Noise exposure in vocational school

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Abstract. Hearing Conservation Program is a series of activities designed to prevent hearing loss in Vocational High School students. The objectives of the research were to know the difference between 10th grade and 12th grade student’s questionnaires result which includes the presence of hearing loss, personal protective equipment, the student’s knowledge of hearing loss, and both ears Pure Tone Average (PTA) value of the 10th grade and 12th grade students that exposed to noise. The research was analytic observational by assessing the result of questionnaire and audiometric examination using cross sectional study. The questionnaires charging, audiometric examination, and the measurement of equipment’s noise with Sound Level Meter (SLM) have been conducted for 3 months. The samples were 74 students taken from each 10th grade and 12th grade classes at light vehicle engineering majors. The data were processed, analyzed statistically. Assessment of questionnaire results, there was no difference between 10th grade and 12th grade students (Mann-Whitney test, p = 1). There were no differences in right-ear PTA value between 10th grade and 12th grade students (Two-Sample t-Test, p = 0.10), whereas left ear PTA indicate differences between 10th grade and 12th grade students (Mann-Whitney test, p = 0.001). The questionnaires data indicate that schools haven’t done yet a hearing conservation program for 10th grade and 12th grade students. The differences in the student’s right and left ear PTA indicate the possibility that noise exposure on students of light vehicle engineering majors have some effect.

1. Introduction
Noise Induced Hearing Loss (NIHL) is often occurs due to high level of noise exposure over long period of time. This type of hearing loss, in general, caused by prolonged occupational exposure to noise. Noise induced hearing loss is sensorineural type of hearing loss. Factors which affect hearing loss that is high intensity noise, high frequency, duration of noise exposure, individual sensitivity and other factors that can lead to hearing loss [1], [2].

Educational process in vocation school are not only done in class but requires learning in the form of a practicum that uses machine in long period of time. Lack of information that the students receive about the danger of noises may influence their hearing loss so that a hearing conservation program is necessary [3].

This research aimed to know the implementation of hearing conservation program in vocational school and to know the hearing loss in group of students exposed to noise.
2. Method
The research was analytic observational using cross sectional study design. The research population is all students of vocational school majoring in light vehicle engineering that using machine, the sample in this research 10th grade students as control group which have not exposed yet to noise and 12th grade students as case group in light vehicle engineering majors which fulfill the inclusion and exclusion research criteria.

Questionnaires were filled in by answering the options deemed correct by the respondent and the ears are sure to be clean of dirt prior to the audiometric examination. In this research the audiometric examination (GSI-Arrow brand) was conducted on both ears. The examination results obtained values on four frequencies of 500Hz, 1000Hz, 2000Hz, 4000Hz and the PTA calculated on all four frequencies in both ears. Measurement of noise level of practicum tool was done with SLM tool (Tenmars brand), the data obtained was processed and analyzed using statistical method. Place of research is SMK Negeri 5 Surabaya, research conducted in March until May 2016.

3. Results
The study was conducted in two groups of students. 10th grade students as a control group of 74 students with age ranged between 15 years to 17 years and 12th grade students as case group of 74 students, with the age ranged between 17 years to 19 years. All the students picked as a sample is male. The result of statistical analysis of the questionnaire results showed that there was no difference in all three categories includes hearing loss, the use of personal protective equipment, and the students knowledge (Mann-Whitney test, p = 1), this may indicate the school have not done yet the hearing conservation program for the students, so that there are no distinguishable results of the three categories of questionnaire data assessment. Whereas the audiometry examination of both groups showed difference PTA value of right ear and left ear in the amount of 1,71 dB (Table 1).

| Table 1. PTA Data of 10th and 12th grade |
|-----------------------------------------|
| **PTA (dB)**                            |
|-----------------------------------------|
| Right Ear                               |
| 25,70                                   |
| Left Ear                                |
| 23,99                                   |

Normality test (Kolmogorov-Smirnov test) performed on statistical analysis results of PTA right and left ear 10th and 12th grade. The result of PTA of right ear obtained normally distributed data (p = 0,18), then Two-Sample t-Test was performed and there was no difference on right ear PTA (p = 0,10). Whereas the result of PTA left ear normality test obtained abnormally distributed data (p = 0,004), then Mann-Whitney test was performed and obtained difference of PTA of left ear (p = 0,001) (Table 2).

| Table 2. Statistical Analysis Results of 10th and 12th grade PTA |
|-----------------------------------------|
| **Statistical Analysis**                | **PTA Right Ear** | **PTA Left Ear** |
|-----------------------------------------|-------------------|------------------|
| Kolmogorov-Smirnov Test                 | p=0,18            | p=0,004          |
| Two-Sample t-Test                       | p=0,10            | Not performed    |
| Mann-Whitney Test                       | Not performed     | p=0,001          |

At the measurement of engine noise level, the students were exposed to the machine noisy for ± 9 hours (08.00 am-05.00 pm). There were 3 types of machines that caused noise above the limits of
harmful noise level that is the compressor engine with noise level of 84.8 dB-102.8 dB, iron cutting machine (grinders) of 81.9 dB-93.5 dB and car lab of 88 dB (Table 3).

### Table 3. Practicum Machine Noise Level

| Type of Machine       | Noise Level (dB) |
|-----------------------|------------------|
| Compressor            | 84.8 – 102.8     |
| Iron cutting machine  | 81.9 – 93.5      |
| (grinders)            |                  |
| Car lab               | 88               |

4. Discussion

Modern technology can induce few problems on hearing, which also has wide effect towards concentration and communication impairments. It leads toward permanent hearing loss. The main effect of noise exposure is impairment in hearing organs, causing temporary or permanent hearing impairments, depends on the intensity, time of exposure, and host’s sensitivity [4].

Environmental noises are the main health problem in various countries, including Indonesia. Based on World Health Organization (WHO), noise is classified as a pollutant. A structured program is needed to prevent hearing impairments and reduce noise in school environment. Hearing conservation program is a chain of activities, which aiming to prevent Noise Induced Hearing Loss [5].

In this experiment, the result is gained through questionnaire in tenth and twelve graders. There is not any significant difference on hearing impairment, utilization of personal protection equipment and knowledge about the danger of noise problem, since the school has not applying the hearing conservation program in students. Lack of knowledge about the danger of noise problem and no utilization of personal protection equipment while doing the experiment causing danger, which raise the risk of hearing impairments in students.

Based on WHO (2000), there are significant elevations in hearing impairments and hearing loss prevalence. Indonesia is one of four South East Asia countries with a quite high hearing impairment prevalence (4.6%), 328 million of the population (about 91%) is adult, meanwhile the other 32 million is children [6].

Based on Survei Kesehatan Indera Penglihatan dan Pendengaran in year 1993 until 1996, it is showed that the morbidity rate data is high: disease of the ear is 18.5%, hearing impairments prevalence is 16.8%, meanwhile hearing loss is 0.4% and occurs mostly in school age (about 7-18 years old) [7].

In this experiment, measurement is done in two groups. Tenth grader is the control group and twelve graders are the case group. There is difference of Pure Tone Average (PTA) in left ear, because located near the source of the noise. (PTA > 25 dB) It is classified as mild hearing impairment.

Noise induced by the practicum machine exceeds the save margin (85 dB). Protecting the students from noise exposure is important, such as utilizing personal protection equipment for ear. It is also important to educate the students as soon as possible so they can avoid noise exposure. For the future, hearing conservation program needs to be applied in school.

5. Conclusion

There is not any significant difference in the questionnaire result, showing that the school has not applying hearing conservation program in tenth and twelve graders. There is not any PTA difference in right ear, means the students are in high risk of the danger of experiment machine (>85 dB). There is difference between right and left ear. Could be caused by the location of the noise source. The left ear is at the higher risk of experiment machine’s noise.
6. References

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