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Classification of residual hearing of deaf students based on audiometer using google data studio visualization method

Amril Samosir[1*], Sulistiyanto[2], Sony Oktapriandi[3], M Muhammad[4]
[1,4]Department of Management, Universitas Malahayati, Indonesia
[2,3]Information Management, Politeknik Negeri Sriwijaya, Indonesia

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ABSTRACT

Classification of hearing loss is necessary because it provides treatment or learning methods for students which are certainly not the same. This classification is displayed in a graphical form because graphics are able to provide information quickly. The results of this writing are information in the form of visualization of the residual hearing which is grouped according to the decibels or residual hearing they have. Patterns that will be applied in learning will later be adjusted based on classification, so that students can comfortably follow the learning process. When creating this visualization, use Google Data Studio because it can be used to represent complex data sets in an interesting and clear way. The data used are data on deaf students for 2014-2021, with a total of 357 data and 14 attributes. The results of data processing are in the form of graphs of students for each generation, distribution of student demographics, and classification of student hearing measurement results. From the visualization results, 3 categories were obtained, with the results being 9 light categories,, 129 medium categories and 219 heavy categories. The mild category will receive oral treatment, while the moderate and severe categories will be given sign language and written treatment.

Corresponding Author:

Amril Samosir,
Jl. Pramuka No.27, Kemiling Permai, Kec. Kemiling, Kota Bandar Lampung,
Universitas Malahayati, Lampung, Indonesia
Email: Amril@Malahayati.ac.id
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1. INTRODUCTION

Hearing loss causes defects in the function of the ear, and children who have defects in the function of their ears, either partially or completely, affect their life. Overall, the level of hearing impairment in deaf children can be grouped into mild impairment, moderate impairment and severe impairment. Atr (deaf child) is a term used to indicate the state of hearing loss experienced by a person [1]. This aspect of disability affects your life, especially language and communication. Loss of hearing ability results in children never knowing sounds and sounds; this also causes deaf children to have difficulty producing sounds and sounds which are important components of communication for them, thereby triggering deaf children's understanding of language and its use to be hampered. Hearing impairment causes poor language skills and significantly hinders communication in deaf children [2].

These limitations certainly affect methods in the learning process for deaf students. Of course, each student does not have the same level of residual hearing, which will also influence the learning methods or

treatment provided by the teacher. Some methods or treatments that can be done are improving communication, improving sign language skills, improving writing, copying, reading material, and discussing skills.

In order for learning methods to be decided quickly, it is necessary to display information on the classification of residual hearing for each student. One way to display information is through dashboard-based visualization information. The dashboard itself is a display or visualization that presents important information using graphs, tables, images, etc., so it is interesting and easy to understand by all parties [3]. Dashboards can also be used to present performance quality information from a work process in a company or institutional institution [4]. One of the benefits that can be obtained from this data visualization, one of the benefits obtained is that it facilitates communication between stakeholders or decision makers [5]. The use of dashboard information is useful for speeding up decision processes, measuring organizational/agency performance, monitoring ongoing processes, and predicting future conditions [6]. Several studies have been carried out on creating dashboard-based information using various tools, such as using Tableau [5], [6], r studio [7], highchart [8], microsoft power bi [9] and google data studio [4], [5].

In this article, data on residual hearing of deaf children will be visualized using Google Data Studio tools. Google data studio is able to create visualizations easily and practically and can be accessed online [12], a data visualization application that allows free collaboration and integration of reports from various data sources [13], [14], as well as being interesting and easy to understand [15]. Google Data Studio also provides various alternative visualization forms and can use various types of file extensions [16].

By presenting information on students' residual hearing in the form of graphic information, special school administrators (SLB) can make quick decisions regarding appropriate treatment or learning methods based on the classification of students' residual hearing, which will have a comfortable effect on deaf students, because the learning process between students is not the same.

2. METHOD

Data Collection

This research uses experimental research, with data collection using the following techniques.

1) Observation.
   Make systematic direct observations about matters related to deaf students.
2) Interview
   Conduct a direct approach or communication with the school as the person in charge, namely Mrs. Hartatiningsih S.Pd, in order to obtain data on deaf students which will be used as research material.
3) Documentation
   Collecting data in the form of text, images, and videos as supporting research material
4) Literature review
   Data collection takes the form of references, archives, and documents related to the problems in this research.

In this research, the author used data on deaf students from 2014 - 2021 with a total of 357 data and 14 attributes.

Measurement of Residual Hearing

Deaf people have limited speech because they are hampered by the language imitation process. Hearing limitations cause language activities to be diverted to visual and motor activities. Changes in language and communication abilities of deaf children, especially those classified as totally deaf, make it impossible to achieve language mastery through hearing, but must go through their sight and utilize their remaining hearing [5]. To obtain data in the form of students' residual hearing, audiology lab cards are used as in Figure 1.

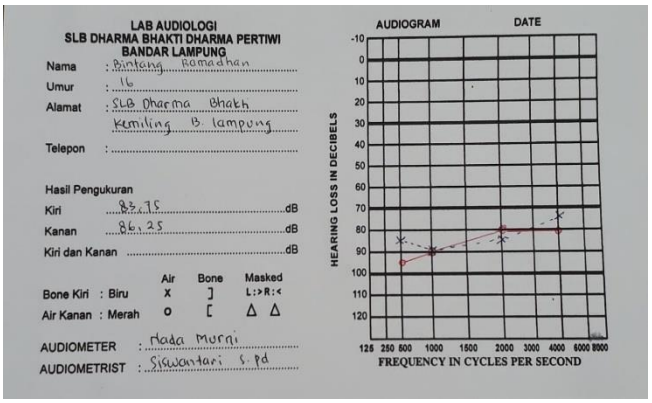


Figure 1Hearing measurement card

The way to calculate the results of the hearing measurement paper in Figure 1 is as follows:

1) Counting the left ear (blue dot): Frequencies 500, 1000, 2000, 4000
   Calculation process:
   500 hz --------→ 85 db (desibell)
   1000 hz -------→ 90 db (desibell)
   2000 hz ------→ 85 db (desibell)
   4000 hz ------→ 75 db (desibell)
   Output/hasil 85+90+85+75/4 = 83,75
2) Menghitung telinga kiri (titik merah): Frequency 500, 1000, 2000, 4000
   500 hz --------→ 95 db (desibell)
   1000 hz -------→ 90 db (desibell)
   2000 hz ------→ 80 db (desibell)
   4000 hz ------→ 80 db (desibell)
   Output / haze 95 + 90 + 80 + 80 / 4 = 86,25

The results of measuring residual hearing using an audiometer for deaf students at SMALB-B, SLB-B & C Dharma Bhakti Kemiling Bandar schools can be seen in the following graph/visualization

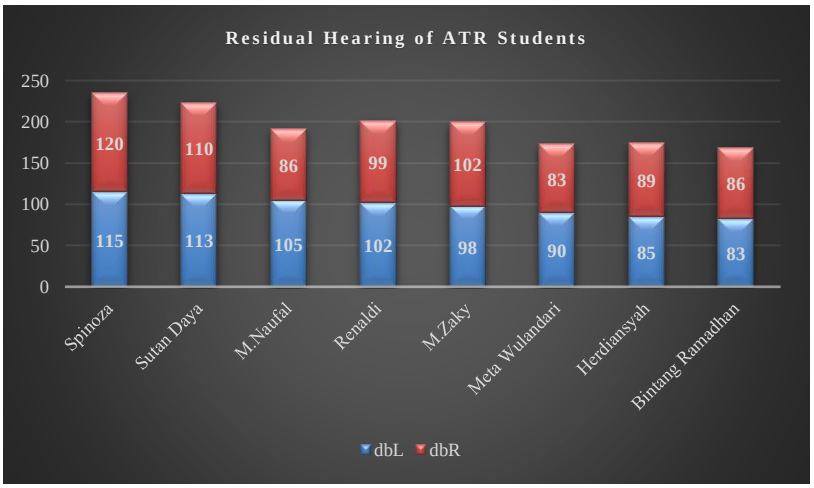


Figure 2Graph of residual hearing of deaf students

The results of residual hearing measurements are also displayed in the table below.

Table 1The remaining hearing of deaf students

Name	dbL	dbR
Spinoza	115	120
Sutan Daya	113	110
M. Naufal	105	86
Renaldi	102	99

M. Zaky	98	102
Meta Wulandari	90	83
Herdiansyah	85	89
Ramadan Star	83	86

Data Visualization

According to [17] visual data studio is a new data visualization program designed as an easy-to-use tool to represent complex data sets in an attractive and clear way. Meanwhile, in the opinion of [18] visual data studio is a Google-created service to manage data. One of the data processes in visual data studio is visualizing data in the form of graphs or diagrams so that it is easier to draw conclusions. According to [19] visual Data Studio is a general term that describes any attempt to help people understand the importance of data

Data Studio's core functionality is dashboard-style visual interpretation of social media and web analytics such as Google AdWords and YouTube analytics; however, the support of tools such as MySQL and Google Sheets means that the program can be used by researchers to interpret their own data in an equally attractive and user-friendly format.

Data Processing

The data processing process begins by collecting some information starting with observations, interviews, and documentation. The results obtained are in the form of residual hearing data (decibels), skill value data,, general knowledge value data and other supporting data. The following is a flow diagram of the data processing process using the Google Data Studio method.

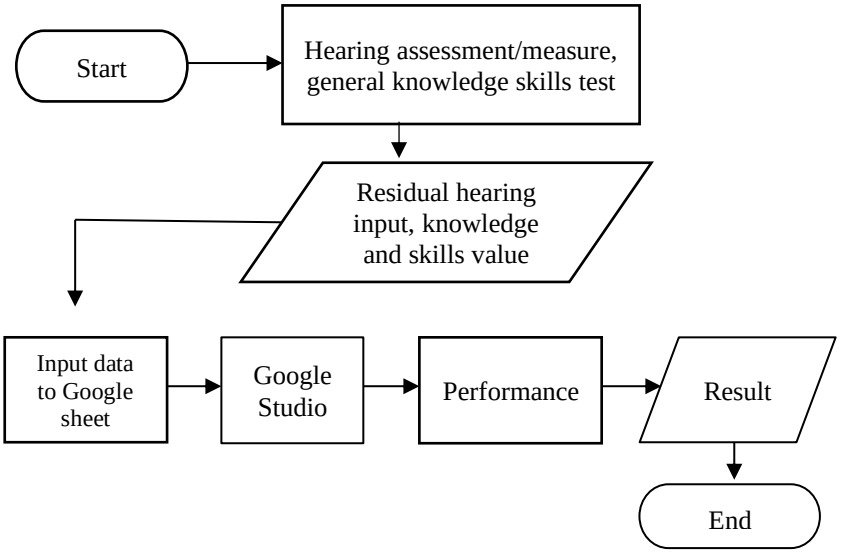


Figure 3. Data processing process flowchart

From the results of data processing, several attributes are obtained that will be used to create data visualizations, including:

Table 2. Description of data processing attributes

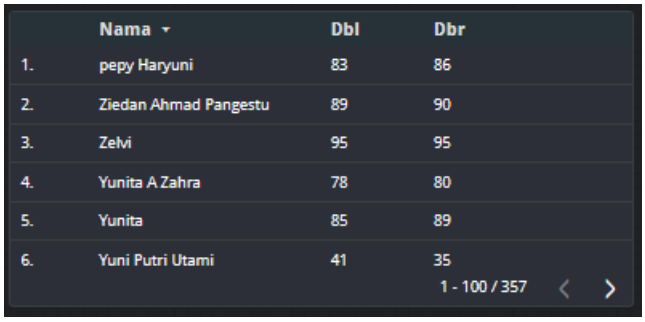
Attribute Name	Information
Student's name	Identity of deaf students
DBL	Decibel (to measure sound intensity) in the left ear
DBR	Decibel (to measure sound intensity) in the right ear
Results	T = very severe, S = moderate, R = low
NilP	Ability test scores are given at the beginning.
NilK	Assess deaf students' talents/skills
JlhLingan	The amount is included in the light category
JlhMedium	The amount is in the medium category
JlhHeavy	The amount included in the heavy category
Oral Treatment	The treatment is given in verbal form
TreatmentWriting	Treatment is given in written form
TreatmentIsarat	Treatment is given in the form of signs
Jk	Gender
Force	Period/class

3. RESULTS AND DISCUSSIONS

From data processing of ATR (Deaf Children) students, several visualization data can be produced both in graphic form, the number of students' achievements for each generation, and mapping of student addresses.

Measurement of Residual Hearing

The process of collecting student data from filing and measuring remaining listening can be seen in the following picture.



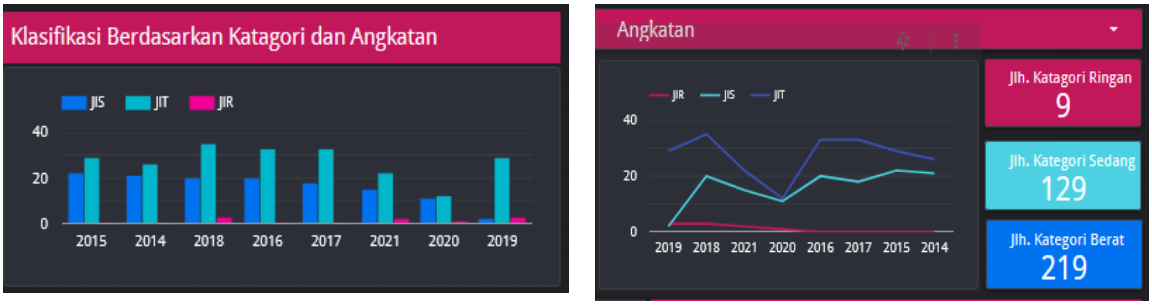
	Nama	Dbl	Dbr
1.	pepy Haryuni	83	86
2.	Ziedan Ahmad Pangestu	89	90
3.	Zelvi	95	95
4.	Yunita A Zahra	78	80
5.	Yunita	85	89
6.	Yuni Putri Utami	41	35

1 - 100 / 357

Figure 4. Graph of residual hearing measurements

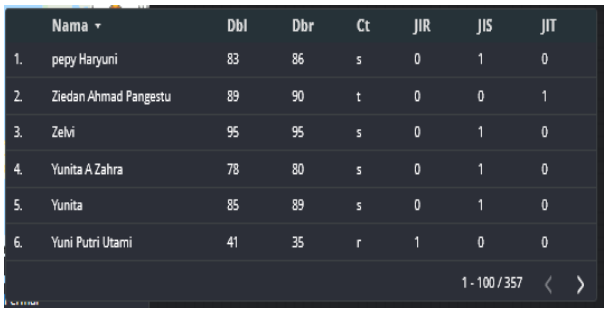
Categories Of Residual Hearing

The residual hearing category is a classification of residual hearing processes which are categorized according to the type of decibels obtained; from this category treatment will be given, which can be a differentiator during the teaching and learning process following the classification based on decibels.



(a) (b)

Figure 5. Graph of light, medium, and heavy categories



	Nama	Dbl	Dbr	Ct	JIR	JIS	JIT
1.	pepy Haryuni	83	86	s	0	1	0
2.	Ziedan Ahmad Pangestu	89	90	t	0	0	1
3.	Zelvi	95	95	s	0	1	0
4.	Yunita A Zahra	78	80	s	0	1	0
5.	Yunita	85	89	s	0	1	0
6.	Yuni Putri Utami	41	35	r	1	0	0

1 - 100 / 357

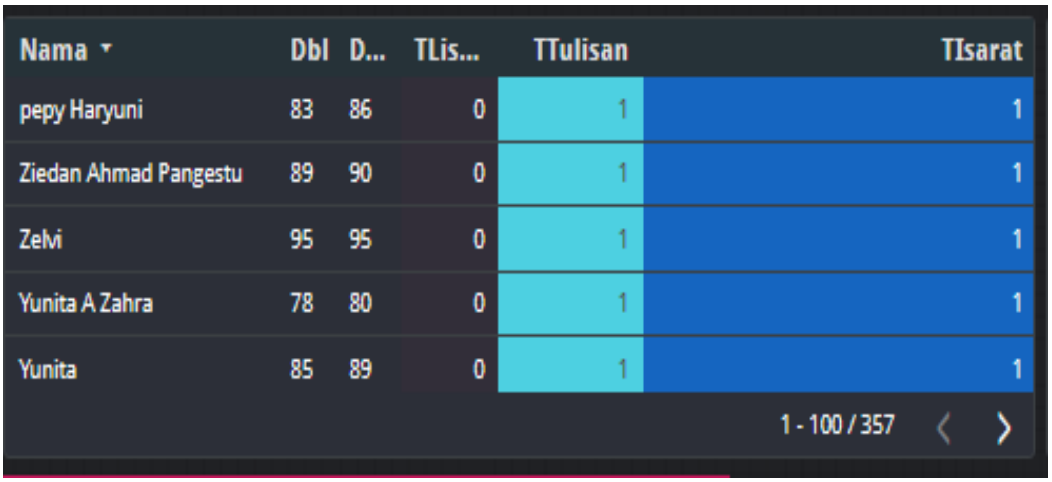
Figure 6. Classification graph r,s,t / force

Table 3. Description of Figures 4 and 5

Force	Light	Currently	Heavy
2014	0	21	26
2015	0	22	29
2016	0	20	33
2017	0	18	33
2018	3	20	35
2019	3	2	29
2020	1	11	12
2021	2	15	22

Treatment

Treatment is a policy or strengthening of the teaching patterns given to ATR students, which aims to get a better learning process from class 1 to class 3 based on the classification of their residual hearing to lead to better results. Classification and treatment from the following graph:



Nama	Dbl	D...	TLis...	TTulisan	TIsarat
pepy Haryuni	83	86	0	1	1
Ziedan Ahmad Pangestu	89	90	0	1	1
Zelvi	95	95	0	1	1
Yunita A Zahra	78	80	0	1	1
Yunita	85	89	0	1	1

1 - 100 / 357

Figure 7. The treatment graph is mild (r), moderate (s), and severe (t).

According to Boothroyd (1982:8) in Murni Winarsih (2010:7), and Haenudin (2013:57) the grouping of hearing disorders is as follows:

Group I: loss of 15-30 dB, mild hearing loss or mild deafness; ability to perceive normal human speech sounds.

Group II: loss of 31-60 dB, moderate hearing loss, or moderate deafness; The ability to perceive the sound of human conversation is only partial.

Group III: Loss of 61-90 dB, serving hearing loss or severe deafness; the ability to perceive human speech sounds is nonexistent.

Group IV: Loss of 91-120 dB, profound hearing loss, or very severe deafness; the ability to perceive the sound of human conversation is completely absent.

Group V: Loss of more than 120 dB, total hearing losses, or total deafness; the ability to perceive human speech sounds is completely absent.

Data Mapping

Visual data studio is able to provide information in the form of data that are processed and formatted into graphics in the form of maps that provide an accurate representation of certain areas in more detail. In this case, data on the whereabouts of deaf students will be presented in map form, as shown below.

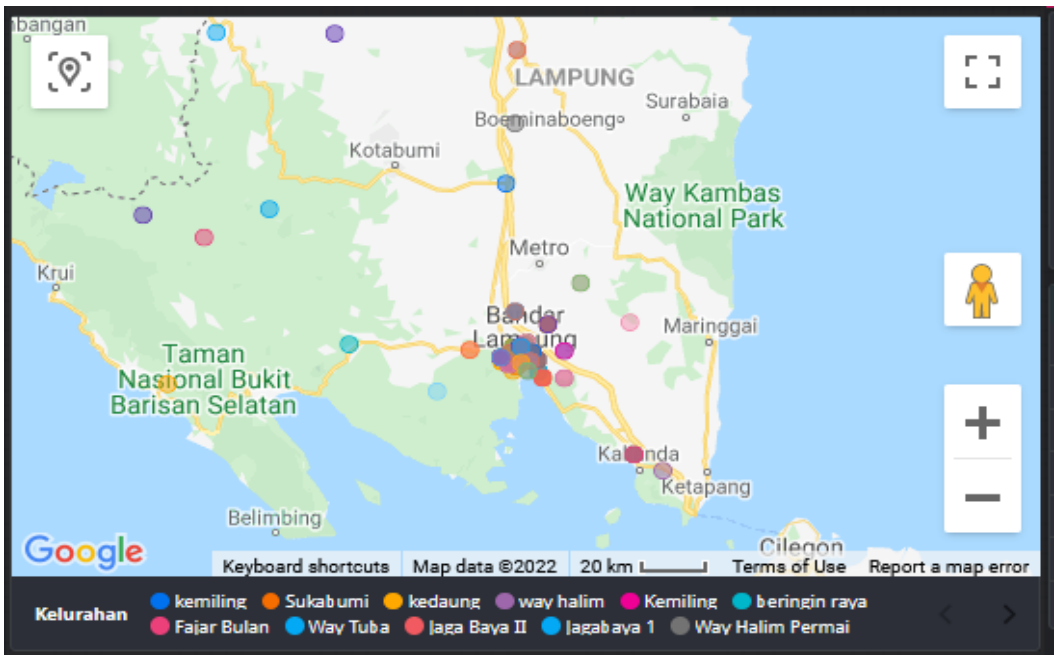


Figure 8Map of the distribution of deaf students

4. CONCLUSION

The grouping of residual hearing almost on average has Dbl = 70 - 80 in the moderate category and Dbl = 90 - 100 is classified as very heavy, only a small portion is classified as mild with Dbl = 35 - 40. From this category, learning methods will be applied with mild will be given oral treatment, while those in the moderate and severe categories will receive written and sign language and written treatment. For the moderate and severe categories, it is not given orally because the student no longer has residual hearing.

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