

BAB V

KESIMPULAN DAN SARAN

Bab ini akan menjelaskan mengenai kesimpulan dan saran terkait penelitian yang dilakukan. Kesimpulan akan menjawab tujuan penelitian yang dilaksanakan. Saran akan berisikan beberapa hal penting disampaikan agar penelitian selanjutnya lebih baik. Kesimpulan dan saran ini dibuat agar pembaca mengetahui apa hasil dari penelitian yang telah dilakukan.

V.1 Kesimpulan

Pada bagian ini akan dijelaskan mengenai kesimpulan yang berdasarkan hasil penelitian dan pengolahan data yang dilakukan. Kesimpulan ini merupakan jawaban dari tujuan dilakukannya penelitian. Berikut ini merupakan kesimpulan berdasarkan hasil penelitian yang didapatkan.

1. Pada penelitian ini, terdapat beberapa variabel independen yang berpengaruh dan beberapa yang tidak berpengaruh. Variabel jenis kelamin tidak mempengaruhi tingkat kinerja pekerjaan perakitan repetitif pembuatan senter pada penelitian ini. Hal ini diduga disebabkan karena jenis pekerjaan repetitif yang cukup sederhana sehingga tidak secara signifikan mempengaruhi proses kognitif pada partisipan dengan berjenis kelamin berbeda. Variabel realitas tidak berpengaruh terhadap hasil tingkat stres tetapi berpengaruh rata-rata waktu penyelesaian. Namun, variabel realitas mempengaruhi waktu penyelesaian (*main effect*). Selain itu, terdapat interaksi faktor jenis kelamin dan realitas pada waktu penyelesaian. Interaksi ini diduga diakibatkan oleh perbedaan kemampuan kognitif pada perempuan dan laki-laki. Penemuan ini dapat dijadikan sebagai bahan pertimbangan untuk penelitian yang lebih lanjut.
2. Rekomendasi yang dapat diberikan berdasarkan dengan hasil penelitian yang dilakukan adalah untuk melakukan pelatihan pekerjaan perakitan repetitif perakitan senter pada realitas *real world* ataupun *virtual reality* dengan mempertimbangkan ketersediaan sumber daya (terutama biaya) yang dimiliki serta kesesuaian pekerjaan terhadap lingkungan virtual.

Perlu diperhatikan waktu *set up* dari setiap realitas, karakteristik pekerjaan serta komponen penyusun agar dapat menentukan realitas yang terbaik untuk digunakan dalam pelatihan.

V.2 Saran

Berdasarkan penelitian yang dilakukan, terdapat beberapa saran yang dapat diberikan. Saran ini diharapkan dapat bahan pertimbangan untuk penelitian selanjutnya. Berikut ini merupakan saran yang dapat diberikan berdasarkan penelitian yang sudah dilakukan.

1. Pembatasan waktu latihan pada *virtual reality* sebaiknya dilakukan sesuai dengan rekomendasi yang sudah diberikan oleh Oculus LLC, untuk menghindari terjadinya *cybersickness*.
2. Pada penelitian yang lainnya, dapat dipertimbangkan juga variabel tambahan, yaitu *visual latency*. Hal ini dilakukan untuk melihat pengaruh dari *visual latency* terhadap kecepatan respons dari partisipan dalam *virtual reality*. Selain itu, Lalu, dapat dipertimbangkan juga aspek lainnya mengenai *head mounted display* dari *virtual* seperti *field-of-view*.
3. Pada penelitian selanjutnya, dapat dilakukan pembuatan lingkungan virtual yang semakin mirip dengan lingkungan pada dunia nyata. Baik dari kualitas *render* objek dan lingkungan sampai cara partisipan dapat berinteraksi dengan objek di dalam lingkungan virtual. Lalu, dapat dipertimbangkan aspek kognitif seperti rotasi mental. Selain itu, jika masih mempertimbangkan variabel kewaspadaan, sebaiknya durasi tidur serta konsumsi kafein dari partisipan dikontrol oleh peneliti. Hal ini dilakukan untuk mengurangi efek yang tidak diinginkan dari durasi tidur serta konsumsi kafein terhadap tingkat kewaspadaan partisipan.
4. Menggunakan partisipan yang berlatar belakang pekerja pada industri manufaktur. Pekerja ini sebaiknya sudah sering mengerjakan pekerjaan repetitif.

DAFTAR PUSTAKA

- Abad, V. C., & Guilleminault, C. (2012). Polysomnographic evaluation of sleep disorders. In *Aminoff's Electrodiagnosis in Clinical Neurology* (6th ed.). Elsevier Inc. <https://doi.org/10.1016/B978-1-4557-0308-1.00033-9>
- Abidi, M. H., Al-Ahmari, A., Ahmad, A., Ameen, W., & Alkhalefah, H. (2019). Assessment of virtual reality-based manufacturing assembly training system. *International Journal of Advanced Manufacturing Technology*, *105*(9), 3743–3759. <https://doi.org/10.1007/s00170-019-03801-3>
- Al Zayer, M., Adhanom, I. B., MacNeilage, P., & Folmer, E. (2019). The effect of field-of-view restriction on sex bias in VR sickness and spatial navigation performance. *Conference on Human Factors in Computing Systems - Proceedings*, 1–12. <https://doi.org/10.1145/3290605.3300584>
- Ali, D. F. B., & Nordin, D. M. S. B. (2011). *GENDER ISSUES IN VIRTUAL REALITY LEARNING ENVIRONMENTS*.
- Ausburn, L. J., Martens, J., Washington, A., & Steele, D. (2009). Journal of Industrial Teacher Education A CROSS-CASE ANALYSIS OF GENDER ISSUES IN DESKTOP VIRTUAL REALITY LEARNING ENVIRONMENTS. *Current*, *46*(3), 1–16. Retrieved from <https://ir.library.illinoisstate.edu/cgi/viewcontent.cgi?article=1103&context=jste>
- Basavanna, M. (2015). Research Methods in Psychology. *Psychology for Nurses*, 27–27. https://doi.org/10.5005/jp/books/12408_3
- Bassi, M. A., Lopez, M. A., Confalone, L., Gaudio, R. M., Lombardo, L., & Lauritano, D. (2020a). Real-world and Virtual-world Practices for Virtual Reality Games: Effects on Spatial Perception and Game Performance. *Nature*, Vol. 388, pp. 539–547.
- Bassi, M. A., Lopez, M. A., Confalone, L., Gaudio, R. M., Lombardo, L., & Lauritano, D. (2020b). The effects of Age, Gender, and Control Devices in a Virtual Reality Driving Simulation. *Nature*, Vol. 388, pp. 539–547.
- Berg, L. P., & Vance, J. M. (2017). Industry use of virtual reality in product design and manufacturing: a survey. *Virtual Reality*, *21*(1), 1–17.

<https://doi.org/10.1007/s10055-016-0293-9>

- Boud, A. C., Haniff, D. J., Baber, C., & Steiner, S. J. (1999). Virtual reality and augmented reality as a training tool for assembly tasks. *Proceedings of the International Conference on Information Visualisation, 1999-Janua*, 32–36. <https://doi.org/10.1109/IV.1999.781532>
- Burdea, G. C., & COIFFET, P. (2017). *Virtual Reality Technology Second Edition*. 464.
- Buyuksalih, I., Bayburt, S., Buyuksalih, G., Baskaraca, A. P., Karim, H., & Rahman, A. A. (2017). 3D MODELLING and VISUALIZATION BASED on the UNITY GAME ENGINE - ADVANTAGES and CHALLENGES. *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, 4(4W4), 161–166. <https://doi.org/10.5194/isprs-annals-IV-4-W4-161-2017>
- Chang, C. W., Li, M., Yeh, S. C., Chen, Y., & Rizzo, A. (2020). Examining the Effects of HMDs/FSDs and Gender Differences on Cognitive Processing Ability and User Experience of the Stroop Task-Embedded Virtual Reality Driving System (STEVDRS). *IEEE Access*, 8, 69566–69578. <https://doi.org/10.1109/ACCESS.2020.2966564>
- Chao, C. J., Wu, S. Y., Yau, Y. J., Feng, W. Y., & Tseng, F. Y. (2017). Effects of three-dimensional virtual reality and traditional training methods on mental workload and training performance. *Human Factors and Ergonomics In Manufacturing*, 27(4), 187–196. <https://doi.org/10.1002/hfm.20702>
- Choi, S., Jung, K., & Noh, S. Do. (2015). Virtual reality applications in manufacturing industries: Past research, present findings, and future directions. *Concurrent Engineering Research and Applications*, 23(1), 40–63. <https://doi.org/10.1177/1063293X14568814>
- Ciccarelli, G., M. Rao, H., J. Smalt, Christopher Edwards, H., Mehta, D., Reynolds, H., Cave, K., & Quatieri, T. (2021). *Non-Invasive Physiological Biomarkers of Cognitive Fatigue in a Virtual Reality Simulated, Rotary-Wing Flight Environment*.
- Clark, R. A., Szpak, A., Michalski, S. C., & Loetscher, T. (2021). Rest intervals during virtual reality gaming augments standing postural sway disturbance. *Sensors*, Vol. 21. <https://doi.org/10.3390/s21206817>
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (Second Edi). New York: Lawrence Erlbaum Associates.

- Craighead, J., Burke, J., & Murphy, R. (2008). Using the Unity Game Engine to Develop SARGE : A Case Study. *2008 IEEE/RSJ International Conference on Intelligent Robots and Systems Simulation Workshop*, (August 2015). Retrieved from http://dl.getdropbox.com/u/18762/jeffcraighead/Craighead_IROS2008_Workshop.pdf
- Development, C., & Development, C. (2016). *Sex Differences and Individual Differences Author (s): Robert Plomin and Terryl T . Foch Published by: Wiley on behalf of the Society for Research in Child Development Stable URL : <http://www.jstor.org/stable/1129258> REFERENCES Linked references are av. 52(1), 383–385.*
- Fang, J. Y., & Davis, T. L. (2016). Reaction time in parkinson's disease. *The Curated Reference Collection in Neuroscience and Biobehavioral Psychology*, (November 2015), 16–18. <https://doi.org/10.1016/B978-0-12-809324-5.00770-7>
- Freina, L., & Ott, M. (2015). A literature review on immersive virtual reality in education: State of the art and perspectives. *Proceedings of ELearning and Software for Education (ELSE)(Bucharest, Romania, April 23--24, 2015)*, (July), 8.
- Gao, X. (2022). Low-poly Mesh Generation for Building Models. In *Special Interest Group on Computer Graphics and Interactive Techniques Conference Proceedings (SIGGRAPH '22 Conference Proceedings), August 7â•fi11, 2022, Vancouver, BC, Canada* (Vol. 1). Association for Computing Machinery. <https://doi.org/10.1145/3528233.3530716>
- Grantcharov, T. P., Bardram, L., Funch-Jensen, P., & Rosenberg, J. (2003). Impact of hand dominance, gender, and experience with computer games on performance in virtual reality laparoscopy. *Surgical Endoscopy and Other Interventional Techniques*, 17(7), 1082–1085. <https://doi.org/10.1007/s00464-002-9176-0>
- Grassini, S., Laumann, K., & Rasmussen Skogstad, M. (2020). The Use of Virtual Reality Alone Does Not Promote Training Performance (but Sense of Presence Does). *Frontiers in Psychology*, 11(July). <https://doi.org/10.3389/fpsyg.2020.01743>
- Gruen, R., Ofek, E., Steed, A., Gal, R., Sinclair, M., & Gonzalez-Franco, M. (2020).

- Measuring System Visual Latency through Cognitive Latency on Video See-Through AR devices.* 791–799. <https://doi.org/10.1109/vr46266.2020.00103>
- Harris, D. (1984). Computer Graphics and Applications. In *Comput Graphics and Appl.* [https://doi.org/10.1016/0734-189x\(85\)90098-2](https://doi.org/10.1016/0734-189x(85)90098-2)
- Hart, S. G., & Staveland, L. E. (1988). *HUMAN MENTAL WORKLOAD P.A. Hancock and N. Meshkati (Editors) Elsevier Science Publishers.*
- Khitrov, M. Y., Laxminarayan, S., Thorsley, D., Ramakrishnan, S., Rajaraman, S., Wesensten, N. J., & Reifman, J. (2014). PC-PVT: A platform for psychomotor vigilance task testing, analysis, and prediction. *Behavior Research Methods*, 46(1), 140–147. <https://doi.org/10.3758/s13428-013-0339-9>
- Killgore, W. D. S. (2010). Effects of sleep deprivation on cognition. *Progress in Brain Research*, 185(C), 105–129. <https://doi.org/10.1016/B978-0-444-53702-7.00007-5>
- Laine, C. M., Spitler, K. M., Mosher, C. P., & Gothard, K. M. (2009). Behavioral Triggers of Skin Conductance Responses and Their Neural Correlates in the Primate Amygdala. *J Neurophysiol*, 101, 1749–1754. <https://doi.org/10.1152/jn.91110.2008>
- Linowes, J. (2015). *Unity virtual reality projects - explore the world of virtual reality by building immersive and fun VR projects using Unity 3D.* Retrieved from <http://www.worldcat.org/title/unity-virtual-reality-projects-explore-the-world-of-virtual-reality-by-building-immersive-and-fun-vr-projects-using-unity-3d/oclc/961514719?referer=di&ht=edition>
- Lisa, R. (2015). *Managing Cybersickness in Virtual Reality.* 22(1). <https://doi.org/10.1145/2810054>
- MacArthur, C., Grinberg, A., Harley, D., & Hancock, M. (2021). *You're Making Me Sick.* 1–15. <https://doi.org/10.1145/3411764.3445701>
- Martin, D. W. (2008). *Doing Psychology Experiments (Seventh).*
- Marucci, M., Di Flumeri, G., Borghini, G., Sciaraffa, N., Scandola, M., Pavone, E. F., ... Aricò, P. (2021). The impact of multisensory integration and perceptual load in virtual reality settings on performance, workload and presence. *Scientific Reports*, Vol. 11. <https://doi.org/10.1038/s41598-021-84196-8>
- Maxwell, S. E., & Delaney, H. D. (1990). Designing Experiments and. In *Analysing Data Wadsworth Belmont California.*
- Meshkati, N., Hancock, P. a., Rahimi, M., & Dawes, S. M. (1995). Techniques in

- mental workload assessment. *Evaluation of Human Work: A Practical Ergonomics Methodology*, (JANUARY 1995), 749–782.
- Moè, A. (2009). Are males always better than females in mental rotation? Exploring a gender belief explanation. *Learning and Individual Differences*, 19(1), 21–27. <https://doi.org/10.1016/j.lindif.2008.02.002>
- Montgomery, D. C. (2017). Design and Analysis of Experiments. In *Mycological Research* (Vol. 106).
- Montgomery, D. C., & Runger, G. C. (2003). *Applied Statistics and Probability for Engineers* (Third Edit). John Wiley & Sons.
- Muehlenhard, C. L., & Peterson, Z. D. (2011). Distinguishing Between Sex and Gender: History, Current Conceptualizations, and Implications. *Sex Roles*, 64(11–12), 791–803. <https://doi.org/10.1007/s11199-011-9932-5>
- Navea, R. F., Buenvenida, P. J., & Cruz, C. D. (2019). Stress Detection using Galvanic Skin Response: An Android Application. *Journal of Physics: Conference Series*, 1372(1). <https://doi.org/10.1088/1742-6596/1372/1/012001>
- Nee, A. Y. C., & Ong, S. K. (2013). Virtual and augmented reality applications in manufacturing. In *IFAC Proceedings Volumes (IFAC-PapersOnline)* (Vol. 46). <https://doi.org/10.3182/20130619-3-RU-3018.00637>
- Neubauer, A. C., Bergner, S., & Schatz, M. (2010). Two- vs. three-dimensional presentation of mental rotation tasks: Sex differences and effects of training on performance and brain activation. *Intelligence*, 38(5), 529–539. <https://doi.org/10.1016/j.intell.2010.06.001>
- Nourbakhsh, N., Chen, F., Wang, Y., & Calvo, R. A. (2017). Detecting users' cognitive load by galvanic skin response with affective interference. *ACM Transactions on Interactive Intelligent Systems*, 7(3). <https://doi.org/10.1145/2960413>
- Olasky, J., Chellali, A., Sankaranarayanan, G., Zhang, L., Miller, A., De, S., ... Cao, C. G. L. (2014). Effects of sleep hours and fatigue on performance in laparoscopic surgery simulators. *Surgical Endoscopy*, 28(9), 2564–2568. <https://doi.org/10.1007/s00464-014-3503-0>
- Parsons, T. D., Larson, P., Kratz, K., Thiebaut, M., Bluestein, B., Buckwalter, J. G., & Rizzo, A. A. (2004). Sex differences in mental rotation and spatial rotation in a virtual environment. *Neuropsychologia*, 42(4), 555–562.

<https://doi.org/10.1016/j.neuropsychologia.2003.08.014>

- Perkins Coie LLP. (2020). *2020 Augmented and Virtual Reality survey report: Industry insights into the future of immersive technology*. 4, 3–33. Retrieved from <https://www.perkinscoie.com/images/content/2/3/231654/2020-AR-VR-Survey-v3.pdf>
- Prabaswari, A. D., Basumerda, C., & Utomo, B. W. (2019). The Mental Workload Analysis of Staff in Study Program of Private Educational Organization. *IOP Conference Series: Materials Science and Engineering*, 528(1). <https://doi.org/10.1088/1757-899X/528/1/012018>
- Reifman, J., Kumar, K., Khitrov, M. Y., Liu, J., & Ramakrishnan, S. (2018). PC-PVT 2.0: An updated platform for psychomotor vigilance task testing, analysis, prediction, and visualization. *Journal of Neuroscience Methods*, 304, 39–45. <https://doi.org/10.1016/j.jneumeth.2018.04.007>
- Santl, J., Shiban, Y., Plab, A., Wüst, S., Kudielka, B. M., & Mühlberger, A. (2019). Gender Differences in Stress Responses during a Virtual Reality Trier Social Stress Test. *International Journal of Virtual Reality*, 19(2), 2–15. <https://doi.org/10.20870/ijvr.2019.19.2.2912>
- Sharma, M., Kacker, S., & Sharma, M. (2016). A Brief Introduction and Review on Galvanic Skin Response. *International Journal of Medical Research Professionals*, 2(6). <https://doi.org/10.21276/ijmrp.2016.2.6.003>
- Sherman, W. R., & Craig, A. B. (2003). Introduction to Virtual Reality Systems. *Understanding Virtual Reality*, 70–73. <https://doi.org/10.1016/B978-155860353-0/50003-3>
- Silverman, M. N., Heim, C. M., Nater, U. M., Marques, A. H., & Sternberg, E. M. (2010). Neuroendocrine and Immune Contributors to Fatigue. *PM and R*, 2(5), 338–346. <https://doi.org/10.1016/j.pmrj.2010.04.008>
- Smit, A. S., Eling, P. A. T. M., & Coenen, A. M. L. (2004). Mental effort causes vigilance decrease due to resource depletion. *Acta Psychologica*, 115(1), 35–42. <https://doi.org/10.1016/j.actpsy.2003.11.001>
- Waller, D. A. (1999). *An assessment of individual differences in spatial knowledge of real and virtual environments*.
- Wan, B., Wang, Q., Su, K., Dong, C., Song, W., & Pang, M. (2021). Measuring the Impacts of Virtual Reality Games on Cognitive Ability Using EEG Signals and Game Performance Data. *IEEE Access*, 9, 18326–18344.

<https://doi.org/10.1109/ACCESS.2021.3053621>

Wilson, J. R., & Sharples, S. (2015). *Evaluation of Human Work F O U R T H E D I
T I O N.*

Zheng, B., Tien, G., Atkins, S. M., Swindells, C., Tanin, H., Meneghetti, A., ...
Panton, M. (2011). Surgeon's vigilance in the operating room. *American
Journal of Surgery*, 201(5), 673–677.
<https://doi.org/10.1016/j.amjsurg.2011.01.016>

