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PERFORMANCE AND EVALUATION OF DISASTER IMAGINATION GAME (DIG) IN CHILE

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Abstract

As one of the practical performances of disaster prevention education and/or practice, Disaster Imagination Game (DIG) is frequently performed in Japan. DIG is a simple disaster prevention training method that can be planned and operated even by non-professionals using maps. DIG has been improved to be used effectively and practically to enhance local disaster prevention capability.

We introduced the DIG into Chile and performed it in four cities: Talcahuano city where severe damage was caused by the tsunami due to the 2010 Maule earthquake; Iquique city, stroke by an earthquake and tsunami in 2014; and Valparaíso and Viña del Mar where tsunami disaster is anticipated in the future.

First, we rearranged the method to be applicable in the societies in Chile and made a plan, i.e., selecting the participants, making scenario and determining how to evaluate the effect. The first DIG was performed in Talcahuano city, where about 150 citizens participated, including among them many leaders of communities in the city. They were divided into two main groups, Group A and group B, and each group was divided into seven or eight subgroups based on their residence areas. Each subgroup consists of about 10 members.

Each group practiced in two main stages. In the first one, they work over a map searching for safe places as well dangerous places against tsunami attacking, how to evacuate from it, how to help others especially children, old people and handicapped persons, etc., while writing onto their area maps with exchanging their opinions. After the performance, they discussed and shared information, such as what were the causes of obstacles for evacuation and how to solve the problems and so forth.

In the second stage, they did the role playing under the situation that disaster information was given to them one after another. They had to make decisions and respond to the information in succession. At the end of the performance, discussion and evaluation were made again. Most of them experienced the 2010 tsunami disaster, so they could seriously think about the situation and recognized the importance of such kind of simulation even though it was just an imagination.

In Valparaiso, the target of the DIG session was to refine the guide that was prepared before Talcahuano's sessions. For that purpose, the method was applied for a reduced group or persons, mainly high school students and teachers. This allows giving a detailed introduction of the hazard conditions, and a fruitful discussion at the end. Similar performances were carried out in Iquique and Viña del Mar.

Based on the performances, we made a guideline of DIG in Chile. The contents are as follows; Chapter 1: What is DIG, Chapter 2: What we prepare, Chapter 3: How to perform, Chapter 4: Evaluation, Chapter 5: Application of DIG to other disasters. We are going to disseminate the DIG in Chile.

Keywords: Disaster Imagination Game; DIG; Disaster Risk Reduction; Tsunami Disaster; Earthquake; Vulnerabilitiy.

1. Introduction

As one of the practical tools for disaster prevention education and/or practice, Disaster Imagination Game (DIG) is frequently performed in Japan. DIG is a simple disaster prevention training method that can be planned and operated even by non-professionals using maps, and it has been improved to be used effectively and practically to enhance local disaster prevention capability. For those reasons and surely many others, it was considered as one of the options to be analyzed and applied in Chile, as part of a joint research project between Japan and Chile, aiming to develop technologies for creation of tsunami resilient communities. The origin of that research project was basically the earthquake and tsunami that stroke the central region of Chile on February 27th, 2010, commonly called "The Maule Earthquake". One year after, the Great Earthquake of East Japan, namely Tohoku Earthquake, stroke the Japanese land on March 11th, 2011. Those events demonstrated again the importance of preparation and scientific research for the understanding of natural hazards, earthquake and tsunami in this case, and the fundamental need for reduction of vulnerabilities in human systems. So, DIG was assumed as a tool to be introduced in Chile aiming to reduce vulnerabilities in the coastal zones.

DIG was originally developed in Japan to be used as training and educational tool, thanks to the joint work of the Prefectural Government of Mie, and the National Institute for Defense Studies (Gifu Prefectural Government, 2010). It is a simple, low cost and versatile methodology, and very effective for strenghthening of local capacities for disaster prevention.

Both Chile and Japan are permanently exposed to natural hazards. Both countries have great strengths and great weaknesses, but Japan undoubtedly has much greater development and knowledge in the sciences associated with Disaster Risk Reduction (DRR) and its practical application. DIG is an example of this, because it comes from a professional and scientific work focused on delivering knowledge and tools to ordinary citizens, specialists or decision-makers, to be able to successfully deal with potential natural disasters, from their respective roles. This is very relevant, since the adaptation of human systems (cities, communities, industries, etc.) to changes in the environment, necessarily involves strengthening local communities. It means, involving the people in the analysis of the impacts that a natural disaster can cause over their territory, resources, community and way of life, all with an individual approach, but at the same time deeply collective.

As has been mentioned, the DIG method was created in Japan, and its practice has been developed mainly in that country, so there is a specific cultural and educational basis in its genesis. Therefore, its importance was considered when applying the methodology in Chile, looking for a social and cultural adaptation of the method. Thus, a fundamental aspect that was observed and analyzed during test sessions of the method was the basis of knowledge that people have about natural disasters, in this case a near-field earthquake and tsunami.

During the test of the method, through 4 sessions with different participants, several adaptations were propose for improvement of the methodology, and the most relevant is the structure of activities following a systemic conceptualization of vulnerabilities, which is considered also for the design of an introductory lecture and an evaluation instrument. In other hand, some methodological recommendations from the Japanese methodology were not necessary to introduce, also due to cultural reasons, as the case of "ice breaking" processes.

2. Methodology

2.1 Basic aspects of DIG

The acronym DIG is an abbreviation of "Disaster Imagination Game", and also means digging, explore or make a hole in the ground. This can be understood as "deepening disaster risk awareness and prevention", "explore the area" or "understand the disaster," and in that sense its application focuses [1].

DIG is a kind of workshop for disaster prevention. Whether it is performed for professional citizens, or for common people, any age or gender and without specific training, the participants are arranged around a large map, coloring and drawing symbols on it, as they discuss the aspects of the disaster on the territory under study. Usually the discussion is a funny activity, and the enthusiasm of participants during the work is evident. Thus,

participants can detect weaknesses and strengths, clarifying their understanding of their own situation and their territory regarding to the occurrence of natural disasters. As a result, opportunities and limitations are evident, and so they can discover new directions for actions of disaster prevention in the community [1].

For the prevention of natural disasters, it is fundamental to recognize the particularities of a disaster that may occur in a given territory. This involves understanding the particular characteristics of the threat (for example, an earthquake, tsunami or storm) and the exposed system (a city, a company, a school, etc.). While DIG participants are marking and coloring the map, they must answer questions about where, how big and what kind of damage can happen if the threat occurs? Thus, with DIG is possible to imagine more specifically what would happen due to a natural disaster in a given territory.

By looking at a map or an aerial photo of a territory it is possible to find a large amount of information. And while drawing or writing more information on the map the participants can understand the study area and its components, with fair consideration of its complexities. By thinking, talking and arguing about the dangers and important facilities, they improve the understanding of the territory. Then, its strengths and weaknesses become more familiar and understandable. Therefore, to play DIG is a way for participants to "rediscover" their own territory [1].

One of the vulnerabilities that usually emerge during a DIG session refers to the support necessary for some groups of people in a given territory: Questions like “where is the people who need emergency support?”, or “is there someone who needs help in my neighborhood?” can be easily answered thanks to team work, and using few material resources. By collecting those answers and registering them during the game, the participants can access to fresh information about their community and realize the requirements and importance of generating solidarity networks, which are of tremendous value during a natural disaster. In other words, through DIG the relationships between people are nurtured and strengthen, thus increasing their resilience capacity [1].

The methodology proposed in this guide is based on the recommendations from the manual developed by Gifu Prefecture, Japan [1]. In that document a flow chart for DIG is proposed, basically describing the activities for coordination previous to the working session, and the activities under responsibility of the implementation team during the performance, both of fundamental importance for a successful game. In summary the activities necessary for a DIG session refers to preparatory work, logistics and coordination.

2.2 Test sessions

The test sessions were held in the cities of Talcahuano, Valparaíso, Iquique and Viña del Mar. The table 1 summarizes the work done, in terms of lessons learned.

Table 1 – DIG sessions performed in Chile.

CITY	PARTICIPANTS	LESSONS LEARNED
TALCAHUANO (April 20th - 24th, 2015)	People with several backgrounds, villagers in general, some community leaders. They were part of a community risk management course, given by the local government.	• The method is sensitive to the number of participants. Ten persons by group is a good quantity. • The scale of maps is fundamental, allowing to work over a manageable territory, without difficulties for drawing and adding information onto the map. • As DIG sometimes became very intense in conversations, the acoustic conditions of the room should be controlled, thus reducing the excessive or uncomfortable noise. • The vocabulary used for explanations by the implementation team should be as simple as possible, avoiding to use too much technical

		terminology. • The methodology must be easy to be explained and understood, thus facilitating the start up of the game. • The experience of the implementation team regarding to disaster prevention activities is very important, and can be an improvement for DIG. • The introduction of techniques from role-playing games is useful to make people recognizing different conditions during a hypothetical disaster. • The methodology facilitates the detection of hot spots of risk in the territory.
VALPARAÍSO (August 24th, 2015)	High school students and teachers from high schools, public and private, from the *Almendral* neighborhood.	• It is important to avoid hierarchical relations between participants, because it can block the active participation of some persons, especially younger people. That is particularly relevant in the school context, reducing the influence of teachers in the working group.
IQUIQUE (November 13th, 2015)	Community leaders and urban rescue specialists.	• In spite of the basic level of analysis that was planned for this session, the experience, attitude and skills of participants allowed a more specific discussion. • The methodology allows to generate advanced discussions or to talk about more complex thematic.
VIÑA DEL MAR (September 17th, 2015)	High school students	• The leaderships are evident when the discussion is open and relaxed. As noted in the 2nd session, the hierarchies should be avoid.

2.3 Adaptation of the methodology

During the year 2015, four sessions of DIG were performed in coastal cities of Chile, as a test for the implementation and adaptation of the method. The work plan is outlined in Fig. 1, where can be observed the systematization of the activity, with particular focus on disasters related to earthquake and near field tsunami. Four main aspects of vulnerability are established, regarding to its association with the people's behavior before, during and after the occurrence of the hazard, and that can be mitigated with specific knowledge [2]. A fifth aspect related to particular and specific issues that may arise from work in DIG is considered, as an ending activity, usually moving to conclusions about local conditions of the territory under analysis. These five components of the adapted methodology are:

- Knowledge about hazard scenarios
- Knowledge about conditions of lifelines, transportation systems and other facilities
- Knowledge about building conditions
- Knowledge about human impacts
- Analysis and group conclusions

For practical aspects, the flow chart proposed in the reference [1] was expanded and modified, with the result shown in Fig. 2. It conserves the preparatory, logistical and coordination aspects, but with emphasis in the

control of knowledge transference process. But, the final stage of process is described with more detail, defining activities for time control, and for the adaptation of the methodology. For that, the fundamental importance of the theme introduction is key factor. In fact, during the initial lecture for theme introduction during test sessions, was evident the need of knowledge that Chilean people have, showing interest during the lecture. It is only comparable in terms of importance, maybe just with the recent experience of a near field tsunami, like Talcahuano's people have. However, as in Chile there is lack of formal education programs on Disaster Risk Reduction (DRR), the experience is not enough. And, just following a conservative criteria, all the people needs knowledge about this, anywhere in the world.

Another aspect that should be take into account for the justification of this methodological adaptation, is the scarcity of resources that the educational system can show. Material resources don't need to be so necessary for DIG, but it is evident that with better material and more time, a better work can be done. Anyways, the material requirement for this method is not too hard to get in Chile, and probably the scarcest resource is time and people to organize and manage a DIG session, like teachers. However we think that this methodology is flexible enough to overpass those barriers, because it allows structuring the time schedule of the game, minimizing resources needed and having good results.

Regarding to practical aspects, two main adaptations where introduce: the use of satellite images from Google Earth© instead of maps; and the introduction of role playing together with the detailed description of disaster scenarios.

In terms of evaluation, it was performed using a qualitative instrument for self-evaluation, considering the four components of knowledge (A, B, C and D in Fig. 1), and with a fifth item for general evaluation of knowledge about earthquake and tsunami disaster in the city. The qualitative scale used for this evaluation is shown in Table 2.

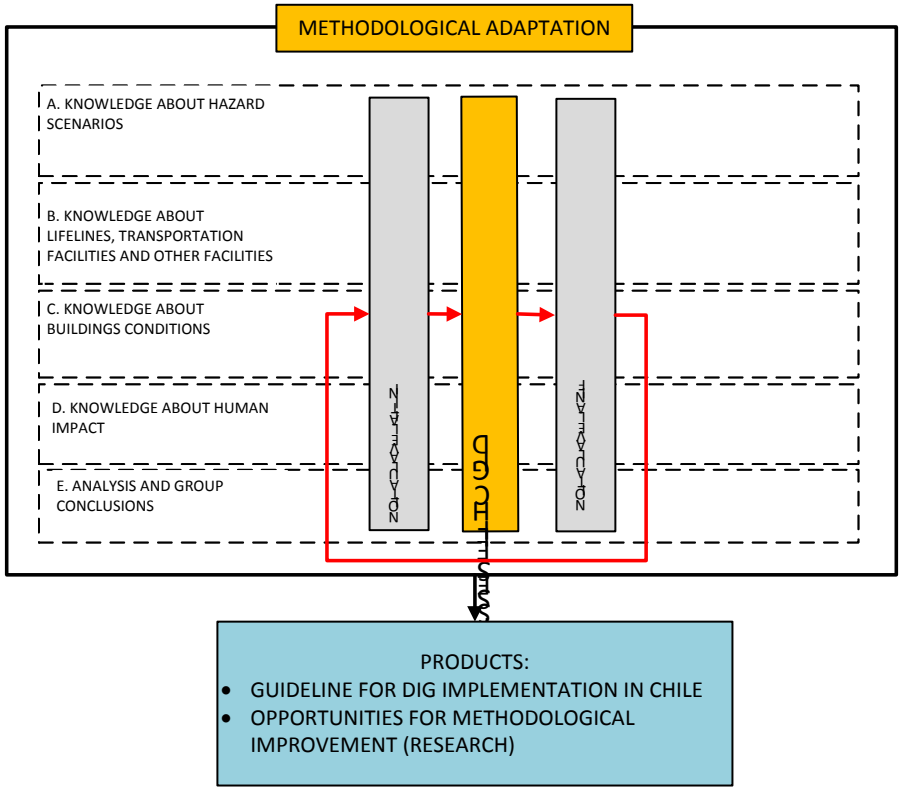

Fig. 1 – Work plan for adaptation of DIG methodology in Chile.

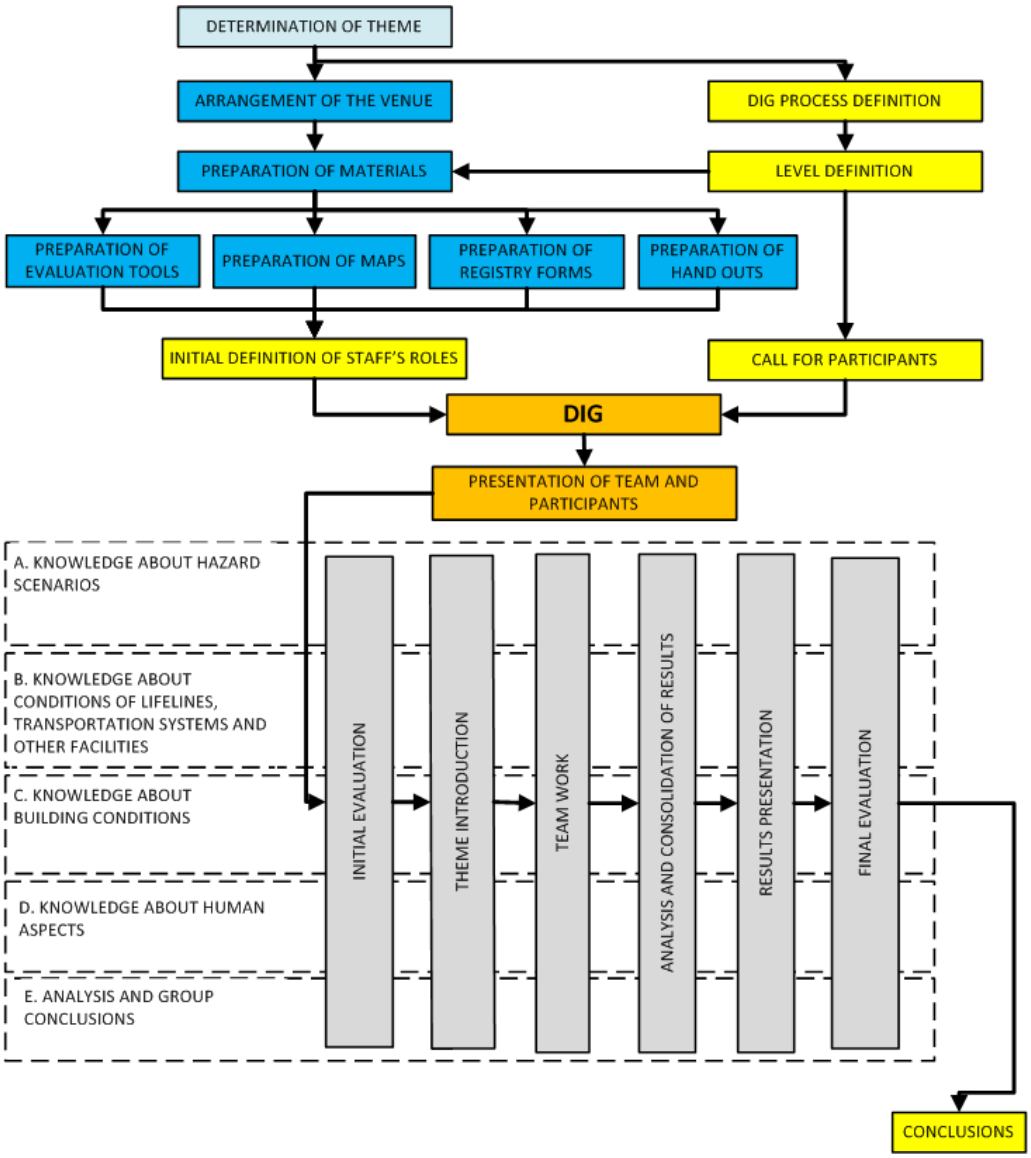

Fig. 2 – Flow chart for adapted methodology

Table 2 – Qualitative scale for self evaluation.

QUALITY LEVEL	QUALITY INDEX
VERY BAD	1
BAD	2
NORMAL	3
GOOD	4
VERY GOOD	5

3. Results

The evaluation process was implemented in all test sessions. However, the evaluation at Talcahuano city was not considered for final calculus, because it was not representative of DIG activity in exclusive way due to

distortions in the final process. So, the evaluation process is representative of the test sessions at Valparaíso, Viña del Mar and Iquique. Those three sessions where performed using satellite images instead of maps, The Fig. 3 shows a radar chart with average results, where a general improvement in knowledge quality can be observed. However, through hearing the participant's opinions after each session, a need for a better evaluation instrument arise, because the initial evaluation looks overestimated.

Regarding to the general performance of the game, 19 participants over 31, wrote comments in the answers sheet. All those comments are positive or thankful. The word cloud is shown in Fig. 4, where the font size is proportional to the frequency of use of each word in the registered comments.

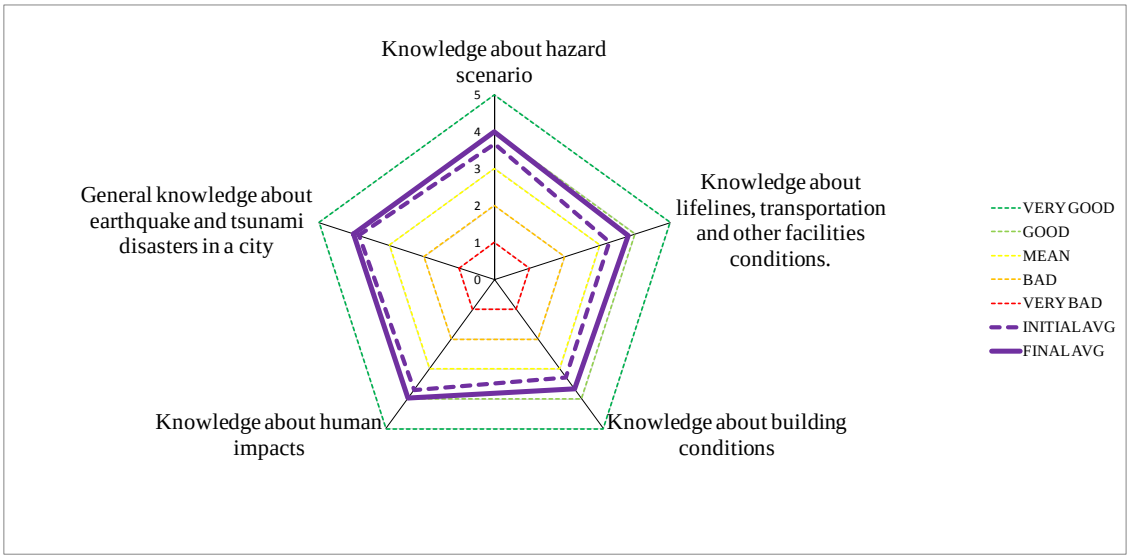

Fig. 3 – Radar chart with average results from self-evaluation.

Fig. 4 – Word cloud for comments. Elaborated using [3].

4. Conclusions

The observations and results found in this research and exposed in this document, allow us to conclude that the DIG is applicable in Chile. Taking into consideration the cultural and educational context of the country, its application can be more effort-demanding, as it requires levelers elements of knowledge for the participants. For

that reason, the proposed methodology has been adapted for the cultural and economical context of Chile, and it can be use in a wide range of conditions, thanks to its versatility, low cost and easy application.

The evaluation performed shows an increment of the quality of knowledge about near field tsunami disaster risk, but more studies are needed for a better measurement of that increment. However, the results obtained and commentaries given by participants about the game are very positive.

Based on the DIG performances, a Guideline for Implementation of DIG in Chile was prepared The contents are as follows; Chapter 1: What is DIG, Chapter 2: What we prepare, Chapter 3: How to perform, Chapter 4: Evaluation, Chapter 5: Application of DIG to other disasters. We are going to disseminate the DIG in Chile.

The next steps of this research will be toward the improvement of didactic aspects of the methodology, and its massification.

5. Acknowledgements

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6. Copyrights

7. References

[1] Gifu Prefectural Government (2012). *Disaster Imagination Game (DIG) Guidebook for Leaders.* Gifu-shi, Japan.

[2] Reyes M, Miura F. (2015). A Proposal of Qualitative and Quantitative Analysis Method for Vertical Evacuation from Tsunami in Coastal Cities. *ICE Coastal Management Congress.* Amsterdam, Netherlands.

[3] Davies J.(2016). *Word Cloud Generator*. www.jasondavies.com. [Internet].