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Usability of immersive technology for education and training of firefighters in Brazil

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Abstract

Practice-based training in realistic environments is important in preparing a firefighter. Live infrastructure simulation training with real fire and smoke, using real buildings and equipment, has been the only practice-based training format accepted and available, but sometimes with limitations. The integration of virtual reality and artificial intelligence can provide interaction for different fields of application and possibilities for complementary training. However, there is hesitation, often in doubt as to the real, often in fire situations. This article investigates how immersive VR supports cognitive processes and affects fidelity in firefighter training. The data were collected from 91 participating firefighters, including instructor officers and firefighters from Paraná and other states, participated in various scenarios, and real and virtual firefighting simulations. With tactile feedback, students used PPE for daily use at work and other equipment such as hoses and nozzles. In this bias, the usability of the immersive technology was compared with the real fire simulation performed in training containers. The results showed that tacit and explicit knowledge compared through VR can be shared correctly within the Fire Department facilities.

Keywords: Virtual Reality, Training, Fire Department, Skills, Military Experiences

1. Introduction

Firefighters train to handle various emergencies. Regarding fires, no fire is the same as the previous one, because of material, fuel, location, and other variables. What is expected is that firefighters deal with the situation, which requires care, and the ability to recognize risks and make quick and correct decisions in moments of uncertainty where lives can be in danger and risk.

Immersive technology in the post-pandemic period provided opportunities for several sectors such as health so that they could reorganize themselves in crisis management. In addition, developing differentiated and continuous training formats [1], [2], [3], to use different learning scenarios and situations, comparing, for example, real firefighting training to those used with VR. In this way, expanding interactions between teams, favoring sensory stimuli and adaptation to real situations experienced in the daily work context.

According to [4] virtual environments are convincing tools in disaster management situations in the

coronavirus pandemic because they allow the practicality of being made available to smaller groups, in different places in a planned way and especially corporate integration, even in times of social isolation. In Brazil, the acquisition of the FLAIM Trainer (VR) motivated the fire department to use VR because it is an unprecedented technology in Latin America and mainly because of the possibility of promoting training in critical operations for its soldiers in new techniques in an environment risk-free. For other employees in charge of critical operations, (VR) training can be a vital tool that reduces errors and reduces liability.

In turn, [5] states that the competence of a firefighter is linked to the levels of training and skills he experiences, this becomes possible, through knowledge about how to respond to occurrences, the numerous equipment, vehicles combat, hierarchy and care protocols, among others. Under these conditions, Brazilian firefighters, upon entering the military service, participate immersively (for a year and a half) in the training course at the preparatory school for firefighters. And so, you have the opportunity to learn and develop professionally, acting in any kind of emergency.

Based on a field study, this paper investigates how immersive VR can be fundamental and precise as a pedagogical, theoretical, and practical complementation tool for training in the Fire Department of the State of Paraná - Brazil, through the participation of military personnel from the Fire Operations Course. Fire Fighting (COCI). In this way, the researchers introduced immersive VR in the COCI within a month, which is a specialization course, aimed at experienced combatants [6]. And, in the mentioned period, there was the insertion of simulations with VR, measuring practically and virtually, the main differences between theoretical and practical training and practical and virtual, through research assisted with questionnaires, interviews, and training images.

The methodology applied in this study is the one recommended by a systematic literature review through the main databases (Scopus, Web of Science, Science Direct) to search for the most relevant articles on the topic addressed. Another reference source used in this work is the indicators used by NVivo, which is a qualitative data analysis software, which allows identifying what is treated in each material, to extract the main terms mentioned throughout the portfolio articles [7].

Finally, this research aims to offer notes concerning the importance and acceptability of the VR tool, in the evaluation of military firefighters, and it will later be approved by the General Command of the Corporation, as to the feasibility or not of its use with the troops. In this way, seeking to verify the benefits and possible difficulties encountered during the application in the field of the research, it could be measured with the samples, that about 75.9% of the participants showed interest in the use of VR for future training and qualifications, and demonstrated good productive performance about firefighting in various scenarios.

2. Background

Firefighter training is typically developed around two different situations, one being used in real fire and smoke conditions. In this first case, the metallic training container is used for a basic understanding of fire behavior and firefighting techniques. And so, the second training case is the use of a real concrete structure mirroring the real housing conditions of masonry and concrete buildings to understand the boundary condi-

tions of an accident scenario. Both formats require firefighters to be properly dressed and with breathing apparatus (Images 1 and 2).

Images 1 and 2 - Firefighting in containers and buildings.

Source: Corpo de Bombeiros, PR, 2022

The metal container can be used to simulate various scenarios in the available physical location. The container is used to train techniques and skills in a controlled environment and is closer to realism about real accidents.

In many countries, it is very common to have training buildings to mirror real firefighting and other similar emergencies. However, there are some usability limitations of this type of structure, as there are safety regulations regarding the use of this type of structure and environmental regulations that often limit the use of concrete structures about the type of fuel that will be used. And these guidelines directly impact the development of firefighting training, limiting their actions [8].

In turn [9] corroborate the idea that the use of immersive education in cognitive processes can help greatly improve the learning aspects of those involved in the training process. With the use of immersive technology used in training [10], it is possible to measure performance through self-reports and field observations.

The Military Firefighters in Brazil, professionally develop numerous activities aimed at attending to unusual situations, with imminent risk of death and unpredictable. Therefore, the nature of each occurrence denotes several facts such as traffic accidents with victims trapped in hardware, searches in an underwater environment, confined spaces, dangerous products, firefighting, search and rescue in collapsed structures, etc.

For this phase to work effectively, the general command needs to offer quality education in the form of courses and training so that the military can offer the services provided with quality. At these points, there are constant investments in advanced equipment and vehicles, specialized pedagogical training, all of this, to guarantee the efficiency and safety of the professionals in service. In Figure 1: the infographic demonstrates the importance of continuing education for professionals.

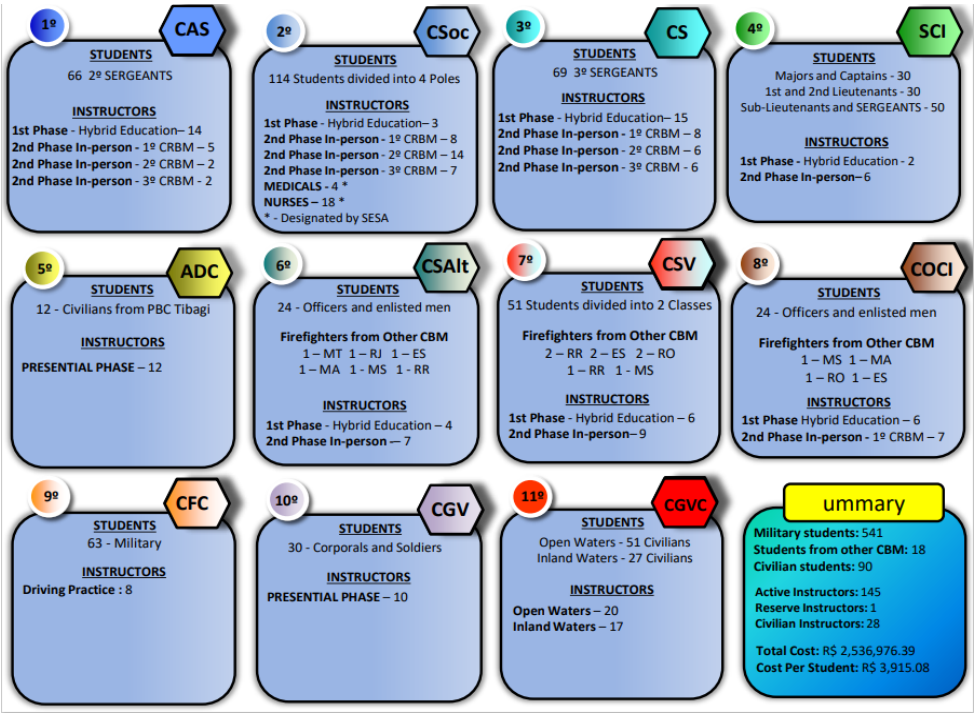
Figure 1: Courses Taken in 2021

Source: Corpo de Bombeiros, PR, 2022.

As described in Figure 1: info presents 11 courses taught in 2021 that received didactic and pedagogical investments for emergency care, vehicles, equipment, ethics, and domain of actions. To guarantee and mitigate impacts and safeguard lives. Therefore, the courses are intended for officers and enlisted personnel. Officials: regular (6), specialization and training (13), mixed (28), and graduate (6). Places: regular (3), specialization, and training (9). The Fire Department of the State of Paraná is a reference in Brazil, for its investments in training and qualifications, equipment, and materials, to provide exquisite service to an entire society.

As technological innovations, they are more improved tools for the new, through them, through possible mechanisms to respond to occurrences, information security, data reliability, cyber security, among others.

Figure 2: Distribution of courses 2021



Source: Corpo de Bombeiros, PR, 2022

Figure 2 describes the number of courses given in 2021, and students who took the training (instructors, officers, soldiers). And, at the end, it declares the number of trained soldiers, financial investments, general cost, cost/student. This identifies the seriousness in the formation of the set of skills required for a firefighter in Paraná.

It is clear that technological advances have reached and improved several areas, especially the educational field, which has been positively impacted. This fact occurs due to the ease of obtaining information more quickly, which improves and evolves learning in a very innovative way.

In this context, training and education always need to be improved with technologies. That said, choosing whether or not to include technology in the classroom is no longer an option, since it is part of students' lives in the extracurricular context. Therefore, its application for the benefit of training development and knowledge aggregation is seen as an excellent and necessary opportunity to allow classes and training to be more dynamic and productive.

To affirm that technology provides a differentiated teaching moment, as an example, we can mention the arrival of the SARS-CoV-2 pandemic in 2019, in the quest to safeguard as many lives as possible, we had to innovate and invest assertively in such tools; [11], [12], [13], [14], [15]. Official health agencies have made it possible, through artificial intelligence (AI), to integrate emergency care services [16], [17]. Connected to billions of devices such as healthcare 4.0, applications, data collection sensors, data, patient information bank, georeferencing, hospital bed centers, emergency transport, supply chain, supplies and medical logistics [18[, [19].

In turn, the General Command of the firefighters of the State of Paraná is adapting its barracks and professionals, to count on the (VR) as a pedagogical vehicle for qualification and training. Providing training to continuing education, inserting into military curricula.

The usability of (VR) proposes a taxonomy of different levels of learning. In this way, it establishes levels of knowledge that allow efficient training, intercultural encounters, and faithful reproduction of established environments, times, and conditions [20]. In Brazilian education, virtual reality equipment was introduced from entertainment technology (games), gradually moving to EAD education, and was accentuated in the post-pandemic in a dynamic, creative, and attractive way to learn, stimulating a spirit critical, independent, and knowledge [21].

The virtual tool FLAIM Trainer brought aspects of technological innovation to Brazilian firefighters and throughout Latin America. The adaptation and structuring processes are already happening, allowing synchronized training, between the (theoretical/practical real/theoretical/practical immersive).

In Brazil, the inclusion of immersive education in the military fire brigade is becoming known and unprecedented from this research, with the acquisition by the firefighters of the FLAIM trainer VR and the research being designed to promote innovation through the usability of immersive technology for the education and training of firefighters in Brazil in an accessible way for future training of troops.

3. Materials and Methods

3.1. Ethics

The Committee of Ethics in Research of the Federal University of Technology, Paraná-Brazil analyzed this study and it received the authorization to be conducted in November 2021, under the **no. 53739221.7.0000.5547** CAAE, by the Declaration of Helsinki. The experiments that were conducted in this study took place in the Head of the Parana Fire Department Education and Instruction Center -Brazil.

3.2. Participants

The recruitment of the military for the research was designated by the General Command of Firefighters, after a meeting with the researchers, adopting all the necessary health protocols against COVID19. Therefore, the decision was reached to add the theoretical/practical training with the virtual one at the same time. Through the same group of students (officials and soldiers) from the firefighting specialization course (COCI), who were able to evaluate real training situations, with simulated virtual scenarios (VR), promoted immersive technology [22].

A questionnaire was applied to the participants after using VR. The population of military firefighters surveyed was 91 people of both sexes, being: a) 10 female and b) 77 males; c) 4 instructors assigned for RV training. All of them, at the end of the simulation, were able to answer the described questions. Making it possible to measure the usability of the tool.

With the parameters that will be obtained, it was possible to configure the variables by the statistical method of data analysis such as: what is the perception of users about the use of VR; what are the main difficulties faced by the Fire Department with the mandatory training after the coronavirus outbreak; verify the possibility

of expanding the number of trainings required.

3.3 Equipment

Immersive digital technology, acquired by the Paraná Fire Department in 2021, has brought new ways of learning, training and training to the Paraná military teams. FLAIM Trainer, [23], [24, [25] is a software developed to offer immersive learning solutions based on the experience, needs and feedback of emergency professionals.

Promoting virtual fire environments in high definition, enabling physical interfaces in real time. And, offering the opportunity to carry out the simulations in diversified and restricted spaces, such as a classroom. Enabling the military to exchange daily experiences in an economic, safe and sustainable way. Comparing lived occurrences with virtual situations.

3.4 Description of the study

This study aims to evaluate the usability of the VR simulator, with the effectiveness of Paraná firefighters, as a training and qualification instrument. Thus, the research problem is:

What is the impact of (VR) usability on military training in terms of effectiveness, performance, practicality, autonomy, sustainability, and acceptance?

According to the Centro de Ensino e Instructor of the Fire Department of Paraná, the arrival of the simulator in Brazil took place through structured research on immersive education, established by the corporation. According to the interview with the representative of the corporation, when he realized that such technology was incorporated into the training of international firefighters. The Brazilian corporation sought information from the device manufacturer in Australia for acquisition.

In the quest to evaluate the troops regarding the usability of the VR, and as it was already part of the continuing training calendar. From 11.03.21 to 12.03.21, it was held at the Military Police Academy in Guatupê – Curitiba – Paraná. The course had the participation of numerous military firefighters, including officers and soldiers and among them instructor officers from all areas of activity. There was, therefore, significant intellectual and financial investment, (the value of the FLAIM Trainer (VR) virtual reality equipment was $140,749.23).

The Framework spent on initial training (VR), activated training in early 2021. Consider this the insertion of immersive technology, as training and continuity tools for the Paraná corporation.

The course has a workload of 330h/a distributed in 13 disciplines initiated (theory/practice) of firefighting (CI). The human capital of qualified instructors and equipment are organized in order to lead the troop to tactical, safe and behavioral learning. Striving for the use of PPE (flameproof clothing (IC), autonomous breathing, etc.), aimed at flammable products; tall buildings; victim monitoring; search and rescue applied to fires. In addition, to provide the officers with the teaching/learning, control and strategic monitoring of their students [26].

During the course, periods of the virtual class were established, in which its military could participate in

the VR combat simulations. They learned the opportunity to use the equipment, with all the practical/practical steps, and at that moment, they learned 3 simulations in different environments (2) they learned the opportunity to use the equipment (vehicle, industrial kitchen, buildings). And, they participated fully and all of them, in practice, as skills proposals, providing feedback on their actions among the group.

Immersive technology aims to insert the individual into a three-dimensional environment, which can be manipulated in such a way as to provide the interaction of the tool and the 3D environment [27]. RV became known in the military field from the 1960s onwards, currently, it has its contribution to health preparation,2020,20; Held Bustillo in universities [28]. As advantage of using digital technology, the opportunity to learn about new concepts and technological skills is extended [29]. In Brazil, such innovation is inserted in the military branch, by firefighters, from 2021, as shown in Images 3 and 4.

Images 3 and 4: Theoretical Class - Fire Fighting Operations Course (COCI) 2021

Source: Corpo de Bombeiros, PR, (2022).

Images 3 and 4: describes the pedagogical training given by Commander of Instructions, bringing relevant information to the 26 COCI students, on strategic and tactical content in the execution of burning and firefighting activities that will occur during the course, in different environments in the practical modality. Then, in Images 5 and 6: the sequences of field training are contained, using containers for allusion in closed environments.

Images 5 and 6: Starting the COCI Fire Fighting Simulation - 2021

Source: Corpo de Bombeiros, PR, (2022).

Images 5 and 6: on the left, demonstrates the information and attitudes to be used by the student to protect

himself and the entire team, from the ignition point of the flames to the highest temperatures (up to 700%C). During the simulation in which they will be exposed (from 10 to 15 minutes) to flames and as a consequence there may be episodes of dehydration, physical and mental fatigue, but all the time they were guided and protected by their instructors, not allowing any risk to the life.

The military firefighters, in turn, redoubled the requirements of hydration, good nutrition, safety precautions, and the correct clothing of their PPE, in addition to being in full health and physical aptitude conditions, which were previously evaluated before participating in the course. Also, at the end of each test, the students were taken to an installed health environment, for the capture and evaluation of vital data, through athlete monitoring straps and other measurement equipment. Such data will be mined and tabulated to generate a general health status report for troops in practical exercises. At another time, the teams were taken to the classrooms, as described in Images 7,8 and.

Images 7, 8 and 9: Simulated Practical Simulation of the FLAIM Trainer VR

Source: Corpo de Bombeiros, PR, (2022).

Images 7, 8 and 9: comprises a sequence of guidelines for training with the virtual simulator, ranging from theoretical classes on the equipment, its functionality, the correct clothing, how to request operational support (water bowl, foam), teleportation, etc. Steps that range from the calibration and testing of the equipment, to the attire, handling and conditions that the scenario imposes, in the quest to safeguard lives and extinguish fire outbreaks. In addition, to participate at the end of the instructor/student feedback, student/other students in the classroom, providing opportunities for learning and exposing the lived experiences.

The objective of this chapter will be to present the methodological path followed for the construction of the research, as well as the materials and elements combined for this work, correlating the theoretical concepts with the empirical data. This research is characterized as exploratory and descriptive [30], [31]. It is exploratory, as it aimed to explore, discover and understand the topics covered and descriptive, since in addition to the bibliographic research, field research was carried out, whose results will be described in detail. The technical procedures used are classified as bibliographic and documentary research, data collection and unsystematic participant observation [32].

To this end, two questionnaires about the research were analyzed, seeking to evaluate, together with the samples, data that would validate this study. One of them, aimed at instructor firefighters and the other at student firefighters, in an attempt to measure elements related to the usability of the equipment individually and collectively, represented by questionnaire 1 (Q1) and questionnaire 2 (Q2).

- **Q1:** for Instructors, had 40 open questions, and 6 following patterns based on the Likert scale and 20 more open questions "yes" or "no", and 1 suggestion. Testing 46 questions;

- O **Q2** Firefighters Students: had 9 open questions, and 28 following patterns based on the Likert scale and 5 more open questions "yes" or "no", and 1 suggestion. Totaling 43 questions;

Firefighters Students: had 9 open questions, and 28 following patterns based on the Likert scale and 5 more open questions "yes" or "no", and 1 suggestion. Totaling 43 questions;

During the participation of the teams, some points were observed that contribute to future training. Also listed as suggestions such as:

- The participation of other soldiers in the same scenario suggested to the manufacturer (as for the possibility of adapting two or more hoses, making teamwork accessible); That the scenarios received new combat teams (cars, equipment, vehicles, etc.). That victims could accept help and rescue procedures, bringing the scene as relaxed as possible, among others.

The proposal would be, in future studies, to establish parameters between data initially collected at COCI 2021 (first counted from the Paraná military with VR). And, later, continue the research in new barracks, covering different teams, other municipalities and regions. Seeking to offer fidelity over the results presented, as to the psychopedagogical usability that virtual reality has to offer.

The samples collected in Brazil will be indexed on the Likert scale, subsequently presenting the degree of relevance of the research. The data presented from Q1 and Q2 were tabulated and analyzed, in a scalar way, also making it possible to add statistics to open questions, yes or no, Likert and suggestions. In order to consider the real acceptance of the equipment and feasibility of its use for the corporation.

Item analysis was performed first considering the total sample. Subsequently the questions were grouped on how the factors mentioned in the literature were understood by the firefighting with the potential restrictive of the study area. In data analysis we calculated the Cronbach's α to check the internal consistency of the scale (reliability) of the instrument applied in firefighting.

According to [33] there is no default value for the Cronbach's α is considered good. [34] considered a low value of less than 0.6 and between 0.6 and 0.7 moderate.

The processing of data using Minitab 15 software licensed to UTFPR - PG showed that total and Cronbach's α of each construct the level achieved "very good" depending on the choice α used by the researcher, according to the classification of [35]. The value of α for the total scale reached the level $\alpha = 0.9565$. This total indicates that firefighting that answered the questionnaire were consistent in their responses, valuing very closely the items within each construct. Table 1 shows the results for the construct.

Table 1 - Cronbach alphas

Cronbach alphas for total scale and construct												
Rating	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Reference	0,9551	0,9541	0,9551	0,9555	0,9598	0,9544	0,9551	0,9547	0,9545	0,9549	0,9543	0,9539
Rating	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24
Reference	0,9543	0,9538	0,9545	0,9544	0,9538	0,9549	0,9547	0,9547	0,9544	0,9550	0,9545	0,9542
Rating	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34		
Reference	0,9543	0,9537	0,9541	0,9547	0,9566	0,9569	0,9581	0,9616	0,9616	0,9577		
Cronbach's alpha coefficient:								0,9565				

Source: Cronbach alphas, adapted by the authors (2022).

4. Results based on background

Table 2, represented by the participation of the officers and students involved who responded promptly to the two questionnaires given after the simulates with the VR. Among the questions, about 34 of them obeyed the Likert scale (scoring from 1-5), in order to evaluate the main data such as: acceptance, usability, viability, dexterity, functionality and importance of immersive technology in coping. Acting as complementary equipment to the numerous training and training.

4.1 Results and experiences presented

Table 2: describes the recognition of the object, through the data collected in the questionnaires with the military, comparing the daily activities of firefighting (real) and the simulated ones with the (VR). The proposal was to measure physiopsychological information and sensations, which pointed to similarities between the conditions (thermal, stress, heat, noise, fire, use of hose, squirt, smoke, locomotion, teleportation, etc.). Below are the percentage indices collected in the Likert scale questions.

Table 2: Percentage indices of usability of the (VR) by firefighters in the Likert Scale questions

Comparative questions between Actual training and the use of (VR)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
1. Combat training feel	82,8%											
2. Feeling of using VR equal to real		66,6%										
3. Feeling of using the squirt			75,8%									
4. Feeling of freedom of action				73,6%								
5. Difficulty in teleportation					66,6%							
6. Similarities in tasks						75,8%						
7. Sensation of heat emitted by VR							69,0%					
8. The sounds emitted by VR are similar								69,0%				
9. Stress VR-like training									75,8%			
10. Understand the task you need to do										80,4%		
11. Similarity of real and VR scenarios											75,8%	
12. Feeling of being in a fire												75,8%
Comparative questions between Actual training and the use of (VR)	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q19**	**Q20**	**Q21**	**Q22**	**Q23**	**Q24**
13.Feeling of using the nozzle is similar	71,2%											
14. Similar movement sensation		57,4%										
15. VR heat matches real fire			59,8%									
16. VR sounds are similar to fire				71,2%								
17. Stress equals real fire					75,8%							
18. Strategic similarity of actions						71,2%						
19. Similarity of task comprehension							71,2%					
20. Autonomy and task management								78,2%				
21. Visual appearance of fire is similar									82,4%			
22. Visual appearance of smoke is similar										85%		
23. Visual appearance of water is similar											82,8%	
24. Similarity of the squirt water jet												85%
Comparative questions between Actual training and the use of (VR)	**Q25**	**Q26**	**Q27**	**Q28**	**Q29**	**Q30**	**Q31**	**Q32**	**Q33**	**Q34**	**VR Usability Index**	
25. How realistic is VR fire	80,4%											
26. VR fire is similar to real		75,8%										
27. Similarity of nozzle/hose use			68,6%									
28. Similarity of heat sensation to fire				62,6%								
29. Fire response and its actions					72,6%							
30. Similarity of fire spread						84,6						
31. Smoke propagation similarity							76,6%					
32. The state of burnt objects								72,6%				
33. How often do you play with VR									50%		95,6%	
34. Using VR in everyday life										83,3%		
The results obtained in the survey prove the usability and acceptance of the immersive VR technology – Cronbach's Alpha												

Fonte: Source: Created by the authors (2022).

Table 2: Demonstrates the proximity between fire-fighting activities carried out in real training, such as the simulated ones carried out with the (VR). Demonstrating that immersive technology can be used in the training of troops of military firefighters in Brazil.

The research brought to the fore, the importance of the playful learning format, as an attractive and relevant instrument for the stimulation and interactive participation of the work teams. Mobilizing, military of various ranks, with differentiated career times, vast work experience, together with younger individuals, in full training. Promoting, complementation of teaching, the techniques elaborated for extinguishing and fighting fire, with the opportunity to revaluate and simulate whenever possible.

4.2 The relevance of the search

This research showed relevance according to the data presented, because it enables the use of the virtual reality tool (VR), as a complement in the teaching/learning of military firefighters. Connecting, the theoretical /practical training with digital immersive technology, in order to promote aspects of interactive, auditory and visual. Highlighting, the possibility of practicing concepts of prediction of actions, mastery of the scene, team security, exchange of experiences and sustainability, during each simulation.

5. Discussion

Although, the immersive technology in the Brazilian Fire Department is something new, it was observed that the use of VR contributes with other aspects to be considered as:

- Immersive cognitive development (ability to interact with virtual scenarios that promote learning, information and strategic planning for work);

- Mobility – (VR can be transported to all barracks, enabling its usability, without exposure to risks and being able to teleport to larger occurrences, such as collapsed areas);

- Sustainability (saving water, people, reducing carbon footprint (burning), saving fuels, vehicles, equipment, etc.). Among the information captured together with the military, a fire of a small residence, the combatant can use on average about 2 to 4 thousand litres of water. And in case of large fires this amount may be immeasurable.

- Savings with costs with training logistics (location, time, environments for instructions, etc.).
  Such notes demonstrate that VR can be an equipment of full use to corporations.

6. Conclusion

The Brazilian military firefighter is a professional who needs constant training and qualifications, as he is inserted daily in emergency and risk situations. In which a carelessness could compromise your life, the victims, and others. This study sought to demonstrate the importance of inserting immersive VR technology as an instrument of pedagogical complementation (theoretical/practical) in the training of teams.

The FLAIM Trainer is an Australian technology, in the form of virtual reality (VR) equipment that enables troops to train in firefighting. And the positive effects of its usability could be proven in the Fire Fighting Operations Specialization Course (COCI-2021). With the Paraná State Fire Department.

The main challenge was to identify the benefits and limitations that the virtual reality (VR) equipment brought to the group involved. During this period, samples were collected through two virtual questionnaires, one for officers and another for students, thus measuring strengths, weaknesses, and possible suggestions on the importance of the tool for future training.

The results themselves pointed to the importance of new digital technologies added to the continued formation of teams. Opportunities, a comparison between the practical simulations with the interactive ones, favoring, even more, the exchange of information lived in each occurrence by them, with the tactile flexibility of the teleportation, of the attendance to the virtual victims, of the possibility to remain in the occurrence, reassessing the scene and scoring how to be more efficient in less time.

The simulated ones with the (VR), similar to the access and work in real occurrences, because the equipment emits sounds between vibrations, intensity, heat, locomotion difficulties, the weight of the PPE). In addition, make the effort of the hose with a squirt, which requires the demand for support to the command, connecting different forms of fog, flames, and exposure to heat access, to the place, which compare with the

difficulties experienced.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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