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Developing a valid VR-based safety tool framework for hospitality TVET: A Fuzzy Delphi analysis with academic and industry experts
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Abstract
The research explores academia and industry experts' viewpoints regarding the innovative progression of Virtual Reality (VR)-based safety tools customized for technical and vocational education training (TVET) within commercial kitchen contexts. Developing a VR-based safety tools holistic framework is crucial in identifying constructs to mitigate the risks prevalent in commercial kitchens, encompassing physical, chemical, biological, ergonomic, and psychosocial hazards workers encounter. Introducing VR-based safety training represents a proactive strategy to bolster education and training standards, especially given the historically limited attention directed toward workers' physical and mental well-being in this sector. This study pursues a primary objective: validating a framework for VR-based kitchen safety within TVET's hospitality programs. In addition to on-site observations, the research conducted semi-structured interviews with 16 participants, including safety training coordinators, food service coordinators, and IT experts. Participants supplemented qualitative insights by completing a 7-Likert scale survey. Utilizing the Fuzzy Delphi technique, seven constructs were delineated. The validation process underscored three pivotal constructs essential for the VR safety framework's development: VR kitchen design, interactive applications, and hazard identification. These findings significantly affect the hospitality industry's safety standards and training methodologies within commercial kitchen environments. © 2024 by author(s).

Author Keywords
commercial kitchens; environment; Malaysia; occupational safety and health; sustainability; technical and vocational education training (TVET)

References

- Aasekjær, K., Gjesdal, B. E., Rosenberg, I., Bovim, L. P.
  (2022) *Virtual Reality (VR) in anatomy teaching and learning in higher healthcare education*,
  Springer

- Alhazmi, A. A., Kaufmann, A.
  Phenomenological Qualitative Methods Applied to the Analysis of Cross-Cultural Experience in Novel Educational Social Contexts
  (2022) *Frontiers in Psychology*, 13.

- Al-Rikabi, Y. K., Montazer, G. A.
  Designing an E-learning Readiness Assessment Model for Iraqi Universities Employing Fuzzy Delphi Method
  (2023) *Education and Information Technologies*, 29 (2), pp. 2217-2257.

- Aromaa, S., Väänänen-Vainio-Mattila, K.
  Suitability of virtual prototypes to support human factors/ergonomics evaluation

during the design
(2016) *Applied Ergonomics*, 56, pp. 11-18.

- Azlan, C. A., Wong, J. H. D., Tan, L. K.
  Teaching and learning of postgraduate medical physics using Internet-based e-learning during the COVID-19 pandemic—A case study from Malaysia
  (2020) *Physica Medica*, 80, pp. 10-16.

- Baldev, D.
  (2006) *Design of a Construction Safety Training System Using Contextual Design Methodology*,
  [Master's thesis]. Virginia Polytechnic Institute

- Belanich, J., Moses, ., . Fedele, A
  (2022) *Training Effectiveness Framework for augmented and Virtual reality: Developing a knowledge base*,
  F E. 1st ed. IDA Systems and Analyses Center

- Braun, V., Clarke, V., Hayfield, N., Terry, G.
  Thematic analysis
  (2019) *Handbook of research Methods in Health Social Sciences*,
  Liamputtong, P. (editor). Sage

- Campbell, S., Greenwood, M., Prior, S.
  Purposive sampling: complex or simple? Research case examples
  (2020) *Journal of Research in Nursing*, 25 (8), pp. 652-661.

- Chawla, S., Papp, A.
  Adult kitchen-related burn injuries: The impact of COVID-19
  (2022) *Burns*, 49 (6), pp. 1328-1334.

- Chen, C. T.
  Extensions of the TOPSIS for group decision-making under fuzzy environment
  (2000) *Fuzzy Sets and Systems*, 114, pp. 1-9.

- Chen, H., Wu, J., Li, J.
  Enhancing Food Safety Training through Virtual Reality: The Role of Perceived Usefulness and Perceived Ease of Use
  (2021) *Journal of Culinary Science & Technology*, 19 (6), pp. 576-589.

- Cheng, C. H., Lin, Y.
  Evaluating the best main battle tank using fuzzy decision theory with linguistic criteria evaluation
  (2002) *European Journal of Operational Research*, 142 (1), pp. 74-86.

- Chu, C.-H., Kao, E.-T.
  A Comparative Study of Design Evaluation with Virtual Prototypes Versus a Physical Product
  (2020) *Applied Sciences*, 10 (14), p. 4723.

- Cieri, R. L., Turner, M. L., Carney, R. M.
  Virtual and augmented reality: New tools for visualizing, analyzing, and communicating complex morphology
  (2021) *Journal of Morphology*, 282 (12), pp. 1785-1800.

- Crofton, E. C., Botinestean, C., Fenelon, M.
  Potential applications for virtual and augmented reality technologies in sensory science
  (2019) *Innovative Food Science & Emerging Technologies*, 56, p. 102178.

- Ibrahim, S. A., Yasmin, E., Mohamed, E. R.
  A framework to integrate virtual reality into international standard safety training
  (2023) *Engineering, Construction and Architectural Management*,

- Irshad, S., Perkis, A.
  Increasing User Engagement in Virtual Reality: The Role of Interactive Digital Narratives to Trigger Emotional Responses
  (2020) *Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences*,
  Shaping Society

- Jeinie, M. H., Md Nor, N.
  Food Hygiene and Storage Practices towards the Understanding of Food Microbe among Universiti Malaysia Sabah (UMS) Students
  (2022) *Malaysian Journal of Medicine and Health Sciences*, 18 (s15), pp. 178-183.

- Lee, L., Nisar, H., Roberts, J.
  Face and Content Validation of Food Safety Training in Virtual Reality (VR)
  (2022) *Proceedings of the 2022 IEEE 10th International Conference on Serious Games and Applications for Health (SeGAH)*,

- Lee, S., Kim, J., Park, Y.
  Exploring the Acceptance of Virtual Reality Technologies for Food Safety Training in Professional Culinary Environments: A Technology Acceptance Model Approach
  (2023) *Journal of Food Protection*, 86 (5), pp. 870-884.

- Magar, S. T., Suk, H. J.
  The Advantages of Virtual Reality in Skill Development Training Based on Project Comparison (2009–2018)
  (2020) *International Journal of Contents*, 16 (2), pp. 19-29.

- Makhtar, N. K., Parasuraman, B., Zakaria, M. N., Ismail, A. R.
  Safety culture and its contributing factor in education sector in Malaysia
  (2017) *Advances in intelligent systems and computing*,
  Springer

- Manakandan, S. K., Rosnah, I., Ridhuan, M. J., Priya, R.
  Pesticide applicators questionnaire content validation: A fuzzy delphi method
  (2017) *Med J Malaysia*, 72 (4), pp. 228-235.

- Mast, C., Berg, . D.
  Prototyping supermarket designs using virtual reality
  (1997) *Proceedings of the 3rd Conference on Design and Decision Support Systems in Architecture and Urban Planning*,
  M

- (2022) *Workplace Safety and Health Report 2021*,
  2nd ed. Ministry of Manpower Services Centre

- Mohd Jamil, M. R., Siraj, S., Hussin, H.
  (2017) *Introduction of the Fuzzy Delphi Method in Reconstruction and Development Research (Indonesian)*,
  Minda Intelek

- Moore, E.
  (2023) *Virtual reality and Augmented Reality in eLearning: Providing Deeper engagement*,
  (accessed on 29 May 2024)

- Nayl, M. N. A.
  (2021) *The Impact of Technical Aspects of Kitchen Equipment Selection on the*

Occupational Safety of Hotel Sector Employees,
Fayoum University

- Peng, H., Ma, S., Spector, J. M.
Personalized adaptive learning: an emerging pedagogical approach enabled by a smart learning environment
(2019) *Smart Learning Environments*, 6 (1).

- Purwanto, A., Tawar
Investigating The Role of the use of computer Hardware, software and lecturer involvement on online universities student satisfaction
(2024) *Universal Journal of Science and Technology*, 3 (1), pp. 1-10.

- Rahman, F. B. A., Mustafa, Z., Kharuddin, A. F.
Employing Fuzzy Delphi Technique to Validate Multiple Intelligence Based Instructional Teaching Module for Preschool Children
(2021) *Southeast Asia Early Childhood Journal*, 10 (1), pp. 62-71.

- Ramlie, H. A., Hussin, Z., Mohd Jamil, M. R.
Application of Fuzzy Delphi Technique to the Requirements of the 'Riadhah Ruhiyyah' Aspect for the Professionalism of Islamic Education Universities (Indonesian)
(2014) *The Online Journal of Islamic Education*, 2 (2), pp. 53-72.

- Rejab, M. M., Firdaus, N., Chuprat, S.
Fuzzy Delphi Method for Evaluating HyTEE Model (Hybrid Software Change Management Tool with Test Effort Estimation)
(2019) *International Journal of Advanced Computer Science & Applications (Online)*, 10 (4).

- Saad, M., Haminuddin, N., Jeinie, M. H.
Needs Analysis for Virtual Reality-based Safety Training in a Commercial Kitchen
(2023) *Tuijin Jishu/Journal of Propulsion Technology*, 44 (6).

- Saad, M., Najib, M. D. H. M., Pratt, T. J.
Valid virtual reality applications for commercial kitchen safety training
(2022) *Environment-Behaviour Proceedings Journal*, 7 (19), pp. 403-409.

- Shringi, A., Arashpour, M., Golafshani, E. M.
Enhancing safety training performance using extended reality: a hybrid Delphi–AHP Multi-Attribute analysis in a Type-2 fuzzy environment
(2023) *Buildings*, 13 (3), p. 625.

- Solmaz, S., Van Gerven, T.
Automated integration of extract-based CFD results with AR/VR in engineering education for practitioners
(2021) *Multimedia Tools and Applications*, 81 (11), pp. 14869-14891.

- Sun, Y.
The construction and application of intelligent learning environment
(2023) *Proceedings of the 2nd International Conference on Internet, Education and Information Technology (IEIT 2022)*,

- Suk-Tae, O.
Study on the Accident of Kitchen Food Service Industry Employees in Accordance with the Safety and Environment Awareness and Accident Experience
(2015) *Culinary Science and Hospitality Research*, 21 (2), pp. 85-102.

- **Survey of Occupational Injuries and Illnesses**
(2022) *BLS Department of Labor (USDL-22-2139)*,
U.S. Department of Labor. U.S. Department of Labor

- Wohlgenannt, I., Simons, A., Stieglitz, S.
  VR
  (2020) *Business & Information Systems Engineering*, 62 (5), pp. 455-461.

- Xie, B., Liu, H., Alghofaili, R.
  A review on virtual Reality skill training applications
  (2021) *Frontiers in Virtual Reality*, 2.

- Yamaguchi, T., Foloppe, D. A., Richard, P.
  A Dual-Modal virtual reality kitchen for (Re) Learning of everyday cooking activities in Alzheimer's disease
  (2012) *Presence: Teleoperators & Virtual Environments*, 21 (1), pp. 43-57.

- Yusof, N., Hashim, N. L., Hussain, A.
  (2022) *A review of fuzzy Delphi method application in human-computer interaction studies*,
  AIP Publishing LLC

- Yusoff, A. F. M., Hashim, A., Muhamad, N., Hamat, W. N. W.
  Application of Fuzzy Delphi technique towards designing and developing the elements for the E-PBM PI-POLI Module
  (2021) *Asian Journal of University Education*, 17 (1), p. 292.

- Zamzuri, M. I. A., Naserrudin, N. A., Ali, N. K. M.
  "Best of Both World": The Amalgamation of Fuzzy Delphi Method with Nominal Group Technique for Dengue Risk Prioritisation Decision-Making
  (2022) *Journal of Function Spaces*, pp. 1-8.