

# Stop Disasters Game Experiment with Elementary School Students in Rio de Janeiro: Building Safety Culture

**Felicio, S.P.A.S**

UFRJ

soraiapas@gmail.com

**Dargains, A.R.**

UFRJ

andre.dargains@gmail.com

**Sampaio, F.**

UFRJ

felippess84@gmail.com

**Gomes, J.O.**

UFRJ

joseorlando@nce.ufrj.br

**Silva, V.S.R**

UFRJ

prof.vivianerodrig@gmail.com

**Souza, P.R.A**

UFRJ

prasouza@msn.com

**Carvalho, P.V.R.**

UFRJ

paulov195617@gmail.com

**Borges, M.R.S.**

UFRJ

mborges@nce.ufrj.br

## ABSTRACT

Currently, the city of Rio de Janeiro is in total evidence, hosting important events such as the Pope's Francis' visit in 2013, the World Cup in 2014 and the Olympic Games in 2016. In order to make the population aware, of some environmental problems this article was produced to analyze what factors people consider dangerous. In 2011, Rio de Janeiro went through difficult times, caused by one of the biggest floods seen in the city which ended up partly destroying cities of the state's the mountain region. Kids from aged 10 to 13 years from a high school in Rio were invited to participate in a study and they had to answer questionnaires before and after playing the game. From the results obtained, we analyzed how the game "Stop Disasters" developed by the by the UN can help create awareness and learning on how to behave in flooding situations at an accelerated rate.

## Keywords

Serious Games, Educational Game, Resilience, Risk, Emergence.

## INTRODUCTION

In recent years, Brazil has suffered successive natural disasters and recently the worst natural disaster in its history. In the summer of 2011, heavy rains hit the mountainous region of Rio de Janeiro (Fig. 1), causing floods and landslides that killed 900 people and caused economic losses estimated at \$ 1.2 billion (UNISDR, 2013). In 2012, once again natural disasters have had a significant impact on Brazilian society. In Brazil, it was officially reported the occurrence of 376 natural disasters, which caused 93 deaths and affected 16,977,614 people. (Brasil – Ministério da Integração Nacional – Secretaria Nacional de Defesa Civil, 2012). Rio de Janeiro has been selected to host big events such as the World Cup, the Olympics, Pope Francis' visit and so forth. Therefore, the city should be prepared for emergencies. However, despite being one of the most attractive cities in the world when it comes to natural beauty, it is also marked by consequences of a proven physical and unstructured urban area which finds it hard to endure heavy rains always present and expected to be more intense in the summer, see Figure 1.

**Figure 1. Heavy rains in January 2011 caused mudslides in Teresópolis, Rio de Janeiro state, Brazil. (Photo: Fábio Motta/AE)**

Efforts have been made to minimize the enormous human and economic losses that occurred due to this disaster by studying and implementing preventive actions. In this context, the United Nations International Strategy for Disaster Reduction Announced the opening of the Centre of Excellence for Disaster Risk Reduction located in the city of Rio de Janeiro (Salim, 2012). While Brazil participates in the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, an international agreement and plan for coordination of disaster risk reduction and related issues.

Brazilian government agencies and the Federal University of Rio de Janeiro have shown similar efforts to contribute to disaster reduction initiatives in accordance with the Hyogo Framework (Bernardo et al, 2013). The latter emphasizes the need for effective plans of awareness raising and preparation to learn how to cope with situations arising from natural disasters, especially for the most vulnerable population.

According to Brazil - National Progress Report on the Implementation of the Hyogo Framework for Action (2011-2013), our country has an ongoing project, still in the formulation stage, to implement the theme 'Civil Defense' at Schools who shall have full teaching of the subject: "School curricula, educational material and relevant trainings include disaster risk reduction, recovery concepts and practices".

Considering the current risky scenario in Rio de Janeiro, this paper aims to conduct an initial survey on the use of games with primary school students regarding their understanding and awareness of accidents, risks and resilience.

We want to show that learning about risky situations in a playful way through computer games can be effective and raise awareness of security and resilience issues.

Therefore, in this study, an experiment using the game Stop Disasters, which was developed by the UN in order to build a safety culture related to emergency preparedness, was done with the participation of students from different areas of the city belonging to the same school. Through two questionnaires, one answered before the game and the other one after, data on perceptions and risk behaviors in emergency events were collected. Moreover, it was possible to test the effectiveness of the game Stop Disasters as a learning and awareness tool, through the analysis of the results extracted from the game and search sessions.

We hope that through the analysis of the impressions and suggestions of the children who took part in the experiment to contribute to possible improvements for future implementations of this kind of game. Even though the game 'Stop Disasters' is not an open source software, we believe in the possibility of suggesting improvements to the UN developers to collaborate with this initiative.

We also hope to be able to target, with greater accuracy and efficiency, awareness-raising and training efforts, leveraging the strengths and addressing the weaknesses with utmost care, so that a new generation, with greater knowledge about accidents and risks, can be raised. Thus, the damage in accidents will be less frequent and more efficiently mitigated, avoiding risks and losing fewer lives.

## LITERATURE REVIEW

‘Emergence’ is what happens when we try to understand the properties of a system that exceeds the size and complexity level that our intellect can grasp at once, so we decompose the system into interacting component parts (Pariès, 2006). Thus, scenario-based games represent a form of guided simulation, which could be better suited for getting to know situations of emergence.

Therefore, Serious Games (Salim, 2012) like ‘Stop Disasters’ are excellent educational tools to work with children and adolescents concepts of resilience and resistance. Games are project experiences (Squire, 2006). The use of serious games requires study to understand the full range of human practices through which players actively use the worlds of rules and strategies to make learning more meaningful than in conventional teaching.

In a simulation model, rather than solving equations, one describes the underlying mechanism and let them run over time to see what happens (Colella and Resnick, 2001). As the student will be involved in the game ‘Stop Disasters’. It is easier to incorporate random events and probability, reflecting important aspects of the world around us.

Following this idea, (Bernardo et al, 2013) one experience with the UN ‘Stop Disasters’ is going to be shown in the next topic with the goal of testing the effectiveness of the game as a learning tool and analyzing the results across the focus groups with different demographic characteristics.

Games designed for a primary purpose other than pure entertainment, generally pretended to refer to products used for education, scientific exploration, health care, emergency management, city planning, engineering, social science (Salim, 2012).

## METHODOLOGY

This study assessed a group of children aged 10 to 13 years old. They were selected at random from a high school in Rio de Janeiro. Some questions were created to verify what these children knew about the subject, while other questions evaluated aspects of the game aiming at collecting information for possible improvement, adapting it to our reality.

We used the “Stop Disasters” online simulation. At the beginning, the students are asked to choose one of five natural hazards: a tsunami, a hurricane, a wild fire hitting arid plains, an earthquake hitting lowland hills or a flood hitting a valley town. However, during the application of the game we focus only the flood scenario, since that kind of disaster is virtually the only one faced by the Brazilian population.

We conducted a pre and post questionnaire to come to the conclusions on the exploratory aspects of the game with two kinds of questionnaires. The data analyzed is described in the next section.

When applying the first kind of questionnaire, the children were divided into eight (8) groups with children aged 11 to 13 years old from different school grades, at different dates and times which meant the total amount of 185 children.

In same institution, a more elaborate questionnaire with the following groups was distributed, totaling one (1) experiment: we selected one group of the same degree of study. Finally, the quantity of participants was 23 students.

## RESULTS

### Data Analysis from the First Applying of the Game

The initial survey was conducted with students from a school in Rio de Janeiro. Prior to the first survey, a “getting to know you” form was completed with a view to profiling our population. Almost all of them had computers at home and played games on a daily basis on their computers or mobile phones. The participants completed a pre-game survey, which included questions about demographics, basic knowledge and awareness of natural disasters and appropriate behavior in emergency situations. This survey was meant to be very brief, taking in consideration the short time available with the students to conduct the experiments.

After completing the first survey, participants were randomly paired and asked to play UN’s game "Stop Disasters", in the “flood” scenario. This specific scenario was chosen due to the lack of other types of disasters in Rio de Janeiro, such as tsunamis, earthquakes or wildfires. Furthermore, a very common disaster scenario in Rio are landslides, as the topography of the city includes many hills and valleys that are also depicted in the

*Proceedings of the 11<sup>th</sup> International ISCRAM Conference – University Park, Pennsylvania, USA, May 2014*  
S.R. Hiltz, M.S. Pfaff, L. Plotnick, and P.C. Shih, eds.

flood scenario as an implicit consequence of the flooding.

The participants were then asked to complete a post-game survey, with similar questions from the pre-game survey, in order to examine and validate the gains during the playing session. The survey also asked for feedback and suggested improvements for the game, from the students' point of view.

Thus, it is possible to conclude that the game "Stop Disaster" raised awareness of natural disasters such as flooding, faced by the population of Rio de Janeiro.

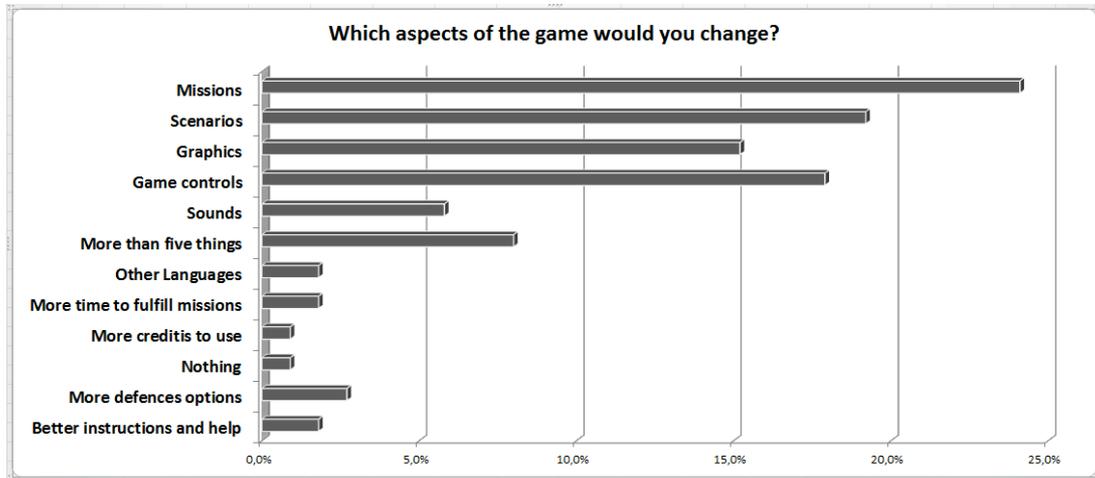


Figure 2. Aspects of Game – Stop Disaster

Despite the fact that the game was not available in the Portuguese language, the native language of the students, less than 5% identified it as an aspect to be changed. Showing that the language was not a restrictive factor for playing the game.

Between 10% and 15% of the students believe that the sound effects should be reviewed. Between 15% and 25% of the students would change the game controls, the scenarios and the graphics.

Finally, almost 25% of the students indicated that the missions need to be reviewed. This makes us believe that the missions were either too difficult to be met thus discouraging the players or were completed easily and needed to become more challenging. Nevertheless, the need to have some more specific feedback on the real impressions of the students about the game for future improvements was identified.

**Data Analysis from the Second Time Applying the Game**

In a second experiment, we used the same questionnaires as in Bernard et al, 2013 in order to obtain more precise feedback on the impressions the players of "Stop Disasters" had as well as to confirm the results already found in the work cited above (the data used in this article are from 2012).

This second phase brought light to the students perspectives and also new information given that the second pre and post-questionnaires were more complex than the ones used on the first time, and were answered by students that had not participated in the previous test.

Differently from Fig. 2, Fig. 3 pointed to other ways to promote interest in the game, by implementing the following improvements: advanced levels; points; playing it with another person. This issue was present in the pre-test points and features which express the preferences of the players. Such features are not present in the game "Stop Disasters" and would be good suggestions for future improvement.



Figure 3. Graphic depicting the aspects that the participants liked the most about the game

It is interesting to notice that throughout the experiment the participants often got excited about the game, shouting together the countdown to the disaster and writing down the rank and the scores. Most of them (91.3%) stated that they would play the game again, pursuing the perfect scenario - minimal losses of human lives and damage, as shown in Fig. 4.

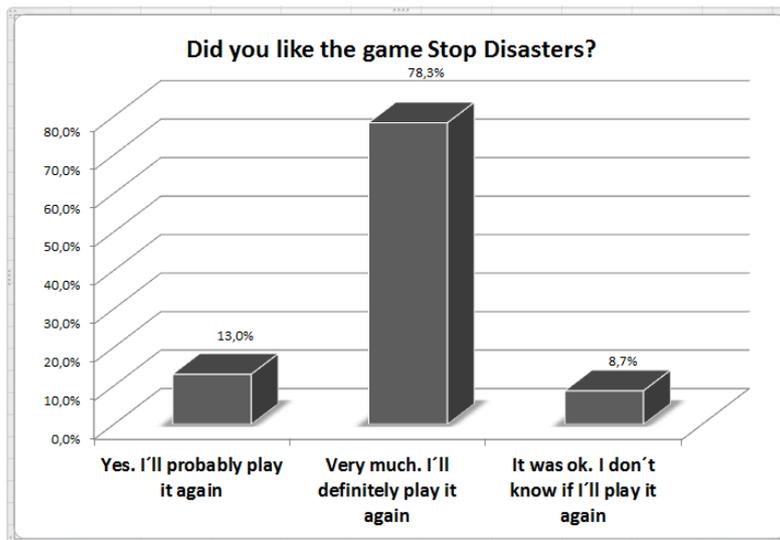


Figure 4. Graphic depicting the participants' opinion about the game

The post-survey results showed that there was a gain in some aspects concerning knowledge and awareness regarding disasters and risk control. When asked about what a risk map is, the percentage of students that answered "I don't know" went from 20% to 4%. The percentage of students that answered the right answer (A map that shows the probabilities for the occurrence of accidents) increased by 5%. These improvements were obtained due to the strategic nature of the game (refer to Fig. 5).

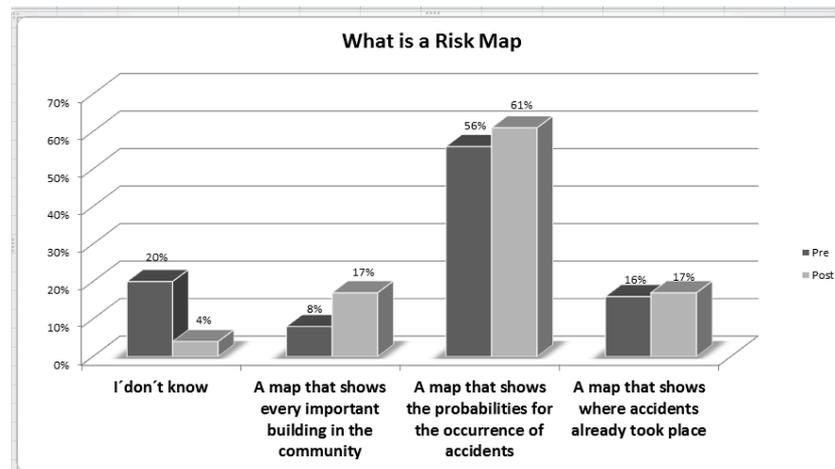


Figure 5. What is a Risk Map?

## CONCLUSION

Natural disasters are often impossible to avoid. However, it is possible to understand how they work and the sequence of events involved through the application of simulations of these events. It would be beneficial for the population of Rio de Janeiro if the whole system, the people and institutions got involved in understanding the importance of resilience. Thus, people would learn how to react to tragedies like these that periodically occur in Rio de Janeiro, as well as learn how to mitigate the risks of these kinds of accidents.

The experiment showed that the game needs to be improved in many ways to become more attractive, such as graphics, missions, game control and sound. According to the results, the most important aspects in a game are “To advance levels”, “Earn points” and “Multiplayer”, showing a strong reliance on feedback and competitive profile among the gamers. There have been some gains in terms of understanding the natural disasters topic. In the question “What is a risk map?”, before playing the game 20% of the students did not know what it meant, but after playing the game almost all students knew how to answer the question.

We have concluded that the use of educational games can raise awareness about natural disasters as shown in the results. The research indicated that the students who responded to the questionnaires and played the game “Stop Disaster” did not know initially exactly how to react to moments of chaos: flooding and landslides among others disasters, or how to protect their own lives. Bearing in mind that the city of Rio de Janeiro features such risky situations we conclude that serious games are an important tool to promote resilience. We can say that based on the fact that the children who have played the “Stop Disaster” game have significantly changed their perception of the risks faced in the tests, indicating that the use of educational games raise awareness about the subject.

## ACKNOWLEDGMENTS

We would like to thank the teachers of the Federal Institution of Rio de Janeiro and the students who willingly participated in the whole experiment.

## REFERENCES

1. Bernardo, K. B. , Cannabrava M.P, Trystyn K. R., Michelle C. H., Molly E. K., Joseph T. M., Bernardo B. R., Gomes J. O., and James H. L.. (2013) Evaluating Preparedness and Resilience Initiatives for Distressed Populations Vulnerable to Disasters in Rio de Janeiro, Brazil - Published in Systems and Information Engineering Design Symposium (SIEDS) IEEE , pg 58-63, ISBN 978-1-4673-5662-6, Charlottesville, VA, april, 2013 .
2. Brazil National progress report on the implementation of the Hyogo Framework for Action (2011-2013), Retrieved from [http://www.preventionweb.net/files/33056\\_bra\\_NationalHFAprogress\\_2011-13.pdf](http://www.preventionweb.net/files/33056_bra_NationalHFAprogress_2011-13.pdf), november, 2013.

3. Brasil. Ministério da Integração Nacional. Secretaria Nacional de Defesa Civil. Centro Nacional de Gerenciamento de Riscos e Desastres. Anuário brasileiro de desastres naturais: 2012 - Centro Nacional de Gerenciamento de Riscos e Desastres. - Brasília: CENAD, 2012. 84 p.: il. color.; 30 cm. , Retrieved from [http://www.integracao.gov.br/c/document\\_library/get\\_file?uuid=f22cccd-281a-4b72-84b3-654002cffe6&groupId=185960](http://www.integracao.gov.br/c/document_library/get_file?uuid=f22cccd-281a-4b72-84b3-654002cffe6&groupId=185960), 2013, November
4. Colella, V.; Klopfer, E.; Resnick, M. *Adventures in Modeling: Exploring Complex, Dynamic Systems with StarLogo*. Teachers College Press, 2001.
5. Crookall D., Kiyoshi A. *Simulation and gaming across disciplines and cultures: ISAGA at a watershed* (pp. 178-187). Thousand Oaks, CA: Sage, 1995
6. Druckman, D. The educational effectiveness of interactive games, In D. Crookall and K. Arai (Eds.), 1995.
7. United Nations International Strategy for Disaster Reduction Hyogo framework for action 2005 - 2015: Building the resilience of nations and communities to disasters. United Nations World Conference on Disaster, 2007. Reduction. Retrieved from [http://www.unisdr.org/files/1037\\_hyogoframeworkforactionenglish.pdf](http://www.unisdr.org/files/1037_hyogoframeworkforactionenglish.pdf), 2013, November 11.
8. Hoffman, R.R.; Andrews D. H. and Feltovich, P.J. What is "Accelerated Learning?". Institute for Human and Machine Cognition Stephen M. Fiore, University of Central Florida. IEEE Intelligent Systems, 2012
9. Hollnagel, E. Resilience: The Challenge of the Unstable In Resilience Engineering: Concepts And Precepts, pp. 9-17 edited by Erik Hollnagel, David D. Woods, Nancy Leveson, 2006.
10. Metcalfe, Janet and Shimamura, Arthur P. *Metacognition: knowing about knowing*. Cambridge, Massachusetts, 1994
11. Meesters, K. and Walle B. Disaster in my backyard: a serious game introduction to disaster information management, Proceedings of the 10th International ISCRAM Conference – Baden-Baden, Germany. T. Comes, F. Fiedrich, S. Fortier, J. Geldermann and T. Müller, eds, 2013
12. Pariès, J. Complexity, emergence, resilience - Chapter 4 - In Resilience Engineering: Concepts And Precepts, pp. 39-48 edited by Erik Hollnagel, David D. Woods, Nancy Leveson, 2006.
13. Salim, D. Brazil to open centre of excellence for disaster risk reduction, 2012. Retrieved from <http://www.unisdr.org/archive/24792>, 2013, November 11.
14. Squire, K. D. From Content to Context: Videogames as Designed Experience. Educational Researcher, 2006. Retrieved from [http://legacy.aera.net/uploadedFiles/Publications/Journals/Educational\\_Researcher/3508/10289-03\\_Squire.pdf](http://legacy.aera.net/uploadedFiles/Publications/Journals/Educational_Researcher/3508/10289-03_Squire.pdf), 2013, November.
15. Vargas M. R. R., et al. Safety Villages: a computer game for raising children's awareness of risks, Proceedings of the 9th International ISCRAM Conference – Vancouver, Canada, 2012
16. UNISDR Campaign (International Strategy for Disaster Reduction) in Partnership With the Secretary of Defense National Civil - Rio de Janeiro in Search of Resilience Front Heavy Rains, 2013. Retrieved [http://www.rio.rj.gov.br/dlstatic/10112/4402327/4109121/RIODEJANEIRORESILIENTE\\_2013.pdf](http://www.rio.rj.gov.br/dlstatic/10112/4402327/4109121/RIODEJANEIRORESILIENTE_2013.pdf), 2013, November.