BAB V
KESIMPULAN DAN SARAN

Pada bab ini, akan diberikan kesimpulan dan saran atas hasil penelitian yang telah dilakukan. Kesimpulan akan menjawab rumusan masalah yang telah ditentukan di awal penelitian. Saran akan ditujukan untuk penelitian-penelitan ke depannya.

V.1 Kesimpulan

Berdasarkan hasil analisis yang telah dilakukan, berikut merupakan kesimpulan yang dapat ditarik:

1. Dengan nilai α=0,05, kualitas tidur berpengaruh secara simultan terhadap tingkat kantuk (tingkat gelombang theta), tingkat kewaspadaan (rata-rata waktu reaksi dan jumlah *lapses*), dan performansi mengemudi (*speeding* dan *wheel slip*) pada mengemudi jangka panjang.
2. Dalam kondisi kualitas tidur baik pada mengemudi jangka panjang disarankan beristirahat setelah 82 menit megemudi. Dalam kondisi kualitas tidur buruk pada mengemudi jangka panjang disarankan beristirahat setelah 60 menit mengemudi.

V.2 Saran

Saran ini dibuat berdasarkan hasil penelitian yang telah dilakukan untuk penelitian selanjutnya. Berikut merupakan beberapa saran yang dapat diberikan:

1. Menentukan waktu istirahat bagi pengemudi dengan mempertimbangkan kualitas tidur dan waktu keterjagaan.
2. Menentukan durasi istirahat bagi pengemudi dengan memperhatikan kualitas tidur.
3. Penambahan jumlah partisipan untuk memperkuat nilai *power* dari penelitian.

DAFTAR PUSTAKA

Alhola, P. dan Polo-Kantola, P. (2007). *Sleep Deprivation: Impact on Cognitive Performance*. Finland : University of Turku.

Armanfard, N., Komeili, M., Reilly, J. P., Pino, L. (2016). Vigilance Lapse Identification Using Sparse EEG Electrode Arrays. DOI: 978-1-4673-8721-7/16/$31.00

Badan Pusat Statistik. (2018). Jumlah Penumpang Kereta Api 2006-2017. Diunduh dari https://www.bps.go.id/linkTableDinamis/view/id/815. Diakses pada tanggal 27 September 2018.

Bray, J. dan Maxwell, S.E. (1985). *Multivariate Analysis of Variance*. *Series* Quantitative Applications in the Social Sciences, 33-34.

Correa, A.G., Orosco, L., dan Laciar, E. (2014). *Automatic detection of drowsiness in EEG records based on multimodal analysis*. *Medical Engineering dan Physics,* 36,244-249*.*

Damayanti, K.A. dan Cantikawati, Y. (2012). Pengukuran Beban Kerja Mental Masinis Kereta Api Rute Jarak Jauh (Studi Kasus Pada PTKAI DAOP 2). Simposium Nasional RAPI XI FT UM.

Dawson, D., Searle, A. K., & Paterson, J. L. (2014). Look before you (s)leep: Evaluating the use of fatigue detection technologies within a fatigue risk management system for the road transport industry. *Sleep Medicine Reviews*, 18, 141-152. DOI:10.1016/j.smrv.2013.03.003.

De Valck, E., Smeekens, L., & Vantrappen., Luc. (2015). Periodic Psychological Examination of Train Drivers' Fitness in Belgium Deficits Observed and Efficacy of the Screening Procedure. *Journal of Occupational and Environmental Medicine*, 00(00). DOI:10.1097/JOM. 0000000000000384.

Dinges, D. F. (1995). An overview of sleepiness and accidents. *Journal of Sleep Research,4*, 4-14. doi:10.1111/j.1365-2869.1995.tb00220.x

Djamal, E. C., Tjokronegoro, H. A., & Soegijanto. (2005). The use of Wavelet Power Spectrum for Detection and Identification of Thinking-Induced EEG Signals. *Majalah IPTEK*, 16(1), 12-21.

Dorrian, J., Roach G. D., Fletcher, A., & Dawson D. (2007). Simulated Train Driving: Fatigue, Self-Awareness and Cognitive Disengagement. *Applied Ergonomics*, 38, 155-166. DOI: 10.1016/j.apergo.2006.03.006.

Dunn, N. & Williamson, A. (2011). Monotony in the Rail Industry: The Role of Task Demand in Mitigating Monotony-Related Effects on Performance. *Ergonomics Australia – Special Edition*. Diunduh dari https://www.ergonomics.org.au/documents/item/269.

Dunn, N. & Williamson, A. (2012). Driving Monotonous Routes in a Train Simulator: The Effect of Task Demand on Driving Performance and Subjective Experience. Ergonomics, 55(9), 997-1008. DOI: 10.1080/001-40139.2012.691994.

Dunn, N. J. (2011). Monotony: *The Effect of Task Demand on Subjective Experience and Performance*. Sydney: University of New South Wales.

Field, A. (2009). *Discovering Statistics Using SPSS*. London: Sage Publications.

Gastaldi, M., Rossi, R., & Gecchele, G. (2014). Effects of driver task-related fatigue on driving performance. *Social and Behavioral Sciences*, *111*, 955-964. DOI:10.1016/j.sbspro.2014.01.130.

Harma, M., Sallinen, M., Ranta, R., Mutanen, P., & Muller, K. (2002). The Effect of an Irregular Shift System on Sleepiness at Work in Train Drivers and Railway Traffic Controllers. *Journal of Sleep Research*, 11:141-151. DOI: 10.1046/j.1365-2869.2002.00294.x.

Hidayat, A. A. A. (2006). *Pengantar Kebutuhan Dasar Manusia: Aplikasi Konsep dan Proses Keperawatan*. Jakarta. Salemba Medika.

Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., Hazen, N., Herman, J., Hillard, P. J. A., Katz, E. S., Kheirandish-Gozal, L., Neubauer, D. N., O'Donn'ell, A. E., Ohayon, M., Peever, J., Rawding, R., Sachdeva, R. J., Setters, B., Vitiello, M. V., dan Ware, J. C. (2015). *National Sleep Foundation's Update Sleep Duration Recommendations: Final Report*. *Sleep Health*, 1(4), 233-243. doi:10.1016/j.jsmc.2013.04.001.

Irawati, E. (2017). *Usulan Saat Istirahat Bagi Pengemudi yang Kekurangan Tidur Kronis pada Jalan Monoton dengan Memperhatikan Tipe Sirkadian*. Bandung: Universitas Katolik Parahyangan.

Interaxon. (2015). Technical specification, validation, and research use, diperoleh melalui situs internet: http://developer.choosemuse.com/hardware-firmware/hardware-specifications

Jap, B. T., Lal, S., Fischer, P., dan Bekiaris, E. (2009). *Using EEG spectral components to assess algorithms for detecting fatigue*. *Expert System with Applications*, 36, 2352-2359. doi:10.1016/j.eswa.2007.12.043.

Kaida, K., Takahashi, M., Åkerstedt, T., Nakata, A., Otsuka, Y., Haratani, T., dan Fukasawa, K. (2006). *Validation of the Karolinska sleepiness scale against performance and EEG variables*. *Clinical Neurophysiology*, 117, 1574-1581. doi:10.1016/j.clinph.2006.03.011.

Kementerian Perhubungan. (2015). Berita Negara Republik Indonesia Mengenai Peraturan Menteri Perhubungan Republik Indonesia Nomor PM 24 Tahun 2015 tentang Standar Keselamatan Perkeretaapian. Diunduh dari http://ditjenpp.kemenkumham.go.id/arsip/bn/2015/bn422-2015.pdf. Diakses pada tanggal 27 Januari 2019.

Krigolson, O.E., Williams, C.C., Norton, A., Hassall, C.D., dan Colino, F.L. (2017). *Chossing MUSE: Validation of a Low-Cost, Portable EEG System for ERP Research*. Doi: 10.3389/fnins.2017.00109.

Komite Nasional Keselamatan Transportasi. (2016). Introduction. Diunduh dari http://knkt.dephub.go.id/knkt/ntsc_railway/railway.htm. Diakses pada tanggal 27 September 2018.

Kusumaningsari, A., Suliantoro, H., Budiawan, W. (2014). *Pengaruh Distraksi dan Kelelahan Kerja Terhadap Tingkat Kewaspadaan Masinis dan Asisten Masinis Kereta Api Kaligung Mas (Studi Kasus di PT. KAI DAOP IV Semarang)*. Diunduh dari https://media.neliti.com/media/publications/187798-ID-pengaruh-distraksi-dan-kelelahan-kerja-t.pdf. Diakses pada tanggal 26 Januari 209

Lal, S. K. L dan Craig, A. (2001). *A critical review of the psychophysiology of driver fatigue*. *Biological Psychology,* 55, 173-194.

Lerman, S. E., Eskin, E., Flower D. J., George, E. C., Gerson B., Hartenbaum, N., Hursh, S. R., & Moore-Ede, M. (2012). Fatigue Risk Management in the Workplace. *Journal of Occupational and Environmental Medicine, 54* (2), 231-258. DOI: 10.1097/JOM.0b012e318247a3b0.

Martin, D., W. (2008). *Doing Psychology Experiment. 7th Edition*. North Carolina : North Carolina State University.

Maxwell, S. E., dan Delaney, H. D. (2004). Designing Experiments and Analyzing Data. *A Model Comparison Perspective. Second Edition*. London : Mahwah, New Jersey.

McBain,W. (1970). Arousal, Monotony, and Accidents in Line Driving. Jurnal Application Psychology.

Montgomery, D.C. (2012). Design and Analysis of Experiments. Eighth Edition. New York: *John Wiley & Sons, Inc*.

Montgomery, D.C. dan Runger, G. C. (2011). Applied Statistics and Probability for Engineers. Fifth Edition. New York: *John Wiley & Sons, Inc*.

National Transport Commission Australia. (2017). National Standard for Health Assessment of Rail Safety Workers. Diunduh dari https://www.ntc.gov.au/Media/Reports/(7B079897-1863-CA93-474F-AD96AD9C6C3F).pdf. Diakses pada tanggal 21 Juli 2019.

Noy, Y.I., Horrey, W.J., Popkin, S.M., Folkard, S., Howarth, H.D.,dan Courntey, T.K. (2011). *Future directions in fatigue and safety research*. *Accident Analysis and Prevention*. 43, 495–497.

Ohayon, M., Wickwire, E.M., Hirshkowitz, M., Albert, S.M., Avidan, A., Daly, F.J., Dauvilliers, Y., Ferri, R., Fung, C., Gozal, D., Hazen, N., Krystal, A., Lichstein, K., Mallampalli, M., Plazzi, G., Rawding, R., Scheer, F.A., Somers, V., dan Vitiello, M.V. (2017). National Sleep Foundation Sleep Quality Recommendations: First Report. *Sleep Health*, 3(1), 6-19. doi: 10.1016/j.sleh.2016.11.006.

ORR (2012). Managing Rail Staff Fatigue. Diunduh dari http:// orr.goy.uk/__data/assets/pdf_file/005/2867/managing_rail_fatigue.pdf. Diakses pada tanggal 2 Oktober 2018.

Pearce, K. (1999). *Australian Railway Disasters*. IPL Books, NSW, Australia.

Pollard, J. (1991). *Issues in Locomotive Crew Management and Scheduling*. Federal Railroad Administration, US Department of Transportation, Washington D.C.

Purves, D., Augustine, G.J., Fitzpatrick, D., Hall, W.C., Lamantia, A.S., McNamara, J.O., dan Williams, S.M. (2004). *Neuroscience Third Edition*. Sunderland, Massachusetts USA.

Razali, N.M. dan Wah, Y.B. (2011). *Power Comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling Tests. Journal of Statistical Modeling and Analytics*, 2(1), 21-33.

Reed, D. L. dan Sacco, W. P. (2016). *Measuring sleep efficiency: what should the denominator be?* J Clin Sleep med. 2016; 12(2):263-6

Rencher, A. C. (1998). *Multivariate Statistical Inference and Applications*. Kanada: John Wiley and Sons, Inc

Sarwono, J. (2006). Metode Penelitian Kuantitatif dan Kualitatif. Edisi Pertama. Yogyakarta: Graha Ilmu.

Sathyanarayana, A., Joty, A.,dan Fernandez-Luque, L. (2016). *Sleep Quality Prediction From Wearable Data Using Deep Learning*. *JMIR Mhealth Uhealth*, 2016; 4(4) : E130.

Siswanto, D., Lestari, V., dan Iridiastadi, H. (2017). *Evaluation of Machinist's Fatigue at PT. Kereta Api Persero DAOP II Bandung*. Diunduh dari https://doi.org/10.14716/ijtech.v8i2.6143.

Siswanto, D., Yogasara, T., Sutjitro, T. V. L., dan Levin. (2017). *Studi Perbandingan Psychomotor Vigilance Task (PVT) Dan Flicker Sebagai Alat Uji Tingkat Kewaspadaan*. Bandung: Lembaga Penelitian dan Pengabdian kepada Masyarakat Universitas Katolik Parahyangan.

Smit, A.S., Eling, P.A.T., dan Coenen, A.M.L. (2004). *Vigilance: In Search of Sensitive Measures.* Decis Lab, *Thales Research and Technology*, Delft. NICI, *Department of Psychology*, Radboud University Nigmegen

Sutrisno dan Wulandari, D. (2018). Multivariate Analysis of Variance (MANOVA) untuk Memperkaya Hasil Penelitian Pendidikan. Diunduh dari https://www.researchgate.net/publication/326837868

Steven, J. (2002). Applied Multivariate Statistics for the Social Sciences. New Jersey: Lawrence Erlabaum Associates

Tabachnick, B. G. dan Fidell, L. S. (2007). *Using Multivariate Statistics.* Boston: Pearson Education, Inc

Teo, J. dan Chia, J. T. (2018). EEG-based Excitement Detection in Immersive Environments: An Improved Deep Learning Approach. Diunduh dari https://doi.org/10.1063/1.5055547.

Thiffault, P. & Bergeron, J. (2003). Monotony of Road Environment and Driver Fatigue: A Simulator Study. *Accident Analysis and Prevention*, 35(3), 381-391. DOI: 10.1016/S0001-4575(02)00014-3.

Tuck. (2018). *Stages of Sleep and Sleep Cycles*. Diunduh dari https://www.tuck.com/stages. Diakses pada tanggal 5 Agustus 2018.

Wavy, 2008. The Relationship Between Time Management, Perceived Stress, Sleep Quality And Academic Performance Among University. Diunduh dari http:Libproject.Hkbu.Eduhk/Hk/Trsimage /Hp/0663306. Diakses Tanggal 8 Januari 2014.

Weinger, M. B. & Ancoli-Israel, S. (2002). Sleep Deprivation and Clinical Performance. *JAMA,* 287(8):955-7. DOI: 10.1001/jama.287.8.955.

Wiechert, G., Triff, M., Liu, Z., Yin, Z., Zhao, S. Zhong, Z., Zhaou, R., dan Lingras, P. (2016). *Identifying Users and Activities with Cognitive Signal Processing from a Wearable Headband*. DOI: 10.1109/ICCI-CC.2016.7862025.

Williamson, A., Lombardi, D., Folkard, S., Stutts, J., Courtney, T., dan ga, J. (2011). The link between fatigue and safety. *Accident Analysis and Prevention*, *43*, 498–515. doi:10.1016/j.aap.2009.11.011.

Zambotti, M. D., Baker, F. C., Willoughby, A. R., Godino, J. G., Wing, D., Patrick, K., dan Colrain, I. M. (2016). *Measures of sleep and cardiac functioning during sleep using a multi-sensory commercially-available wristband in adolescents*. *Physiology and Behavior,158*, 143-149. doi:10.1016/j.physbeh.2016.03.006

Zhao, C.,Zheng, C. Zhao, M., dan Liu, J. (2010). *Physiological Assessment of Driving Mental Fatigue Using Wavelet Packet Energy and Random Forests*. *American Journal of Biomedical Sciences*, 2(3), 262-274. doi: 10.5099/aj100300262.

Zhuang, T., Zhao, H., dan Tang, Z. (2009). *Study of Brainwave Entrainment Based on EEG Brain Dynamics*. *Computer and Information Science, 2*(2), 80-86.

Zurika, Abida., (2011). Kajian Tingkat Kelelahan Melalui Evaluasi Beban Mental dan Kantuk pada Pekerjaan Masinis Kereta Api Pandan Wangi. Program Studi Teknik Industri. Institut Teknologi Bandung. Bandung