

**Short thesis for the Degree of Doctor of Philosophy
(Ph.D)**

**Enhancing Safety Training with Virtual Reality
Applications in High-Risk Environments**

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Chapter 1

Introduction

1.1 Background and Motivation

High-risk work environments like construction sites, manufacturing plants, mines, and warehouses have a number of characteristics that contribute to high levels of risk and many opportunities for interaction between people and materials, which creates a variety of safety issues [1, 2, 3]. The types of risks present at these locations are not limited, but they could include falls from heights; failure of equipment used in the operation of the workplace; and accidents caused when vehicles collide with each other or stationary objects [4, 5], all of which can cause serious injury, death, and economic loss.

Fatal work-related injuries in the United States rose by 18.54% between 2012–2022. U.S. Bureau of Labor Statistics reports 1.5 million work-related injuries and illnesses in workplaces in 2023, where the Transportation and Warehousing industry recorded the highest number at 250,319 cases. Laborers and material movers made up the majority of warehouse cases, with a third of injuries occurring to new employees. As a result, there is a high level of risk for all warehouse employees, especially in their first year of employment. Traditional training through lectures, videos, and handbooks has failed to engage trainees or simulate realistic hazards adequately [6, 7]. Therefore, the present work was conducted to improve safety training in high-risk environments, using logistics and warehousing operations as a representative case study.

Virtual reality (VR) is considered an innovative technology that allows the assessment and management of risks in a controlled environment by simulating dangerous situations without real consequences [8, 9]. In warehouses, where a high number of workers are injured each year [4], this dissertation presents four interconnected theses to investigate VR effectiveness.

The first thesis, in Chapter 2, employs a combination of methods [10]. That

includes observational studies, expert interviews, TRIZ's 9-Window tool, Critical Thinking (CT) analysis, and the Analytic Hierarchy Process (AHP) to identify workplace hazards and rank VR characteristics for developing effective training and audit programs.

The second thesis, in Chapter 3, addresses additional risks that are present in a work environment and demonstrates how VR can be used to incorporate the 5M's and 5S's to reveal the root causes of workplace accidents and reduce the number of workplace hazards. Accordingly, this chapter integrates root cause analysis (RCA) through 5M and structured workplace organization through 5S to enhance hazard recognition and safety compliance in simulated.

The third thesis, in Chapter 4, builds an AHP-Quality Function Deployment (QFD) Framework to Optimize User-Centered Design (UCD) in VR Training [11]. It is based on aligning the users' needs with technical solutions through AHP and QFD. Lastly, the fourth thesis in Chapter 5, the use of VR is evaluated to investigate students' intrapersonal and cognitive skills through Kirkpatrick's evaluation model [12]. It also investigated the detailed sub-skills of the intrapersonal (e.g., decision-making, problem-solving, self-awareness, and spatial abilities) along with cognitive skills (e.g., critical thinking, management skills, creativity) that are required to perform the safety tasks effectively.

Chapters 2-5 developed a fully integrated VR safety training system by combining multiple methods and analyses, which included hazard identification through observation, deep interviews for experts' perspectives, AHP to rank the importance of various aspects of VR safety training, integration of the 5M/5S into RCA and risk mitigation for the implementation of VR safety training, the AHP-QFD model to enhance UCD of VR safety training systems, the 9 Window as an analytical tool over time and systems, critical thinking for more advanced analysis, Kirkpatrick's model for evaluation, and linking these methodologies to learning theories for robust baselines. For the purpose of acquiring skills related to the use of VR safety training systems to enhance hazard recognition, safety compliance, intrapersonal & cognitive skills, and practical application of VR safety training in high-risk environments. Recent evidence highlights user-centered VR approaches to enhance warehouse safety and resilience, particularly by aligning user needs with safety-training requirements to support effective and practical training systems [13].

The frameworks are designed to give both an experiential and theoretical base for knowledge and skills development, according to UCD procedures, to provide systematic training, to sustain engagement, and to develop task values that align with training goals. These frameworks allow individuals to develop skills using VR simulations that are developed in high-risk environments and increase engagement,

knowledge retention, and safety awareness of trainees. [14, 15].

Through the integration of advanced methodologies like AHP, QFD, and multicriteria evaluation, the present work applies a systematic methodology to design and validate VR training systems that bridge the gap between theoretical safety training, user needs, technological advancement, and practical applications; therefore, it creates a proactive safety culture in high-risk environments by providing a critical case study of how to use VR to foster safety training in high-risk environments such as warehouses. Additionally, it addresses industry challenges and evaluates the effect of VR on a variety of user groups; therefore, it provides evidence-based solutions to prevent workplace injuries and improve safety training practices.

The main concern of immersive risk management training for high-risk scenarios is directly related to VR's effectiveness. [16] investigated the utilization of immersive VR training to improve risk management techniques. They found that VR training is the most effective method for managing risk and making decisions in simulated conditions when compared to blended training and augmented reality (AR). In doing so, it prioritizes the use of VR in the development of safety training programs based on the following three factors: cost-effectiveness, user engagement, and safety impact. As such, it established a foundational, evidence-based basis for the use of VR as a transformative technology for workplace safety in the current dissertation.

In addition to the potential use of VR as a tool in various other educational and training environments, researchers have also studied the effectiveness of VR in multiple educational/training settings; for instance, [17] found that students utilizing VR in their physical education classes retained information with higher engagement. Overall, a well-developed and designed VR experience can lead to significant improvement in the users' ability to enhance skills and interact with the virtual world environment.

In addition to the apparent safety issues associated with the use of VR in various operational environments, additional concerns arise as VR expands its role. These concerns would include the possible increase in security and privacy risks due to the collection of user data and expansion of its entire ecosystem. Therefore, the concern for increasing the dependability and reliability of VR-based safety training will have to consider secure protocols and user awareness of their individual roles in the design and implementation [18].

1.2 Problem Statement

The main problem is that there are inefficiencies of conventional safety education techniques in high-risk environments such as construction, industry, mining, and logistics warehouses, resulting in the inability to recognize hazards sufficiently, a low level of learner engagement with their training experience, and the inability to effectively translate skills learned through training into real-life working situations [19, 6]. Traditional safety training methods such as classroom-based learning and non-interactive training methods do not offer the realistic and interactive learning experiences that are needed to educate users to respond safely to dynamic workplace hazards; therefore, these methods continue to result in high numbers of workplace accidents and injuries and subsequently poor or unacceptably unsafe working conditions. The critical case study of logistics warehouses is an area where there are a very large number of annual injury cases [20, 4] that demonstrate the need for innovative safety training solutions [21, 22].

There are several critical deficiencies that exacerbate the above challenges. First, there is a lack of a systematic framework for identifying and prioritizing users' needs and technical features related to VR safety training, which prevents it from being scaled up and adopted in high-hazard workplaces [8]. Second, many studies of VR safety training focus on general workplace safety issues, such as construction [23], mining [24], and manufacturing [25]; however, few of these studies examine high-hazard work environments such as warehouse-specific hazards and/or how VR impacts safety and audit techniques [3]. Finally, due to the lack of mixed-methods approaches that combine both qualitative and quantitative data, the current work has a comprehensive perspective of how effectively VR improves users' intrapersonal and cognitive skills, as well as their auditing techniques [7, 26].

This presented work addresses these gaps through four theses: a mixed-methods investigation of VR training and auditing needs (Chapter 2), integrating the 5M framework for root cause analysis and the 5S methodology for risk mitigation in VR training. (Chapter 3), a novel AHP-QFD framework for user-centered design to match user needs with available technical measurements (Chapter 4), and multicriteria evaluations of VR's impact (Chapter 5).

1.3 Objectives and Scope

The objectives of this present work are to provide better safety training in risky working environments; the study used logistics and warehouse operations as a case study and applied both VR and advanced analytical techniques. Specific objectives were to follow the study's four theses:

- To identify the hazardous conditions in a workplace, especially those workplaces where there is a higher level of risk, such as a warehouse. by using a mixed methodology to evaluate the current risks, understand user needs, explore VR potential in different contexts, define essential VR functionalities, and prioritize VR features. Ultimately, to create a structured framework for developing VR-based training programs that can effectively target key hazards and improve risk mitigation. (Chapter 2).
- To integrate the 5M framework into the study of root cause analysis and the 5S methodology for risk mitigation into VR training and improve hazard recognition and workplace safety compliance through the use of lean principles (Chapter 3).
- To develop a new AHP-QFD framework to establish user priorities and optimize the design of user-centered VR training and assure that VR training aligns with the user needs for safety in high-risk settings with an emphasis on warehousing (Chapter 4).
- To assess how VR impacts students' intrapersonal (e.g., decision-making, self-awareness) and cognitive (e.g., critical thinking, creativity) abilities through a multi-criteria evaluation in order to enhance VR training program outcomes in warehouse safety scenarios (Chapter 5).

The scope focuses on VR applications designed for safety training and auditing in logistics and warehouse environments, particularly targeting current hazards to mitigate the most frequent risks, as discussed in Chapter 2. It utilizes the 5M method as an RCA tool and lean tools such as 5S, as detailed in Chapter 3, based on user criteria and employing the latest VR technical measurements, as shown in Chapter 4. A critical case study within the VR training experience was conducted to evaluate user reactions, learning experiences, and behavior. The study involves university students in Chapter 5 to evaluate cognitive and intrapersonal skill development. A mixed-methods approach is employed, integrating observational studies, semi-structured interviews, CT analysis, the AHP, QFD, and Kirkpatrick's evaluation model.

The current study uses VR technology (Unity for a software application and Oculus Quest 2 & 3 as an affordable VR hardware solution) in simulated hazard-specific environments while also examining potential applications of this method to other high-hazard industries. The current study does not include non-VR-based training methods; therefore, this study is focused on evaluating immersive safety training solutions.

This study provides an overall framework for developing and assessing VR-based safety training systems, the study scope focusing on three main aspects:

Technical Scope Designing immersive VR applications for safety training optimization and hazard auditing in warehouse operations. Additionally using the latest VR hardware (Oculus Quest 2/3) with customized hazard simulations.

Methodological Scope Mixed-methods approach combining quantitative techniques (AHP, QFD, Kirkpatrick's model) and qualitative techniques (observations, interviews, critical thinking).

Application Scope Focusing on university student groups (Chapter 5) to assess intrapersonal and cognitive skills, technological experience, user reaction, learning outcomes, and behavioral intention.

1.4 Contributions of the Thesis

There is a lack of studies that have taken a comprehensive approach to addressing continuing weaknesses in high-risk warehouse safety training through a combination of user-centered design methodologies, mixed methodologies for data collection and analysis, and an array of advanced analytical modeling techniques. Therefore, this work makes theoretical, methodological, and practical contributions.

Thesis 1: Enhancing Warehouse Safety Training using Virtual Reality for Improved Hazard Identification and Prevention (Chapter 2) Introducing how VR is used as a transformative tool for warehouse safety training and auditing techniques [10]. *Contributions:*

1. **A New Mixed-Methods Approach:** By combining observation studies, expert interviews, CT analysis, and AHP for assessing warehouse safety practices and the role of VR.
2. **Identify and Prioritize VR Features:** using CT and AHP tools.
3. **Guidelines for Industry:** How VR can be used to improve warehouse safety, auditing, and risk reduction.

Thesis 2: Integrating 5M and 5S Principles into Virtual Reality for Improved Hazard Recognition and Safety Compliance (Chapter 3) VR integration with 5M and 5S frameworks to improve warehouse safety indicates that VR training is the most effective modality for safety training compared with CBT and traditional training [27]. *Contributions:*

1. **Novel 5M/5S-VR Framework:** through embedding 5M and 5S philosophies into a VR simulation.
2. **Comparative AHP Analysis:** Utilized an AHP comparative analysis to compare VR training with alternative traditional training methods.

3. **Warehouse Safety Improvements (Practical Training Applications):** The study demonstrates that VR is superior since it increases users' ability to be aware of their surroundings and to complete tasks properly.

Thesis 3: Optimizing User-Centered VR Safety Training through AHP-QFD-Based Data Analytics (Chapter 4) Introducing a new AHP-QFD-based approach to VR user-centered safety training optimization, connecting user needs with technology requirements. This addresses the lack of effective training development by incorporating factors such as user experience (UX) and immersion into the VR-based training design. [11]. *Contributions:*

1. **Innovative AHP-QFD Integration:** An analytical framework for integrating AHP and QFD to prioritize user needs and map them to VR technology features has been proposed.
2. **Comparative Superiority of VR:** Compared to AR and CBT, this study shows the superiority of VR with respect to the improved immersive and effective learning processes.

Thesis 4: Multicriteria Evaluation of VR Safety Training for Students' Intrapersonal and Cognitive Skills (Chapter 5) This thesis investigates the effect of VR on university student intrapersonal skills as well as their cognitive awareness, as it relates to warehouse safety training, through a multi-criteria method that is based upon educational theories such as SDT and EVT. The effectiveness of the training assessed at three levels: reaction, learning, and behavior [12]. *Contributions:*

1. **Multicriteria Evaluation Model:** A multicriteria evaluation model was developed as a robust evaluation framework that combined Kirkpatrick's model and other learning theory models to assess the impact of VR on various forms of safety skills acquisition.
2. **Enhanced Skill Acquisition:** VR has been shown to be an effective way to acquire and enhance both intrapersonal and cognitive skills.
3. **Motivation and Engagement Insights:** Insights related to motivation and engagement were developed using SDT and EVT.

In combination, these theses offer a complete evidence-based solution to the identified issue of inadequate safety training for warehouse users by developing a framework that includes the integration of VR into warehouse work settings. Additionally, this work focuses on educational users in order to develop scalable solutions within the academic community and across industries.

Chapter 2

VR Integration in Warehouse Safety and Auditing

The results of this investigation show how virtual reality can be used to provide more comprehensive and safe warehouse safety training experiences for employees of safety training. This was accomplished through a comprehensive mixed-methods approach, which included observations, an empathy map, a 9-window analysis, critical thinking discussion, and an AHP evaluation. These data illustrate the diversity of hazards in warehouse environments and demonstrate the inability of current methods to meet the needs of safety training. Additionally, this chapter demonstrated that VR technology can address these deficiencies in traditional safety training by allowing participants to engage in realistic, interactive, and hands-on learning experiences. This chapter identified several attributes of VR, which include the degree of realism provided by simulations, the immersion of learners through use of interactive training tools, and the ability to recognize hazards as key factors to be used in developing and delivering successful safety training. Finally, although there are still many technical and operational challenges to overcome in order to successfully develop and implement safety training programs using VR technology, the data collected from this investigation will help guide organizations in the development of optimal VR safety training programs and ultimately lead to improved workplace safety and productivity through the use of VR technology.

The key findings of Thesis I are summarized as follows: VR enhances users' ability to recognize possible hazards and develop ways to effectively manage those hazards in warehouse environments. Traditional training is unable to deal with the dynamic hazards, whereas immersive VR improves hazard awareness and promotes proactive safety behavior. Observation studies, expert interviews, and AHP analysis provide an evidence base for integrating VR into warehouse safety systems [10].

Chapter 3

Immersive VR Safety Training with 5M and 5S Integration

Three key results are produced to inform and enhance safety training research and practice. The combined application of 5M and 5S approaches in VR environments is shown to offer substantial potential to improve workplace safety. The integrated approach addresses two important deficiencies in hazard identification and adherence to procedures via an immersive representation of the root cause (5M) and the systematic solution (5S) of hazards. VR is also better than other training methods because it can be used to train employees on how to identify hazards and react safely in emergency situations; it has the ability to engage employees in a way other training methods cannot, as well as the potential to make employees develop the critical thinking needed to be safe while working. While there may be some obstacles to using VR to train employees, these advantages make it worthwhile for organizations to consider investing in VR technology to use as part of their employee training. In addition, this study outlines an entirely new assessment structure for measuring the effectiveness of the various technologies available to provide employee safety training through the lens of both educational effectiveness and practical application by organizations. The three-dimensional assessment model allows organizations to have a clear format to evaluate and select or design training technologies when they are needed.

The key findings of thesis II are summarized as follows: The 5M framework is used in immersive VR to determine the causes of workplace accidents. The 5S approach is employed to reduce the dynamic hazards within a warehouse. VR-based integration of 5M and 5S improves awareness of hazards and adherence to safety. Expert interviews, workplace observations and AHP analysis help to evaluate the effectiveness of VR for safety training. VR training is found to be the most effective modality as compared to computer based training and conventional training methods [27].

Chapter 4

Optimizing User-Centered VR Training: An AHP-QFD Framework

The AHP-QFD model was introduced to optimize VR-based safety training development. AHP-QFD translates user needs into technical specifications, strengthening VR training design and performance in high-hazard industries. Four major findings starting from the AHP analysis identify the most important user requirement criteria as training efficiency and effectiveness and cognitive experience, pointing to the necessity of measurable educational outcomes and the creation of genuine, engaging virtual environments. Second, AHP comparison established VR as the most effective alternative (score of 0.508), followed by augmented reality (A2, 0.282) and computer-based training (A3, 0.210). The superiority of VR is directly related to its alignment with those criteria of highest priority. Third, the QFD analysis converted those priorities into technical requirements and indicated that software performance, content features, scalability, functionality, and usefulness are the most important technical factors. Fourth, the DEMATEL analysis illustrated the relationships between those technical requirements and demonstrated that the primary causal relationship exists between performance and other technical measures and that performance is the causal factor that yields the greatest benefit across the entire system.

The key findings of Thesis 3 are summarized as follows: A novel AHP-QFD framework is introduced to optimize user-centered VR safety training in warehouse environments. Also, the framework follows a four-phase methodology, including user requirement identification through expert consensus, AHP prioritization, technical measures identification, and QFD mapping. Additionally, user needs

such as usability and immersion are systematically prioritized and aligned with VR technical specifications. And finally, the results demonstrate that VR has a superior advantage in its technical measurement characteristics for designing and developing effective safety training programs [11].

Chapter 5

Evaluating VR Safety Training on Intrapersonal and Cognitive Skills

VR safety training application has been tested against traditional lecture-based methods using the first 3 levels of Kirkpatrick's model: reaction, knowledge, and behavior. The results indicate that both VR training and traditional training are effective in delivering safety knowledge, but VR training is superior to traditional training in many aspects regarding users' reactions to the training. The VR training group showed higher levels of motivation and engagement, resulting in a more engaging learning experience. Additionally, the users who completed VR training demonstrated as high a level as the traditional ones in learning and knowledge transfer of the safety training. These results illustrate the ability of VR to transform safety education and training. With its use of immersive, interactive, and contextualized learning experiences grounded in educational theories and practices, VR has the capability to create the complex combination of knowledge, personal competencies, and cognitive processes necessary to safely navigate high-hazard workplaces such as warehouses. The increased motivation and engagement exhibited by participants in the VR training group demonstrates the power of VR training to foster a more competent, confident, and ultimately safer workforce and thus contribute to the overall goal of improving occupational safety as outlined in this dissertation.

This thesis evaluates the impact of VR training on intrapersonal skills (decision-making, problem-solving, self-awareness, and spatial awareness) and cognitive skills (critical thinking, managerial skills, and creativity) among university students. The study applies a multicriteria evaluation and compares VR with traditional training across reaction, learning, and behavior levels.

Conclusion

This work develops a comprehensive VR-based framework that advances the safety training in high-risk warehouse environments, addressing the ineffectiveness of traditional methods that contribute to 250,319 annual injuries [4]. The dissertation is built around four connected theses presented in Chapters 2-5 and uses immersive virtual reality to improve users' identification of potential hazards, increase users' compliance with safety policies, and improve users' ability to develop new skills through the use of multiple methodologies, including AHP, QFD, and mixed methodologies. In Chapter 2, we conducted observational studies and interviewed subject matter experts and used AHP to determine the warehouse hazards and rank VR features to show greater hazard recognition when compared to non-VR methods [10]. In Chapter 3, we applied the 5M model for RCA and the 5S method for risk mitigation, conducted interviews, ranked VR against CBT, and showed increasing hazard recognition and compliance [27]. In Chapter 4, we developed an AHP-QFD model to optimize user-centered VR design by relating user requirements to technical specifications to improve the effectiveness of training [11]. Chapter 5 was dedicated to exploring how VR impacts the student's intrapersonal and cognitive skills. The study showed VR has a positive impact on motivating students to learn, increasing participation, allowing them to be autonomous, and seeing the value of their training, which leads to better learning and skill retention.

The four theses contribute to integrating new frameworks of application, such as 5M/5S-VR, AHP-QFD, comparative analyses that demonstrate the advantages of VR compared to other approaches, and practical strategies for industries to apply VR, as well as fostering proactive workplace safety cultures. These also address many of the shortcomings of traditional training, such as low engagement, low realism, and inadequate transfer of skills into real-world applications, thus providing a scalable solution to improve logistics and warehouse safety training. There is a substantial amount of opportunities for its utilization in additional high-risk areas like construction and manufacturing as well. The research utilizes both qualitative data and the most rigorous quantitative methodologies to ensure

the evidence supporting the transformational effects of VR on workspaces is strong. Collectively, this body of literature bridges the theory of safety training with the practice of utilizing the latest technology to implement safety standards within the workplace and also minimize risks of accidents in hazardous work environments.

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List of Publications

List of Publication related to the dissertation

- [A1] A. Al-Hamad, M. Csernoch, A. Gilányi, Enhancing Warehouse Safety and Resilience Through Virtual Reality: A User-Centered Design Approach to Training Feasibility. *Journal of Safety Science and Resilience*, vol. 7, no. 4, 100305, 1–20, 2026. [doi:10.1016/j.jnlssr.2026.100305](https://doi.org/10.1016/j.jnlssr.2026.100305) (SJR: Q1).
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- [A11] M. Wedyan, D. SafaA, A. Al-Hamad, A. Gilányi, A Review of Emotion-Aware Adaptive Virtual Reality Games for Player Emotional Profiling and Intelligent Personalization. In: *17th International Conference on Information and Communication Systems*, 25, 2026. ISBN: 9798400723506. [doi:10.1145/3812734.3813715](https://doi.org/10.1145/3812734.3813715)
- [A12] A. Al-Hamad, A. Gilányi, F. Al-Fayyadh, Effectiveness and Usability of Virtual Reality in Physical Education: A Case Study on Dance Teaching. In: *2nd IEEE International Conference on Cognitive Aspects of Virtual Reality – cVR 2023*, IEEE, Piscataway, NJ, 109–114, 2024. ISBN: 9798350338638. [doi:10.1109/CVR58941.2023.10394799](https://doi.org/10.1109/CVR58941.2023.10394799)
- [A13] F. Al-Fayyadh, A. Gilányi, A. Al-Hamad, Evaluating Virtual Reality Application from the Teacher's Perspective in Dance Education. In: *2nd IEEE International Conference on Cognitive Aspects of Virtual Reality – cVR 2023*, IEEE, Piscataway, NJ, 39–44, 2024. ISBN: 9798350338638. [doi:10.1109/CVR58941.2023.10395355](https://doi.org/10.1109/CVR58941.2023.10395355)



Registry number:
Subject:

DEENK/583/2026.PL
PhD Publication List

Candidate: Abdallah Al-Hamad

Doctoral School: Doctoral School of Informatics

MTMT ID: 10094545

List of publications related to the dissertation

Foreign language scientific articles in international journals (5)

1. **Al-Hamad, A.**, Csernoch, M., Gilányi, A.: Enhancing Warehouse Safety and Resilience Through Virtual Reality: A User-Centered Design Approach to Training Feasibility.
Journal of Safety Science and Resilience. 7 (4), 1-20, 2026. ISSN: 2666-4496.
DOI: <http://dx.doi.org/10.1016/j.jnlssr.2026.100305>
IF: 6.3 (2025)
2. **Al-Hamad, A.**, Gilányi, A.: TAP express: A simplified think-aloud protocol for evaluating traditional and virtual training and education.
Soc. Sci. Human. Open. 13, 1-13, 2026. ISSN: 2590-2911.
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3. **Al-Hamad, A.**, Gilányi, A.: A data-analytics framework for optimizing user-centered virtual reality training.
Decis. Anal. J. 16, 1-16, 2025. ISSN: 2772-6622.
DOI: <http://dx.doi.org/10.1016/j.dajour.2025.100610>
4. **Al-Hamad, A.**, Gilányi, A.: Immersive VR safety training: Enhancing hazard recognition and compliance through 5M and 5S integration.
Results in Engineering. 26, 1-11, 2025. ISSN: 2590-1230.
DOI: <http://dx.doi.org/10.1016/j.rineng.2025.105135>
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5. **Al-Hamad, A.**, Wedyan, M., Gilányi, A.: Virtual reality safety training and auditing in warehouse environments: AHP and critical thinking approach.
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Foreign language conference proceedings (1)

6. **Al-Hamad, A.**, Gilányi, A.: The Role of Immersive Virtual Reality Training in Enhancing Risk Management Practices.
In: 2025 IEEE 16th International Conference on Cognitive Infocommunications (CogInfoCom) / Péter Baranyi, IEEE, Wien, Austria, 231-236, 2025. ISBN: 9798350356922

List of other publications

Foreign language scientific articles in international journals (4)

7. Düzenli, K., **Al-Hamad, A.**, Gilányi, A.: A python pipeline for interactive visualization of systematic literature review data.
SoftwareX. 35, 1-5, 2026. ISSN: 2352-7110.
DOI: <http://dx.doi.org/10.1016/j.softx.2026.102773>
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8. Düzenli, K., Al-Bazooni, A. M. R., **Al-Hamad, A.**, Gilányi, A.: A systematic review of utilizing extended reality technologies for historical site preservation and visualization.
Result Engin. 30, 1-19, 2026. ISSN: 2590-1230.
DOI: <http://dx.doi.org/10.1016/j.rineng.2026.110592>
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9. Waste, P., Jogi, B., Ratna, D., Warhatkar, H., **Al-Hamad, A.**, Dalvi, V., Chakraborty, B., Kulkarni, A., Balogh, G.: Viscoelastic and damping properties of ethylene vinyl acetate (EVA) and its dicumyl peroxide (DCP) cross-linked variants.
Discov Mater. [Epub ahead of print], 1-38, 2026. ISSN: 2730-7727.
DOI: <http://dx.doi.org/10.1007/s43939-026-00803-3>
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10. Wedyan, M., Alturki, R., **Al-Hamad, A.**, Malkawi, R., Gilányi, A.: Awareness of cybersecurity vulnerabilities in virtual reality: an analytical study.
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DOI: <http://dx.doi.org/10.1057/s41284-025-00473-5>
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Foreign language conference proceedings (3)

11. Wedyan, M., SafaA, D., **Al-Hamad, A.**, Gilányi, A.: A Review of Emotion-Aware Adaptive Virtual Reality Games for Player Emotional Profiling and Intelligent Personalization.
In: Proceedings of the 17th International Conference on Information and Communication Systems (ICICS '26). Eds.: Muneer Bani Yassein; Ahmad M. Mustafa; Qasem Abu Al-Haija, Association for Computing Machinery, New York, 1-6, 2026. ISBN: 9798400723506





12. **Al-Hamad, A.**, Gilányi, A., Al-Fayyadh, F.: Effectiveness and Usability of Virtual Reality in Physical Education: A Case Study on Dance Teaching.
In: 2nd IEEE International Conference on Cognitive Aspects of Virtual Reality - cVR 2023.
Szerk.: IEEE, IEEE, Piscataway (NJ), 109-114, 2024. ISBN: 9798350338638
13. Al-Fayyadh, F., Gilányi, A., **Al-Hamad, A.**: Evaluating Virtual Reality Application from the Teacher's Perspective in Dance Education.
In: 2nd IEEE International Conference on Cognitive Aspects of Virtual Reality - cVR 2023.
Szerk.: IEEE, IEEE, Piscataway (NJ), 39-44, 2024. ISBN: 9798350338638

Total IF of journals (all publications): 37,7

Total IF of journals (publications related to the dissertation): 18,5

The Candidate's publication data submitted to the Tudóstér have been validated by DEENK on the basis of the Journal Citation Report (Impact Factor) database.

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