

Exploring Possibilities to Partially Transform Simulation Exercises into Interactive Games on OpenWHO.org

Digitizing Live Role-Playing Game Exercises Online for Epidemics and Health Emergency Work

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Abstract—Training responders for outbreaks and health emergencies is one of the key functions of the Health Emergencies Programme of the World Health Organization (WHO). Staff trainings include, in some instances, intensive live role-play simulation exercises, in which responders are trained for disease outbreaks with a large training faculty and mentoring. This staff involvement cannot be fully replaced, as it is critical for performance assessment. However, if some live elements can be even partially replaced by online-supported formats, it can provide for more content-aligned, structured and replicable exercises while also creating cost efficiencies and reaching larger audiences.

HPI together with the Transfer of Knowledge Team of the WHO Health Emergencies Programme is therefore exploring how to digitize parts of such training exercises. The goal of this paper is to identify and suggest how parts of one sample intensive staff training exercise could be replaced by online exercises. One staff training simulation exercise was observed and is used as an example for this purpose.

For digitizing parts of the intense simulation training, the existing learning platform OpenWHO – which already provides frontline responder online training – could be further developed. OpenWHO is operated by the Hasso Plattner Institute (HPI).

Keywords—Game-Based Learning; Health Emergency Training; Simulation Exercise; Online Learning; WHO; OpenWHO; Serious Games; Influenza, Pandemic Influenza Preparedness; Pandemics, Epidemics

I. INTRODUCTION

Pandemics, epidemics, disease outbreaks including emerging and re-emerging pathogens, and health emergencies are a severe threat to humankind. To better respond to and limit the impact of these crises, training health emergency and outbreak response staff is critical.

The World Health Organization (WHO) was established in 1948 to improve health conditions for people all over the world [2]. WHO strives to combat both infectious as well as non-communicable diseases, injuries, disabilities and violence, but also increase access to affordable health services of high quality [3]. As part of its recently created Health Emergencies Programme, WHO trains emergency health responders using different methods. An online learning platform *OpenWHO*¹, which is operated and was developed by the Hasso Plattner Institute (HPI), “aims to equip all frontline responders with the knowledge they need to better contain disease outbreaks and manage health emergencies.” [4] WHO also uses this Massive Open Online Course (MOOC) type of a platform to share expert knowledge on public health emergencies.

In addition to various online trainings and learning materials on OpenWHO and other platforms, some WHO teams organize intensive face-to-face trainings, which often include simulation exercises (Simex). While these trainings with simulation exercises are highly efficient due to a high mentoring ratio and an intense training experience in small teams, they require significant resources in terms of staff inputs and cost of logistics and locations. The theoretical sessions of several face-to-face trainings have already been shortened with the help of online

¹ <https://openwho.org/>

learning pre- and post-training. Further exploration is currently being undertaken on how to reduce the operationally complex and resource-heavy real-time live role-playing exercises, while still achieving the same learning objectives and outcomes. These simulation exercises are normally 1–3 days long.

The observed simulation training exercise was targeted for social scientists to be operationally prepared to work in epidemics, pandemics and other health emergencies and be subject to competency assessment [5]. The simulation exercise of SocialNet training [6] was observed in October 2017 to analyze the potential for digitizing at least parts of it. For adapting the simulation exercises into an online context, the same scenario- and game-based learning approach as in the face-to-face experience should be maintained.

This chapter aims to point out different advantages and challenges for game-based learning relevant to the observed WHO SocialNet simulation exercise.

A. Game-Based Learning

Game-Based Learning (GBL) describes the use of games, both digital and non-digital, for educational purposes. Children often play roles to set themselves in different contexts. The same can apply for role-playing games like those used by the WHO to train social science experts in health emergency response.

Various simulation games exist, both for entertainment as well as for educational purposes. They are efficient because players and learners can experiment with action and reaction. As seen in Fig. 1, especially for educational purposes attendees seem to like puzzle games and strategy games [1]. The simulation exercises offered by the WHO resemble more such games than the simulation games mentioned in this figure.

When creating GBL exercises, it is important to create immersive game worlds. For better learning outcomes, it is important to discuss the experience to reflect on actions and events in person, outside of the gaming setting.

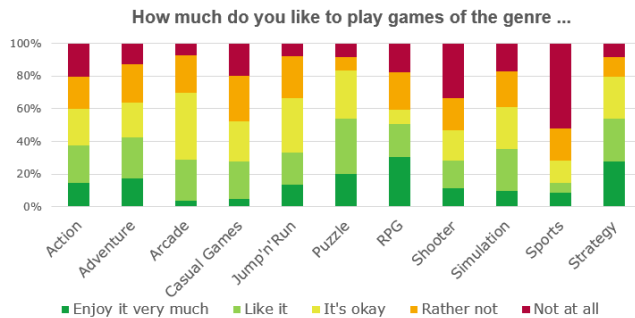


Fig. 1. Survey results on the prevailing mood about game-based learning and favored game genres amongst openHPI users. While role-playing games (RPGs) are favoured by many people, they are also disliked by a high number of people. Simulation games here address games like farming simulations rather than the simulation exercises offered by the WHO. Source: [1].

B. Game-Based Learning in the Massive Open Online Course context

There is an example of a MOOC designed to be a Serious Game on the topic of Sustainable Mobility [7]. This game-based MOOC is designed to be an adventure game, mostly in the style of a point-and-click adventure, including real-life videos and different simulation mini-games. The graphics are 2.5-dimensional, mostly in a comic style (see Fig. 2). This can serve as an initial starting point to create game-based MOOCs for the WHO Health Emergencies Programme user trainings



Fig. 2. Screenshot of the educational game in the “Sustainable Mobility: Technical and environmental challenges for the automotive sector” MOOC [7].

II. OVERVIEW OF THE SIMULATION EXERCISE

The observed simulation exercise of SocialNet training was scheduled for 48 consecutive hours over three days. Twenty-four participants were split into four teams and sent on identical missions, working solely within their own teams. Prior to the simulation exercise, four days of on-site theory training was conducted and online pre-learning on OpenWHO was required. About 25 training faculty members took part in the exercises as the exercise control team, role players and observers, as well as for exercise functions covering feedback and assessment.

The Simex was designed to create a safe yet realistic, immersive environment for the participants with likely real-life situations. The exercise put them under pressure, both time-wise and emotionally, and created a feeling of urgency. During the exercise, the teams worked as they would during field deployment, liaising with communities, partners and other stakeholders. In this type of a boot-camp environment, participants were able to apply existing and newly acquired knowledge for working in an outbreak and health emergency context. All exercise components included feedback on the team decisions, actions, deliverables and performance.

The exercise objectives were to demonstrate knowledge of the Emergency Response Framework (ERF) and Social Science Interventions (SSI) and apply those to different tasks, as well as apply field skills—including self and stress management, teamwork, and an understanding of ethics and the code of conduct—and increase professional and interpersonal skills. As a result of the Simex, the participants were also able to understand their own learning gaps and develop a personal learning plan closely assessed with the training faculty.

In the following chapter, the scenario and exercise conduct is described.

A. Scenario

The simulation exercise takes place in the imaginative district capital Kotwa of the Mudzi District (see Fig. 3) where an unknown disease begins spreading rapidly. It is a severe, highly transmissible respiratory illness of unknown origin, with mainly men between the ages of 20–40 currently being affected. It is determined to be a non-seasonal influenza A virus, subtype A(H8N5).

An outbreak of severe acute respiratory infection (SARI) is detected by local public health authorities after the deaths of the first patients showing symptoms. More than 600 infections have been detected and 55 deaths have been confirmed to the WHO from the middle to end of August in the country. A Grade 2 Emergency is declared, indicating increased evidence of sustained human-to-human transmission. Social science experts are deployed to the affected area due to the novel virus and the difficulties in containing it. The experts are needed to understand the social context within the area and adjust the biomedical response accordingly.

The following month, WHO declares a Public Health Emergency of International Concern (PHEIC), as more than 75,000 people are infected with A(H8N5) in this one country (see Fig. 4 and Fig. 5). New cases are reported from all neighboring countries as well, while the virus is spreading internationally. There is increased evidence that the world is at risk of a pandemic.



Fig. 3. Fictive area of deployment. Source/Credit: WHO 2017.

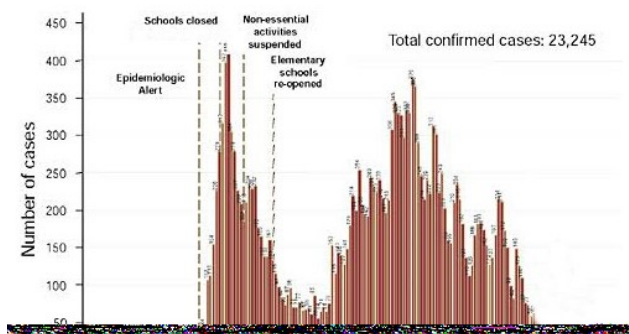


Fig. 4. Number of cases on a fictive scenario timeline: WHO 2017.

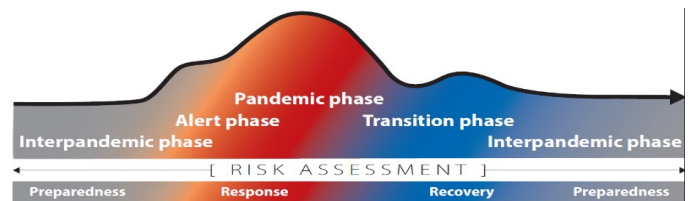


Fig. 5. Phases of a pandemic. The response phase is mainly portrayed in this simulation exercise. Source/Credit: WHO 2017.

Due to these circumstances, a football championship match is cancelled in Mudzi, which sparks outrage among fans. All public gatherings are stopped and school closures are implemented. The Simex teams are asked to attend various live role-played meetings to find out about the situation in Kotwa. Each team receives the same background information but makes their own decisions on how to run the meetings and what decisions and actions to take based on them.

One month later, the WHO declares an influenza pandemic. Cases as per the scenario are now detected in four out of six WHO regions.

Another month later, the influenza pandemic continues to spread. There is an urgent need for vaccines, increased supply of antivirals and other treatments from several countries. Also, increased supply of personal protective equipment (PPE) is requested along with technical assistance associated with strengthening risk and operational communications. Vaccine trials are underway, with teams targeting young children and older adults for vaccination. The following month, vaccine development finally nears completion. WHO vaccine deployment then begins under the Pandemic Influenza Preparedness (PIP) framework.

B. On-Site Preparations

For a simulation exercise with role play and live elements, a suitable training ground has to be arranged. Normally military and civil protection sites meet all requirements and are arranged for that purpose, as with the SocialNet exercise. Five Simex exercise control staff members set up the site the day before the role-playing exercises started. Full logistics including gear for exercise control, team rooms, meeting rooms, meeting facilities and support aspects are required, creating quite a large preparatory stage.

III. CONDUCTING THE EXERCISE: 48 HOURS OF ROLE PLAYING

The exercise was divided into five intervals, each session containing one extract of the simulated time (see Fig. 6):

Day 1 evening: table-top exercise
Simulated time: August 2017

Day 2 morning: live play on simulation exercise ground
Simulated time: September 2017

Day 2 afternoon: live play on simulation exercise ground
Simulated time: September 2017

Day 2 evening: table-top exercises with live elements
Simulated time: October 2017

Day 3 morning: large-scale meeting simulations
Simulated time: November 2017

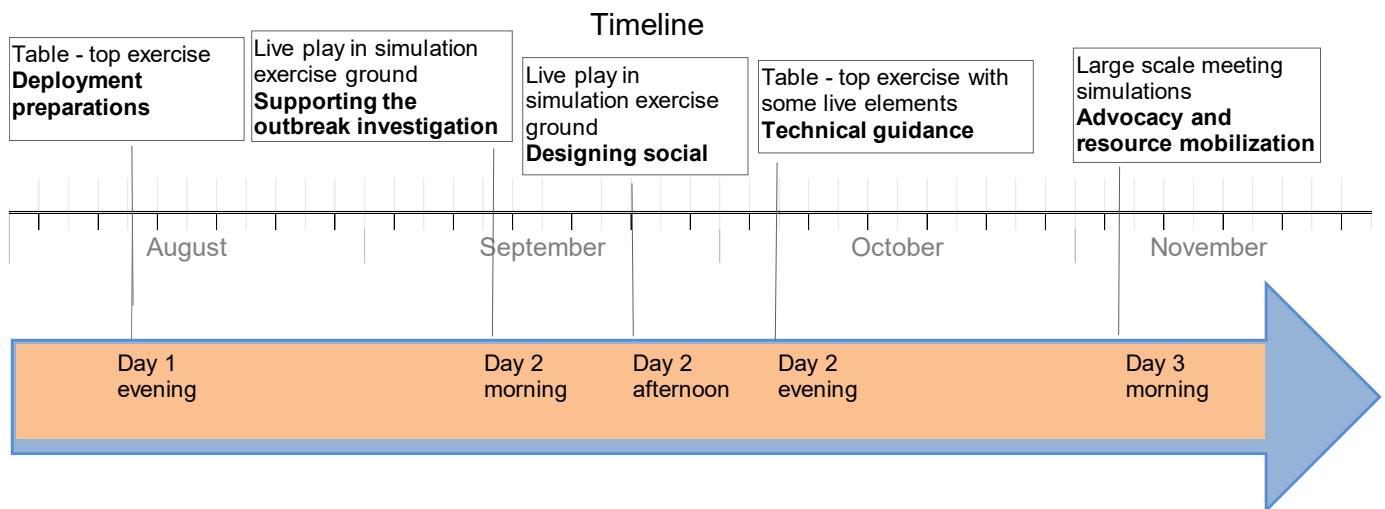


Fig. 6. Timeline with real time and simulated time with timejumps: WHO 2017.

All sessions were divided into activities and tasks. Throughout the Simex, different platforms and tools were used to access information and submit results to the exercise control team. Background materials were available in a Moodle Simex folder. During the exercise the participants received various information, “injects”, through various channels such as e-mail, leaflets, phone calls and briefings (see Fig. 7). Those injects included, amongst other things, fictive WHO information, news articles, and social media responses. Other information channels included print materials, meetings and direct role plays. Communication with the exercise control team relevant to the Simex was organized via e-mail. Deliverables had to be uploaded to the Moodle team-based return folder, where the assessment staff accessed them for viewing. Additionally, a team-based Skype account was needed for some exercises to reach the control team, thus accounts were created for each team and the exercise control team.

September 2017 (Friday morning)
WHO declares PHEIC

- **Publishes:**
 - Clinical diagnosis guidelines
 - Clinical management guidelines
 - Infection control and prevention guidelines
 - Vaccine-strain recommendations
- **Actions:**
 - Makes candidate vaccine available
 - Collaborating centers begin testing on vaccine virus
 - WHO escalates to the pandemic phase
 - Increasing evidence of sustained human-to-human transmission
 - Increasing evidence that the new virus causes severe disease

Fig. 7. Example of the scenario inject: WHO 2017.

Technical feedback on Simex outputs were conducted by training faculty through team-based discussions, interactive exchange and learning recaps that took place at designated discussion points. For some sessions, direct feedback and out-

of-role feedback was provided. At the end of the exercise, each participant was individually de-briefed by the team of four training faculty staff members.

A. Day One: Briefing on the Exercise

The Simulation Exercise started with a short briefing in the evening of the first day. Participants first were informed about all organisational parts of the exercise, including communication channels, team work, naming conventions for documents and e-mails, and schedules.

Afterwards, they were briefed on the scenario, as well as the conditions and data of the fictive Mudzi district area. This included not only geographical information and a profile of the Mudzi district, but also health care capacity and health centre conditions, faith profiles and funeral practices. As a first task, the available social information needed to be scoped and initial interventions related to the outbreak had to be listed. Each team had to prepare for the mission by delivering a deployment plan. They had about two hours of time to finish and present the task.

Before beginning the team exercises, every participant received a kit with working items, and WHO vests and shirts. Participants were supposed to bring appropriate IT gear to be able to work on data analysis, planning and reporting, as well as warm clothing for the outside exercises and drinking water, just like in real deployments. Mission preparations continued the whole evening, including background research on the materials.

B. Day Two: Role-Playing Sessions

On the second day, teams had to visit communities, partners, stakeholders and officials in the different training spots. In the morning sessions, teams were deployed to outbreak communities surrounding Pudia town. In the afternoon, they worked with partners and district-level liaisons in Kotwa (see Fig. 3). The morning session of the exercise had the most role-playing elements of the whole Simex. All teams were supposed to go to the training spots in the same order, each team starting half an hour after the previous one left. However, one team ended up at one of the training spots too early. The role

players reacted flexibly to this and handled both teams at the same time.

All teams reacted in unique ways to the role-playing scenarios and faced characters. After visiting all of the training spots, the teams had to write a brief report on the field visit. The key areas that should be included in the Mudzi response plan had to be outlined. They had two hours to finish those exercises. This is the normal interval for the tasks to be submitted from the time they were requested.

The afternoon sessions were mostly discussion and information-sharing types of activities. As a result, an analysis on health belief models, a knowledge-attitude-practice (KAP) survey, also available as an online tool, was designed as an outline for social science interventions strategy and submitted along with inputs to global technical guidance.

The evening sessions were conducted with various stakeholders and a multi-level call with the WHO. For various reasons, teams had problems arriving and initiating at the correct time in some of the role-play spots, resulting sometimes in losing time from the role play.

For all morning, afternoon and evening sessions, staff member role players sometimes provoked situations and this pressure often created emotional reactions from the participants, which both added to the immersion and could also easily happen in real-life situations, thus it is deemed important to train for such situations in face-to-face simulations.

C. Day Three: Influenza Pandemic continues to spread

The last day required team-based work and interactions and one larger meeting simulation, also conducted as a role-play session. During this day, all teams and participants received a lot of team and individual feedback.

IV. POSSIBILITIES FOR DIGITIZING THE SIMEX

Digitizing the whole exercise, especially in one game, is neither possible nor meaningful. However, at least parts of the exercise can be implemented in an online-driven context in different ways and using various formats. Reducing the time in the on-site training area makes the exercise easier to organize and replicate sessions according to the same standard, and further is more cost-efficient. While live role plays are important for experimental and assessment reasons, more stagnant parts of the training, such as setting the scene, information flow and some situation updates, as well as some community and partner interfaces, could be turned into digitized information injects. This would also reduce human error, such as delays and use of incorrect scripts and data, and help ensure the same scope of exercise is conveyed to all teams.

A way forward could be to reduce the in-person staff training exercise time and cover sessions through online simulations. In addition, creating one platform that includes all needed tools to manage all materials, information channels and team submissions would be beneficial for both the training audience and faculty.

The following suggestions are made to digitize parts of the simulation exercise. Suggestions are in the order of complexity and feasibility and explained briefly in the following section:

- Development of an exercise management tool on OpenWHO to use one platform instead of various exercise support tools
- Creation of adventure games in 2.5-dimensional style
- 3-dimensional online scenario presentation
- Online live video chats for discussion-based sessions
- Games with pre-recorded video snippets and search phrases
- Virtual reality (VR) games for some interactive sessions
- VR games supported by planning maps

A. Suggestions

For many live sessions, Virtual Reality (VR) games could be an opportunity for creating suitable immersion while offering the freedom to explore the area as if the learner actually was in the area. Like in the real-time role-playing exercise, having multiple human participants act at the same time in the game seems functionally possible even when work is team based. VR scenarios can either be presented as short scenes or in a whole game. Both possibilities have advantages and disadvantages concerning immersion, presentation of information and time for reflection. Either way, VR scenarios should be interrupted when moving to the next scenario and discussion with team members as in a real-world scenario should be arranged. Those discussions for preparing next steps can also be live video chats like Skype, where the teaching team can trace how long each team spends on a task and what contents participants are contributing.

Regardless of the use of VR in a 3D game scenario, a planning map, like a skill tree in games, can be created by teams and/or participants to place their planned actions, deliverables, etc. Next, actions can be taken in a game scene with multiple non-player characters (NPCs) and/or other participants. A first-person perspective will add to the immersion and give people the feeling they are indeed acting compared to a third-person perspective. Instead of having training faculty in the roles, the staff could observe the participants' actions live and react with pre-scripted events. As a training faculty member, having the possibility to directly act as an NPC will also be an option. If the training faculty member is monitoring the actions in real-time, they can also unlock different goals that have been achieved by each player and team.

Many intensive interaction sessions work best as real-world live play as there would otherwise be so many aspects that need to be analyzed—e.g. gestures and facial expressions of the participants. Creating a human interaction play for learning purposes is required, and the immediate high-quality feedback functions only in a face-to-face format. This is not possible in a game, not even when using VR.

In addition, VR systems are still comparably expensive, especially when using them for numerous participants at the same time. While there are technical possibilities for using VR in small places, this could also be a challenge if multiple users are trained at the same time in a small room. Analyzing both

gestures and facial expressions is also a challenge in the VR context.

A different promising suggestion is to support the trainings through an embedded online scenario instead of a dedicated stand-alone game. At least parts of the exercise contexts and events can be presented in a 2.5D-style adventure and simulation game as introduced in the Serious Game MOOC in Chapter I. In this kind of simulation game, learners directly see actions and reactions. As this will not make use of VR, it will be easier to implement and require less hardware from learners.

Thus, an integration of an interactive game exercise tool that can be used to create short simulation adventure games could be explored for OpenWHO. With this, at least the background scenario, purpose, and similar replicable aspects of the exercises can be explained to the users in a more consistent way. Such an exercise tool can be developed and tested within premises similar to the OpenWHO platform software: openHPI, which is developed and maintained by the Hasso Plattner Institute as well. In a first step, requirements for such tool are currently identified by creating multiple game prototypes for different learning scenarios. In the next step, the tool is developed for and tested at openHPI. Afterward, the tool could be integrated into OpenWHO. This way, it is first tested on an e-learning platform in general and then adjusted to the needs of WHO.

For the table top-based discussion sessions, one suggestion is to assess the session outcomes by online live video chats. While transporting all emotions is not possible like in a real-life meeting, it would release the on-site space and staff needs. Along with creating real-world experiences like this with other team members, it is also possible to create an individual dialogue game for each team or participant, where learners can choose from different options. Such game could be created by the previously described tool.

Another option is to create a game with pre-recorded video snippets like in the video game "her story." In this game, the player tries to solve a crime by watching police questioning records. By entering different search phrases in a search mask of the police database, the player discovers more and more of the story and background while considering new search phrases. All recorded statements from the suspect will be searched with the entered search phrase, but results are limited to the first five. This way, the player is not able to see all details from the beginning.

The same could apply to a game for the low-intensity sessions, such as fact finding or searching for the scenario information. This way, participants could obtain needed information by asking the right questions, or in this case searching for the right phrases. In addition, the story can be altered by adding different exclusive search phrases, so that once a phrase has been searched, other videos get deactivated; thus, not all videos can be reached, creating a more individualized outcome.

V. SUMMARY AND FUTURE WORK

The SocialNet training is highly complex emergency responder training with an extensive live role-playing simulation exercise over several days. The simulation exercise has a high mentoring and feedback ratio. Participants are by design under

pressure during the whole exercise to simulate the pressure they would experience in a real field deployment. While the pressure levels and some intense sessions must remain, there is an interest in exploring possibilities to reduce the live-play elements of the simulation exercise.

In addition, different communication channels and tools are used to provide participants with feedback and assess their results. Combining those channels and creating one tool for both participants and staff would be much appreciated by the organizers. As the OpenWHO online learning platform is already used for frontline responder resources and will also be used for more trainings, it would be best to combine all materials and tools on this one platform, where they are accessible to each user.

To be able to create more interactive exercises, it is important to integrate a tool that enables course organizers to create at least short interactive games. This tool would be first developed and tested on openHPI and afterward adjusted to the needs of OpenWHO. In this process, preparations to test it on the OpenWHO platform will be made. Afterward, game exercises will be created and evaluated to improve the tool.

Features for managing documents through a document centre have been recently introduced and an additional function of creating "live briefings" will soon be launched on the OpenWHO platform. The suitability of these functions for simulation exercise support still needs to be evaluated and tested, but the possibility of using the live briefing function in particular is under exploration. In a later stage, creating more complex game exercises is possible. As this is quite costly, it is, however, not specified when and if those game exercises can or should be implemented on the OpenWHO platform.

Integrating the presented ideas is a step toward making the staff trainings more efficient and easier to manage in preparing for pandemics, disease outbreaks and other health emergencies.

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