ERGONOMICS INVESTIGATION ON THE EFFECT OF NOISE ON HUMAN PERFORMANCE

MOHZANI MOKHTAR

UNIVERSITI SAINS MALAYSIA
KAMPUS KEJURUTERAAN
2008

Laporan Akhir Projek Penyelidikan Jangka Pendek

Ergonomics Investigation on the Effect of Noise on Human Performance

by
Mohzani Mokhtar
Dr. Shahrul Kamaruddin
Dr. Zahid Akhtar Khan

UNIVERSITI SAINS MALAYSIA

PEJABAT PENGURUSAN & KREATIVITI PENYELIDIKAN
RESEARCH CREATIVITY AND MANAGEMENT OFFICE [RCMO]

LAPORAN AKHIR PROJEK PENYELIDIKAN JANGKA *PENDEK*
FINAL REPORT OF SHORT TERM RESEARCH PROJECTS

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1). Nama Ketua Penyelidik :
Name of Research Leader :

Ketua Penyelidik *Research Leader*	PTJ *School/Centre*
En. Mohzani Mokhtar	Pusat Pengajian Kejuruteraan Mekanik

Nama Penyelidik Bersama
(Jika berkaitan) :
Name/s of Co-Researcher/s
(if applicable)

Penyelidik Bersama *Co-Researcher*	PTJ *School/Centre*
Dr. Shahrul Kamaruddin	Pusat Pengajian Kejuruteraan Mekanik
Dr. Zahid Akhtar Khan	Department of Mechanical Engineering, Faculty of Engineering & Technology Jamia Millia Islamia, Central University, India.

2) Tajuk Projek : ..... Ergonomics Investigation on the Effect of Noise on Human Performance
Title of Project:

3) **Abstrak untuk penyelidikan anda**

(Perlu disediakan di antara 100 – 200 perkataan di dalam **Bahasa Malaysia dan Bahasa Inggeris**. Ini kemudiannya akan dimuatkan ke dalam Laporan Tahunan Bahagian Penyelidikan & Inovasi sebagai satu cara untuk menyampaikan dapatan projek tuan/puan kepada pihak Universiti & luar).

Abstract of Research

(Must be prepared in 100 – 200 words in Bahasa Malaysia as well as in English. This abstract will later be included in the Annual Report of the Research and Innovation Section as a means of presenting the project findings of the researcher/s to the university and the outside community)

Versi Bahasa Malaysia

Projek penyelidikan ini telah menumpukan kepada kesan-kesan bunyi bising di dalam kawasan industri kepada pekerja industri. Dijangkakan pekerja-pekerja yang bekerja di dalam persekitaran yang bising mungkin akan menerima kesan daripada bunyi bising seperti kesan fisiologi, kesan psikologi, kesan hilang pendengaran, kesan kepada perbualan dan gangguan tidur.

Objektif kajian penyelidikan adalah menentukan sama ada tahap-tahap kebisingan yang berbeza memberi kesan terhadap prestasi kerja manusia. Di samping itu, ianya juga dapat menentukan pendedahan kebisingan yang bersesuaian dengan prestasi kerja manusia.

Bagi mencapai objektif tersebut, tiga industri berbeza yang telah dipilih untuk kajian ialah pengeluar produk berasaskan getah, syarikat hentakkan logam dan syarikat percetakan penerbitan. Set-set soalselidik yang mengandungi 40 soalan yang meliputi pelbagai aspek kesan bunyi bising telah disediakan dan diedarkan kepada sejumlah 120 orang pekerja-pekerja di ketiga-tiga lokasi yang dinyatakan diatas. Maklumbalas daripada pekerja-pekerja telah dikumpulkan dan dijadikan sebagai data asas analisis seterusnya.

Satu ujian statistik yang terkenal iaitu Ujian Chi-Square telah digunakan untuk menentukan signifikan kesan-kesan bunyi bising tersebut. Didapati pada tahap signifikan $\alpha = 0.1$, kesan fisiologi, kesan psikologi, kesan hilang pendengaran, kesan kepada perbualan dan gangguan tidur adalah signifikan manakala jika diukur pada tahap signifikan $\alpha = 0.05$, hanya kesan psikologi yang tidak signifikan manakala empat kesan lain adalah signifikan.

Kajian tambahan menggunakan rekabentuk faktorial pengukuran berulang satu faktor ke atas kesan kebisingan terhadap prestasi manusia semasa kerja kemasukkan telah dilaksanakan pada empat tahap kebisingan yang berbeza. Berdasarkan analisa variasi (ANOVA), peningkatan kebisingan memberikan impak yang signifikan terhadap prestasi manusia,

Berdasakan kajian penyelidikan yang telah dijalankan, dapat disimpulkan bahawa kesan kebisingan boleh menyebabkan masalah seperti masalah pendengaran, ganguan komunikasa dan tidur, prestasi manusia dan kelakuan sosial, kesihatan dan gangguan dalam kehidupan seharian manusia. Strategi yang sewajarnya untuk pemantauan, pengawalan dan penilaian kebisingan perlu diperkenalkan bagi mengurangkan masalah kesan kebisingan.

Versi Bahasa Inggeris

The research project has concentrated on the effects of noise on industrial worker in work place compounds. The effect of noise at the work place had shown that people who work in noisy environments might have be affected by the noise like physiological effects, psychological effect, hearing loss effect, auditory effects and sleep disturbances effects.

The objectives of the research are to determine whether different levels of noise effect human performance and to determine the effect of desirable noise exposure towards human performance.

To established the research work objective, three industries i.e. rubber product manufacturing, metal stamping, publication and printing were selected for the study. A questionnaires consisting of 40 questions on different aspects of effects of noise was prepared and served to a total of 120 workers of the above mentioned industries. Responses from the workers were collected which served as a preliminary data and it was compared with the actual noise data collected with the noise level meter at the three

selected industries. A well known statistical test call Chi-Square test was used to determine significance of the effects of noise. It was found that at level of significance $\alpha = 0.1$, physiological effects, psychological effects, hearing loss effect, auditory effect and sleep disturbances effect were significant and at level of significant $\alpha = 0.05$, only psychological effects was not significant but the rest were significant.

An additional study employing single factor repeated measure factorial design on the effect of noise on human performance in data entry task was conducted four different levels of noise. Based on analysis of variance (ANOVA) indicates that the increased of noise shows significant impacts towards human performance.

Based from the research study carried out, it was concluded that the effect of noise ha been found to cause problems to humans such as hearing impairment, interference with communication and sleep, human performance and social behaviour, health and annoyance in daily life. Further strategies for noise assessment and control should be introduced to reduce ill effects of noise.

4) Sila sediakan Laporan teknikal lengkap yang menerangkan keseluruhan projek ini. [Sila gunakan kertas berasingan]
Kindly prepare a comprehensive technical report explaining the project (Prepare report separately as attachment)

Senaraikan Kata Kunci yang boleh menggambarkan penyelidikan anda :
List a glosssary that explains or reflects your research:

(b) Senarai Kata Kunci yang digunakan di dalam abstrak :

Bahasa Malaysia	Bahasa Inggeris
Ergonomik	Ergonomics
Kesan kebisingan	Effects of noise
Kesan psisiologi	Physiological effects
Kesan kehilangan pendengaran	Hearing loss effects
Kesan audiotori	Auditory effects
Kesan psikologi	Psychological effects
Gangguan tidur	Sleep disturbance

5) **Output Dan Faedah Projek**
Output and Benefits of Project

(a) * Penerbitan *(termasuk laporan/kertas seminar)*
Publications (including reports/seminar papers)
(Sila nyatakan jenis, tajuk, pengarang, tahun terbitan dan di mana telah diterbit/dibentangkan).
(Kindly state each type, title, author/editor, publication year and journal/s containing publication)

TAJUK	PENGARANG	STATUS
A Study On The Effect of Noise on Industrial Workers In Malaysia	Mohzani Mokhtar, S. Kamaruddin[1], Zahid A. Khan[2] and & Z. Mallick[1] [1]School of Mechanical Engineering, Universiti Sains Malaysia, Engineering Campus, 14300 Nibong Tebal, Penang, MALAYSIA. [2]Faculty of Engineering & Technology, Jamia Millia Islamia, Central University, New Delhi 110025, INDIA	Submited to Jurnal Teknologi A UTM, (corrected proof and to be published in 2007)
Development of Framework In Enhanching Ergonomics Practices For Computer User In Malaysian Industries	Shaliza Azreen Mustafa, Mohzani Mokhtar, Shahrul Kamaruddin, Khairanum Subari & Zalinda Othman. School of Mechanical Engineering, University Science of Malaysia, Engineering Campus, 14300 Nibong Tebal, Penang, MALAYSIA.	Accepted for the International Advanced Technology Congress (ATCi 2005).
Effect of Noise On Humans Performance In Data Entry Task	Zahid A. Khan, Jamaluddin Abdullah and W.M. Wan Muhamad School of Mechanical Engineering, University Science of Malaysia, Engineering Campus, 14300 Nibong Tebal, Penang, MALAYSIA.	Accepted in Journal of Mechanical Engineering UiTM, 2005.
Effect of Noise On Humans: A Review	Razman Mustaffa, Zahid A. Khan, A. Suhail and K. Subari School of Mechanical Engineering, University Science of Malaysia, Engineering Campus, 14300 Nibong Tebal, Penang, MALAYSIA.	Accepted in Journal Energy and Environment 2005.

(b) **Faedah-Faedah Lain Seperti Perkembangan Produk, Prospek Komersialisasi Dan Pendaftaran Paten atau impak kepada dasar dan masyakarat.**
Other benefits such as product development, product commercialisation/patent registration or impact on source and society

Hasil keputusan kajian dapat dijadikan asas dan input bagi membantu pihak industri menyedari keperluan menyediakan suasana kerja yang kondusif. Dari segi perubatan pula, pakar perubatan dapat mengaitkan tahap kesihatan dengan tahap kebisingan dalam mengenal pasti punca gangguan kesihatan pekerja industri.

* Sila berikan salinan
* *Kindly provide copies*

(c) **Latihan Gunatenaga Manusia**
Training in Human Resources

i) Pelajar Siswazah : .....
Postgraduate students:
(perincikan nama, ijazah dan status)
(Provide names, degrees and status)

Shaliza Azreen Mustafa (MSc. Manufacturing)

.....

.....

ii) Pelajar Prasiswazah : .....
Undergraduate students:
(Nyatakan bilangan)
(Provide number)

Nafirizuan Mat Yahya (B.Eng. Mekanik, 2004)

.....

.....

iii) Lain-Lain : .....
Others:
.....
TIADA
.....

.....

6. **Peralatan Yang Telah Dibeli :**
Equipment that has been purchased:

.....

.....
TIADA
.....

.....

KOMEN JAWATANKUASA PENYELIDIKAN PUSAT PENGAJIAN
Comments of the Research Committees of Schools/Centres

Penyelidikan yang dibuat adalah sangat relevan di pelbagai industri. Kesan kolaborasi telah menunjukkan bahawa prestasi kerja meningkat. Penyelidikan ini juga telah menghasilkan beberapa penerbitan melalui pelajar sarjana.

TANDATANGAN PENGERUSI
JAWATANKUASA PENYELIDIKAN PUSAT PENGAJIAN
Signature of Chairman
[Research Committee of School/Centre]

1/8/07.
TARIKH
Date

Updated : 16MAC2006

2004/12	BL	42044	28/12/04	304	221	21102	PMEKANIK	6035107	NO BTP 44930 - SUITESTAY EXECUTIV	INV 049943	525.00
2004/12	BL	42045	28/12/04	304	221	21102	PMEKANIK	6035107	NO BTP 44931 - SUITESTAY EXECUTIV	INV 049942	525.00
2005/3	BL	44524	22/03/05	304	221	21101	PMEKANIK	6035107	T/P 12/04 - G/J/PEN	T/P 12/04 - G/J/PEN	76.20
2005/3	BL	44525	22/03/05	304	221	21101	PMEKANIK	6035107	T/P 1/05 - G/J/PEN	T/P 1/05 - G/J/PEN	112.50
2005/3	BL	44525	22/03/05	304	221	21104	PMEKANIK	6035107	T/P 1/05 - G/J/PEN	T/P 1/05 - G/J/PEN	40.00
2005/3	BL	44525	22/03/05	304	221	21102	PMEKANIK	6035107	T/P 1/05 - G/J/PEN	T/P 1/05 - G/J/PEN	220.00
2006/10	BL	63917	11/10/06	304	221	21104	PMEKANIK	6035107	T/P 8/06 - G/J/PEN	T/P 8/06 - G/J/PEN	190.40
2006/10	BL	63917	11/10/06	304	221	21199	PMEKANIK	6035107	T/P 8/06 - G/J/PEN	T/P 8/06 - G/J/PEN	29.00
2006/10	BL	63918	11/10/06	304	221	21104	PMEKANIK	6035107	T/P 9/06 - G/J/PEN	T/P 9/06 - G/J/PEN	142.80
2006/10	BL	63918	11/10/06	304	221	21199	PMEKANIK	6035107	T/P 9/06 - G/J/PEN	T/P 9/06 - G/J/PEN	16.80
											1,877.70
2004/10	JR	3609	20/10/04	304	223	23101	PMEKANIK	6035107	W/PANJAR-DR ZAHID A.KHAN	BR 01/2004 - 08/2004	175.20
2005/3	JR	4284	14/03/05	304	223	23101	PMEKANIK	6035107	W/PANJAR R&D DR ZAHID AKHTAR	BR 01/05 -07/05	149.90
2006/8	BL	62309	28/08/06	304	223	23102	PMEKANIK	6035107	BIL 04-5995999/D92790-672-8107	BIL 25 JULAI 2006	10.70
											335.80
2004/10	JR	3609	20/10/04	304	227	27102	PMEKANIK	6035107	W/PANJAR-DR ZAHID A.KHAN	BR 01/2004 - 08/2004	19.40
2005/3	JR	4284	14/03/05	304	227	27199	PMEKANIK	6035107	W/PANJAR R&D DR ZAHID AKHTAR	BR 01/05 -07/05	45.21
2006/2	BL	55580	18/02/06	304	227	27103	PMEKANIK	6035107	NO PO 114231 - ALPHA DATA COM	INV 109890	500.00
2006/10	BL	63748	07/10/06	304	227	27799	PMEKANIK	6035107	NO PO 114444 - DRIVE SOLUTION	INV 1377/09	5,398.50
											5,963.11
2006/2	BL	55579	18/02/06	304	228	28601	PMEKANIK	6035107	NO PO 114230 - ALPHA DATA COM	INV 109889	1,990.00
2006/2	BL	55581	18/02/06	304	228	28601	PMEKANIK	6035107	NO PO 114232 - ALPHA DATA COM	INV 109889	1,500.00
											3,490.00
2005/9	BL	50387	14/09/05	304	229	29107	PMEKANIK	6035107	INT. CONF. ON ADVANCE MATERIAL 20	EN MOHZANI MOKHTAR	550.00
2005/10	BL	51544	14/10/05	304	229	29107	PMEKANIK	6035107	YURAN - ATCI2005	CIK SHALIZA AZREEN M	300.00
2006/3	BL	56635	17/03/06	304	229	29115	PMEKANIK	6035107	NO PO 114283 - KUTKM	INV K0001406(P0008)	5,640.00
2006/3	BL	56734	21/03/06	304	229	29107	PMEKANIK	6035107	SEMINAR ON CHALLENGES FACED	MOHZANI MOKHTAR	80.00
2006/8	BL	61926	17/08/06	304	229	29107	PMEKANIK	6035107	YURAN- INDUSTRIAL PROCESS OPTIM	EN MOHZANI MOKHTAR	450.00
											7,020.00
									JUMLAH BESAR		18,686.61

2004/5	BL	34318	23/05/04	304	A11102	304	PMEKANIK	6035107	W/PANJAR-DR ZAHID AKHTAR KHAN	2 ORG PENYELIDIK	200.00
2004/10	JR	3609	20/10/04	304	A11102	304	PMEKANIK	6035107	W/PANJAR-DR ZAHID A.KHAN	BR 01/2004 - 08/2004	(194.60)
2004/10	BL	39636	24/10/04	304	A11102	304	PMEKANIK	6035107	WANG PANJAR - DR ZAHID A KHAN	23/10/04	194.60
2005/3	JR	4284	14/03/05	304	A11102	304	PMEKANIK	6035107	W/PANJAR R&D DR ZAHID AKHTAR	BR 01/05 -07/05	(195.11)
2005/3	BL	44222	15/03/05	304	A11102	304	PMEKANIK	6035107	W/PANJAR -DR ZAHID AKHTAR KHAN	15/03/05	195.11
											200.00

DR. ZAHID AKHTAR KHAN

304.PMEKANIK.6035107

KAMPUS KEJURUTERAAN
SERI AMPANGAN
PENYATA KUMPULAN WANG

TEMPOH BERAKHIR 31/12/2006

ERGONOMIC INVESTIGATION ON THE EFFECT OF NOISE ON HUMAN

JUMLAH GERAN :-

NO PROJEK :-

PANEL :- J/PENDEK

PENAJA :-

Tempoh Projek:01/04/2004 - 31/03/2006

Vot		Peruntukan (a)	Perbelanjaan sehingga 31/12/2006 (b)	Tanggungan semasa 2006 (c)	perbelanjaan Semasa 2007 (d)	Jumlah Perbelanjaan 2007 (c + d)	Jumlah perbelanjaan Terkumpul (b+c+d)	Baki Peruntukan Semasa (a-(b+c+d)
11000	GAJI KAKITANGAN AWAM	2,631.60	0.00	0.00	0.00	0.00	0.00	2,631.60
21000	PERBELANJAAN PERJALANAN DAN SARA	3,700.00	1,877.70	0.00	0.00	0.00	1,877.70	1,822.30
23000	PERHUBUNGAN DAN UTILITI	200.00	335.80	0.00	0.00	0.00	335.80	(135.80)
27000	BEKALAN DAN ALAT PAKAI HABIS	8,000.00	5,963.11	0.00	0.00	0.00	5,963.11	2,036.89
28000	PENYELENGGARAAN & PEMBAIKAN KECIL	215.00	3,490.00	0.00	0.00	0.00	3,490.00	(3,275.00)
29000	PERKHIDMATAN IKTISAS & HOSPITALITI	4,000.00	7,020.00	0.00	0.00	0.00	7,020.00	(3,020.00)
35000	HARTA-HARTA MODAL LAIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		18,746.60	18,686.61	0.00	0.00	0.00	18,686.61	59.99
	Jumlah Besar	18,746.60	18,686.61	0.00	0.00	0.00	18,686.61	59.99

Penerbit
UNIVERSITI TEKNOLOGI MALAYSIA
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Rujukan Kami (Our Ref.): UTM.01.06/18.10/17 Jld. 34 (152)
Rujukan Tuan (Your Ref.):

18 Julai 2006

En. Mokhzani bin Mokhtar
Pusat Pengajian Kejuruteraan Mekanikal
Kampus Kejuruteraan
Universiti Sains Malaysia
14300 Nibong Tebal
Seberang Perai Selatan
Pulau Pinang

Assalamualaikum Wrt. Wbt.,

Yg. Bhg. Prof./Saudara,

Pembetulan Semula Artikel *Jurnal Teknologi*
A Study on the Effects of Noise on Industrial Workers in Malaysia (JTA/2005/13).

Dengan hormatnya saya merujuk kepada perkara di atas.

2. Terlebih dahulu **Penerbit UTM** mengucapkan terima kasih atas sokongan Yg. Bhg. Prof./Saudara menyumbang artikel bagi dimuatkan dalam *Jurnal Teknologi*. Setelah artikel ini disemak dan dinilai semula, Ketua Editor berpendapat bahawa artikel ini perlu dibuat beberapa pembetulan (*rujuk salinan Naskhah Pembetulan*). Kerjasama Yg. Bhg. Prof./Saudara diminta membuat pembetulan sebagaimana yang diminta oleh penilai.

3. Kerjasama saudara diminta mengembalikan artikel yang telah diperbaiki berserta **CD/DISKET PEMBETULAN** kepada **Penerbit UTM** pada/sebelum ***14 Ogos 2006***.

4. Keprihatinan saudara dalam hal ini diharap dapat membantu **Penerbit UTM** meningkatkan lagi kualiti penerbitan *Jurnal Teknologi*. Sokongan saudara saya dahului dengan ucapan terima kasih.

Wassalam.

"BERKHIDMAT UNTUK NEGARA"

Yang benar,

NOORITA BT. MD. SHAFEIN
noorita@utm.my
Pegawai Penerbitan
Penerbit UTM
b/p: Naib Canselor
☎: 07 – 521 8135

s.k. - ***Prof. Madya Dr. Hishamuddin bin Jamaluddin***
Ketua Editor Jurnal Teknologi A
Sekolah Pengajian Siswazah

A STUDY ON THE EFFECTS OF NOISE ON INDUSTRIAL WORKERS IN MALAYSIA

MOHZANI MOKHTAR[1], ZAHID A. KHAN[2], S. KAMARUDDIN[3] & Z. MALLICK[4]

Abstract. This paper presents results of an ergonomic study pertaining to the effect of noise on industrial workers in Malaysia. Three different industries selected for the study were rubber product manufacturing, metal stamping, publication and printing. A questionnaire consisting of 37 questions, covering all possible reported effects of noise on humans, was prepared and served to a total of 120 workers at the above mentioned industries. Responses from the workers were collected for analysis. A Chi-Square test was used to determine whether the effects of noise were statistically significant or not. It is found that at a level of significance, $\alpha = 0.05$, physiological, hearing loss, auditory, and sleep disturbances effects of noise are statistically significant. However, psychological effect of noise is found to be non-significant.

Keywords: Ergonomics, effects of noise, physiological effects, hearing loss effects, auditory effects, psychological effects

Abstrak. Kertas kerja ini mempersembahkan keputusan satu kajian ergonomik berkaitan kesan kebisingan terhadap pekerja industri di Malaysia. Tiga industri berbeza yang telah dipilih untuk kajian ialah pengeluar produk berasaskan getah, syarikat hentakkan Logam dan syarikat percetakan penerbitan. Satu soal selidik yang mengandungi 37 soalan yang merangkumi semua aduan berkaitan kesan kebisingan terdahap manusia telah disediakan dan diberikan kepada 120 pekerja industri yang dipilih. Maklumbalas daripada pekerja dikumpulkan sebagai data untuk analisa selanjutnya. Satu pengujian "Chi-Square" telah digunakan untuk menentukan sama ada kesan kebisingan adalah signifikan atau tidak signifikan. Didapati bahawa pada tahap signifikan, $\alpha = 0.05$, fisiologi, kehilangan pendengaran, auditori dan gangguan tidur adalah kesan kebisiangan yang secara satistiknya signifikan. Bagaimanapun, kesan kebisingan terhadap psikologi telah ditemui secara tidak signifikan.

Kata kunci: Ergonomik, kesan kebisingan, kesan psisiologi, kesan kehilangan pendengaran, kesan audiotori, kesan psikologi

1.0 INTRODUCTION

Sound can be measured objectively but noise is a subjective phenomenon. Bridger [1] defined noise as a sound or sounds at such amplitude as to cause annoyance or to interfere with communication. Kroemer *et al* [2] mentioned that noise was psychological and subjective feeling. Single, short tones of low intensity may be considered noise under certain conditions, just as loud, lasting, complex sounds may be deemed noise under other circumstances. Any sound which is annoying or level of sound exceeds 75 dBA may be conceived as noise. The threshold for noise annoyance varies, depending on the conditions,

[1, 3 & 4] School of Mechanical Engineering, Universiti Sains Malaysia, 14300 Nibong Tebal, Seberang Perai Selatan, Pulau Pinang, Malaysia.
[2] Department of Mechanical Engineering, Faculty of Engineering & Technology, Jamia Millia Islamia, Central University, Jamia Nagar, New Delhi 110025, India.
[1] Corresponding author; Tel: 604-5937788, Fax: 604-5921025, E-mail: mohzani@eng.usm.my

DEVELOPMENT OF A FRAMEWORK IN ENHANCING ERGONOMICS PRACTICES FOR COMPUTER USER IN MALAYSIAN INDUSTRIES

Shaliza Azreen Mustafa, Mohzani Mokhtar, Shahrul Kamaruddin, Khairanum Subari, Zalinda Othman
School of Mechanical Engineering,
Engineering Campus, Universiti Sains Malaysia,
14300, Nibong Tebal, Pulau Pinang, MALAYSIA.

Abstract

Since computers are being introduced in Malaysia, its usage has been an important contribution to the development of the industrial sector. Even though computers or usually known as visual display terminals (VDT) have improved productivity and made work easier for industrial workers, they have also caused adverse effects such as musculoskeletal disorders (MSD). Therefore, in order to help in reduce MSD among Malaysian industrial workers, the primary emphasis is to enhance employees awareness and on improving the employee's knowledge of efficiently using VDT workstation by applying ergonomics principles in ergonomics training program. Based on literature review focus on VDT training programs, it shows that each of the training programs had different contents. To achieve the purpose of this study, each of the contents from the best practices of VDT training programs are combine to develop a comprehensive framework of ergonomics VDT training program. The framework was developed using Kawakita Jiro (KJ) method, which the principal tool is an affinity diagram. The KJ method was used because it is conceivable in education and training fields especially in prioritize the training items.

Computer or VDT Usage in Malaysian Industries

Computer or usually known as visual display terminals (VDT), herein after referred to as 'VDT', is a medium which the users and computer interact [1]. The usage of VDT in Malaysian has been drastically increasing since 1996, which correlates to the estimated amount of 4 million personal computers being installed in 2003 [2]. The increased was partly due to the launched of a program called Vision 2020 by the Malaysian government. The vision will be achieved through the development of the information and communication technology (ICT) sector and the use of ICT to increase global competitiveness [2]. Therefore, the VDT usage plays important roles in Malaysian industry especially among office workers and operating VDT.

Along with the increased use of VDT, there have been reports about the health effects largely related to musculoskeletal disorders (MSD) such as visual discomfort and other stress related disorders [3, 4]. However, in the industrial sector, attention is given fully to end-customers, which decide whether the products or services meet their needs. Although this is important for a company's achievement, there is not enough human factors attention given to the industrial workers. In this case, the company may be successful in marketing their products but unfortunately, their workers are working in a non conducive environment. Even though VDT has been blamed for a wide range of industrial health problems but VDT users actually suffer

-- No. 1 , Volume No. 2
June 2005
Universiti Teknologi Mara, Shah Alam.

Zahid A. Khan
Jamaluddin Abdullah
W. M. Wan Muhamad

ABSTRACT

Studies on the effect of noise on human performance involving various kinds of tasks such as cognitive, analytical, and memory have been conducted for long. However, the effect remains both elusive and interesting. All kinds of results, suggesting improved, degraded, and unaffected performance, have been reported. The present study reports the effect of intermittent noise on data entry task of short duration. The study was conducted at four levels of noise intensity, viz 70 dBA L_{eq}, 80 dBA L_{eq}, 90 dBA L_{eq}, and 100 dBA L_{eq}. The noise used was actually sharp sound beads at a frequency of 60 $\pm$ 5 beads per minute. A total of 10 young male subjects participated in the study. The results show an improvement of performance, especially at moderately higher levels of noise intensity. Conjectured reason for such behaviour and suggestions for further research are given.

Keywords: *Noise, data entry task, human performance.*

Introduction

With the massive introduction of computers in varieties of work environments, a huge number of humans are using computers in almost all walks of their lives. With the recent technological advances, varieties of computers such as desktop, laptop, note-book, palmtop, and wrist-top are available in the market. The number of persons using computers for various purposes has increased substantially in recent years. The performance of humans working on computers may be affected by many environmental variables in which they work. Among these, noise is considered to be an important and critical one [1]. Noise, as an environmental variable, occupies significant importance because of the fact that it is increasing at an alarming rate due to increase in traffic (both road and air) density, increase in industrial establishments, and other noise producing equipment/instruments. In the past, studies have been conducted to examine effect of noise on human performance in varieties of tasks. Many researchers have reported adverse effect

FOY NOISE Project

Energy and Environment
Abdul Mubeen, M. Emran Khan and M. Muzaffarul Hasan (Editors)

Effects of Noise on Humans: A Review

Razman Mustaffa, Zahid A. Khan, A. Suhail and K. Subari
School of Mechanical Engineering, Engineering Campus, University Sains Malaysia
Seri Ampangan, 14300 Nibong Tebal, Pulau Pinang, Malaysia

ABSTRACT
This paper presents a review on the effects of noise on various aspects of human's health and activities such as hearing loss, task performance, interference with communication, sleep disturbance, social behavior, health and annoyance. It has been found that although a lot of researches have been conducted in the past and are still being carried out, the effects of noise on humans have not been fully understood and in many cases the results are inconclusive. This necessitates further investigations on the effects of noise on humans.

Keywords: Noise, Hearing loss, Sleep disturbance, Interference with communication, Effect on health

1. INTRODUCTION

Noise is defined as the effect of the presentation of moderately intense or loud auditory stimuli (Broadbent, 1979; Gulian, 1973; Jones et al., 1981; Kryter, 1970, 1994; Smith, 1989). Noise is also commonly defined as undesirable or unwanted sound (Cohen and Weinstein, 1982). Therefore, sound is the result of pressure changes in a medium, which is usually air, caused by vibration or turbulence. The amplitude of these pressure changes is stated in terms of sound level, and the rapidity with which these changes occur is the sound's frequency. Another important aspect is the duration of the sound, and the way it is distributed in time. The effect of noise is determined mainly by the duration and the level of the noise, but also influenced by the frequency and intensity (Sutter, 1991).

Noise has a significant impact and indeed, can impair the quality of life, through reduction in the ability to hear important sounds, performance and to communicate with all human being. In fact, according to the World Health Organization (WHO), noise is a health problem. WHO's definition of health includes total physical and mental well-being, as well as the absence of disease. Along these lines, a 1971 WHO working group stated: "Noise must be recognized as a major threat to human well-being" (Suess, 1973).

2. EFFECTS OF NOISE ON HUMANS

Effects of noise can not be ignored particularly in situations where it is increasing at a rapid rate due to increase in traffic density, industries and people living habits. A review on the effects of noise revealed by researches is being presented as follow:

UNIVERSITI SAINS MALAYSIA

PEJABAT PENGURUSAN & KREATIVITI PENYELIDIKAN
RESEARCH CREATIVITY AND MANAGEMENT OFFICE [RCMO]

LAPORAN AKHIR PROJEK PENYELIDIKAN JANGKA *PENDEK*
FINAL REPORT OF SHORT TERM RESEARCH PROJECTS

---

1). Nama Ketua Penyelidik :
Name of Research Leader :

Ketua Penyelidik *Research Leader*	PTJ *School/Centre*
En. Mohzani Mokhtar	Pusat Pengajian Kejuruteraan Mekanik

Nama Penyelidik Bersama
(Jika berkaitan) :
Name/s of Co-Researcher/s
(if applicable)

Penyelidik Bersama *Co-Researcher*	PTJ *School/Centre*
Dr. Shahrul Kamaruddin	Pusat Pengajian Kejuruteraan Mekanik
Dr. Zahid Akhtar Khan	Department of Mechanical Engineering, Faculty of Engineering & Technology Jamia Millia Islamia, Central University, India.

2) Tajuk Projek : ..... Ergonomics Investigation on the Effect of Noise on Human Performance
Title of Project:

3) **Abstrak untuk penyelidikan anda**

(Perlu disediakan di antara 100 – 200 perkataan di dalam **Bahasa Malaysia dan Bahasa Inggeris**. Ini kemudiannya akan dimuatkan ke dalam Laporan Tahunan Bahagian Penyelidikan & Inovasi sebagai satu cara untuk menyampaikan dapatan projek tuan/puan kepada pihak Universiti & luar).

Abstract of Research

(Must be prepared in 100 – 200 words in Bahasa Malaysia as well as in English. This abstract will later be included in the Annual Report of the Research and Innovation Section as a means of presenting the project findings of the researcher/s to the university and the outside community)

Versi Bahasa Malaysia

Projek penyelidikan ini telah menumpukan kepada kesan-kesan bunyi bising di dalam kawasan industri kepada pekerja industri. Dijangkakan pekerja-pekerja yang bekerja di dalam persekitaran yang bising mungkin akan menerima kesan daripada bunyi bising seperti kesan fisiologi, kesan psikologi, kesan hilang pendengaran, kesan kepada perbualan dan gangguan tidur.

Objektif kajian penyelidikan adalah menentukan sama ada tahap-tahap kebisingan yang berbeza memberi kesan terhadap prestasi kerja manusia. Di samping itu, ianya juga dapat menentukan pendedahan kebisingan yang bersesuaian dengan prestasi kerja manusia.

Bagi mencapai objektif tersebut, tiga industri berbeza yang telah dipilih untuk kajian ialah pengeluar produk berasaskan getah, syarikat hentakkan logam dan syarikat percetakan penerbitan. Set-set soalselidik yang mengandungi 40 soalan yang meliputi pelbagai aspek kesan bunyi bising telah disediakan dan diedarkan kepada sejumlah 120 orang pekerja-pekerja di ketiga-tiga lokasi yang dinyatakan diatas. Maklumbalas daripada pekerja-pekerja telah dikumpulkan dan dijadikan sebagai data asas analisis seterusnya.

Satu ujian statistik yang terkenal iaitu Ujian Chi-Square telah digunakan untuk menentukan signifikan kesan-kesan bunyi bising tersebut. Didapati pada tahap signifikan $\alpha = 0.1$, kesan fisiologi, kesan psikologi, kesan hilang pendengaran, kesan kepada perbualan dan gangguan tidur adalah signifikan manakala jika diukur pada tahap signifikan $\alpha = 0.05$, hanya kesan psikologi yang tidak signifikan manakala empat kesan lain adalah signifikan.

Kajian tambahan menggunakan rekabentuk faktorial pengukuran berulang satu faktor ke atas kesan kebisingan terhadap prestasi manusia semasa kerja kemasukkan telah dilaksanakan pada empat tahap kebisingan yang berbeza. Berdasarkan analisa variasi (ANOVA), peningkatan kebisingan memberikan impak yang signifikan terhadap prestasi manusia,

Berdasakan kajian penyelidikan yang telah dijalankan, dapat disimpulkan bahawa kesan kebisingan boleh menyebabkan masalah seperti masalah pendengaran, ganguan komunikasa dan tidur, prestasi manusia dan kelakuan sosial, kesihatan dan gangguan dalam kehidupan seharian manusia. Strategi yang sewajarnya untuk pemantauan, pengawalan dan penilaian kebisingan perlu diperkenalkan bagi mengurangkan masalah kesan kebisingan.

Versi Bahasa Inggeris

The research project has concentrated on the effects of noise on industrial worker in work place compounds. The effect of noise at the work place had shown that people who work in noisy environments might have be affected by the noise like physiological effects, psychological effect, hearing loss effect, auditory effects and sleep disturbances effects.

The objectives of the research are to determine whether different levels of noise effect human performance and to determine the effect of desirable noise exposure towards human performance.

To established the research work objective, three industries i.e. rubber product manufacturing, metal stamping, publication and printing were selected for the study. A questionnaires consisting of 40 questions on different aspects of effects of noise was prepared and served to a total of 120 workers of the above mentioned industries. Responses from the workers were collected which served as a preliminary data and It was compared with the actual noise data collected with the noise level meter at the three

selected industries. A well known statistical test call Chi-Square test was used to determine significance of the effects of noise. It was found that at level of significance $\alpha = 0.1$, physiological effects, psychological effects, hearing loss effect, auditory effect and sleep disturbances effect were significant and at level of significant $\alpha = 0.05$, only psychological effects was not significant but the rest were significant.

An additional study employing single factor repeated measure factorial design on the effect of noise on human performance in data entry task was conducted four different levels of noise. Based on analysis of variance (ANOVA) indicates that the increased of noise shows significant impacts towards human performance.

Based from the research study carried out, it was concluded that the effect of noise ha been found to cause problems to humans such as hearing impairment, interference with communication and sleep, human performance and social behaviour, health and annoyance in daily life. Further strategies for noise assessment and control should be introduced to reduce ill effects of noise.

4) Sila sediakan Laporan teknikal lengkap yang menerangkan keseluruhan projek ini. [Sila gunakan kertas berasingan]
Kindly prepare a comprehensive technical report explaining the project (Prepare report separately as attachment)

Senaraikan Kata Kunci yang boleh menggambarkan penyelidikan anda :
List a glosssary that explains or reflects your research:

(b) Senarai Kata Kunci yang digunakan di dalam abstrak :

Bahasa Malaysia	Bahasa Inggeris
Ergonomik	Ergonomics
Kesan kebisingan	Effects of noise
Kesan psisiologi	Physiological effects
Kesan kehilangan pendengaran	Hearing loss effects
Kesan audiotori	Auditory effects
Kesan psikologi	Psychological effects
Gangguan tidur	Sleep disturbance

5) **Output Dan Faedah Projek**
Output and Benefits of Project

(a) * Penerbitan *(termasuk laporan/kertas seminar)*
Publications (including reports/seminar papers)
(Sila nyatakan jenis, tajuk, pengarang, tahun terbitan dan di mana telah diterbit/dibentangkan).
(Kindly state each type, title, author/editor, publication year and journal/s containing publication)

TAJUK	PENGARANG	STATUS
A Study On The Effect of Noise on Industrial Workers In Malaysia	Mohzani Mokhtar, S. Kamaruddin[1], Zahid A. Khan[2] and & Z. Mallick[1] [1]School of Mechanical Engineering, Universiti Sains Malaysia, Engineering Campus, 14300 Nibong Tebal, Penang, MALAYSIA. [2]Faculty of Engineering & Technology, Jamia Millia Islamia, Central University, New Delhi 110025, INDIA	Submited to Jurnal Teknologi A UTM, (corrected proof and to be published in 2007)
Development of Framework In Enhanching Ergonomics Practices For Computer User In Malaysian Industries	Shaliza Azreen Mustafa, Mohzani Mokhtar, Shahrul Kamaruddin, Khairanum Subari & Zalinda Othman. School of Mechanical Engineering, University Science of Malaysia, Engineering Campus, 14300 Nibong Tebal, Penang, MALAYSIA.	Accepted for the International Advanced Technology Congress (ATCi 2005).
Effect of Noise On Humans Performance In Data Entry Task	Zahid A. Khan, Jamaluddin Abdullah and W.M. Wan Muhamad School of Mechanical Engineering, University Science of Malaysia, Engineering Campus, 14300 Nibong Tebal, Penang, MALAYSIA.	Accepted in Journal of Mechanical Engineering UiTM, 2005.
Effect of Noise On Humans: A Review	Razman Mustaffa, Zahid A. Khan, A. Suhail and K. Subari School of Mechanical Engineering, University Science of Malaysia, Engineering Campus, 14300 Nibong Tebal, Penang, MALAYSIA.	Accepted in Journal Energy and Environment 2005.

(b) **Faedah-Faedah Lain Seperti Perkembangan Produk, Prospek Komersialisasi Dan Pendaftaran Paten atau impak kepada dasar dan masyakarat.**
Other benefits such as product development, product commercialisation/patent registration or impact on source and society

Hasil keputusan kajian dapat dijadikan asas dan input bagi membantu pihak industri menyedari keperluan menyediakan suasana kerja yang kondusif. Dari segi perubatan pula, pakar perubatan dapat mengaitkan tahap kesihatan dengan tahap kebisingan dalam mengenal pasti punca gangguan kesihatan pekerja industri.

* Sila berikan salinan
* *Kindly provide copies*

(c) **Latihan Gunatenaga Manusia**
Training in Human Resources

i) Pelajar Siswazah : .....
Postgraduate students:
(perincikan nama, ijazah dan status)
(Provide names, degrees and status)

Shaliza Azreen Mustafa (MSc. Manufacturing)

.....

.....

ii) Pelajar Prasiswazah *:* .....
Undergraduate students:
(Nyatakan bilangan)
(Provide number)

Nafirizuan Mat Yahya (B.Eng. Mekanik, 2004)

.....

.....

iii) Lain-Lain : .....
Others:
.....
TIADA
.....

.....

6. **Peralatan Yang Telah Dibeli :**
Equipment that has been purchased:

.....

.....
TIADA
.....

.....

KOMEN JAWATANKUASA PENYELIDIKAN PUSAT PENGAJIAN
Comments of the Research Committees of Schools/Centres

Penyelidikan yang dibuat adalah sangat relevan di peringkat industri. Kesan kajiannya telah menunjukkan bahawa prestasi kerja menurun. Penyelidikan ini juga telah menghasilkan beberapa penerbitan melalui pelajar sarjana.

TANDATANGAN PENGERUSI
JAWATANKUASA PENYELIDIKAN PUSAT PENGAJIAN
Signature of Chairman
[Research Committee of School/Centre]

1/8/07.
TARIKH
Date

Updated : 16MAC2006

									Keterangan	Rujukan 1	Amaun
[illegible]	[illegible]	42044	28/12/04	304	221	21102	PMEKANIK	6035107	NO BTP 44930 - SUITESTAY EXECUTIV	INV 049943	525.00
2004/12	BL	42045	28/12/04	304	221	21102	PMEKANIK	6035107	NO BTP 44931 - SUITESTAY EXECUTIV	INV 049942	525.00
2005/3	BL	44524	22/03/05	304	221	21101	PMEKANIK	6035107	T/P 12/04 - G/J/PEN	T/P 12/04 - G/J/PEN	76.20
2005/3	BL	44525	22/03/05	304	221	21101	PMEKANIK	6035107	T/P 1/05 - G/J/PEN	T/P 1/05 - G/J/PEN	112.50
2005/3	BL	44525	22/03/05	304	221	21104	PMEKANIK	6035107	T/P 1/05 - G/J/PEN	T/P 1/05 - G/J/PEN	40.00
2005/3	BL	44525	22/03/05	304	221	21102	PMEKANIK	6035107	T/P 1/05 - G/J/PEN	T/P 1/05 - G/J/PEN	220.00
2006/10	BL	63917	11/10/06	304	221	21104	PMEKANIK	6035107	T/P 8/06 - G/J/PEN	T/P 8/06 - G/J/PEN	190.40
2006/10	BL	63917	11/10/06	304	221	21199	PMEKANIK	6035107	T/P 8/06 - G/J/PEN	T/P 8/06 - G/J/PEN	29.00
2006/10	BL	63918	11/10/06	304	221	21104	PMEKANIK	6035107	T/P 9/06 - G/J/PEN	T/P 9/06 - G/J/PEN	142.80
2006/10	BL	63918	11/10/06	304	221	21199	PMEKANIK	6035107	T/P 9/06 - G/J/PEN	T/P 9/06 - G/J/PEN	16.80
											1,877.70
2004/10	JR	3609	20/10/04	304	223	23101	PMEKANIK	6035107	W/PANJAR-DR ZAHID A.KHAN	BR 01/2004 - 08/2004	175.20
2005/3	JR	4284	14/03/05	304	223	23101	PMEKANIK	6035107	W/PANJAR R&D DR ZAHID AKHTAR	BR 01/05 -07/05	149.90
2006/8	BL	62309	28/08/06	304	223	23102	PMEKANIK	6035107	BIL 04-5995999/D92790-672-8107	BIL 25 JULAI 2006	10.70
											335.80
2004/10	JR	3609	20/10/04	304	227	27102	PMEKANIK	6035107	W/PANJAR-DR ZAHID A.KHAN	BR 01/2004 - 08/2004	19.40
2005/3	JR	4284	14/03/05	304	227	27199	PMEKANIK	6035107	W/PANJAR R&D DR ZAHID AKHTAR	BR 01/05 -07/05	45.21
2006/2	BL	55580	18/02/06	304	227	27103	PMEKANIK	6035107	NO PO 114231 - ALPHA DATA COM	INV 109890	500.00
2006/10	BL	63748	07/10/06	304	227	27799	PMEKANIK	6035107	NO PO 114444 - DRIVE SOLUTION	INV 1377/09	5,398.50
											5,963.11
2006/2	BL	55579	18/02/06	304	228	28601	PMEKANIK	6035107	NO PO 114230 - ALPHA DATA COM	INV 109889	1,990.00
2006/2	BL	55581	18/02/06	304	228	28601	PMEKANIK	6035107	NO PO 114232 - ALPHA DATA COM	INV 109889	1,500.00
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2005/9	BL	50387	14/09/05	304	229	29107	PMEKANIK	6035107	INT. CONF. ON ADVANCE MATERIAL 2(	EN MOHZANI MOKHTAI	550.00
2005/10	BL	51544	14/10/05	304	229	29107	PMEKANIK	6035107	YURAN - ATCI2005	CIK SHALIZA AZREEN M	300.00
2006/3	BL	56635	17/03/06	304	229	29115	PMEKANIK	6035107	NO PO 114283 - KUTKM	INV K0001406(P0008)	5,640.00
2006/3	BL	56734	21/03/06	304	229	29107	PMEKANIK	6035107	SEMINAR ON CHALLENGES FACED	MOHZANI MOKHTAR	80.00
2006/8	BL	61926	17/08/06	304	229	29107	PMEKANIK	6035107	YURAN- INDUSTRIAL PROCESS OPTIM	EN MOHZANI MOKHTAI	450.00
											7,020.00
									JUMLAH BESAR		18,686.61

2004/5	BL	34318	23/05/04	304	A11102	304	PMEKANIK	6035107	W/PANJAR-DR ZAHID AKHTAR KHAN	2 ORG PENYELIDIK	200.00
2004/10	JR	3609	20/10/04	304	A11102	304	PMEKANIK	6035107	W/PANJAR-DR ZAHID A.KHAN	BR 01/2004 - 08/2004	(194.60)
2004/10	BL	39636	24/10/04	304	A11102	304	PMEKANIK	6035107	WANG PANJAR - DR ZAHID A KHAN	23/10/04	194.60
2005/3	JR	4284	14/03/05	304	A11102	304	PMEKANIK	6035107	W/PANJAR R&D DR ZAHID AKHTAR	BR 01/05 -07/05	(195.11)
2005/3	BL	44222	15/03/05	304	A11102	304	PMEKANIK	6035107	W/PANJAR -DR ZAHID AKHTAR KHAN	15/03/05	195.11
											200.00

DR. ZAHID AKHTAR KHAN

304.PMEKANIK.6035107

JABATAN BENDAHARI
UNIT KUMPULAN WANG AMANAH
UNIVERSITI SAINS MALAYSIA
KAMPUS KEJURUTERAAN
SERI AMPANGAN
PENYATA KUMPULAN WANG

TEMPOH BERAKHIR 31/12/2006

ERGONOMIC INVESTIGATION ON THE EFFECT OF NOISE ON HUMAN

JUMLAH GERAN :-

NO PROJEK :-

Tempoh Projek:01/04/2004 - 31/03/2006

PANEL :- J/PENDEK

PENAJA :-

Vot		Peruntukan (a)	Perbelanjaan sehingga 31/12/2006 (b)	Tanggungan semasa 2006 (c)	perbelanjaan Semasa 2007 (d)	Jumlah Perbelanjaan 2007 (c + d)	Jumlah perbelanjaan Terkumpul (b+c+d)	Baki Peruntukan Semasa (a-(b+c+d)
11000	GAJI KAKITANGAN AWAM	2,631.60	0.00	0.00	0.00	0.00	0.00	2,631.60
21000	PERBELANJAAN PERJALANAN DAN SARA	3,700.00	1,877.70	0.00	0.00	0.00	1,877.70	1,822.30
23000	PERHUBUNGAN DAN UTILITI	200.00	335.80	0.00	0.00	0.00	335.80	(135.80)
27000	BEKALAN DAN ALAT PAKAI HABIS	8,000.00	5,963.11	0.00	0.00	0.00	5,963.11	2,036.89
28000	PENYELENGGARAAN & PEMBAIKAN KECIL	215.00	3,490.00	0.00	0.00	0.00	3,490.00	(3,275.00)
29000	PERKHIDMATAN IKTISAS,& HOSPITALITI	4,000.00	7,020.00	0.00	0.00	0.00	7,020.00	(3,020.00)
35000	HARTA-HARTA MODAL LAIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		18,746.60	18,686.61	0.00	0.00	0.00	18,686.61	59.99
	Jumlah Besar	18,746.60	18,686.61	0.00	0.00	0.00	18,686.61	59.99

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Rujukan Tuan (Your Ref.):

En. Mokhzani bin Mokhtar
Pusat Pengajian Kejuruteraan Mekanikal
Kampus Kejuruteraan
Universiti Sains Malaysia
14300 Nibong Tebal
Seberang Perai Selatan
Pulau Pinang

Assalamualaikum Wrt. Wbt.,

Yg. Bhg. Prof./Saudara,

Pembetulan Semula Artikel *Jurnal Teknologi*
A Study on the Effects of Noise on Industrial Workers in Malaysia (JTA/2005/13).

Dengan hormatnya saya merujuk kepada perkara di atas.

2. Terlebih dahulu **Penerbit UTM** mengucapkan terima kasih atas sokongan Yg. Bhg. Prof./Saudara menyumbang artikel bagi dimuatkan dalam *Jurnal Teknologi*. Setelah artikel ini disemak dan dinilai semula, Ketua Editor berpendapat bahawa artikel ini perlu dibuat beberapa pembetulan (*rujuk salinan Naskhah Pembetulan*). Kerjasama Yg. Bhg. Prof./Saudara diminta membuat pembetulan sebagaimana yang diminta oleh penilai.

3. Kerjasama saudara diminta mengembalikan artikel yang telah diperbaiki berserta **CD/DISKET PEMBETULAN** kepada **Penerbit UTM** pada/sebelum ***14 Ogos 2006***.

4. Keprihatinan saudara dalam hal ini diharap dapat membantu **Penerbit UTM** meningkatkan lagi kualiti penerbitan *Jurnal Teknologi*. Sokongan saudara saya dahului dengan ucapan terima kasih.

Wassalam.

"BERKHIDMAT UNTUK NEGARA"

Yang benar,

NOORITA BT. MD. SHAFEIN
noorita@utm.my
Pegawai Penerbitan
Penerbit UTM
b/p: Naib Canselor
☎: 07 – 521 8135

s.k. - ***Prof. Madya Dr. Hishamuddin bin Jamaluddin***
Ketua Editor Jurnal Teknologi A
Sekolah Pengajian Siswazah

A STUDY ON THE EFFECTS OF NOISE ON INDUSTRIAL WORKERS IN MALAYSIA

MOHZANI MOKHTAR[1], ZAHID A. KHAN[2], S. KAMARUDDIN[3] & Z. MALLICK[4]

Abstract. This paper presents results of an ergonomic study pertaining to the effect of noise on industrial workers in Malaysia. Three different industries selected for the study were rubber product manufacturing, metal stamping, publication and printing. A questionnaire consisting of 37 questions, covering all possible reported effects of noise on humans, was prepared and served to a total of 120 workers at the above mentioned industries. Responses from the workers were collected for analysis. A Chi-Square test was used to determine whether the effects of noise were statistically significant or not. It is found that at a level of significance, $\alpha = 0.05$, physiological, hearing loss, auditory, and sleep disturbances effects of noise are statistically significant. However, psychological effect of noise is found to be non-significant.

Keywords: Ergonomics, effects of noise, physiological effects, hearing loss effects, auditory effects, psychological effects

Abstrak. Kertas kerja ini mempersembahkan keputusan satu kajian ergonomik berkaitan kesan kebisingan terhadap pekerja industri di Malaysia. Tiga industri berbeza yang telah dipilih untuk kajian ialah pengeluar produk berasaskan getah, syarikat hentakkan Logam dan syarikat percetakan penerbitan. Satu soal selidik yang mengandungi 37 soalan yang merangkumi semua aduan berkaitan kesan kebisingan terdahap manusia telah disediakan dan diberikan kepada 120 pekerja industri yang dipilih. Maklumbalas daripada pekerja dikumpulkan sebagai data untuk analisa selanjutnya. Satu pengujian "Chi-Square" telah digunakan untuk menentukan sama ada kesan kebisingan adalah signifikan atau tidak signifikan. Didapati bahawa pada tahap signifikan, $\alpha = 0.05$, fisiologi, kehilangan pendengaran, auditori dan gangguan tidur adalah kesan kebisiangan yang secara satistiknya signifikan. Bagaimanapun, kesan kebisingan terhadap psikologi telah ditemui secara tidak signifikan.

Kata kunci: Ergonomik, kesan kebisingan, kesan psisiologi, kesan kehilangan pendengaran, kesan audiotori, kesan psikologi

1.0 INTRODUCTION

Sound can be measured objectively but noise is a subjective phenomenon. Bridger [1] defined noise as a sound or sounds at such amplitude as to cause annoyance or to interfere with communication. Kroemer *et al* [2] mentioned that noise was psychological and subjective feeling. Single, short tones of low intensity may be considered noise under certain conditions, just as loud, lasting, complex sounds may be deemed noise under other circumstances. Any sound which is annoying or level of sound exceeds 75 dBA may be conceived as noise. The threshold for noise annoyance varies, depending on the conditions,

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DEVELOPMENT OF A FRAMEWORK IN ENHANCING ERGONOMICS PRACTICES FOR COMPUTER USER IN MALAYSIAN INDUSTRIES

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Abstract

Since computers are being introduced in Malaysia, its usage has been an important contribution to the development of the industrial sector. Even though computers or usually known as visual display terminals (VDT) have improved productivity and made work easier for industrial workers, they have also caused adverse effects such as musculoskeletal disorders (MSD). Therefore, in order to help in reduce MSD among Malaysian industrial workers, the primary emphasis is to enhance employees awareness and on improving the employee's knowledge of efficiently using VDT workstation by applying ergonomics principles in ergonomics training program. Based on literature review focus on VDT training programs, it shows that each of the training programs had different contents. To achieve the purpose of this study, each of the contents from the best practices of VDT training programs are combine to develop a comprehensive framework of ergonomics VDT training program. The framework was developed using Kawakita Jiro (KJ) method, which the principal tool is an affinity diagram. The KJ method was used because it is conceivable in education and training fields especially in prioritize the training items.

Computer or VDT Usage in Malaysian Industries

Computer or usually known as visual display terminals (VDT), herein after referred to as 'VDT', is a medium which the users and computer interact [1]. The usage of VDT in Malaysian has been drastically increasing since 1996, which correlates to the estimated amount of 4 million personal computers being installed in 2003 [2]. The increased was partly due to the launched of a program called Vision 2020 by the Malaysian government. The vision will be achieved through the development of the information and communication technology (ICT) sector and the use of ICT to increase global competitiveness [2]. Therefore, the VDT usage plays important roles in Malaysian industry especially among office workers and operating VDT.

Along with the increased use of VDT, there have been reports about the health effects largely related to musculoskeletal disorders (MSD) such as visual discomfort and other stress related disorders [3, 4]. However, in the industrial sector, attention is given fully to end-customers, which decide whether the products or services meet their needs. Although this is important for a company's achievement, there is not enough human factors attention given to the industrial workers. In this case, the company may be successful in marketing their products but unfortunately, their workers are working in a non conducive environment. Even though VDT has been blamed for a wide range of industrial health problems but VDT users actually suffer

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ABSTRACT

Studies on the effect of noise on human performance involving various kinds of tasks such as cognitive, analytical, and memory have been conducted for long. However, the effect remains both elusive and interesting. All kinds of results, suggesting improved, degraded, and unaffected performance, have been reported. The present study reports the effect of intermittent noise on data entry task of short duration. The study was conducted at four levels of noise intensity, viz 70 dBA L_{eq}, 80 dBA L_{eq}, 90 dBA L_{eq}, and 100 dBA L_{eq}. The noise used was actually sharp sound beads at a frequency of 60 $\pm$ 5 beads per minute. A total of 10 young male subjects participated in the study. The results show an improvement of performance, especially at moderately higher levels of noise intensity. Conjectured reason for such behaviour and suggestions for further research are given.

Keywords: *Noise, data entry task, human performance.*

Introduction

With the massive introduction of computers in varieties of work environments, a huge number of humans are using computers in almost all walks of their lives. With the recent technological advances, varieties of computers such as desktop, laptop, note-book, palmtop, and wrist-top are available in the market. The number of persons using computers for various purposes has increased substantially in recent years. The performance of humans working on computers may be affected by many environmental variables in which they work. Among these, noise is considered to be an important and critical one [1]. Noise, as an environmental variable, occupies significant importance because of the fact that it is increasing at an alarming rate due to increase in traffic (both road and air) density, increase in industrial establishments, and other noise producing equipment/instruments. In the past, studies have been conducted to examine effect of noise on human performance in varieties of tasks. Many researchers have reported adverse effect

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Effects of Noise on Humans: A Review

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ABSTRACT
This paper presents a review on the effects of noise on various aspects of human's health and activities such as hearing loss, task performance, interference with communication, sleep disturbance, social behavior, health and annoyance. It has been found that although a lot of researches have been conducted in the past and are still being carried out, the effects of noise on humans have not been fully understood and in many cases the results are inconclusive. This necessitates further investigations on the effects of noise on humans.

Keywords: Noise, Hearing loss, Sleep disturbance, Interference with communication, Effect on health

1. INTRODUCTION
Noise is defined as the effect of the presentation of moderately intense or loud auditory stimuli (Broadbent, 1979; Gulian, 1973; Jones et al., 1981; Kryter, 1970, 1994; Smith, 1989). Noise is also commonly defined as undesirable or unwanted sound (Cohen and Weinstein, 1982). Therefore, sound is the result of pressure changes in a medium, which is usually air, caused by vibration or turbulence. The amplitude of these pressure changes is stated in terms of sound level, and the rapidity with which these changes occur is the sound's frequency. Another important aspect is the duration of the sound, and the way it is distributed in time. The effect of noise is determined mainly by the duration and the level of the noise, but also influenced by the frequency and intensity (Sutter, 1991).
Noise has a significant impact and indeed, can impair the quality of life, through reduction in the ability to hear important sounds, performance and to communicate with all human being. In fact, according to the World Health Organization (WHO), noise is a health problem. WHO's definition of health includes total physical and mental well-being, as well as the absence of disease. Along these lines, a 1971 WHO working group stated: "Noise must be recognized as a major threat to human well-being" (Suess, 1973).

2. EFFECTS OF NOISE ON HUMANS
Effects of noise can not be ignored particularly in situations where it is increasing at a rapid rate due to increase in traffic density, industries and people living habits. A review on the effects of noise revealed by researches is being presented as follow: