themselves.

The subjects in the current study were two junior high school students (age 14 and 16 years old) with dyslexia and had no comorbid impairment. Hereafter, the term participants were used to refer to the subjects of this research. In Sekolah Inklusi Galuh Handayani, the students' range of age is equivalent to students of grade 7 and 9 respectively. The range of grade was chosen considering that at that grade the students are exposed to sufficient amounts of readings. Moreover, the students have been taught to read for quite a long time. Therefore, it was expected that they would be able to read at least basic words and simple sentences.

The instrument that was prepared was 160 words which was then constructed into 55 sentences that was expected to stimulate any pattern of deviations. The words used in the sentences were obtained using corpus methodology from texts in five student books of Indonesian Language lesson for Grade 6. Student book for grade 6 was chosen because there is an unknown degree of delay in reading ability experienced by the dyslexic students despite the sufficient amount of language exposure. Therefore, the vocabularies used in grade six were chosen with the assumption that their range of frequency and difficulties were equal with the reading ability that was expected to be acquired by the participants. Another consideration in choosing the words was the phonological features. The phonological aspects that were taken into account were the presence of two types of syllable (opened and closed), the two types of vowel (monophthong and diphthong) and the types of consonant sequence in a syllable (singular and cluster). The words used in the instrument were designed in such a way so that they covered all of those aspects.

The instrument was also tested in several adolescent students without dyslexia whose grade and age were equal with the participants to find out whether the instrument was suitable to be tested. The result showed that the students without dyslexia were significantly better in both reading accuracy and comprehension. There were only few inaccuracies in reading the text (less than 5 errors). This showed that the instrument was not difficult to be read and answered by adolescent students without dyslexia. In brief, the data were collected by recording using audio recorder the reading test. During the reading test, each participant was asked to read 55 sentences.

In analysing the phonological aspect Phonological operation (Davenport & Hannahs, 2005) is applied. According to them, phonological operation means a set of phonological processes which occur in producing sounds. He stated that there are five categories of operation which occur during the production of sound, namely: Feature Changing-rules, deletion, Insertion, Metathesis, and Reduplication. Furthermore, since the language in discuss is Indonesian Language, the rules and phonological systems of Indonesian language is applied. There are two categories of phonemes in Indonesian language based on the existence of air flow blockage in sound tunnel; vowels and consonants (Alwi et al., 1998). The following is table of vowel phonemes along with the representative grapheme.

Table 1. Vowel Phonemes of Indonesian Language

i	e		a	o	u	ai	au	oi
/i/	/ə/	/e/	/a/	/o/	/u/	/ay/	/aw/	/oy/

The other category of phoneme in Indonesian Language is consonant phonemes. The following are tables of vowels and consonant phonemes in Indonesian Language.

Table 2. Consonant Phonemes of Indonesian Language

Place of Articulation		Bila- bial	Labiod- ental	Dental/al veolar	Palatal	Velar	Glottal
Manner of articulation							
Stop	Voiceless	p		t		k	
	Voiced	b		d		g	
Affricate	Voiceless				c		
	Voiced				j		
Fricative	Voiceless		f	s	š	x	h
	Voiced			z			
Nasal	Voiced	m		n	ñ	ŋ	
Vibrate	Voiced			r			
Lateral	Voiced			l			
Semivowel	Voiced				y		

Commonly, in a language with a transparent orthography like Indonesian Language, each sound can be represented with a single grapheme and vice versa (Winskel & Widjaja, 2007). In addition, some of consonant clusters were also included in the instrument to find how the participants read the cluster.

Findings and Discussion

Among the 160 words tested, there are 55 occurrences of deviations. However, among those deviations, only 33 belong to phonological deviations. The consideration for it was based upon the linguistic level of the deviations. Those 33 deviations were occurred in the phonemic level, thus they were categorized as phonological deviations. Meanwhile, the other 22 deviations occurred in the morphemic level, thus categorized as morphological deviations. However, the present study only focus on the phonological deviations. Table 3. List frequency of phonological deviations that produced both non-words and other semantic meaning in each word class.

Table 3. The Phonological Deviation Frequency Based on the Meaning

No	Word class	Non-words	Other semantic meaning
1	Noun	11	5
2	verb	5	4
3	adjective	3	0
4	adverb	1	2
	total	20	11
	pronoun	2	

As it is described in Table 3, there are several characteristics that can be seen from it. The first one is that phonological deviations occurred in all word classes involved in this study. Among the 33 occurrences of phonological deviation, 20 of them were non-words and only 11 words were produced in the process. In addition, among the five phonological processes that Davenport & Hannah (2005) proposed, only four of them presented in the deviations produced by both of the participants; feature-changing, insertion, deletion, and methathesis. In addition, there were several words produced after experiencing more than one phonological processes. Table 4 shows the distribution of occurrences in the phonological processes.

Table 4. The Occurrence Frequency of Phonological Deviation

No	Type of Phonological deviation	Number of occurrence
1	Feature Changing	16
2	Insertion	6
3	Deletion	4
4	Combination	7
	Total	33

As shown in table 5, the most frequent phonological processes that occur was feature changing. According to (Davenport & Hannahs, 2005), feature changing process happens when there is one or more phonemes that experience changes in their phonological features. Table five list the words that experienced this process.

Table 5. The Phonological Process Occurred in the Deviations

Feature changing	Participant
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Place of articulation: Dental/Alveolar fricatives						
Phoneme :/z/						
1	3302	zamrud (N)	sssamrud	[samrud]	P1	
2	3603	zamannya (N)	samannya	[samanña]	P2	
Phoneme /ʃ/						
3			keasikan	[kəasikan]	P1	
4	4002	keasyikan (A)	keasikan	[kəasikan]	P2	
Place of articulation: Alveolar Stop						
Phoneme :/t/						
5	2201	Membuat (V)	membuak	[məmbuak]	P2	
6	2401	Dido (pronoun)	Dito	[dito]	P2	
Place of articulation: Bilabial stops						
Phoneme /p/						
7	601	pelajar (N)	belajar	[bələjar]	P2	
8	3004	pengasuh (N)	mengasuh	[məŋasuh]	P2	
9	4001	pengacau(N)	mengacau	[məŋacau]	P2	
10	301	Penyihir (N)	menyihir	[məñihir]	P1	
Phoneme /b/						
11	3001	berenang (V)	merenang	[məɾənaŋ]	P2	
Place of articulation: velar						
Phoneme :/k/						
12	3005	khawatir (V)	kawatir	[kawatir]	P2	
Phoneme : /g/						
13	2504	Ketiga (Adv)	ketika	[ketika]	P2	
14	2504	Ketiga (Adv)	ketika	[ketika]	P1	
Consonant /m/ and vowel /a/						
15	3702	flamboyan (N)	flaiboyin	[flaiboyin]	P2	
Vowel phoneme /u/						
16	303	Mengutuk (V)	mengetuk	[mengetuk]	P1	
Insertion						
Vowel Phoneme Insertion						
1	4501	atraksi(N)	ataraksi	[ataraksi]	P1	
2	3901	stasiun(N)	setasiun	[sətašium]	P1	
Consonant Velar						
3	4401	mengamplas (V)	menggamplas	[menggamplas]	P1	
	1802	mungil (A)	munggil	[munggil]	P1	
Consonant bilabial						
4	3301	zamrud (N)	zambrud	[zambrud]	P2	
Syllable insertion						
6	1402	akuarium (N)	akuaraium	[akuaraium]	P1	
Deletion						
Vowel						
1	1402	Akuarium (N)	akurium	[akurium]	P2	

Consonant: Velar /ŋ/ and /k/					
2	3003	melarang (V)	melara	[məlara]	P2
3	4801	mengiklankan (V)	mengilankan	[meŋilankan]	P1
Consonant: alveolar /n/					
4	1001	Nanda (pronoun)	nada	[nada]	P2
Methathesis					
	3201	siang (N)	singa	[siŋa]	P2
Combination					
Insertion and deletion					
1	503	ladang (N)	landa	[landa]	P2
2	4501	Atraksi (N)	astrasi	[astrasi]	P2
Insertion and Feature Changing					
	3201	dedaunan (N)	dindanunan	[dindanunan]	P1
Deletion and Feature changing					
3		Digulai (V)	digulay	[digulay]	P1
			digulay	[digulay]	P2
Insertion, Feature Changing, and Metathesis					
4	604	akhirnya (Adv)	lahrinya	[lahrinya]	P2

As shown in Table 5, there were nine feature changes in phoneme. The first one was phoneme /z/ in the word *zamrud* (emerald) and *zamannya* (her era). Originally, /z/ is alveolar voiced fricative. However, during the reading activity Participant 1 change the phoneme feature into voiceless, though the place of articulation remains the same. Thus /z/ was sounded /s/.

Another fricative that experienced this process was found in the word *keasyikan* (engrossingly). Unlike the previous fricatives discussed, this occurred in the middle of the word, though also becomes the initial sound of a syllable. This fricative phoneme /ʃ/ experienced the change in its place of articulation. Both participants pronounced this palatal fricative as alveolar fricative /s/.

In text 601, Participant 2 misread two similar words; *pelajar* (student) and *belajar* (study). This occurrence shows that the target phoneme /p/, which is bilabial voiceless stop, in the word *pelajar* changed into its voiced counterpart /b/. However, the participant also changed the voiced /b/ in the word *belajar* into its voiceless counterpart. This change of feature might happen due to the similarity of letter p and b in terms of the form. Dyslexic readers are known to experience confusion in identifying letter with similar form and tend to see them reversed or upside down (Sanders, 2001). Thus, it is expected to find this occurrence in the word-reading product of dyslexics.

Other than occurring the mirror effect symptoms, the stops phonemes /p/ and /b/ also experienced the change into the nasal /m/. This feature change occurs in the word *pengasuh* (governess), *pengacau* (mischief-maker), *penyihir* (witch) and *berenang* (to swim). The following transcriptions illustrate the deviation

The similarity of those three sounds is their place of articulation; bilabial. However, /p/ and /b/ are stops while /m/ is nasal. Another similarity of this phonological process is their phonological environment. All of the phonemes that changed are preceding phoneme /ə/. However, further research is needed to verify the correlation of this tendency.

The fifth phoneme which experienced this phonological process is velar /x/ that is found in the target words *khawatir* (worried) and *ketiga* (the three). This following is extracted from the texts read by the participant

Similar to previous phonemes, the deviations shared the same place of articulation with the phonemes in target words. Participant read [xawatir] as [kawatir]. And to this, the voiced fricative /x/ in the initial sound of the word was changed into voiceless stop /k/. However, only Participant 2 who produced this deviation. Participant 1 pronounced the phoneme /x/ correctly. In the second text, both participants read [kətiga] as [kətika]. Similar to the first word, they changed the voiced velar phoneme /g/ into the voiceless /k/.

Another two phonemes changed were found in the word *flamboyant* (Flamboyant). Unlike the previous five phonemes which are consonants, the feature change occurred in this word involved vowel phonemes. Instead of inaccurately reading the more difficult cluster placed in the beginning of the word, the participant read the later consonant and vowel phonemes inaccurately. He read [flamboyant] into [flaiboyin]. In this case he changed nasal consonant phoneme /m/ into high vowel phoneme /i/. Moreover, he also changed the low vowel /a/ into high vowel phoneme /i/.

The last feature change occurred in the word *mengutuk* (to curse). The vowel that was changed in this deviation is /u/. In this occurrence, the deviation also appeared in the word which contain /ə/. However, this time it is the vowel phoneme that change. The target phoneme was /u/ which is back and closed vowel. However, the phoneme produced in the deviation was centre and middle vowel /ə/. Unlike the previous feature changing in vowel phoneme which only changed the shape of the lips, this process was not only changed the shape of the lips but also the position of the tongue.

As it is shown in Table 4 the second most frequent phonological process occurred in the Participants' deviations is insertion (n=6). This process involved the adding of one or more phonemes in a word (Davenport and Hannahs, 1998). Commonly, this occurred when Javanese utter borrowed or foreign vocabularies which contain cluster such as *stop*. It is common for Javanese to insert phoneme /ə/ between the initial cluster of /s/ and /t/ whenever uttering the word. Thus, instead of pronouncing it as [stop], they are more likely to pronounce it [sətop].

The first phoneme insertion was experienced by Participant 1 in the target word *stasiun* (station). Both of these insertions involved two different vowel phonemes and occurred within consonant cluster. The second phoneme insertion involved phoneme /g/. There are two target words in which this insertion occurred. Both words contain phoneme /ŋ/ and phoneme /g/ was inserted after /ŋ/ in them. This changed the target word [muŋil] (tiny) into [muŋgil] and [meŋamplas] (sanding) into /meŋamplas/. Participant 1 apparently only produced this kind of deviation when reading the word *muntil* and *mengamplas*. There were several target words which contained phoneme /ŋ/ within them that were prepared in the instrument such as, *menyeberangi* (to cross), *pangeran* (prince), *tengah* (middle), *mengerjakan* (to do), *pengasuh* (governess), *pengacau* (mischief-maker), and *mengiklankan* (to advertise). Some of them contain similar phonological environment to the two words in discussed; phoneme /ə/ and /a/ flanked phoneme /ŋ/ (*tengah*, *pengasuh*, and *pengacau*). Nevertheless, the insertion only occurred in *mengamplas*. Moreover, this type of insertion is only experienced by Participant 1.

The third insertion was experienced by Participant 2 when reading the word *zamrud* (emerald). In reading this word, unlike Participant 1 who changed the feature of initial phoneme of the word, Participant 2 inserted phoneme /b/ within consonant sequence contained in the word; /m/ and /r/. In this case, Participant 2 inserted phoneme which share similar feature with the one preceeding it; /m/ and /b/ are both bilabial and voiced. In regards of the similar place and manner of articulation, inserting phoneme /b/ would only take a little more pressure on lips. The last type of insertion occurred in the word *akuarium* (aquarium). In reading this, Participants 2 inserted phoneme /a/ in the fourth syllable after phoneme /r/ and thus create

syllable –ra- within the word. In result, this changed the meaningful target word [akuarium] into meaningless non-word [akuaraium].

The third phonological process found in the Participants' deviations is deletion. In short, this process is simply omitting one or more phonemes during the process. During the reading test, there were five deletions that were found. In all of them, the phonemes involved were various. Moreover, the deletions were located in different segment of words; either in the middle or final segment.

The first deletion was presented in the target word *akuarium* (aquarium). This target word experienced different phonological process from each Participant. It has been explained in the previous paragraph that Participant 2 inserted a phoneme within this word. Meanwhile, Participant 1 omitted one phoneme.

Another phoneme deletion that was produced by Participant 1 occurred in the the target word *mengiklankan* (advertise). The similarity of this deletion lies on the segment in which the deleted phoneme was located and the phonemes surrounded them. In both target words, the deleted phonemes were located in the middle segment of the words; a-ku-a-ri-um and meng-ik-lan-kan. However, if the words were broken down into their syllables, since each of those phonemes was vowel and consonant, they represent different segment of syllable. Phoneme /a/ which was deleted in *akuarium* was the nucleus of that syllable. Meanwhile, phoneme /k/ which was deleted in the later word was the coda of that syllable. Nevertheless, both phonemes were included in vowel and consonant sequence in each target word respectively. In the word *akuarium*, vowel phoneme /a/ came following vowel phoneme /u/ while in the word *mengiklankan* consonant phoneme /k/ came preceding consonant phoneme /l/. When the two vowel phonemes came continuously, Participant 1 chose to omit phoneme /a/ instead /u/. In addition, if we take a look at the phonological feature of /k/ and /l/, there was no similarity can be found. Phoneme /k/ is velar voiceless stop meanwhile phoneme /l/ is lateral voiced. When the two consonants came continuously, Participant 1 chose to omit phoneme /k/ instead of /l/.

The last phoneme deletion occurred in the target word *melarang* (forbid). Unlike the previous two occurrences, this one occurred in the final consonant sound of the word. Participant 2 omit the nasal sound /ŋ/ and left the final segment of the word with an open syllable.

As it is shown in table 4, the last type of phonological process found in the deviations of both participants is combination. In this type, five target words experienced more than one processes in the formulation of deviation. However, one of which change into the same product when was being read by both participants.

The first two deviation which were formed through this process were produced by participant 2. In this type of deviation, two target words were involved; *ladang* (field) and *atraksi* (atraction). In the two occurrences, both words experience phoneme insertion and deletion. It may seem quite uncommon for the same word to experience two contradictory processes. Nevertheless, one of the participants involved in this study produced them. The transcriptions illustrated that the participant inaccurately read the word *ladang* (corn field) and *atraksi* (performance). The deviations he produced were both non-words; *landa* and *astrasi*. If we break the process down, it can be seen that insertion occurred in the earlier segment of the word meanwhile the deletion occurred in later part of the words.

Other than the type, there are also a couple of similarities found in this two occurrences. The first one is the feature of the phoneme inserted. Both phoneme inserted in each of the words, /n/ and /s/, share similar place of articulation; alveolar/dental. In addition, they are inserted preceding two phoneme which place of articulation are also dental/alveolar and are stop consonants; /d/ and /t/. Other similarities are the phonemes deleted. Both of the phonemes deleted in the two words are velar phonemes; nasal /ŋ/ and stop /k/. The deleted phoneme /k/, particularly, was located preceding consonant /s/. Thus, in target word *atraksi*, the two

consonant phonemes formed consonant sequence. This occurrence was also experienced by Participant 1 which omit phoneme /k/ by the time it came as consonant sequence preceding phoneme /l/.

The second type of combination process involved insertion and feature changing. This combination occurred in word *dedaunan* (leaves), and produced by Participant 2. The following transcriptions illustrate the sentences in which the deviations occurred.

3201 (Target) *Siang itu angin sepoi berhembus meniup dedaunan di ranting pohon*

(Participant 2) *Siang itu angin sepoi berhembus meniup dada... dan... [dindanunan] di ranting pohon*

According to the transcription, Participant 2 produced the deviation after struggling to read the target word. He tried to read the initial part of the word before finally read it *dindanunan*. As illustrated in the transcription, there was a phoneme which feature had been changed, /e/, and a phoneme that was inserted in two different segments of the word; /n/. Phoneme /e/ in *dedaunan* was changed into /i/ in the process. Meanwhile, phoneme /n/ was inserted between phoneme /i/ and /d/ also between vowel sequence /a/ and /u/ in later segment of the word. Similar to insertions explained previously, the phoneme inserted in this case also share similar feature with phoneme following it. Phoneme /n/ and /d/ share similar place of articulation. Moreover, this process also occurred in the word with phoneme sequence. However, instead of omitting one of the phonemes, the participant inserted one phoneme to separate the vowel which was located in sequence.

The last type of combination processes involved three phonological processes; insertion, feature changing, and metathesis. This deviation is produced by Participant 2 when he read the target word *akhirnya* (finally). Similar to previous explained processes, this deviation occurred in a word which contain velar vowel. The process would be explained in sequence based on the place where the process occurred in the word instead of based on the chronological order. The process is illustrated in the following diagram.

$$V_1 - C_1V_2C_2 - C_3V_3 \rightarrow C_xV_1C_1' - C_2V_2 - C_3V_3$$

According to the diagram, this deviation, lateral phoneme /l/ (C_x) is inserted preceding the initial phoneme /a/ (V_1). Then in the later segment of the word, velar phoneme /x/ (C_1) which is represented by consonant sequence [kh] changed into glottal phoneme /h/ (C_1'). However, the other two features of the original phoneme remain similar with the produced phoneme; voiceless fricative. Then the last process occurred was metathesis. This occurred in the middle segment of the word. The two phonemes following /x/ changed their order in the word; originally /i/ (V_2) then /r/ (C_2), changed into /r/ (C_2) and /i/ (V_2). This result a change of the syllable form of the word. The original syllable form which was CVC changed into CV. The last segment of the word remained unchanged.

Another metathesis also occurred in one of the words *siang* (midday). Participant 2 read the word as *singa* (lion). The metathesis, hence, occurred in the second syllable of the word and in the process it rearranged the structure of the vowel and the consonant phonemes in the word. In short, the rearrangement is illustrated in the following diagram.

$$C_1V_1 - V_2C_2 \rightarrow C_1V_1 - V_2C_2$$

In the process, the phonemes in the last syllable simply changed their order. In the target word, nasal phoneme /ŋ/ became the coda in the syllable and the nucleus /a/ was located in the initial part. Then, in the product, the nasal /ŋ/ became the initial phoneme meanwhile the nucleus /a/ moved backward. However, since the word was not included as the instrument, it was not calculated in the tabulation to find the correlation.

The data indicate that the words produced due to the deviations were mostly non-word. Among the 33 occurrences of phonological deviation, 20 of them were non-words and only 11 words were produced in the process. Reading aloud involves a sequence of processes: selecting semantically appropriate words, retrieving their phonological forms, assembling them into a

phonological utterance, and converting this into an articulatory representation that triggers speech motor commands (Ramus, 2001). This implied that in reading aloud, the process related to selection of appropriate words in semantic level also occurred. Therefore, it can be expected that the readers will produce meaningful words during the speech production even if the text might be misperceived. Yet, the data showed the contrary. In Ramus' (2001) processing model of lexical access, the dual route of the phonological form retrieval in phonological lexicon until speech production during reading aloud required appropriate interpretation of grapheme-phoneme and or phoneme-grapheme representation within the sub-lexical phonological level. Hence, it is suggested that if the deficit lies in this level as the misinterpretation of the grapheme-phoneme and or phoneme-grapheme relationship might result in the misinterpretation of the word on the other level. Thus, there was a possibility that the participants might have deficiency in sub-lexical phonological level since the process of assembling phonological form into phonological utterance (and vice versa) occurred in this level.

In addition, among the five phonological processes that Davenport & Hannah (2005) proposed, only four of them presented in the deviations produced by both of the participants; feature-changing, insertion, deletion, and metathesis. Dyslexic readers are known to have difficulties in associating grapheme with its representative phoneme (Sanders, 2001). Based on the research participants' reading performance, most of the processes that occurred were the feature-changing. In deviations that occurred in consonant phonemes, there are occurrences that come in grapheme which shared similar form; p, b, and d. Dyslexics are known to experience mirror effect during visual-word recognition that results in the misrecognition of the grapheme. Therefore, it sometimes happened in dyslexic readers to view b as p or d, and vice versa. In this research, this symptom occurred in grapheme [p] which were read as [b]. In language with clear orthography such as Indonesian language, this symptom also appears in Indonesian dyslexic readers (Andriani & Elhefni, 2015). Moreover, this research exemplified that this symptom persists even when they reach adolescence, at least the case of the participants in this research.

Within the deviations which pattern were feature changing, the data showed that most of the deviations (10 out of 14) still shared at least one similar feature with the target phonemes. Most of those deviations shared similar place of articulation with target phoneme; Bilabial stops /p/, /b/ → bilabial nasal /m/, velar fricative /x/ and voiced plosive /g/ → velar voiceless /k/, voice alveolar fricative /z/, voiceless post alveolar fricative /ʃ/ → voiceless alveolar fricative /s/. It is widely believed that dyslexics have particular problems phonological decoding. Hence, in consistent with the phonological deficit hypothesis, this exemplified that dyslexics do have subtle difficulties in speech production and perception, yet the products are mild enough to be noticeable in real-life situation (Ramus, 2001). The minimal features that changed demonstrate the slightly inaccurate sub-lexical phonological representation. In addition, Elbro et al., (1994) also found that the way their dyslexic participants pronounced words was less distinct than their controls. This subtle deficit in phonological representation and perception might be the cause of the presence of feature changing pattern in adolescent participants of this research. This also indicated that this deficit is persistence even when the dyslexics have grown older and exposed to reading for quite a long time.

Ramus (2001) argued that phonological format is language-dependent which means that it varies from one language to another. Also, the structure and units of phonological representations are learnt by each child through exposure to their native language. People who live in eastern Java tend to simplify the features of particular phonemes to make them easier to pronounce particular sounds. As an example, phoneme /v/ in English tend to be pronounced /f/ if it is spoken by Javanese. Commonly, sound /f/ is also pronounced /s/ by Javanese. Hence, the case in participants' deviation on velar phoneme /x/, might happen as the influence of participants' native language. Javanese is also known to pronounce /x/ as /k/. Nevertheless, in case of the feature changing of phoneme /g/ to /k/ does not happen due to native language influence.

As one of the significant predictor of dyslexia, phoneme deletion occurred when the dyslexic readers read text even in transparent language (Landerl et al., 2013). This apparently presents also in the participants' reading performance, particularly when they read consonant clusters, digraph, vowel sequence and consonant sequence. Studies revealed that consonant clusters as the onset of a syllable were harder to process than single consonant as an onset (Hidayah, 2009; Treiman, 1989). In dealing with consonant cluster, children who begin to read usually omit the second or third consonant phoneme in the cluster (Bruck & Treiman, 1990). Similar findings also appeared in research on Indonesian dyslexic readers (Hidayah, 2009). Two of her participants, age 9 and 10 years old, showed difficulties in reading words with diphthongs, consonant cluster, and digraph such as [ng] and [ny]. Hidayah mentioned that some of the deviations were produced by deleting the cluster phonemes (ekspresikan became epresikan, [ks] was omitted), and changing the phoneme feature (menyambung become meyabung). This research involved four kinds of consonant-cluster onset, namely; /st/ in syllable sta-, /tr/ in syllable -tra-, and /pr/ in syllable pra-. Data showed that the deviations only occurred in consonant cluster /st/ and /tr/. However, unlike Bruck and Treiman's finding in their participant, the adolescent participants in this research inserted a vowel phoneme between the two consonant phonemes in the consonant cluster.

The insertion of vowel phoneme in between the two consonant phoneme might occurred due to several reasons. The first reason is related to the first kind of cluster; /st/. The participant insert phoneme /ə/ within consonant cluster /s/ and /t/. This kind of insertion is not uncommon to occur in Javanese native speakers when pronouncing any borrowed word initiated with consonant cluster /st/ such as *stasiun*, *starter*, and *stop*. Even, in Surabaya dialect, a term *setopan* had been developed to refer to stoplight. As explained previously, phonological format is language-dependent which structure and units of phonological representations are learnt by each child through exposure to their native language (Ramus, 2001). Therefore, this deviation was likely to occur due to the influence of Participant's mother language which was Javanese. The second reason is related to the second kind of cluster; /trak/. The insertion of vowel phoneme /a/ between two consonant phoneme /t/ and /r/ might exemplify what Bruck and Treiman (1989) pointed out that children who were learning to read found that, as an onset of a syllable, consonant cluster was harder to be processed than single consonant phoneme. Hence, to make /trak/ easier to be processed, a vowel was inserted to separate the consonant within the cluster and change the consonant cluster into two single-consonant-onset; /ta/ and /rak/. As the Participants of this research showed, the lacking phonological ability to process consonant cluster seemed to persist even in adolescents.

The phonological deficit symptom also appears in words with digraphs, vowel sequences and consonant sequence. Similar with cluster, the data shows several alternatives that were used by the participants to read them. Some digraphs were involved in this research that were read inaccurately by inserting another phoneme following the digraph. The example of this occurrence was related to phoneme /ŋ/, which is represented by digraph [ng]. Even though this did not occur in every word consisting this digraph, the deviation did appear with similar pattern; inserting phoneme /g/ following the phoneme /ŋ/. In other words, if the speech were transcribed into graphemes, two [g]s appeared consecutively. One interesting pattern that were shown in this type of deviation was that the phoneme that was inserted also share at least one similar feature with the preceding phoneme. in this occurrence, /ŋ/ and /g/ share similar place of articulation. Meanwhile, the other digraph were read by omitting one of the phoneme. Other than feature changing, another types of deviation also involve velar phoneme /x/ which is represented with grapheme [kh]. Instead changing them into /k/ sound like in the word *khawatir* (worry), this velar phoneme was read /h/; a glottal phoneme.

Other than digraph, the deviation also occurred in consonant sequence *mengiklankan* (advertise) and *atraksi* (attraction). In these two words, two consonant phonemes appeared as the coda of a syllable and followed by another consonant phoneme as the onset of consecutive syllable;

I. meng-**ik-lan**-kan

II. a-**trak-si**

Both in reading I and II, one of the participants in this research omitted the velar phoneme /k/ which was the coda of the second syllable. Further, in II, he inserted phoneme /s/ as the coda of the first syllable. This demonstrate another evidence that the participants were having problem in processing velar phoneme. However, unlike velar phoneme in the other words, this time the participant only omitted it.

When reading words with vowel sequence, there were several patterns of deviation that appear; omitting one of the vowel, inserting another vowel, and swap the syllable. One interesting phenomenon occurred in the word *akuarium* (aquarium). The two participants chose different strategy. One of them chose to add another vowel phoneme to the second vowel sequence (-ri-um → -ra-i-um), while the other chose to omit one of the vowel in the first vowel sequence (a-ku-a-ri- → a-ku-ri-). also become the strategy chosen by participant. The other pattern involved a metathesis. The participant changed the sequence of the phonemes within a syllable (/si/ – /aŋ/ → /si/ – /ŋa/). The vowel sequence was separated by putting the consonant coda of the latter paragraph into the onset of that very paragraph. Both syllable then become two open syllable

The data of this research also demonstrate that the deviations produced open syllable (consonant-vowel) (n=12) more than closed syllable (syllable which final phoneme is consonant) (n= 6). Treiman (1988)⁰ argued that the initial phoneme of a syllable is easier to access than the final phoneme. Hence, in this case, it reflect that the initial consonant in consonant-vowel-consonant syllable is a unit of its own (an onset), meanwhile, the final consonant is part of a larger unit (the rime) (Bruck & Treiman, 1990). This implies that the access of the final consonant in closed syllables is more difficult. Therefore, as dyslexic adolescents, it is harder for the participants to read closed syllables than the open ones. As a

result, it is reflected in their deviations which formed more opened syllables compare to closed syllable.

The data shows that phonological deviations still present in participants' reading performance. This implies that even in language with transparent orthography like Bahasa Indonesia, the problems with phonological awareness become the major handicap to the participant. In accordance with APA (2013), the problem with this lower level ability in reading (Field, 2003) becomes the result of the deficit in the phonological component of the language (Cavalli et al., 2017; Gagliano et al., 2015; Martin et al., 2010; Ramus, 2001; Shaywitz et al., 1999; Undheim, 2009). The occurrence frequency of this deviation and the age of the participant which is in adolescence implies that despite the length of language exposure, experience, and reading practices, the deficits in phonological decoding remain present in dyslexic readers even in adolescence (Cavalli et al., 2018).

Conclusion

The study found that adolescents' reading-aloud performances showed consistent phonological deviations linked to sub-lexical processing weaknesses. Most errors resulted in non-words through feature-changing processes that preserved at least one phonological feature, suggesting imprecise yet systematic representations. Vulnerabilities clustered around velar segments (/k, g, ŋ, x/) and contexts with greater combinatorial load—consonant clusters, digraphs (e.g., <ng>, <kh>), and vowel/consonant sequences—and were often managed by epenthesis or deletion (e.g., vowel insertion within /st/ and /tr/, /ŋ/ realized as /ŋg/, omission of coda /k/). While some patterns align with Javanese phonotactics (e.g., /v/→/f/, /ʃ/→/s/, schwa epenthesis in /st/), others (e.g., certain velar substitutions) are not attributable to L1 influence, underscoring a primary grapheme–phoneme mapping deficit. Deviations favored open syllables over closed ones, consistent with reduced access to syllable-final consonants. Crucially, these patterns persist into adolescence despite years of exposure and occur within a transparent orthography (Indonesian), reinforcing that phonological decoding remains the major handicap for these readers and providing a fine-grained account of where and how their speech-planning pipeline becomes fragile.

The data show, even in their adolescence and the exposure of language and practice, the participants produced phonological deviations. This implies that even in language with transparent orthography like Bahasa Indonesia, the deficiency in phonological awareness still affect participants' reading accuracy. First, phonological deviations during the reading process more frequently resulted in non-words than meaningful words. Next, feature-changing emerged as the most common type of deviation. In this process, phonemes were altered into simpler and less effortful forms, typically by modifying their place or manner of articulation.

This study has several limitations that bound the claims and point to next steps. The evidence is drawn from a small, adolescent sample in Surabaya and from reading-aloud tasks in Indonesian only; consequently, the patterns may reflect local linguistic backgrounds (e.g., Javanese phonotactics) and task demands, and may not generalize to broader populations, silent reading, or other orthographies. The stimulus set emphasized particular clusters, digraphs, and vowel/consonant sequences, so deviation profiles could shift with different lexical items or prosodic contexts. As a qualitative analysis, findings rely on transcription and coding judgments that, while systematic, are inherently interpretive; future work should add inter-rater reliability checks, comparison groups, and complementary measures of phonological awareness/working memory. Even with these constraints, the implications are clear: assessment for dyslexic adolescents should probe sub-lexical grapheme–phoneme mapping—especially codas in closed syllables, velars, clusters, and digraphs—and consider L1-specific

transfer. Instruction and therapy can prioritize explicit practice with these vulnerable structures (e.g., graded cluster training, targeted work on <ng>, <kh>, and coda consonants), encourage strategic segmentation rather than epenthesis, and retain screening/intervention into adolescence given the persistence of deficits in a transparent orthography.

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