

RESEARCH ARTICLE

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The Influence of Knowledge, Attitude, and Behavior of Student's Personal Listening Devices Usage On The Speech Frequency Hearing Threshold In Online Learning During The Pandemic Period

Pengaruh Pengetahuan, Sikap, dan Perilaku Penggunaan *Personal Listening Device* Mahasiswa pada Ambang Dengar Frekuensi Bicara Selama Pembelajaran Daring di Masa Pandemi

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ABSTRACT

During the Covid-19 pandemic, learning activities had to be done online, increasing audiovisual technology usage. Although there are many benefits of PLD usage, these devices also indirectly harm hearing. This study aims to determine the effect of students' knowledge, attitudes, and behaviour in PLD usage on the speech frequency hearing threshold. It was observational-analytic research through filling out questionnaires. The sample was the medical students who took online learning during the pandemic. The respondents were selected by consecutive sampling and according to the inclusion criteria. Bivariate analysis was performed using the chi-square test. The variables measured were knowledge, attitudes, the behaviour of PLD usage, and speech frequency hearing threshold. The results showed a relationship between knowledge in PLD usage and speech frequency hearing threshold ($p\text{-value} < 0.05$). In contrast, attitudes and behaviour did not find a relationship with the speech frequency hearing threshold ($p\text{-value} > 0.05$). This study concludes that there were incidences of Hearing loss in college students in the second year of the pandemic for various reasons, including PLD usage. There was an influence between knowledge regarding excessive PLD usage that can cause hearing loss. There was no effect on attitudes and behaviour of PLD usage on speech frequency hearing thresholds.

Keywords: knowledge, attitude, behavior, PLD, speech frequency

ABSTRAK

Di masa pandemi Covid-19, kegiatan pembelajaran harus dilakukan secara daring sehingga penggunaan teknologi audiovisual meningkat. Meski banyak manfaat penggunaan PLD, perangkat ini juga secara tidak langsung membahayakan pendengaran. Penelitian ini bertujuan untuk mengetahui pengaruh pengetahuan, sikap, dan perilaku siswa dalam penggunaan PLD terhadap ambang dengar frekuensi bicara. Jenis penelitian ini adalah penelitian observasional-analitik melalui pengisian kuesioner. Sampelnya adalah mahasiswa kedokteran yang mengikuti pembelajaran daring selama pandemi. Responden dipilih dengan cara consecutive sampling dan sesuai dengan kriteria inklusi. Analisis bivariat dilakukan dengan menggunakan uji *Chi-Square*. Variabel yang diukur adalah pengetahuan, sikap, perilaku penggunaan PLD, dan ambang dengar frekuensi bicara. Hasil penelitian menunjukkan adanya hubungan antara pengetahuan penggunaan PLD dengan ambang dengar frekuensi bicara ($p\text{-value} < 0,05$). Sebaliknya, sikap dan perilaku tidak didapatkan hubungan dengan ambang dengar frekuensi bicara ($p\text{-value} > 0,05$). Penelitian ini menyimpulkan bahwa terdapat kejadian gangguan pendengaran pada mahasiswa pada tahun kedua pandemi karena berbagai sebab, termasuk penggunaan PLD. Terdapat pengaruh antara pengetahuan tentang penggunaan PLD berlebihan yang dapat menyebabkan gangguan pendengaran. Tidak ada pengaruh sikap dan perilaku penggunaan PLD terhadap ambang dengar frekuensi bicara.

Kata Kunci: pengetahuan, sikap, perilaku, PLD, frekuensi bicara

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Introduction

The Coronavirus pandemic or more commonly referred to as COVID-19 has been going on since December 2019. In just a few months, COVID-19 has spread to various countries, including Indonesia. The Circular Letter of the Minister of Education and Culture Number 4 of 2020 emphasises that learning can be online.

In the era of the COVID-19 pandemic, the use of technology, especially audiovisual technology, has a longer and more frequent duration. A report from the International Data Corporation increased sales of hearing devices in the earware category in 2019. The use of hearing devices such as earphones, headphones and speakers has been very widespread, and most of them are in the current generation of students, namely generation Z. In July 2018, the research results using research respondents of some 236 people in Northwest Indiana with an age range of 18-40 years showed that Generation Z (18-25 years) used headphones 75% more than Generation X (33-40 years). Of the 236 respondents, 36% reported using headphones for more than 2 hours daily. Of 36%, 44% reported having a higher average volume level than recommended (1).

Based on research conducted on 129 students of Triple "J" Health Vocational School, Bogor Regency, in 2019. It is known that as many as 58 students (44.9%) have good knowledge of using hearing devices, and as many as 71 students (55%) have good knowledge. Need to improve at using hearing devices. The study also explained that 66 students (51.1%) had a good attitude about using hearing devices, and 63 students (48.8%) had a bad attitude about using hearing devices (2).

Although there are many benefits of using hearing devices, these devices can also have an indirect impact on hearing if used inappropriately. The World Health Organization (WHO) estimates that more than 1 billion people aged 12-35 years are at risk of hearing loss due to exposure to high-frequency loud sounds. Based on this, it is necessary to research the influence of students' knowledge, attitudes, and behaviour of PLD usage on the average speech frequency threshold during a pandemic.

Method

This research was an analytic observational study with a cross-sectional approach to determine the relationship between students' knowledge, attitudes, and behaviour on the average hearing threshold of speech frequency by filling out a questionnaire. The variables examined in this study were knowledge, attitudes, and behaviour in PLD usage as the independent variables and the average frequency of speech thresholds as the dependent variable.

The knowledge and attitude questionnaire was modified from Ilma et al. and Alanazi research in Indonesian language (15, 28). The knowledge of the PLD usage variable consists of 12 questions tested for validity. The total knowledge score was 0-13. Then the scores were classified into 4 categories, namely "very good" if the score was 11-13, "good" if the score was 8-10, "fairly good" if the score was 5-7, and "poor" if the score was 0-

4. The attitude of the PLD usage variable consists of 9 questions tested for validity. The total attitude score was 0-40. Then the scores were classified into 4 categories, namely "very good" if the score was 31-40, "good" if the score was 21-30, "fairly good" if the score was 11-20, and "poor" if the score was 0-10. The behavioural of the PLD usage variable consists of 11 questions tested for validity. The total behaviour score was 0-30. Then the scores were classified into 4 categories, namely "very good" if the score was 24-30, "good" if the score was 17-23, "fairly good" if the score was 10-15, and "poor" if the score was 0-9.

Hearing assessment using the "Hearing Test" application at 500, 1000, 2000 and 4000 Hz speech frequencies. Based on Masalski's research, the Hearing Test application has a sensitivity and specificity for a mobile-based screening at 98% (95% CI 93-100.0) and 79% (95% CI 71-87), respectively (29). Then the average hearing threshold was classified into 7 categories, namely "normal" if the average hearing threshold was <20 dB, "mild hearing loss" if the average hearing threshold was 20-34.9 dB, "moderate hearing loss" if the average hearing threshold was hearing threshold 35-49.9 dB, "moderately severe hearing loss" if the average hearing threshold was 50-64.9 dB, "severe hearing loss" if the average hearing threshold was 65-79.9 dB, "very severe hearing loss" if the average hearing threshold was > 95 dB.

The sampling method in this study was the consecutive sampling technique. The respondents were Brawijaya University medical students who had met the inclusion criteria, namely students who took part in online learning in the second year of the pandemic period, were willing to be research respondents, filled out a complete questionnaire, and did not have hearing loss at least 1 week before the hearing assessment. The hearing assessment was conducted in a room with a noise threshold of less than 40 dB.

The study results were then analyzed statistically with the Chi-Square test using SPSS 25 software. This research has received ethical feasibility from the Research Ethics Committee of the Faculty of Medicine, University of Brawijaya Malang, No. 210/ec/KEPK/07/2021.

Result

Characteristics of Age and Gender of Respondents.

The number of respondents who filled out the questionnaire was 544, but those who fit the inclusion criteria were 252 students. The data shows that most respondents were aged 19-21, namely 224 out of 252 (88.9%). In contrast, the respondents were at least >22 years old, with 10 respondents (4%). The most common gender was female, with 162 of 252 respondents (64.3%).

Description of Knowledge Level Variables.

From the data, it was found that most respondents had "very good" knowledge of PLD usage, as many as 115 out of 252 respondents (61.5%), followed by a "good knowledge" of 91 out of 252 respondents (36.1%), respondents who had "fairly good knowledge"

only 6 out of 252 respondents (2.4%), and no respondents had "poor knowledge".

Description of Attitude Level Variable

The data found that most respondents had "a very good" attitude toward PLD usage, namely 162 out of 252 respondents (64.2%). Following the number of respondents who had "a good" attitude, as many as 89 out of 252 respondents (35.3%), only 1 out of 252 respondents (0.4%) had "a fairly good" attitude, and no respondents had "a poor" attitude.

Description of Behavior Level Variables

The data found that most respondents had "a fairly good" attitude towards PLD usage, namely 119 out of 252 respondents (47.2%). Followed by respondents who had "good behaviour" as much as 74 out of 252 respondents (29.4%), respondents with "poor" behaviour as much as 51 out of 252 respondents (20.2%), and respondents with "very good" behaviour only as many as 8 out of 252 respondents (3.2 %). It can be concluded that students still need to improve their behaviour towards PLD usage.

Description of Speech Frequency Hearing Threshold

The data shows that out of 252 respondents, there were 37 respondents experienced an increase in the average hearing threshold above 20 dB. Respondents who had an increased hearing threshold were in the right ear (unilateral) 7 out of 37 respondents (19%), in the left ear (unilateral), as many as 13 out of 37 respondents (35%), and both sides (bilateral) as many as 17 out of 37 respondents (46%). So the majority of respondents who experienced an increase in speech frequency hearing threshold were on the unilateral rather than a bilateral side, namely, 20 out of 37 respondents (54%). To determine the degree of hearing loss category, especially in the case of bilateral hearing loss, we took the ear with the least impairment (3). Based on these criteria, most respondents had a normal average hearing threshold, namely 235 out of 252 respondents (93.25%). Followed by mild hearing loss, as many as 15 of 252 respondents (5.95%) and only 1 of 252 respondents (0.8%) had moderate hearing loss.

Correlation between Knowledge of PLD usage with the Speech Frequency Hearing Threshold.

Table 1 shows a significant relationship between knowledge questions 2, 11, and 13 with the average speech frequency hearing threshold because the analysis results have a p-value <0.05. Meanwhile, the other questions had no significant relationship with the speech frequency hearing threshold (p-value > 0.05).

Correlation between Attitude of PLD usage with the Speech Frequency Hearing Threshold.

Table 2 shows no significant relationship between students' attitudes towards using PLD and the speech frequency hearing threshold (p-value > 0.05).

Correlation between Behavior of PLD usage with the Speech Frequency Hearing Threshold.

Table 3 shows no significant relationship between students' behaviour of PLD usage and the speech frequency hearing threshold (p-value > 0.05).

Discussion

Characteristics of Age and Gender of Respondents.

In the research results, it was found that the majority of respondents were aged 19-21 years (61%). It was because the respondents were taken from the 2018-2020 batch, and most were born in 2000-2002. The study's results also found that most respondents were women (64.3%) compared to men (35.7%). Most students were female, so there were more female respondents than male respondents.

Description of Knowledge Level Variables.

Based on the study's results, most respondents had "very good" knowledge of PLD usage (61.5%). These results were slightly different from the results of Pasundan 8 SMA students in Bandung City, with the results being divided into three categories, namely respondents with good knowledge (38.8%), sufficient knowledge (41.5%), and poor knowledge (19.7%) (4). The age factor can influence it; the older you are, the more mature you think and work. Age also affects understanding and thinking. Other factors that can also play a role are education, the media, and the environment (5).

Description of Attitude Level Variable.

The research results found that most respondents had a very good attitude towards PLD usage (64.2%). These results were in line with Zain's research on students of SMAN 5 Kota Padang, with results divided into three categories, namely the good category (80.9%), the moderately good category (17.1%), and the poor category (2%) (6). Irmaati said that education is a process of changing attitudes and efforts to mature memory through teaching and practice. Other factors that can change a person's attitude include the person's environment (home, school), work, experience, and education (8).

Description of Behavior Level Variables.

The research results found that most respondents had quite good behaviour in PLD usage (47.2%), and respondents with very good behaviour only 8 (3.2%). It is in line with research on students of SMAN 5 Padang City regarding research on the description of adolescent behaviour towards earphones usage, with the results being divided into three categories, namely moderately good behaviour (66.3%), good behaviour (25%), and poor behaviour (8.7%) (6). Age can affect this behaviour. Ages 18-25 years are known to use headphones 75% more often than ages 33-40 years (1). Other factors that can affect a person's behaviour can also come from internal factors, namely level of intelligence, emotional level, gender, etc. and external factors like physical environment, social environment, etc. (9).

Description of Speech Frequency Hearing Threshold.

In the study results, it was found that most respondents did not have hearing loss (93.25%). Respondents with speech frequency in the mildly hearing loss were 15 students (5.95%) and only 2 students who fell into the moderately hearing loss (0.8%). It was in line with the results of research on medical students batch 2012 at Sam Ratulangi University with the results that the majority of respondents also did not have hearing loss (66.7%), respondents had mild hearing loss (26.7%), and moderately hearing loss (6.7%) (10). According to Dwiyanto, factors that affect hearing quality can include noise intensity, frequency, type of noise, duration of exposure, individual vulnerability, age, and use of hearing protection (11).

Correlation between Knowledge of PLD usage with the Speech Frequency Hearing Threshold.

There are three questions (2, 11, 13) which have a significant relationship with the hearing threshold, namely "excessive PLD usage can cause hearing loss", "if a person does not hear another person's voice when speaking and responds in the form of yes or what is a sign of hearing loss", and "turning up the TV or radio volume is a sign of hearing loss". Based on Pasi's research concluded that knowledge can positively affect behaviour when a person uses his knowledge correctly (12). In Rifqi's research, it was said that teenagers in the millennial era often underestimate earphone usage wisely, and thoughts about the long-term impact are ignored (13). High knowledge will form a positive attitude reflected in behaviour (14). Knowledge is very closely related to the decisions to be taken because, with knowledge, a person has a basis for making decisions (5). However, if the knowledge of PLD usage is good but not followed by a willingness to change, it will not have an effect and can cause the person to remain at risk of hearing loss.

Correlation between Attitude of PLD usage with the Speech Frequency Hearing Threshold.

Based on the analysis results between the attitude points, no significant relationship exists to the speech frequency hearing threshold. It is in line with Ilma's research on students of SMAN X Tangerang, who found no statistically significant relationship between attitudes and behaviour of PLD usage (15). However, it differs from the results of Susiyanti's research, which concluded that noise-induced hearing loss was not based on a low level of knowledge but was influenced by individual attitudes towards earphone usage themselves (16).

Notoatmodjo argues that when a person's behaviour is based on knowledge, awareness, and a

positive attitude, the behaviour will last long. Conversely, if a behaviour is not based on knowledge and awareness and is followed by a negative attitude, then the behaviour will not last long (14). Putra's research on the factors influencing attitudes towards accepting and using the state budget treasury system found that positive attitudes did not affect output quality, and negative attitudes harmed output quality (17). A person's attitude towards using a hearing device can be positive (accept) or negative (reject) depending on the person's understanding and also produce different speech frequency hearing thresholds.

Correlation between Behavior of PLD usage with the Speech Frequency Hearing Threshold.

Based on the analysis results between the behavioural points and speech frequency hearing threshold, there was no significant relationship to speech frequency hearing threshold. Based on the analysis results on point number one, it is concluded that there is no significant relationship between the use of a hearing device and the average speech frequency hearing threshold. This result is different from the results of Syahrizal's research on 148 Trisakti University medical students, with the results of the study that there was a relationship between headset use and hearing function (18).

In points two, three, five, seven, and ten, it was concluded that there was no significant relationship between the duration, frequency, volume, and type of PLD usage and speech frequency hearing threshold. It has different results from Novita's research on 51 medical students. The data was taken before the pandemic. The study shows a relationship between the duration, intensity, volume, and type of PLD usage with hearing loss. However, there was also no significant relationship between the frequency of PLD usage and hearing loss (19).

According to Bashiruddin, the noise affecting the community has a unit of time or duration of exposure, which is asked in hours per day or week (20). Pandi found hearing loss occurs when exposure lasts 1-4 hours when exposed to 120 dB. Upon exposure, it can cause varying degrees of damage to hair cells and supporting cells, blood vessels, and afferent fibres. Noise exposure considered safe is 8 hours per day or 40 hours per week with an intensity not exceeding 85 dB.

According to Herman, 80% of the volume can be heard up to 1.2 hours per day, and 70% is only 4.6 hours per day. In addition, the risk of trauma due to noise will be greater. Herman also pointed out that earbuds-PLD type cannot block out ambient noise well, causing a person to raise the volume in a noisy environment (21).

Tabel 1. Correlation between Knowledge of PLD usage with the Speech Frequency Hearing Threshold.

No	Knowledge of PLD usage		Speech Frequency Hearing Threshold				Chi Square (<i>p-value</i>)
			Normal (%)	Mild HL (%)	Moderate HL (%)	Total (%)	
1	Young people like you can experience permanent hearing loss.	True	218 (86.5%)	14 (5.6%)	2 (0.8%)	234 (92.9%)	0.922
		False	17 (6.7%)	1 (0.4%)	0 (0%)	18 (7.1%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
2	Excessive PLD usage can cause hearing loss.	True	234 (92.9%)	14 (5.6%)	2 (0.8%)	250 (99.2%)	0.030*
		False	1 (0.4%)	1 (0.4%)	0 (0%)	2 (0.8%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
3	Noise caused by excessive PLD usage can damage hearing cells.	True	234 (92.9%)	15 (6%)	2 (0.8%)	251 (99.6%)	0.964
		False	1 (0.4%)	0 (0%)	0 (0%)	1 (0.4%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
4	Damage to hearing cells (especially the outer hair cells) in the human cochlea is different from animals, that is difficult to regenerate	True	185 (73.4%)	13 (5.2%)	2 (0.8%)	200 (79.4%)	0.586
		False	50 (19.8%)	2 (0.8%)	0 (0%)	52 (20.6%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
5	Excessive PLD usage can cause permanent hearing damage.	True	205 (81.3%)	14 (5.6%)	2 (0.8%)	221 (87.7%)	0.681
		False	30 (11.9%)	1 (0.4%)	0 (0%)	31 (12.3%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
6	Hearing loss caused by excessive PLD usage can result in dizziness, ear ringing, and vertigo.	True	226 (89.7%)	15 (6%)	2 (0.8%)	243 (96.4%)	0.713
		False	9 (3.6%)	0 (0%)	0 (0%)	9 (3.6%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
7	Remove your PLD immediately if ear ringing symptoms appear after excessive PLD usage	True	233 (92.5%)	15 (6%)	2 (0.8%)	250 (99.2%)	0.930
		False	2 (0.8%)	0 (0%)	0 (0%)	2 (0.8%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
8	Tinnitus or ear ringing is the initial symptom of hearing loss due to excessive PLD usage.	True	224 (88.9%)	15 (6%)	2 (0.8%)	241 (95.6%)	0.660
		False	11 (4.4%)	0 (0%)	0 (0%)	11 (4.4%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
9	A hearing device with a loudness level of 85 dB is permitted for only two hours daily.	True	97 (38.5%)	3 (1.2%)	1 (0.4%)	101 (40.1%)	0.254
		False	138 (54.8%)	12 (4.8%)	1 (0.4%)	151 (59.9%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	

10	Hearing loss due to PLD usage can be prevented.	True	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	-
		False	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
11	If a person cannot hear another person's voice when speaking, by responding with "Yes? or What?" is a sign of hearing loss	True	102 (40.5%)	12 (4.8%)	1 (0.4%)	115 (45.6%)	0.022*
		False	133 (52.8%)	3 (1.2%)	1 (0.4%)	137 (54.4%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
12	Hearing loss if other people's voices sound muffled or as if people are mumbling	True	199 (79%)	14 (5.6%)	2 (0.8%)	215 (85.3%)	0.552
		False	36 (14.3%)	1 (0.4%)	0 (0%)	37 (14.7%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
13	Young people like you can experience permanent hearing loss.	True	127 (50.4%)	15 (6%)	1 (0.4%)	143 (56.7%)	0.002*
		False	108 (42.9%)	0 (0%)	1 (0.4%)	109 (43.3%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	

*the significant level for Chi-Square test ($p < 0.05$)

The knowledge and attitude questionnaire was modified from Ilma et al. and Alanazi research in Indonesian language (15, 28).

Tabel 2. Correlation between Attitude of PLD usage with the Speech Frequency Hearing Threshold.

No	Attitude of PLD usage		Speech Frequency Hearing Threshold				Chi Square (p-value)
			Mild HL (%)	Tuli Ringan (%)	Tuli Sedang (%)	Total (%)	
1	I am ready to use a PLD with a safe threshold.	Agree	233 (92.5%)	15 (6%)	2 (0.8%)	250 (99.2%)	0.930
		Disagree	2 (0.8%)	0 (0%)	0 (0%)	2 (0.8%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
2	Listening to music using a PLD during my assignments can help me concentrate.	Agree	131 (52%)	11 (4.4%)	0 (0%)	142 (56.3%)	0.112
		Disagree	104 (41.3%)	4 (1.6%)	2 (0.8%)	110 (43.7%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
3	I will convince my friend to reduce PLD usage.	Agree	210 (83.3%)	13 (5.2%)	2 (0.8%)	225 (89.3%)	0.840
		Disagree	25 (9.9%)	2 (0.8%)	0 (0%)	27 (10.7%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
4	I will convince my friend to reduce PLD volume.	Agree	224 (88.9%)	14 (5.6%)	2 (0.8%)	240 (95.2%)	0.894
		Disagree	11 (4.4%)	1 (0.4%)	0 (0%)	12 (4.8%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	

5	Listening well is important.	Agree	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
		Disagree	0 (0%)	0 (0%)	0 (0%)	0 (0%)	-
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
6	I can protect my hearing function.	Agree	229 (90.9%)	15 (6%)	2 (0.8%)	246 (97.6%)	
		Disagree	6 (2.4%)	0 (0%)	0 (0%)	6 (2.4%)	0.801
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
7	I like it when my surroundings are quiet.	Agree	193 (76.6%)	10 (4%)	1 (0.4%)	204 (81%)	
		Disagree	42 (16.7%)	5 (2%)	1 (0.4%)	48 (19%)	0.179
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
8	I can protect my hearing function.	Agree	96 (38.1%)	7 (2.8%)	0 (0%)	103 (40.9%)	
		Disagree	139 (55.2%)	8 (3.2%)	2 (0.8%)	149 (59.1%)	0.451
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
9	I use PLD with safe volume.	Agree	222 (88.1%)	14 (5.6%)	2 (0.8%)	238 (94.4%)	
		Disagree	13 (5.2%)	1 (0.4%)	0 (0%)	14 (5.6%)	0.926
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
10	I can concentrate even though there are many different sounds around me.	Agree	100 (39.7%)	10 (4%)	0 (0%)	110 (43.7%)	
		Disagree	135 (53.6%)	5 (2%)	2 (0.4%)	142 (56.3%)	0.087
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	

*the significant level for Chi-Square test ($p < 0.05$)

The knowledge and attitude questionnaire was modified from Ilma et al. and Alanazi research in Indonesian language (15, 28).

Tabel 3. Correlation between Behavior of PLD usage with the Speech Frequency Hearing Threshold.

			Speech Frequency Hearing Threshold				Chi Square (<i>p-value</i>)
No	Behavior of PLD usage		Normal (%)	Mild HL (%)	Moderately HL (%)	Total (%)	
1	I am a PLD user.	Yes	181 (71.8%)	14 (5.6%)	1 (0.4%)	196 (77.8%)	0.215
		No	54 (21.4%)	1 (0.4%)	1 (0.4%)	56 (22.2%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
2	How long have you used PLD, from before the pandemic until now?	≥3 year	99 (39.3%)	4 (1.6%)	1 (0.4%)	104 (41.3%)	0.483
		<3 year	136 (54%)	11 (4.4%)	1 (0.4%)	148 (58.7%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
3	The duration of PLD usage per day before the pandemic.	≥4 hours	199 (79%)	11 (4.4%)	2 (0.8%)	212 (84.1%)	0.419

		<4 hours	36 (14.3%)	4 (1.6%)	0 (0%)	40 (15.9%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
4	The duration of PLD usage per day during the pandemic.	≥ 4 hours	129 (51.2%)	10 (4%)	2 (0.8%)	141 (56%)	0.304
		< 4 hours	106 (42.1%)	5 (2%)	0 (0%)	111 (44%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
5	Frequency of PLD usage per weeks before the pandemic.	≥5 days	163 (64.7)	8 (3.2%)	2 (0.8%)	173 (68.7%)	0.272
		<5 days	72 (28.6%)	7 (2.8%)	0 (0%)	79 (31.3%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
6	Frequency of PLD usage per week during the pandemic.	≥5 days	96 (38.1%)	7 (2.8%)	2 (0.8%)	105 (41.7%)	0.221
		<5 days	139 (55.2%)	8 (3.2%)	0 (0%)	147 (58.3%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
7	Noise volume of PLD usage.	>80%	159 (63.1%)	11 (4.4%)	2 (0.8%)	172 (68.3%)	0.753
		60-80%	62 (24.6%)	4 (1.6%)	0 (0%)	66 (26.2%)	
		<60%	14 (5.6%)	0 (0%)	0 (0%)	14 (5.6%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
8	Situations when using PLD.	everytime	150 (59.5%)	12 (4.8%)	1 (0.4%)	163 (64.7%)	0.567
		Online learning and during sleeping	37 (14.7%)	1 (0.4%)	0 (0%)	38 (15.1%)	
		Only at online learning	48 (19%)	2 (0.8%)	1 (0.4%)	51 (20.2%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
9	Increased PLD usage before and after the pandemic.	Yes	82 (32.5%)	5 (2%)	2 (0.8%)	89 (35.3%)	0.157
		No	153 (60.7%)	10 (4%)	0 (0%)	163 (64.7%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
10	The PLD type that often used.	Supraaural & circumaural	27 (10.7%)	4 (1.6%)	0 (0%)	31 (12.3%)	0.193
		Canalphone & earbud/earphone	208 (82.5%)	11 (4.4%)	2 (0.8%)	221 (87.7%)	
		Total	235 (93.3%)	15 (6%)	2 (0.8%)	252 (100%)	
11	Availability of noise-reducing facilities in PLD.	Yes	117 (46.4%)	4 (1.6%)	1 (0.4%)	122 (48.4%)	0.221

No	118	11	1	130
	(46.8%)	(4.4%)	(0.4%)	(51.6%)
Total	235	15	2	252
	(93.3%)	(6%)	(0.8%)	(100%)

*the significant level for Chi-Square test ($p < 0.05$)

The knowledge and attitude questionnaire was modified from Ilma et al. and Alanazi research in Indonesian language (15, 28).

A person's susceptibility can also influence noise that is not the same (22) and may also be due to the person who often used PLD but recently rarely uses it anymore.

In point four, there is no significant relationship between the duration of PLD usage during the pandemic and the speech frequency hearing threshold. Erlanda's research on 42 medical students at Baiturrahmah University showed no relationship between the intensity of earphone usage and the degree of hearing loss (23).

In point number six, there was no significant relationship between the frequency of PLD usage during the pandemic and the speech frequency hearing threshold. It differs from Hartono's research on 146 Triple J Health High School students, Citereup District, Bogor Regency. There was a relationship between the frequency of usage and the subjective complaints of hearing loss. The results may differ due to differences in the definition of frequency asked in research, where in this study, the frequency of PLD usage was <5 days or >5 days and in Hartono's study was <7 days and 1-2 days per week. In points four and six, this can be supported by the results of research number nine, which states that there was no significant relationship between increased use of hearing devices before and after the pandemic with the speech frequency hearing threshold.

In point eight, it was no significant relationship between the situation when using PLD and speech frequency hearing threshold. Dharma's research on medical students at the University of Mataram stated that some behaviours of headsets usage could trigger factors that cause ear disorders, namely the habit of exchanging headsets, the habit of using headsets while sleeping, and the habit of using headsets in crowded places. Dharma stated that these factors significantly affected ear disorders like pain and itching but had no effect on external ear disorders (fluid discharge from the ear) and hearing loss (tuning fork and OAE examination) (24).

In question eleven, no significant relationship existed between the noise-reducing facility and speech frequency hearing threshold. These results contrast Seol's study, which showed that noise-reducing significantly lowered the sound pressure level for all types of earphones, thus demonstrating the potential benefits of noise-reducing as hearing protection (25). The purpose of an active noise-reducing facility is to reduce the amplitude of the sound pressure level of the noise entering the receiver (26).

WHO has advised using noise-reducing facilities in noisy environments (27). Another factor that can influence the respondent's negative attitude (indifferent to noise-reducing), which in this case, can harm the quality of the user's output on his hearing function (17).

It can be concluded from all the discussions above that the behaviour of PLD usage on the average

speech frequency hearing threshold cannot be influenced by just one factor.

Conclusion

Based on the research that we have done, there were incidences of hearing loss in college students in the second year of the pandemic period for various reasons, one of which was due to PLD usage. There was an influence between knowledge regarding excessive PLD usage can cause hearing loss, knowledge if someone hears other people's voices clearly when talking and responds in the form of "yes" or "what" is a sign of hearing loss, and knowledge of raising the volume of the TV or radio were symptoms of hearing loss on speech frequency hearing threshold during a pandemic. There was no effect on attitudes and behaviour on speech frequency hearing thresholds.

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Data Availability Statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author/s.

Supplementary Material

The Supplementary Material for this article can be found online at :

<https://altera.ub.ac.id/index.php/altera/article/view/10>

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