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A MOOC
On Control of Flooding in Prague

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Abstract: *The paper is about the development of a MOOC on the flooding of the river Vltava in the Czech country. The MOOC has been designed as a serious game. Students from all over the world are invited to take part in the management team to reduce the negative impact of the flooding. The MT has to take decisions about evacuation, building barriers and opening of dams upwards the river. Members of the MT negotiate via social media. The design and the implementation of the MOOC will be presented in the paper and the first results of experiments.*

Key words: *Massive Open Online Courses, Social Media, Serious Games, Distant Learning.*

INTRODUCTION

Massive Open Online Courses (MOOCs) have changed the landscape of distant learning. A huge number of students from all over the world enrol in MOOCs. Well-known Universities as MIT, Harvard, CMU, etc. started their special MOOCs platforms. The goal was to offer courses of the best professors and Universities with a lot of innovations to everybody free of charge. Especially underprivileged groups unable to pay the high tuition fees of top Universities should have access. In MOOCs traditional web-lectures are combined with computer simulations, movies with attractive, stimulating educational material. One of the negative aspects of MOOCs is the high drop-off rate and adapted didactical models [4].One of the challenges is to create a network of study friends via social media. Communication with peers provide support and binding and engagement to the course. The learning material should trigger the interest and motivation of students over time and preventing students from early drop-off. In the current MOOC the focus is not on individual self-paced learning but on group work. Students from all over the world are invited to take part in the flooding project and to communicate via social media.

A challenging innovation is the introduction of gaming in MOOCs, especially serious gaming. Serious games are simulations of real-world events or processes designed for the purpose of solving a problem. The goal of serious games is not to amuse the player but the realisation of serious goals. The current MOOC is based on serious gaming and can be used to train first responders how to control the negative impacts of flooding. As case the Vltava river in Prague has been selected. As a typical rain river it happens regularly the water of the river raises dramatically after heavy rainfall in the south of the Czech country close to the border with Germany. Dikes are flooded and great areas along the river are flooded. The lower parts of the city of Prague suffer from the flooding (see Figure 1,2).

The outline of the paper is as follows. First we present related works. Next we present the model of our flooding game. In the following section we discuss some experiments followed by the conclusion and references.

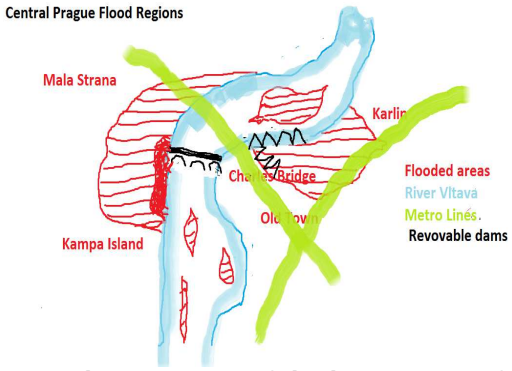


Figure 1: Flooding of the lower parts of Prague in 2002. Figure 2: Map of the lower parts of Prague.

RELATED WORK

In paper [1] the authors explore the integration of serious games as a new type of MOOC activity, providing increased engagement and a valuable source of learning analytics. The inclusion of serious games has implications for both courses and games. Due to the diversity of existing serious game and MOOC platforms, we focus on the specific case of integrating EADVENTURE games into EDX.

In [8] the authors state that playing is associated with pleasure and fun whereas academic learning is associated to effort and hard work. Much research has shown the benefits of introducing games in academic teaching as a way to improve learning. Curiosity is also important when learning. Indeed, when curiosity is awakened, people learn without resistance. The use of a serious game as a form of evaluation in a MOOC is a true innovation in education: students played a video game where different situations were presented and they had to solve problems related to the courses. Innovating in education is certainly a challenge. Although integrating a serious game in the MOOC platform needed a considerable amount of technical effort, it was an absolute success: the completion rate was high (31%) with a great percentage of young students (49%) following the courses.

The current crisis in Europe has raised the need to increase the entrepreneurship orientation of students and adult citizens. At the same time, Massive Open Online Course has appeared as a disruptive innovation that permits to engage a large number of persons in an online open course available through Internet to anyone to enrol. MOOC has been deployed based on basic technologies such as text-based materials, video-lectures and forum based interaction. In a study [3] the authors introduced the design of a MOOC for Entrepreneurship education that aims to go one step further by integrating the use of serious games as a key part of the methodology for teaching and learning entrepreneurship basics in the context of a MOOC.

Janssen [4] developed a prototype of a game on Dutch flood risk management. He tested the Multilayer Safety Approach. In the MLSA approach in flood risk management three layers are considered: prevention, sustainable spatial planning and disaster management organization. Actors can be trained to assess the measures which can reduce flood risk and limiting their impact. To visualize the consequences of human intervention and the effects of flood reducing measures a model has been developed underlying a serious game. The main purpose of the game is to give players insight in each other players responsibilities, insight in others preferences with regard to multilayer safety and sympathy for their role. As a case-study location the flood prone urban area on the Northern IJ-banks area in Amsterdam has been selected.

The first prototype of a MOOC on the flooding game in Prague has been introduced by the author in [5]. The game was modelled after the flooding in 2002. An important aspect of the game is the natural use of social media. Students from all over the world can play a role in the Management Team. They are supposed to negotiate via social media about the priority of measurements to reduce the damage and number of casualties.

A new didactic model using social media has been introduced in [4, 6, 7]. The author introduced a new didactic model on distant learning. Motivation and activation are presented as important driving forces of students in the teaching-learning interaction process. Serious gaming is supposed to trigger motivation and pleasure to learn by playing.

FLOODING GAME

Game description The players of the flooding game are the crisis team composed of the following persons Mayor, head of police, head of the fire brigade, head of the medical team, head of first responders, head of the logistic team. Every member has his special duties and responsibilities written down on special cards. The crisis team has to take

measurements to reduce the number of casualties and amount of damage. Because different members of the team have their own responsibility for different actions there will be discussion between team members about the priority of actions. Decisions have to be taken by a majority of votes. To prevent a deadlock the mayor of the city has double votes. Because the members of the team are remote in place and time they are supposed to negotiate via social media. The mayor is the chairman of the crisis team and manages the discussion. Every day the management team is confronted with new data about the rise of the water, flooded areas in Prague and weather forecast (see Figures 3,4,5). The crisis team takes a decision about a measurement that will be executed that day. They select one of the measurements cards from Table 2 and fill in the corresponding questionnaire (Table 3). Both documents are submitted to the game Manager. The game manager generates an automated response and a briefing at the end of the game.

Script. In the current version of the flooding game we use only one underlying script. In the beginning the water is raising under bad weather conditions. Then there are two days of good weather. But then the heavy rainfall starts again , finally resulting in flooding. The script is realistic and is based on the flooding crisis in 2002 (Table 1). In Figure 1 we show the successive inundation of areas of Prague and in Figure 5 we show an example of an actual weather forecast and raising of the water.
The script is the basis for assessment of the decisions of the MT. Per day for every possible decision an automated response has been generated.

Figure 3: Waterlevel.

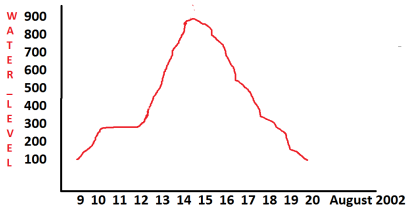


Figure 4: Waterlevel during August.

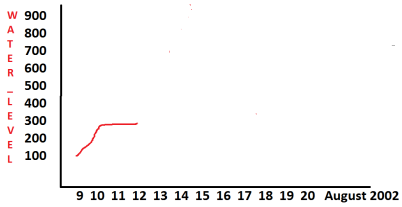


Figure 5: Waterlevel 12 August.

Table 1: Logbook of flooding 2002.

10 August	Fine weather after week of heavy storms and rain
11 August	Bad weather, forecast bad weather via televsion and radio
12 August	Television showed building along the river were sandbagged
12 August	Building barriers of sandbags
12 August	Buses, vans evacuation people Karlin
13 August	Decision to evacuate Old Town (50.000 thousand people) Police were now moving from block to block forcibly removing people from their apartments
13 August	Water breaches defences lower areas of Karlin and Liben Two metres of flood protection above the river sides was installed
14 August	Prague was a ghost town, metro anti flood failed,29 stations under water
14	Kampa flooded first floor, Karlin flooded to second floor, water had peaked
14 August	All bridges closed, hotels submerged
14 August	50 cm below the barrier otherwise Old city will be flooded
15 August	Water starts to recede

Measurements Given the actual weather forecast and raise of the water, the MT takes an optimal decision. The MT is allowed to take only one measurement every day. Every measurement has positive and negative outcomes. For example opening the dams in the South of the Czech country results in local flooding around the dam, but reduces the water pressure in the Vltava river upwards to Prague. If the evacuation process starts too early

many people don't take it too serious and will neglect the evacuation order. Many people stay in their houses until the moment that water and electricity is cut off and the situation becomes dangerous. Next many people have to be rescued.
In the current version of the game there is no interaction between the measurements and the raising of the water. There is only (critical) comment of the game manager on the (order) of measurements.

Table 2:Possible measurements

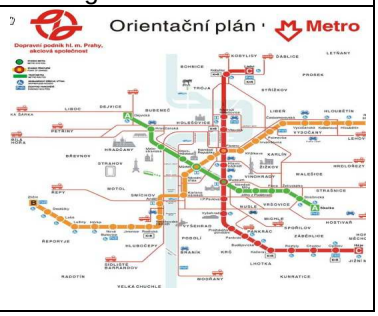
1	Opening dam	2	Evacuation	3	Rescue
FLOODING					
4	Barriers of metal	5	Barriers of sandbags	6	Wait and see
FLOODING					
7	Closing tunnels bridges	8	Cutting off electricity water	9	Closing Metro
FLOODING					

Table 3: Evaluation form measurements.

Items	Description items
i1	Measurements in order of urgency
i2	Decision was taken with full/minimal majority
i3	Increase or decrease of water flow expected next day
i4	MT has full control, no control of flooding disaster
i5	MT used statistical/computational tools to predict the future
i6	MT considered priority region of Prague and regions stream upwards
i7	MT considered priority casualties and damage to buildings/infrastructure
i8	Long/short time spend to negotiation of the MT members
i9	Many or some conflicting roles
i10	Missing information, procedures and knowledge to take measurement
i11	Internet used to look up information

EXPERIMENTS

The first prototype of the Flooding system was implemented at the BlackBoard system of Delft University of Technology. In total 5x6 master students Technical

Informatics were requested to take part in the experiment. After enrolment in the course the teacher forms 5 groups (in the future this process should be automated). After taking their roles students start the game. The communication was via Facebook. All students finished the game. All groups started with opening the dams, but groups used different days as starting point. On the sunny days 10-12 August most groups selected the measurement 6 (wait and see). There was a lot of discussion on starting evacuation and closing the tunnels and bridges. Unfortunately there were no minutes of the negotiations so maybe this will added in the future. To enable automated processing a list of possible discussions items will be added to the evaluation form

CONCLUSIONS AND FUTURE WORK

The first prototype of the Flooding game was tested in a classical e-learning environment. The first results were promising. As expected the focus of group discussions were on negotiation between member of the MT about priority of the measurements. Members of MT with different roles and different responsibilities took their job seriously. All students appreciated the use of serious gaming. But many students considered the current prototype as a game and missed a lot of learning aspects. Next future risk assessment models, models about flooding and buffering water in reservoirs and logistics models for evacuation and transport will be added. The design of the course is based on a spiral form. At the bottom every student

It can be expected that in the summer of 2016 the game will be available as a MOOC. The MOOC will be online using Moodle and server of the Czech Technical University in Prague with a supporting team of the CVUT.

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