PHONOLOGICAL DISORDERS OF CHILDREN WITH DOWN SYNDROME BASED ON THE LEVEL OF INTELLIGENCE: A CASE STUDY

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Abstract

Many of speech therapists have given therapy to the children with Down Syndrome (DS) without thinking whether the children belong to mild mental retardation (IQ 50-69) or moderate mental retardation DS children (IQ 35-49). Therefore, a study was conducted to see the differences and the findings showed that the moderate mental retardation DS child dominated the three types of phonological disorders, i.e. phoneme substitution, simplification, and addition. In this research, the last type of phonological disorder was not found for both DS children. In addition, the mild mental retardation DS child responded the stimulus, yet the moderate mental retardation DS child could not answer about 1/5 stimulus given. It was also found that the moderate mental retardation DS child was so sensitive with touching. So, the therapy for the DS should not be the same. For the mild mental retardation DS children (IQ 5-069), the stimulus given to them could be by using flash cards, but for the moderate mental retardation down syndrome children (IQ 35-49), the stimulus should be something real, concrete, or something that could be touched so that they can respond the stimulus well and their language can be better in the future.

Keywords:
Phonological disorders; Down syndrome; Intelligence

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A. Introduction

A speech therapy given to Down Syndrome (DS) children who have language disorders should be based on their level of intelligence. It is due to the DS children have mental retardation and intellectual disability that are caused by the extra chromosome number 21.[1] Frank says that the intelligent level of DS children is divided into three, mild mental retardation (IQ 50-69), moderate (IQ 35-45), and severe (IQ 20-35).[2]

[1]Vee P Prasher, *Neuropsychological Assessment of Dimentia in Down Syndrome and Intellectual Disabilities* (London: Springer, 2009), 123.

[2]Andre Frank Zimpel, *Trisomi 21: What Can We Learn from Peope with Down Syndrome* (Bristol: Vandenhoeck&Ruprecht GmbH & Co. KG, Gottingen, 2016), 30.

These three IQ levels make the speech therapy for DS children given to them should not be the same, for example speech therapy for mild mental retardation is different with moderate and severe mental retardation. However, it was found that there were still many speech therapists giving therapy to DS children without thinking the children's IQ level.

Related to this case, an investigation was done on 29th-30th 2019 to see the differences of language disorders focused on phonological disorders on DS children in Panti Sosial Bina Grahita Harapan Ibu Padang, a place for DS children to educate and rehabilitate[3].This is one of the technical units of Social Services on the field of social rehabilitation for mental disability or mental retardation around West Sumatera, Indonesia. From the investigation done toward two DS children, mild mental retardation (IQ 50-69) and moderate mental retardation (IQ 35-45), it was found that when a stimulus flash card was given, the mild mental retardation DS could respond it even he still made phonological disorder on that word he produced. He changed phoneme /p/ bilabial stop to be /m/ nasal bilabial voiceless in the beginning of the word 'paruik' /parui?/> /marui?/ 'stomach'.

It was totally different with the respond given by the moderate mental retardation DS child with the same stimulus. He could not answer it or he did not even say a word, but after another stimulus added, i.e. a touching his stomach, he could answer it. He responded that by saying /eyu?/. In this condition, he simplified the phoneme /p/ bilabial stop in the beginning of the word and he changed phoneme /r/ trill to be /y/ in the middle of vowel. From the two examples, it can be concluded that a flash card stimulus given to moderate mental retardation DS (IQ 35-49) was inappropriate. He needs a concrete stimulus to get a good respond. On the other hand, for mild mental retardation (IQ 50-69), he could respond the stimulus well. However, in his respond it was still found a phonological disorder. This was the evidence that speech therapy given to DS children should be based on their ability to respond something.

Previously, there were some studies about language disorders of DS children in Neurolinguistics or Psycholinguistics field, such as hearing loss, memory, lexical-semantic, morphology, syntax, and phonological disorder. For example, a study was done by Caselli at al., about comparing language impairment of children with DS and other children with language disorders.[3] From the research, it was found that DS children and other children with language impairment were worse than normal developing children on lexical and grammatical.

[3] Maria Cristina Caselli et al., 'Language in Italian Children with Down Syndrome and with Specific Language Impairment.', *Neuropsychology* 22, no. 1 (2008): 26, https://doi.org/10.1037/0894-4105.22.1.27.

Another study is also conducted by Brock and Christopher.[4] The study discussed about the effect of language ability of DS children their verbal short-term memory. The findings revealed that DS children were impaired caused by the weaknesses of phonological discrimination ability.

Perovic also investigated about the syntactic impairment of DS children that mainly concentrated about reflexives and pronouns.[5] From the findings, he showed that DS children had difficulties on understanding the reflexives but they could comprehend about pronouns.

Even though, those studies above have not described about the language disorders based on the level of intelligence of DS children, they were only about the language disorders in general. By understanding the differences of language disorder of DS children based on the level of intelligence, for example phonological disorder, the speech therapists can find the best approach to be applied for the speech therapy to the DS based on how each of DS children comprehend the stimulus so that their verbal ability can increase and then they will be self-confidence to communicate with others. Therefore, an investigation about phonological disorder of DS children should have done based on the level of intelligence from the view of Neurolinguistics.

Ahlsen said that Neurolinguistics is a study about the relationship of language and communication to the aspects of brain function, in other words, it tries to investigate about how the brain processes and produces the language.[6] Whintaker in Ingram also says that Neurolinguistics is the understanding of language based on the interdisciplinary related to structure and function of brain.[7] From the two opinions of experts above, it can be seen that in this research, the focus is about analyzing about what happen to the language of DS children based on the ability of how they comprehend something.

Stemmer and Whitaker said that the phenomenon seen about the relationship of language and brain for DS children is DS children's brain volume in several parts is reduced.[8] The parts are frontal lobe and temporal lobe. Those make the language of DS children have some errors, for example

[4] Jon Brock and Christopher Jarrold, 'Language Influences on Verbal Short-Term Memory Performance in Down Syndrome: Item and Order Recognition', *Journal of Speech, Language, and Hearing Research* 47, no. 6 (December 2004): 1334, https://doi.org/10.1044/1092-4388(2004/100).

[5] Alexandra Perovic, 'Syntactic Deficit in Down Syndrome: More Evidence for the Modular Organisation of Language', *Lingua* 116, no. 10 (October 2006): 1616, https://doi.org/10.1016/j.lingua.2005.05.011.

[6] Ahlsen Elisabeth, *Introduction to Neurolinguistics* (Amsterdam: John Benjamins Publishing Company, 2006), 3.

[7] John C. L. Ingram, *Neurolingusitics: An Introduction to Spoken Language Processing and Its Disorders* (Cambridge: Cambridge University Press, 2007), 3.

[8] Brigitte Stemmer and Harry A. Whitaker, *Handbook of Neurolinguistics* (California: Academic Press, 1998), 516.

when they produce words. The frontal lobe works for cognitive function. So, when it has problem like the volume is decreased, the intelligence will decrease too. That is why this research was conducted to analyze the differences words produce by the DS children to find the best speech therapy for them based on their level of intelligence.

B. Method

This was a case study where the representative of the subject of the research was only two children. The two subjects of research were mild mental retardation DS child (IQ 50-69) and moderate mental retardation DS child (IQ 35-49). They are donated DS 1 and DS 2. The two speakers were chosen based on the test of IQ that was held in Prof. HB Sa'anin Padang Mental Hospital. All of the subjects of research were checked that their speech auditory and speech articulator were good before the test given. For further information about the speakers can be seen in the table below:

Table 1

Background information of the two subjects of research

Speaker	Age	Sex	Education	Status	Dominant Language
DS 1	24	male	not go to school	unemployed	Indonesian, Minangkabau
DS 2	18	male	not go to school	unemployed	Indonesian, Minangkabau

From the table above, it can be seen that the two subjects of the research belong to adults. They actually cannot read or understand letters. They both have been rehabilitated in *Panti Sosial Bina Grahita Harapan Ibu Padang* for years, a place for disabilities children to rehabilitate and educate. They were chosen to avoid the influence of gender and both of them can speak Indonesian and their local language, Minangkabau.

Due to the subjects are illiterate, so flash cards were used to increase them respond the stimulus. The number of flash cards was about 52. They consisted of nouns, verbs, adverbs, and prepositions. Before the flash cards given to the subjects of the research, they were validated by the Neurolinguistics experts first. Then, they were tested to the DS mild and moderate mental retardation.

In collecting the data, they were brought one by one of the two subjects of research in a quiet room. The entire session was recorded by using voice recorder ICD PX 470 SONY. The voice recorder was put about 20 cm near the mouth of subjects of the research. The

recording session was about 15 minutes length each. By putting the voice recorder close to the subjects of research, it made the results of recording better and easier to transcribe.

After the test, the recordings were transcribed by using International Phonetic Alphabet.[9] From all of the transcriptions only the errors of words that would be analyzed. Blumstein categorized the errors in four parts.[10]

First, if the responds did not provide enough information to identify of the target words. Second, the words produced by the DS children shown no similarity with Indonesian or Minangkabau words. Third, where the sequences were produced by the DS children bore no phonemic similarity word which could ostensibly fit into surrounding context. The last, words produced by DS children were an obvious substitution of one word for another.

The errors then would be put into four types or phonological errors. They are phoneme substitution, phoneme simplification, phoneme addition, and environment (intra-morphemic, extra-morphemic, and metathesis).

C. Results

The language ability of DS children in understanding the stimulus and producing the words are different. They are may be fast, moderate, or slow. This condition is due to the level intelligence of DS children. Related to this case, a study was conducted.

To prove the assumption, a study, it was found that the phonological disorders met the perception. The bar chart below shows the percentage of phonological disorder found on mild and moderate mental retardation of DS children.

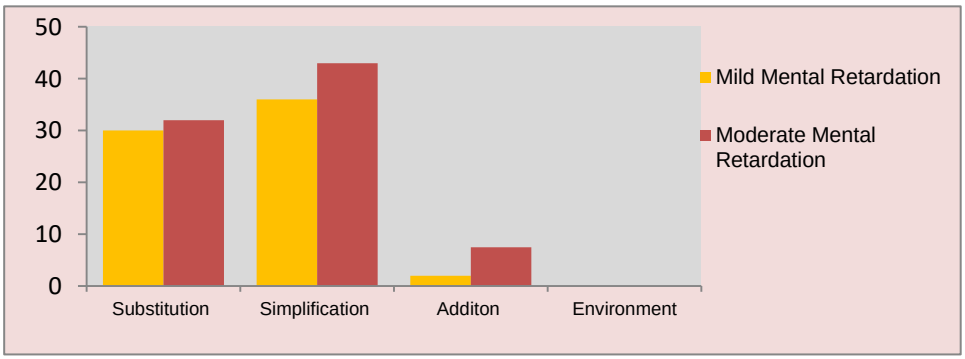


Figure1. Percentage of phonological errors by mild mental retardation (IQ 50-69) and moderate mental retardation (IQ 35-49)

[9]Tri Mastoyo, *Pengantar (Metode) PenelitianBahasa* (Yogyakarta: Caracvatibooks, 2007), 47.

[10]Sheila E. Blumstein, *A Phonological Investigation of Aphasic Speech* (The Haque: Mouton, 1973), 36–37.

The bar chart shows the proportion of phonological disorders found on mild mental retardation (IQ 50-69) and moderate mental retardation (IQ 35-49). In four types of phonological errors, moderate mental retardation DS child outnumbered the mild mental retardation DS child. For the phonological disorder type phoneme simplification, moderate mental retardation of DS child was a slightly higher than the DS mild mental retardation, i.e. it is only about 7 percent. It was also almost the same with phoneme substitution where moderate mental retardation still has larger proportion. The third type is phoneme addition. This proportion was a highly lower than the previous two types. The moderate mental retardation DS child still stands on the higher percentage of the errors. It was about 7.5 percent and mild mental retardation DS child was 2 percent. However, for the phonological disorder type environment did not happen to both mild and moderate mental retardation DS children.

Overall, the chart shows that percentage of phonological disorders was dominated by moderate mental retardation DS child, whether in phoneme substitution, simplification, or addition. It can be used to design model of speech therapy that should be given to DS children based on the level of intelligence to increase their verbal speech.

In addition, the other findings showed that there were about 16 flash cards that were not answered by moderate mental retardation DS child. The mild mental retardation DS child answered all of the flash cards. Those were the evidence that model of therapy for DS children should be given differently because the lower level intelligence of the DS child, the weaker ability to understand the stimulus.

One example of differences how the DS children received and responded the stimulus given for the two level of intelligence can be seen in the picture below.

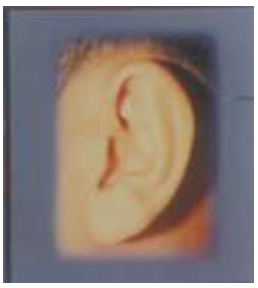
Stimulus	**Respond**
 What picture is this?	/nəliŋa/ ‘ear’

Figure 2. Respond of DS child with mild mental retardation (IQ 50-69).

Based on the respond of DS child with the level of intelligence above, it can be seen that when the stimulus given, the DS child mild mental retardation could understand it well, but he had phonological disorder in producing the word. He changed the consonant phoneme /t/ alveolar voiceless to be phoneme /n/ nasal voiced in the beginning of the word. So, from the answer, it shows that the DS child with mild mental retardation did a phoneme substitution.

It was totally different with DS child with moderate mental retardation (IQ 35-49). The respond can be seen in the figure below.

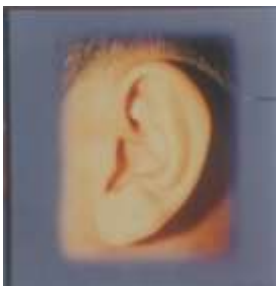
Stimulus	Respond
 What picture is this?	(no respond)
What picture is this? + touching the moderate mental retardation DS child's ear	/əliŋa/ 'ear'

Figure 3. Respond of DS child with moderate mental retardation (IQ 35-49).

From the picture above, it shows that the DS child with moderate mental retardation could not respond the first stimulus given with the flash card. However, in the second stimulus added by touching the DS's ear, the DS child with moderate mental retardation could respond the stimulus spontaneously. If it is seen from the word that he produced, he simplified the phoneme /t/ alveolar voiceless in the beginning of the word.

Related to the two examples above, it can be concluded that the DS child for each level of intelligence had different reception and production ability. For the reception, the DS child with moderate mental retardation, stimulus by using flash card was not appropriate. He needed to sensor something real or touchable to produce the word. On the other hand, for DS with mild mental retardation, giving stimulus by using flash card was fine with child. He did not need something like what the moderate mental retardation DS child did. It was caused by the different level of cognitive

each of them. The moderate mental retardation DS child had weaker cognitive than the mild mental retardation one. That is why the speech therapy given should be based on what they need.

It is also necessary to know that for production ability of each DS child. For moderate mental retardation DS child, he did a substitution of phoneme but for mild mental retardation DS child, he simplified the phoneme in the beginning. This evidence can give some information to the speech therapists to design the approach to decrease the phonological disorders of DS children based on the level of intelligence so that the DS children can increase their language to communicate and people can understand what they say.

D. Discussion

From the findings of the study above, they are very useful to find the most appropriate speech therapy especially stimulus that should be given to the DS children that do not give the treatment in the same way but rather than understand the level of intelligence of the DS children. Principally, the speech therapy is an approach to investigate the language behavior of normal and abnormal of people that can be used to heal any language disorder.[11]

Based on what Monica said, the purpose of speech therapy here is to decrease the phonological disorders of DS children. To give the speech therapy for DS children, the stimulus should be different for mild and moderate mental retardation. For mild mental retardation DS children (IQ 50-69), the stimulus can be flash cards, but for moderate mental retardation DS children (IQ 35-49), it is expected that to give the stimulus with the real things or replications. If the responds are verbs, so the moderate mental retardation DS children should join or see the actions directly, for example watering the flowers. It can make them easy to receive the stimulus and can produce the action words well.

Another way to give the stimulus for moderate mental retardation DS children is by asking them to touch the things provided. For example, part of their body like hand, feet, head, hair, and so forth. They can be told what they are and say to him the name of them. After they understand it, they can be asked to answer loudly what is being touched.

Those speech therapy models above are for mild and moderate mental retardation of DS children. Those also cannot directly increase the verbal ability of them but the findings and the speech therapy models offered can give big advantage as one of scientific ways to decrease the phonological disorders found on DS children based on the level of intelligence.

There were some related studies conducted related to this case, for example Lutfi[12] and Sumarlam.[13] The

[11]Monica Ester, *Terapi Wicara Untuk Praktisi Pendidikan Dan Kesehatan* (Jakarta: Penerbit Buku Kedokteran, 2000), 96.

[12]M. Luthfi Baihaqi, 'Kompetensi Fonologis Anak

study also investigated about the inappropriate phonological produced by children with Down syndrome. The research was done in SLB, a Special State Junior High School in Yogyakarta, Indonesia with 8 of children with Down syndrome age 10-17. In the study, it was found that the DS children were low to produce the words. They could only produce syllable or words not yet to morpheme, syntax, or the higher part is discourse. The findings showed that children with DS produced words based on the sound of the objects. For example a cat, the children said it with /eoŋ/ by simplifying phoneme /m/ nasal bilabial in the beginning of the word. In the research, it was also found that children with DS had stuttered and they did not would like to talk a particular place or situation.

From the two previous researches, it can be concluded that they have not investigated about the phonological disorders of children based on the level of intelligence. They only concluded their findings for all children with DS, yet this study showed the different proportion of phonological errors found on each level of intelligence of DS. The second result was, it was found a new stimulus, touching. It could make the children with DS moderate mental retardation understood and responded the stimulus. These two findings are the novelty of this study.

If these findings are compared with normal people's language disorders, the errors can also be found when the non-native speakers spoke English as a foreign language. One study done by Sardanto was about grammar errors on English speech by radio announcer.[14] He found that the announcer also did errors on omission, addition, wrong formation, and disordering while using English on broadcast.

Another research was conducted by Ridho about speech errors found on EFL learners in telling English story telling.[15] Ridho found that the students did silent and paused when they told the story in front of the class.

Related to the two examples above, they are totally different with the errors found with DS children. The language disorders found in the normal people while they were using and learning a foreign language might be because some intervention of their first language or the process of they acquire the foreign language, but for DS children it is because they have had problem with

Penyandang Down Syndrome di SLB C Negeri 1 Yogyakarta', *Widya riset Pusbindiklat LIPI* 14, No. 1 (2011): 153–62, https://doi.org/10.14203/widyariset.14.1.2011.153-162.

[13]Purnanto, Sumarlam Dwi, and Sri Pamungkas, 'Karakterstik Bahasa Anak-Anak Down Syndrome di Kampung Down Syndrome Kabupaten Ponorogo (SuatuTinjauan Psikolinguistik)', 2014.

[14]Rino Sardanto, 'A Study of Error on English Speech Used by the Radio Announcer at Brass FM Kediri', *OKARA: Jurnal Bahasa Dan Sastra* 1, no. 1 (2014): 12, https://doi.org/10.19105/ojbs.v8i1.454.

[15]Agustina Ridho Utami and Noor Malihah, 'Speech Errors Produced by EFL Learners of Islamic Boarding School in Telling English Story', *OKARA: JurnalBahasa Dan Sastra* 12, no. 2 (30 November 2018): 191, https://doi.org/10.19105/ojbs.v12i2.1930.

their extra chromosome since they were in womb. This makes their cognitive different with normal people because some volumes in their brain have reduced. One effect of DS's brain reducing that can be seen is phonological disorders.

E. Conclusion and Recommendation

1. Conclusion

Based on the findings above, it can be summarized that flash cards stimulus given to DS children with moderate mental retardation (IQ35-49) were not appropriate. Therefore, the best stimulus should be given is the real things or when it is a verb, preposition, adverb, and so forth, the speech therapists should ask the DS child to act, join, or see the activity at the moment. It means that DS children with moderate mental retardation (IQ 35-49) needs concrete stimulus to let them speak up. If the speech therapist cannot provide the real stimulus such as snake, elephant, plane, or things that are hard to provide, the speech therapists can make some replications of them.

However, it is totally different with DS child with mild mental retardation (IQ 50-69) flash cards stimulus could be applied. In addition, it should be paid attention that DS child with moderate mental retardation (IQ 35-49) also found difficulties on understanding stimulus about preposition. He was confused about to differentiate the position of things, for example under, above, between, next to, and other positions. DS children with moderate mental retardation (IQ35-49) should be treated by giving stimulus that make them easy to comprehend and can respond the stimulus well.

2. Recommendation

For future study, it is very suggested to investigate a comparative study of phonological errors on the DS children. Second suggestion for future research is investigating language disorders based on level of intelligence by proving EEG or fMRI. It can be used to see in what part of brain the phonological disorder comes from, whether in the temporal lobe, frontal lobe, parietal lobe, occipital lobe, or in other places that causes the phonological disorders. It can be also investigated about the errors that would be found on morphological, syntactical, semantics, or even pragmatics. It is because the speech therapy for DS children may not be only on phonology but also on the all part of linguistics.

It is also suggested that to see the Wernicke and Broca area that make DS children cannot answer the stimulus and make phonological errors, for example, phoneme substitution, phoneme simplification, phoneme addition, and environment (intra-morphemic, extra-morphemic, and metathesis) so that the researcher can design the appropriate speech therapy as clinical linguistics.

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