Crisis Resource Management in Aviation and Healthcare
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Simulation – both in aviation and in healthcare – contributes enormously to enhancing teamwork during a crisis, as well as fostering situational awareness, contextual intelligence, and cognitive retention of essential steps and procedures to be performed during crisis.
Modern aviation crisis resource management focuses on specific skills and competencies areas: communication, situational awareness, decision making, problem solving, teamwork and leadership.

Steps to follow in abnormal situations
Until 1977, an Aircraft Commander was responsible for almost all decisions in non-standard situations. Crew and Cockpit Resource Management training emerged after the recognition that the technical skills of piloting an aircraft were insufficient to ensure safety and best performance: accidents were occurring for reasons other than inadequate piloting skills.

An important innovative approach was introduced to assign cockpit roles that positively influenced team dynamics. Once aligned on the runway and ready for take-off, new functional roles are established: PF and PM. PF stands for Pilot Flying and PM for Pilot Monitoring. These functional roles are not related to crew seniority.
Also cabin crews are actively involved in crisis management. Since the 1980s, these programs focus on “non-technical” skills that are critical for enhanced operational performance, such as leadership, situation awareness, decision making, teamwork and communication.

Our hypothesis—currently under test and review—for enhancing teamwork is that simulation within a setting based on mixed, or hybrid, reality called e-REAL allows for better results compared with those reached within the other settings available today, such as CAVE-like environments, virtual reality head-mounted displays, or computer based e-learning environments.
Tests are expected to be performed within the e-REAL immersive labs at the Polytechnic School of Milan and at the University Marconi in Rome.

Tests will be focused on teamwork, crisis management and decision making.

**Starting September 2020**, the tests performed will be designed as an escape game within an e-REAL setting—in which a team of players cooperatively discovers clues, solves puzzles, and accomplishes tasks in order to progress and accomplish a specific goal in a limited amount of time.
Effective teamwork during a crisis is also a core element of expert practice in healthcare, wherein professionals are challenged to recognize a situation that requires rapid intervention, communication, knowledge sharing, decision-making and management of unforeseen events—all the while also taking into consideration critical contextual factors such as a lack of time, scarcity of resources and tools, and a multitude of impactful factors.

“Name-Claim-Aim,” a crisis management organizational approach that uses a mnemonic device, was developed at CMS in Boston and is being used in order to facilitate crisis management and decision making.
Knowledge and technical skills are essential components of the decision-making process and actions performed during crises, but they are not sufficient to manage the entire situation, which includes the environment, the equipment and the patient care team with its organizational behavior.

Therefore, an “Event Manager Checklist” was created to facilitate effective role designation. Participants have been given this cognitive aid, designed as an ID badge-sized card, to easily access during their simulation course.

| BASIC Roles          |
|----------------------|
| 1. Event Manager     |
| 2. Circulation -- CPR|
| 3. Airway            |
| 4. Drugs             |
| 5. Recorder / Timer  |
| 6. Resource Person   |

| Additional Roles      |
|-----------------------|
| IVs, Fluids, Labs     |
| Hx & Chart Review     |
| Liaison w/ External Services & Phone |
| Security & Crowd Control |
| Technical Equipment   |
| Monitor Watcher       |
| Emergency Manual Reader |
The role of “Event Manager,” rather than “Team Leader,” is expressly promoted at CMS to facilitate distributed leadership in crises. This distinction has proven to be effective in teams of expert practitioners because it deliberately seeks to flatten hierarchies that may otherwise inhibit speaking-up behavior from team members.

The Event Manager coordinates the communication and the team’s efforts, overseeing the organization and application of CRM principles, in addition to actively soliciting input and decision-making regarding medical care, if necessary. Moreover, the Event Manager acts to facilitate role designation, as well as orchestrate and coordinate team function.

A few years ago, the “Name-Claim-Aim” and “Event Manager Checklist” were adopted by the Massachusetts General Hospital in Boston, for inclusion in the latest version of their Emergency Manuals.
e-REAL allows for better results for learning how to use a mnemonic like “Name-Claim-Aim”, that enables a multilayer vision. The many levels of the situation are made available simultaneously by overlaying multisource info—e.g. words, numbers, images, etc.—similar to an augmented reality display, but without needing to wear special glasses.

e-REAL improves the learners’ cognitive retention by making the relationships between topics visual, which yields better results compared with those from the other systems.

e-REAL offers a unique user experience: a combination of visual communication and direct interaction with the content—by gesture or spoken commands—that immerses people in an entirely interactive ecosystem.
The e-REAL experiences are designed to have the learners working on tasks that simulate an aspect of expert reasoning and problem-solving, while receiving timely and specific feedback from both the trainers and fellow learners.

These elements of deliberate practice and feedback are general requirements for developing expertise at all levels and disciplines.

During an e-REAL session, a number of skills and competencies are challenged: on one side technical knowledge and know-how are tested and, on the other side, behavioral, cognitive and metacognitive skills, such as leadership and followership, team-work facilitation, team spirit and effectiveness, knowledge circulation, effective communication, relationships and power distance, fixation error management and metacognitive flexibility.

Feedback is provided throughout sessions with a focus on key performance indicators.
For Crisis Resource Management and teamwork in healthcare, we performed a number of experiments within the e-REAL Virtual Room at the Environmental Design and Multisensory Experience Lab from the Polytechnic School of Milan (Italy). This was the first research phase, that will be followed by a second one to be performed at CMS in Boston from October 2020.

Tests were designed to compare the learning outcomes of the same Teamwork and Crisis Resource Management Course, but delivered with three different methodologies:
- Classroom-based lesson
- Virtual reality head-mounted displays
- e-REAL immersive setting.

For the first phase of the research, we evaluated a sample of 62 participants that were enrolled in a 1-day training program called “Teamwork and Crisis Resource Management.” Participants and trainings were divided into 6 different cohorts that ran from October 21, 2019, to March 6, 2020. Each cohort was composed of undergraduate medical students, graduates from several healthcare programs, student nurses and professional first responders—in order to reproduce an interprofessional team.
The training started with an introduction of the main concepts in a traditional classroom based setting. After one hour, the students were divided into three different groups and expected to learn the checklist for managing critical events (Name-Claim-Aim). The first group was involved in a traditional classroom-based lesson, the second group was provided with virtual reality head-mounted displays to use in a self-learning mode, and the third group was involved within the e-REAL setting.

The training program was the same, while the activities were different because learners were divided in three groups—two of them, i.e. those not experiencing the e-REAL setting, working as control groups. Early findings show that learners that entered the e-REAL experience were more self-confident in the checklist learned in the simulation and ready to apply it when they had to play it out once back in the main classroom. Also, the quality of the communication in the team who experienced the e-REAL system was more clear, effective, and precise.

The focus of the experiments was on:
- Speed and ease of learning
- Engagement and enjoyment during learning
- Effective understanding
- Cognitive retention
- Confidence and readiness in applying the learning outputs in crisis situations.
Early findings show that learners that entered the e-REAL experience were more self-confident in the checklist learned in the simulation and ready to apply it when they had to play it out once back in the main classroom. Also, the quality of the communication in the team who experienced the e-REAL system was more clear, effective, and precise.

64% of the students in the two control groups reported that practicing the checklist for the first time during the simulation was emotionally overwhelming and very difficult because most of their attention was devoted to facing the case at hand. Additionally, 38% of the students in the second group reported a sense of sickness from the VR head-mounted displays.

Learners who experienced the e-REAL simulation reported an average performance gain of 43% in terms of increased speed and ease of learning, when compared to a traditional face-to-face classroom lesson or a self-learning VR program. 88% of e-REAL learners also reported increased engagement and enjoyment.

Overall, the students that experienced the e-REAL system were able to perform the checklist with a good degree of autonomy (5 out of 7 on a Likert scale), while the students from the two control groups needed active input from the trainer to effectively perform the same checklist (2 out of 7 on a Likert scale those from the VR glasses control group, 3 out of 7 those from the other control group).
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