Are you Ready! to take early action? Embedding serious gaming into community managed DRR in Bangladesh

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ABSTRACT

This paper applies a Game-based Learning Evaluation Model (GEM) to assess whether the early warning – early action serious game "Ready!" is an effective component to add to existing Disaster Risk Reduction (DRR) training curricula, facilitated by NGO staff and applied at the community level. We developed a paper-based survey with 17 five-level Likert items and 15 open questions addressing the different GEM indicators to question 16 NGO staff, and used a simplified set of five questions with emoticons for 58 community people. The results showed that the staff saw great potential in embedding Ready! in DRR processes and that the community highly appreciated the game. The GEM was found to be a useful methodology to evaluate the effectiveness of this serious game. However, in the context of a lower educated and partly illiterate community, the importance of designing an individual, largely visual assessment instrument instead of a paper-based survey was acknowledged.

Keywords

climate change, community-managed disaster risk reduction, curriculum design theory, early warning, game evaluation, preparedness, serious gaming.

INTRODUCTION

Climate change is expected to increase the occurrence of more extreme hydrological and meteorological events especially in deltaic countries such as Bangladesh. In 2014, 30% of the total land area was inundated and 2.8 million people were affected (IFRC, 2014). Limited socio-economic development and a rapid population growth will cause these risks to increase even more. Disaster Risk Reduction (DRR), in particular "people centred" early warning systems that meet the needs of end users and ensure information is acted upon, are important to manage these risks (UNISDR, 2006; 2014). When provided with an early warning message one has to decide on possible response actions, the associated costs, and if such actions are "worthwhile" taking (Coughlan de Perez et al., 2014). Education and training programs can be used to build the end users' capacity to make informed decisions about possible response actions after receiving early warnings (Pescaroli and Magni, 2015; Parker et al., 2009). Integrating such early warning early action training as part of DRR programs at the community level is key, yet there are substantial challenges in communicating forecasts to communities at risk (Patt and Gwata, 2002).

Currently, community managed DRR (CMDRR) programs (Cordaid, 2013) make use of different training components such as exercises to get to know one another at the start of a program, practical field exercises, participatory learning and action events, classroom teaching and individual exercises. New innovative approaches are also being tried out, such as serious gaming and methods drawing from the realms of drama, art and music. We focus on serious gaming as a training component that can be used instead of or alongside traditional DRR approaches. Serious gaming can be used to help people experience the complexity of future risks (Mendler de Suarez et al., 2012). Gaming can be powerful to support training and education, participation and empowerment and decision-making for complex societal issues, that is, when properly embedded within learning-activities e.g. aiming at reflection upon the experiences acquired by gaming (Hays, 2005). In a meta review by Chin et al. (2009), it was observed that students preferred games and simulations over other classroom activities as well as that participation in such "gamed simulations" can actually lead to attitudes changes. Serious gaming opens a new world for gearing up people at all levels in their abilities to experience and learn in a fast, dynamic and complex world. Serious games are now being developed and deployed all over the world and for a variety of applications (e.g. Connolly et al., 2012). In the humanitarian and development world, games are used more and more often (see e.g. Gonsalves et al., 2011; Suarez and Bachofen, 2013). The Red Cross Red Crescent Climate Centre (RCCC) and its partners acknowledged serious gaming as an important addition to their portfolio of learning activities and designed and implemented at least 45 new games about a wide range of key humanitarian issues, including disaster management and early warning. This includes the game "UpRiver" which uses mobile technology allowing communities to report, predict, and gather information about the current and future water level of the river (Gordon et al. 2014). Another example is "Ready!" (Macklin, 2013) focusing on early warning-early action and is described in more detail in the Methodology section. For each type of training, curriculum and instructional design theory can be used to make sure all the different training components are well connected, provide consistency and coherence and –most importantly- lead to the attainment of all the training goals.

The increased use of games has to go hand in hand with a proper validation of their effectiveness. A crucial question is why certain games with specific "game mechanics" contribute to the aim pursued while other game concepts do not? Validating games requires innovative frameworks for collecting qualitative and quantitative evidence, especially in developing countries, where there are resource-poor environments, language barriers and a higher percentage of lower educated and illiterate people. RCCC makes sure that all the national societies that make use of their games generate feedback to inform improvements in the iterative design and use of games developed (Suarez and Bachofen, 2013). However, most organizations face challenges in terms of getting the feedback in a coherent and systematic way. A further complicating factor is that, despite clear facilitation guidelines and game rules, each game session of the same game can have a different effectiveness due to differences in interpretation and execution by the facilitator (Suarez et al., 2014).

In sum, a thorough evaluation of whether a serious game renders a DRR process more effective is essential but challenging especially in resource-poor environments. Furthermore, if evaluations are conducted, then it is often done in

different ways lacking consistency. The Game-based Learning Evaluation Model (GEM) (Oprins et al., 2015) is a validated framework for the systematic evaluation of serious games aiming at learning and behavioural change. The focus of this paper is to 1) evaluate a serious game aiming at DRR called "Ready!" with GEM and 2) to assess whether GEM is a valuable methodology to systematically evaluate the effectiveness of serious games in the context of use in resource-poor environments.
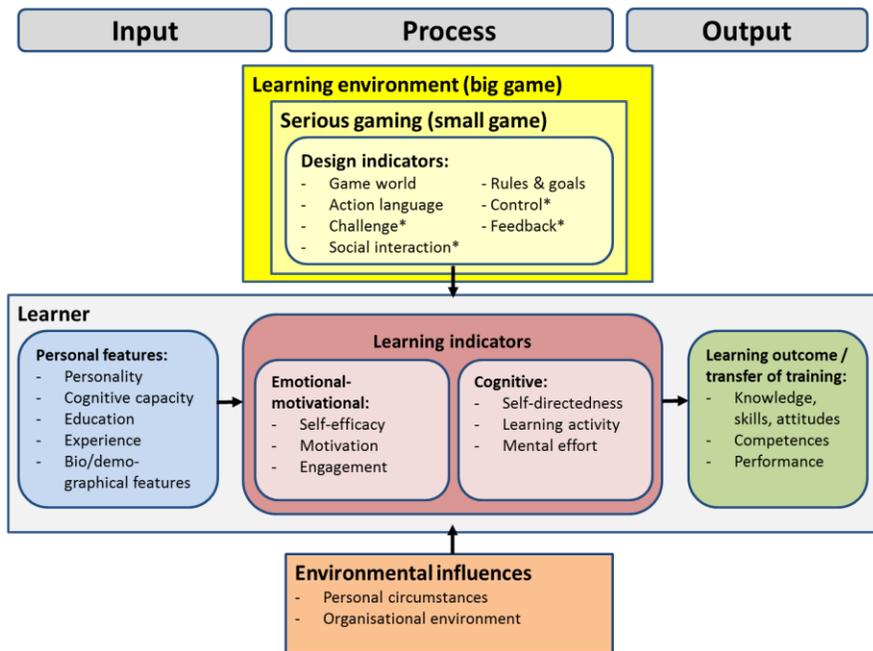

Figure 1. The Game-based learning Evaluation Model (GEM) (Oprins et al., 2015).

METHOD

Evaluation Framework

GEM is an evaluation framework that can be used to assess the learning effectiveness of a game. It is based on literature and field study that revealed a fairly comprehensive set of factors affecting game effectiveness, see (Oprins et al., 2015; Bakhuys-Roozeboom, Oprins, & Visschedijk, 2015). It consists of an input – process – output model, see Figure 1. It is important to realize what has to be measured before, during and after playing the game. Furthermore, a basic principle is that both process variables and outcome variables are included as in many general evaluation models (Alvarez, Salas and Garofano, 2004; Kraiger, Ford and Salas, 1993, Tannenbaum et al., 1993). The process variables are generic so that various learning interventions can be compared (Mayer, 2012) while the outcome variables are domain-specific and based on the learning objectives.

The process variables are split into emotional-motivational and cognitive indicators. Emotional-motivational factors influence information processing and thus affect learning. The specific serious gaming features are considered as the design indicators. The input is determined by personal features of the learners. These are the relatively stable features that are often subdivided into personality, cognitive abilities, and other demographical and biographical features including education and experience. Moreover, certain environmental factors at personal and organizational level influence learning. The learning environment itself, the 'big game', is situated around the game itself, the 'small game', because it is crucial to consider the whole learning environment in which the game is embedded. Some indicators (with *) can be part of the small game but also of the big game. We used GEM to develop a questionnaire where each question was linked to one of the indicators. We did not separately address the environmental influences. We will discuss the questionnaire in more detail in the paragraph on pilot design.

Game description: *Ready!*

Based on a limited desk research on games available in the area of early warning and early action, the project team selected the game *Ready!* for the pilot in Bangladesh. The game "Ready!" was designed in the context of collaboration between RCCC, the American Red Cross, and PETLab - a research lab at Parsons The New School for Design. It aims to offer an innovative way to have focused conversations with the communities around location-specific disaster preparedness (Macklin, 2014).

The rationale of the game is to increase preparedness of communities and NGO workers for taking action in response to early warnings. It is a physical game that can be played using any disaster scenario, and is most effective using a realistic scenario for the participants in the place where people experience the risk. The facilitator is expected to have a medium level of skill. The game can be played with disaster managers, volunteers or branch officers and one can have as many teams (or groups) of 5-10 players as needed. The time needed to play the game is 30 to 60 minutes. Limited material and resources are required to play the game. These include eight pieces of card per team, pens, 20 beans and dice per team. The game is best played in a large open space of at least 20 by 20 meters.

The game, as played in the Bangladesh pilot sites, consists of the following six simplified steps as outlined in Figure 2 (for more details see RCCC (2014));

A.   The participants are presented with a water level forecast and asked to first write down, in a very short time, all the early actions that they think they could take in response to this forecast - and then to prioritize eight of these to write down on the cards;

B.   The teams decide on the level of priority and level of difficulty associated with taking these actions in two separate rounds. This is done by distributing the beans among the different cards with more beans meaning higher priority and a higher level of difficulty;

C.   The result of this is a card as shown in figure 2C. The level of priority is shown by a circle in the left hand corner and the level of difficulty is represented by a square in the right hand corner. These cards are hidden in the open space and the same number of dices are placed next to them representing the level of difficulty;

D.   The teams are brought out into the open space and the facilitator explains that they need to collect all their teams cards in less than 90 seconds;

E.   The participants can collect their cards only when they successfully roll (all) the dice with the number of priority given to that action. The team that collects the most priority action game points in the short timeline available wins;

F.   The game facilitator enables a debriefing conversation to elicit feedback on how the gameplay experience relates to the real-world disaster risk management decisions and consequences. This can cover issues like how they chose their actions, the ones which were difficult to complete, actions that could have been taken further in advance to prepare and the needs of the community to take these actions.

Pilot area and participant selection

Two unions in the Sirajganj district in Bangladesh, i.e. the Gorjan Union of the Chowhali Upazilla and the Rajapur Union of the Belkuchi Upazilla were selected for playing the game. Manab Mukti Sangstha (MMS) is the local NGO that works in these communities supported by Concern Universal Bangladesh (CUB) and Cordaid and facilitated the arrangement for the game. These communities and NGO staff received early warning messages during the 2014 flood season as part of a pilot project (Cumiskey, Altamirano and Hakvoort, 2014) and the volunteers in the communities received CMDRR training. The areas are extremely flood vulnerable, with poor infrastructure and transport facilities along with low illiteracy rates.

The game was played with two sets of participants. First of all, NGO staff played the game with the objective of learning how to facilitate the game at the community level. Secondly, communities were trained by the NGO staff with the objective to test the NGOs facilitation skills and understand the value of the game

for the community people. At the NGO level, 16 NGO staff (10 male, 6 female) participated in the game. Eleven of which have a local university level of education and on average eight years of experience in the disaster management field. At the community level, participants included volunteers, gauge readers, Union Disaster Management Committee (UDMC) members, day laborers, teachers, Imams, health workers and local government officials. In Rajapur, 28 persons (18 male and 10 female) participated, seven of which were educated up to year 12 and 23 beyond year 12. In Gorjan, 33 persons (17 male and 16 female) participated, 13 of which were educated up to year 12 and 20 beyond year 12. The participants in Rajapur and Gorjan were all adults.

Pilot design

The pilot was held for three days on the 10-12th of Dec 2014. An experienced facilitator, who facilitated several sessions in India before, trained the NGO staff on the first day to become "co-facilitators". He started with a presentation on the relationship between climate change and DRR, quizzed the participants and then presented the rules of *Ready!*. Participants did a very quick demonstration round before playing the game in full. The actual playing time was around 45 minutes. Subsequently, the group reflected and discussed in a plenary about how it went. This enabled them to subsequently demonstrate and facilitate *Ready!* themselves, as they did with the group of community members on the second and third day. The experienced facilitator provided feedback on their skills as facilitator of the games. The pilot was conducted in a large open space close to the MMS training facilities in Sirajganj.

The data collection based on GEM consisted of collecting primary data on the input, process and output of the gaming intervention. We developed a paper-based English survey with five personal feature open questions, four open questions on learning indicators, 12 five-level Likert items and two open questions for the design indicators, and five five-level Likert items and four open questions for the learning outcome indicators. Learning outcomes were thus assessed by self-reporting, rather than measured by means of a pre-posttest competency assessment. It should be noted that self-reporting may implicate biases, such as social desirability bias, where. subjects give a positive response to please the

Figure 2. Overview of the Game *Ready!*

experiment leaders. So in total we used 17 five-level Likert items and 15 open questions addressing the different indicators of the GEM for the NGO staff. We used a simplified set of five questions with emoticons (happy, neutral and unhappy) in Bengali in combination with observations for the lower educated

community people. All NGO staff players were asked to fill in the questionnaire either in Bengali or English directly after the game and the discussion. The facilitator asked the community people to answer the five questions and kept the score on a chart board in one community. The questionnaire was filled in using hand out sheets in the other community as the board was found to be ineffective. Apart from the questionnaires, all the *Ready!* cards containing the list of actions, priorities and levels of difficulties were collected. The experienced facilitator made notes of his observations, especially when the trained NGO facilitators where facilitating at the community level. Photographs were also taken and limited video footage.
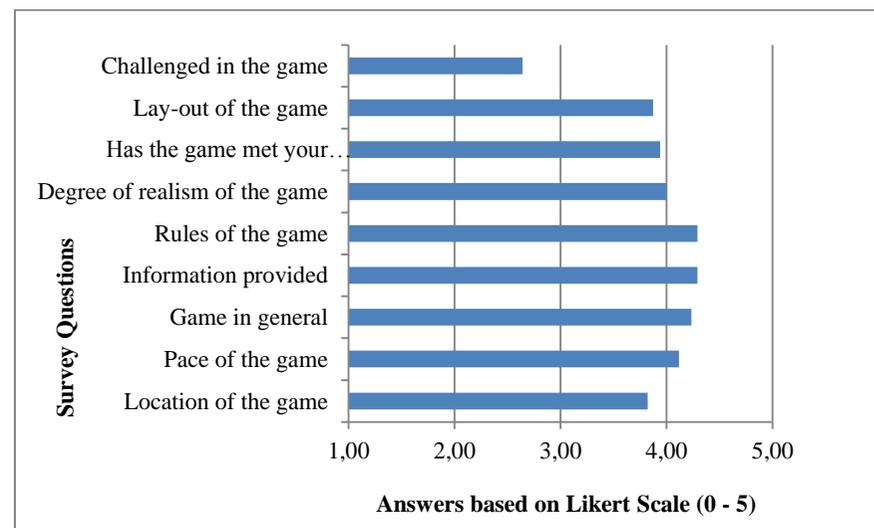
RESULTS

Staff as game participants

We will first present the field test results for the staff and start with the process part of the GEM model which consists of both the emotional-motivational and the cognitive components of the framework. In terms of the emotional-motivational learning indicators (shown in brackets) most participants thought they performed good or very good in the game (self-efficacy), found the game very interesting with "many hidden lessons", fun (motivation), and were absorbed (engagement). One player mentioned: "I think it was like childhood playing". In terms of the cognitive learning process indicators most participants found it easy to stay concentrated: "I was fully busy with the game" (mental effort).

The results for the design part of the game -mostly in terms of the "small game" environment- are depicted in Figure 3. Players gave low scores for the question "Where you challenged in the game?". The information provided and the rules of the game were scored high by the players. The facilitator of the game received a lot of praise for his good explanations, instructions and feedback. Also the degree of realism of the game were well appreciated. In the opening question, regarding the part of the game that was unnecessary, most people answered "nothing". Some mentioned the importance of more explanation towards the community around the trigger points. Players found running and searching for cards, playing the dice and the trigger points the best parts of the game.

The participants gave recommendations on improving the game, especially at the community level, by presenting it in Bengali, using pictures and increasing the playing time. It was evident that the time was really considered too short. One participant mentioned that one should not disqualify a group too easily if they are late with submitting a card, since then the group will be demoralized.

Figure 3. Results for the appreciation of the game design aspects for NGO staff (N = 16)

Figure 4 gives an overview of the quantitative results of the learning outcome component. We note that, as was expected for NGO staff familiar with DRR concepts and practice, overall the scores were pretty low: between 1.9 and 2.3 on a scale of 5. As such we can assume that the answers did not suffer too much from social bias. The question related to increased awareness as a result of playing the game scored lowest which is understandable as the staff members have on average eight years' experience in DRR. However, several NGO staff participants felt that the game would be very helpful and useful for community people because it takes limited preparation and playing time and is easy to understand for illiterate people.

Furthermore, some of the NGO staff players felt that it could be made easily part of contingency planning in the CMDRR process. Nearly all participants indicated that the game taught them to make different choices regarding preparedness. The skills acquired through the game were twofold. First of all, knowing how to facilitate the game and how to mobilize and understand the community through use of the game (e.g. how their action plan works) was acquired. Secondly, the game taught participants how to prioritize early actions.
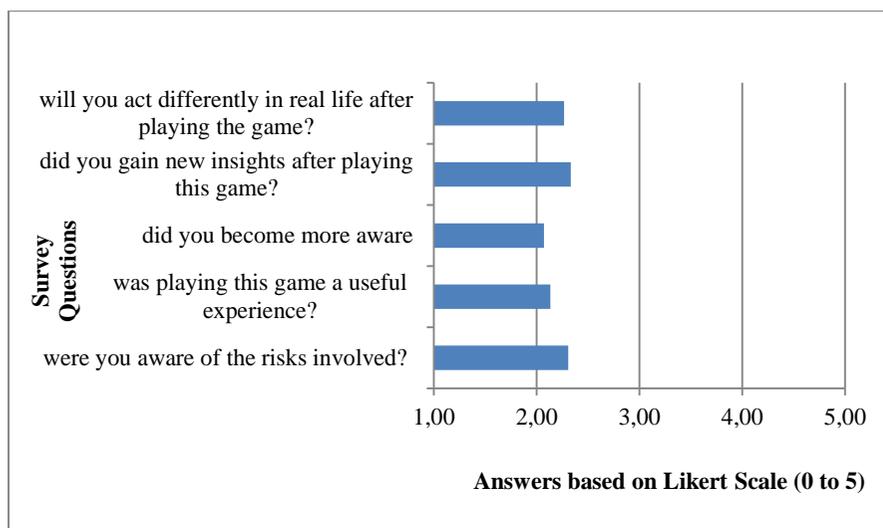

Figure 4. Results for the learning outcome as self-reported by NGO staff (N = 16)

Community members as game participants

Table 1 shows the results of the basic questions posed to the 28 community members from Rajapur union using hand out sheets. The usefulness of the game was considered to be positive (25 out of 28 liked the game). The level of engagement seemed to be somewhat less. This might be due to the fact that the facilitators facilitated for the first time, or because participants are not used to

playful activities. In the Gorjan union 30 out of the 33 participants stayed for responding to the questions. These 30 participants answered every question positively, most likely due to the fact that the questions were not collected individually. Hence, we do not consider the Gorjan Union data to be valid as it did not reflect differences between participants- while the individually elicited Rajapur data revealed such differences. Furthermore, a potential weakness in both the individual and collective data elicitation process is that participants might positively amplify their responses in order to please the NGO staff.

	Positive ☺	Neutral 😐	Negative ☹
Like it	24	4	0
Engaged	17	11	0
Connected to real life situation	25	3	0
Helps me to make decisions	25	3	0
Helps me to plan better	25	3	0

Table 1. Overview of learning process results for Rajapur Union community (N = 28)

We collected all the cards that were prepared during the games with the NGO staff and the community people. The community people drew pictures (if they were illiterate) or someone from the MMS staff wrote them down for them. From the 55 actions that were the result of the brainstorm of the groups, the most difficult early actions were considered to be (1) listing the flood shelters, (2) form the search and rescue team, (3) move disabled, pregnant women and old people, and (4) house plinth raising. The highest priorities were given to (1) disseminate forecast message through mobile phone, (2) form the search and rescue team, (3) disseminate forecast message through community based organization miking, and (4) house plinth raising. The collection of this information proved useful for the NGO teams examining vulnerabilities and capacities, and it is clear that the gameplay experience helped elicit and discuss options. The brainstorm and discussions on early actions can be used as a bridge to the other components of a community managed DRR process for example as input for risk reduction plans.

CONCLUSION

In this work in progress paper the GEM is presented and applied to a pilot of the early warning – early action game *Ready!* The players were 61 flood-prone community members and 16 local NGO staff. The English based paper-based survey based on the GEM worked well for the NGO staff. In contrast, we considered the Gorjan data not valid as the responses did not reveal any differences amongst participants, most likely due to the nature of data collection, which was in a group. Hence, it turned out to be essential to individually question participants. In addition, questioning must be done in a very accessible manner and, the highly visual assessment by means of smileys appeared to have worked well in the Rajapur area. Overall it is important to design an individual, largely visual research instrument that is explained in the local language for the lower educated and partly illiterate community people. Mostly qualitative, process-oriented and participatory research instruments to address the different indicators of the GEM are the most effective.

Bakhuys-Roozeboom et al. validated GEM in a western context (Bakhuys-Roozeboom, Oprins, & Visschedijk, 2015). Apart from the research instruments used, our preliminary research does provide indications that GEM is a valuable methodology to systematically evaluate the effectiveness of serious games in resource-poor areas as well.

Regarding the learning outcome, the initial results do seem to indicate that *Ready!* has an added value for common CMDRR processes, but the evidence base was rather limited. We did not have a control group and there was no transfer measurement of whether what was learned was used in practice. Our research was limited in the sense that it was only a self-assessment of the game which may have revealed a social bias. Future work should address these issues so that better decisions can be made regarding embedding a serious game such as *Ready!* into the overall DRR process and ensuring proper linkages to all other training components from an instructional point of view. There are examples where playing *Ready!* resulted in identifying innovative preparedness actions that were not thought of within the common focus group discussions (Macklin, 2014).

Regarding the game design itself it was striking that, although the NGO staff players mentioned being absorbed in the game, they were not highly challenged by the game. This might be related to the fact that the players had already a considerable track record in disaster management themselves, but were enthusiast about the potential for using the game with communities. The relation between engagement and absorption in the game has to be further evaluated for the people in the community who have no or very little background in disaster management. It is important to take sufficient time for planning, playing and reflection and not rush as participants indicated that they felt the pace of the game was high. For this pilot, no localization and contextualization of the game was done, apart from someone who translated the English speaking facilitator once in a while into Bengali. Adapting some of the pictures and having the facilitator speak in Bengali might enhance the effectiveness of the game. Furthermore, we envision integrating the early warning communication component deeper into the game (for example using mobile services for flood early warning) to see if this would be beneficial for assessing and improving warning communication and thus influence the actions taken by the end users. Much remains to be done to understand and address the challenges of learning evaluation involving games for DRR. We hope that this experience can help practitioners embarking on future initiatives.

ACKNOWLEDGMENTS

REFERENCES

1. Alvarez, K., Salas, E., and Garofano, C.M. (2004). An integrated model of training evaluation and effectiveness. *Human resource development review* 3 (4), 385-416.
2. Bakhuys-Roozeboom, M., Oprins, E., Visschedijk, G. (submitted). Opening the black box of learning with serious gaming: the effectiveness of three serious games measuring generic learning features. *British journal of educational technology.*
3. Chin, J., Dukes, R. and Gamson, W. (2009). Assessment in simulation and gaming: a review of the last 40 years. Simulation & Gaming, vol. 40, no. 4, pp. 553–568, 2009.
4. Connolly, T.M., Boyle, E.A., MacArthur, E, Hainey, T. and Boyle, J.M. (2012). A systematic literature review of the empirical evidence on computer games and serious games. Computers and Education, vol. 59, no. 2, pp. 661–686.
5. Cordaid (2013) Building Resilient Communities: A Training Manual on Community-Managed Disaster Risk Reduction. Available at: http://www.cordaid.org/nl/publicaties/building-resilient-communities-training-manual-community-managed-disaster-risk-reduction/ [Accessed 27. 01.2014]
6. Coughlan de Perez, E., van den Hurk, B., van Aalst, M., Jongman, B., Klose, T., and Suarez, P. (2014). Forecast-based financing: an approach for catalyzing humanitarian action based on extreme weather and climate forecasts. *Natural Hazards and Earth System Sciences Discussions*, 2(5), 3193-3218.
7. Cumiskey, L., Altamirano, M. and Hakvoort, H. (2014). Mobile Services for Flood Early Warning, Bangladesh: Final Report. Deltares, Cordaid, RIMES, Flood Forecasting and Warning Center. The Netherlands.
8. Gonsalves, A. Ternier, F. de Vries, F. Specht, M. (2011). games at the UNHCR with ARLearn, a toolkit for mobile and virtual reality application. In Furht, B. (Ed.) Handbook of Augmented Reality.
9. Gordon, E., Walter, S. and Suarez, P. (2014). Engagement Games: A case for designing games to facilitate real-world action. Boston: EGL. Available at: http://engagementgamelab.org/pdfs/engagement-game-guide.pdf [Accessed 27. 01.2014]
10. Hays, R. T. (2005). The effectiveness of instructional games: a literature review and discussion. Naval Air Warfare Center Training Systems Division, 1–63.
11. IFRC (2014) Bangladesh: Floods, Information bulletin n°2, International Federation of the Red Cross. Available at: http://reliefweb.int/report/bangladesh/bangladesh-floods-information-bulletin-n-2. [Accessed 27. 01.2014].
12. Kraiger, K., Ford, J.K., Salas, E. (1993). Application of cognitive, skill-based, and affective theories of learning outcomes to new methods of training evaluation. *Journal of applied Psychology* 78 (2), 311-328.
13. Macklin, C. (2013), *Ready*! Lessons in the design of humanitarian games. Red Cross Red Crescent Climate Centre Working Paper Series No. 3. Available at: http://www.climatecentre.org/downloads/File/Case%20studies/AW_RCCC_working%20paper%203%20READY%20web.pdf. [Accessed 27. 01.2014]
14. Mayer, I. (2012). Towards a comprehensive methodology for the research and evaluation of serious games. *Procedia Computer Science* 15, p. 233 – 247.
15. Mendler de Suarez, J., Suarez, P., Bachofen, C., Fortugno, N., Goentzel, J., Gonçalves, P., Grist, N., Macklin, C., Pfeifer, K., Schweizer, S., Van Aalst, M., and Virji, H. (2012). Games for a New Climate: Experiencing the Complexity of Future Risks. Pardee Center Task Force Report. Boston: The Frederick S. Pardee Center for the Study of the Longer-Range Future, Boston University.
16. Oprins, E., Visschedijk, G., Bakhuys Roozeboom, M., Dankbaar, M., Trooster, W. (submitted). The Game-based learning Evaluation Model (GEM): measuring the effectiveness of serious games using a standardized method. *International journal of technology enhanced learning*.
17. Parker, D. J., Priest, S. J., Tapsell, S. M. (2009) Understanding and enhancing the public's behavioural response to flood warning information. *Meteorological Applications*, 16: 103-114.
18. Patt A.G. and Gwata, C. (2002). Effective seasonal climate forecast applications: examining constraints for subsistence farmers in Zimbabwe. *Global Environmental Change – Human and Policy Dimensions* 12(3): 185-

195.

19. Pescaroli, G. and Magni, M. (2015). Flood warnings in coastal areas: how do social and behavioural patterns influence alert services?. *Natural Hazards and Earth System Sciences Discussions,* 3(1), 641-674.

20. RCCC (2014) Ready Rules and Facilitation Guidelines, RCCC, version June 28, 2013. Available at: http://www.climatecentre.org/site/ready [Accessed 27. 01.2014]

21. Suarez, P. and Bachofen, C. (2013), Using games to experience climate risk Empowering Africa's decision-makers. Accessible at: http://www.climatecentre.org/downloads/File/Games/CDKNGamesReport.pdf [Accessed 27. 01.2014]

22. Suarez, P., Mendler de Suarez, J., Koelle, B. and Boykoff, M. (2014). Serious Fun: Scaling Up Community Based Adaptation through experiential learning. In: Schipper, E. L., Ayers, J., Reid, H., Huq, S., and Rahman, A. (eds.) Community-based adaptation to climate change: Scaling it up. London, Routledge.

23. Tannenbaum, S., Cannon-Bowers, J., Salas, E., and Mathieu, J. (1993). Factors that influence training effectiveness: A conceptual model and longitudinal analysis (Tech. Rep. No. 93-011). Orlando, FL: Naval Training Systems Center, Human Systems Integration Division.

24. UNISDR (2006) Developing Early Warning Systems: A Checklist, Third International Conference on Early Warning EWC III, Bonn, Germany.

25. UNISDR (2014) Zero Draft, Post 2015 Framework on DRR. Available at: http://www.wcdrr.org/preparatory/post2015 [Accessed 07.01.2014]