

## Water Care Through Gamification: a discussion about its implementability

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### Abstract

It is a reality that the farther from the city people are the more aware they are about water conservation. In undeveloped countries there are continuous efforts, such as social programs, to educate about water conservation, but still, there's not much impact from them. This could be due to the lack of proper water education at home. On a day-to-day basis, it seems we are not aware of the importance of water conservation.

We found an alternative to teach people the value of water conservation in the form of gamification, generating awareness through an activity that most people, regardless of age like to do: play. Strategy games are popular, where intelligence, technical skills, and planning are crucial to guide the player to victory. In this kind of game, it is necessary to gather resources, such as iron, food, wood, etc., but in fact, water is necessary to obtain all of those in real life, so, why not consider it?

We worked with a group of participants, who tried the game. In it, it is simulated living a week with a limited amount of water. The player had to emulate the activities that take part in the use of water and has the possibility to make changes in their habits. We obtained a favorable response from those who played the game. They stated that they learned something about water conservation that they didn't before.

**Keywords:** Gamification; Water conservation; Gameful design; Simulation.

### 1. INTRODUCTION

Today, it is highly evident that we are not aware of water conservation and, generations that have grown up in first-world cities hardly perceive that a shortage of water exists, due to the apparent accessibility of water by simply using the tap.

It is hard to assume that water is running out on a planet made up mainly of water, but not all water is suitable for human consumption, with only 0.2% considered freshwater. For the year 2030, if the current rate of water consumption continues, 40 percent of the liquid that the planet would need to survive will be missing, which could generate conflicts between different economic sectors and between countries, according to a report by the Organization of United Nations for Education, Science, and Culture. The absence of clear awareness of the magnitude of the problem on the part of the world population (in many cases not autonomous enough to react), results in a lack of timely and necessary corrective measures and an inability to infuse work concepts with a resonance more concrete as indicated by the United Nations Report on the Development of Water Resources in the World [The World Water Development Report (WWDR)][1].

It is also difficult to understand that water quality is changing and that it is increasingly difficult to have access to drinking water. In Mexico, the water that is used for drinking or cooking is mostly available in the form of bottled water (industrially treated), a clear example of this is in one of our workgroups, only 5% consume tap water that they themselves purify, the rest buy purified water, resulting in an economic impact that is too high for a developing country. If this economic resource were to be used to improve existing infrastructure and the quality of water, it would positively impact the quality of life as well, especially since it is knowing that most diseases, especially in places far from large cities, are caused by poor water quality, which is ratified in the Agenda 21 of the United Nations conference, that states that 80% of all diseases and more than a third of deaths in these countries are caused by the consumption of contaminated water (Lozada, P.T., Vélez, C.H.C., & Patiño, P. 2009).

Gamification comes from the word game. It is the adaptation of the different parameters and dynamics, seen in games of various kinds, applied in other areas that aren't conventionally related to this type of entertainment. All resources are generally closely tied to emotions, and these are the main means used to connect with participants. In this way, it is possible to capture their attention and arouse interest. This facilitates the internalization of content after obtaining an experience different, positive, and full of learning. Gamification has become one of the most notable technological developments for human engagement. Therefore, it is not surprising that gamification has especially been addressed and implemented in the realm of education where supporting and retaining engagement is a constant challenge, in the results of a review of empirical literature a considerable majority of the studies reported mainly positively oriented results. However, while the results seem promising, there is also a significant amount of research with null or mixed results (Majuri, J. Koivisto, J. Hamari, J. 2018).

In this work, you will find at point two how the simulation was developed, the methodology, its specifications, study cases, and tools; at point three, Results and discussions; at point four conclusions and comments by the users.

## **2. HOW THE IDEA WAS BORN**

It is a reality that the farther from the city people are the more aware they are about water conservation. In undeveloped countries there are continuous efforts, such as social programs, to educate about water conservation, but still, there's not much impact from them. This could be due to the lack of proper water education at home. On a day-to-day basis, it seems we are not aware of the importance of water conservation.

With this, a question arises, which could be that there is a relationship between the tendency to increase the use of water within the land-living zone, the socioeconomic level of the user, and the lack of awareness about their use of water.

We found a way to increase awareness about water conservation in games. It has been proven that game-based learning (gamification) brings benefits to children (Zosh, Jennifer N., et al. 2017), with good learning results without being tedious, and considering that young people as well as adults also like games, it is then proposed that through a game or simulation, the user can experience the management of water resources, and also, seeing in a short amount of time the water that is consumed in a week, makes for the internalization of the importance of this resource for life on this planet.

The idea appeared in the classroom, while we analyzed the amount of water that young people use in their day to day, considering that the type of supply in the region is intermittent, we came up with the idea of trying to "cope" the week with a certain amount of water. The motivational effects over time in need-supporting gamification in education illustrated by Van Roy, R. Zaman B. (2018) show the significance of the individual nature of motivational processes, the importance of sensitive longitudinal motivation measurements, and the relevance of the implemented game elements' design characteristics, beneficial for the developing of the simulation.

Considering that there are games that have somehow managed to make us aware of our actions and the implications they have, as is the case of the Human shield game, developed by the BTR Consulting, based in Argentina, has developed a video game which aims to make companies/users aware of the dangers of networks, we consider this can work [2] or others that make the sustainability message more compelling and accessible by employing games and social simulations in their areas of activity [3] to simulate specific situations to learn about it.

### **2.1 Specifications**

To establish the simulation was necessary to define the context of where to develop it, to apply it within a familiar scenario as well as limit the amount of water that would be available per user. Relying on the regulations in the country, as given by the national water commission (CONAGUA) to obtain information, some domestic water consumptions were found [4]. Shown in tables 1, 2 and 3, that depends on different variables.

**Table 1.** Domestic consumption in rural areas

Use	Water consumption liters/inhabitant/day
Drinking, cooking and cleaning	30
excreta disposal	40
personal cleanliness	30

**Table 2.** Estimated average drinking water consumption, classified by the prevailing climate

Climate	Water consumption liters/inhabitant/day		
	Low	Average	High
Hot and humid	198	206	243
Hot and sub-humid	175	203	217
Dry or very dry	184	191	202
Warm or cold	140	142	145

**Table 3.** Estimated average drinking water consumption according to socioeconomic level\* and climate

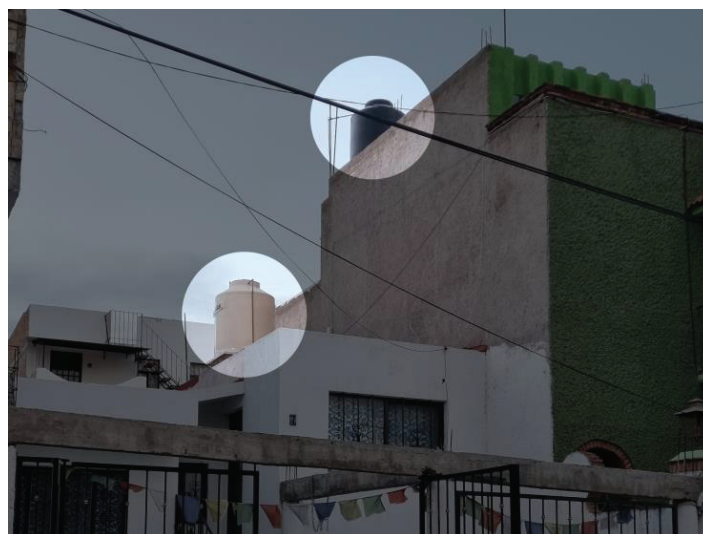
Climate	Socioeconomic status		
	Low	Average	High
	m <sup>3</sup> /hydraulic outlet/month		
Hot and humid	24	25	28
Hot and sub-humid	20	23	26
Dry or very dry	22	22	22
Warm or cold	15	16	14

With this, the following was considered:

- México as a scenario to establish the conditions of the simulation
- CONAGUA data for establishing the number of liters of water needed per inhabitant/day, considering the type of socioeconomic level of development of the neighborhood and climate of the area.
- The place where water is stored, for realism, using common storage.

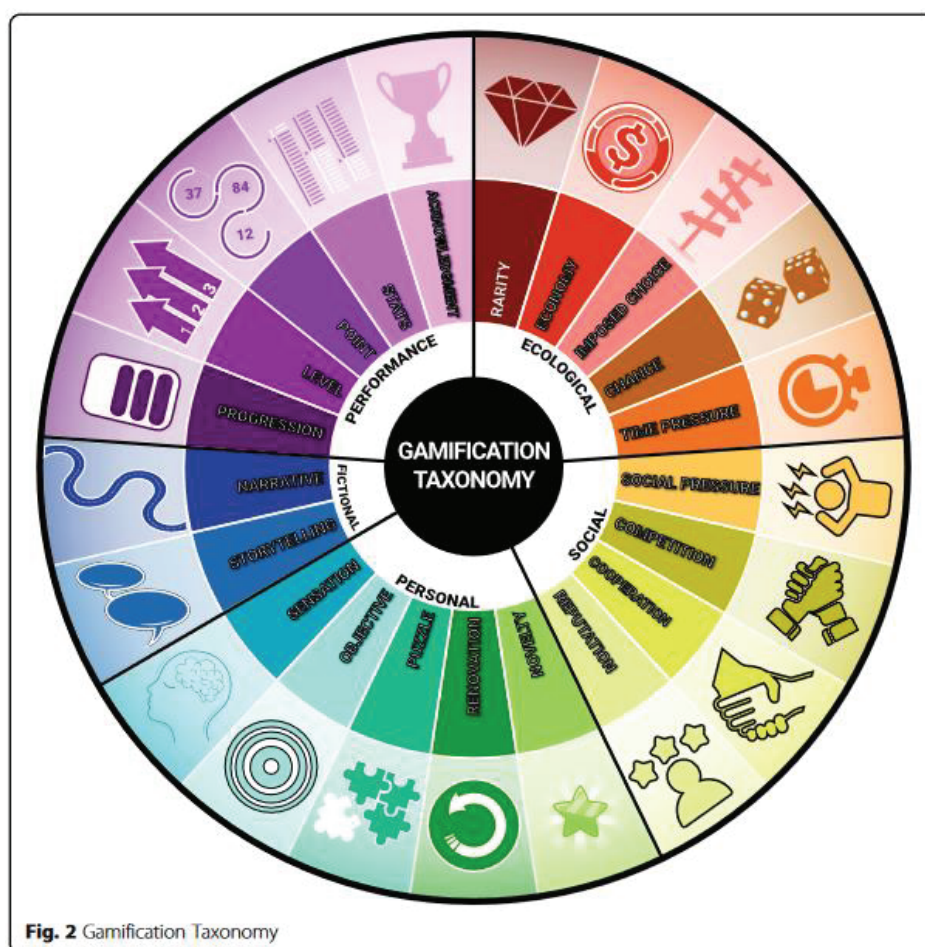
Most of the population of Mexico has an average socioeconomic status, so with this and considering a warm climate we choose to use 140 liters/inhabitant/day, from Table 2 for the week the total amount of water gives us 994 liters/inhabitant for the simulation, it is common too, to have house water storage.

In México, most of the population is supplied by water distribution systems with intermittent flow, for this and so because of this normally each house counts with a small water storage and regulation tank called *tinaco* (see Figure 1). A tinaco can store different quantities of water, the most common hold is 650 or 1000 liters, which are useful too, because water distribution service can be interrupted several times for various reasons. For ordinary people, storing large quantities of water is not possible, with led to establish the amount of water to be used to 1000 liters per inhabitant per week, as a parameter for the simulation game.



**Figure 1.** A couple of *tinacos* (water tanks) on the houses

To structure the game, we take into account the elements of the taxonomy of Toda et al. (2019) shown in Figure 2 considering the following aspects: a short story (narrative) to introduce in the game the problem that we want the user to experience (fictional), with this we seek to analyse their water uses and its conservation of water (sensation) with an aim, that if the user cannot reach it, can reach it by modifying their habits (objective) that involves friends and acquaintances (cooperative) and that you become aware of your day-to-day actions in water conservation (imposed choice).



**Fig. 2** Gamification Taxonomy

**Figure 2.** Gamification taxonomy (Toda et al. 2019)

## 2.2 Study Cases

To test the functionality of the simulation game we made three proposals with different groups:

- Group A carried out the activity after an informative and interactive talk where concepts of sustainability, water uses, garbage separation, and those related to the use of resources, additionally it was explained how water can be polluted. The group expressed itself, asked questions, and learned. At the end of the activity there were comments and interesting contributions were received.
- Group B accessed the activity with a closed questionnaire where they recorded their water use once finished, having then to wait for a while to know their results by accessing a link where all the group was registered (this gives expectation).
- Group C, which was formed by participants elected from group B who, by, knowing the dynamics, were able to rethink their water consumption by playing with water consumption throughout the days of the week, to occupy no more than a thousand liters.

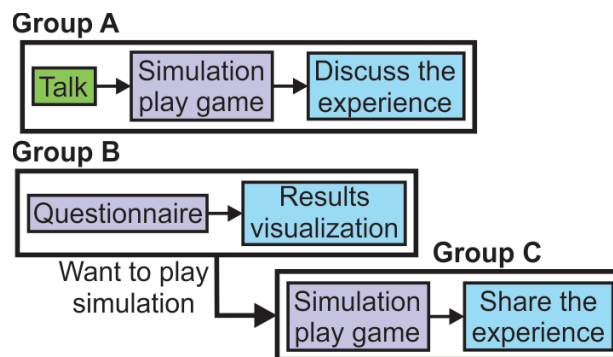


Figure 3. Work structures for groups

## 2.3 Tools and methodology

The simulation was made with simple programs on current available ICTs (Information and Communications Technology), for group A the meetings were virtual, with a talk with material provided to consult, for group B a link to the questionnaire was given, and the results were sent through messages, the group C was contacted by mail. The activity was made know word of mouth and participants were voluntaries.

## 3. RESULTS AND DISCUSSIONS

Group A found the activity instructive, entertaining, and illustrative of a situation that could occur if there's carelessness in the use of water. Some participants made an effort to reduce water consumption through changes in water use habits of the week to reach the number of liters indicated per person. Upon achieving this they commented on what they had to do to archive this.

Interesting conclusions were discussed, in this regard, such as how water use habits must change, demonstrating that it is possible to become aware of water conservation, while considering the topic an interesting one. The participants were able to make contributions, that will be included in future questionnaires since they have been able to identify shortcomings in the current one, which shows interest and involvement in this type of activity, even though it is simple.

We confirmed that the population knows about water scarcity as 98% of the participants confirmed it. 69% of them reuse water, while those who don't, is because of the information about options, or lack of infrastructure. 7% had never seen any information about water conservation.

52% of the people who answered the questionnaire, consider that a strategy/survival game can help raise awareness about water conservation, while 43% indicate that it will depend on the sensitivity of the



person who plays it, only 3% do not believe in the benefits of gamification. If the player involves water resource in the game intending to virtually experience its management, it is possible that this will generate awareness about its care and how to do it.

For group A, the game was presented in the form of software they must know, such as Excel. For group B, which worked with a simple questionnaire, it was more accessible due to the simplicity of the instructions, but its structure and the additional steps for displaying results can make it uninteresting. For group C, which involved a combination of the activities of groups A and B, was the one that allowed us to obtain more information.

We think that if a game is to be developed with this experience, variables such as time manipulation and the inclusion of a character could make it more appealing.

#### 4. CONCLUSIONS

Current communication tools permit reaching more people, to make them more aware of water conservation, and also, educate them about spending water resources more wisely, through decision making.

Gamification can be useful as an immersion activity in countries where there is less awareness of water care, in a real problem, it is appropriate to use this other way of "advertising" water conservation, since even though there are many ways of transmitting giving the people the possibility of involvement in decision making in their own households, makes for a positive net result.

Finally, here's a couple of comments we received:

"After participating in the game, I see great potential in the implementation of these tools, for research, understanding, and generation of techniques for good practices in the use of water that later can be implemented on a day-to-day basis."

"We need more activities like this."

"The hydric footprint, must be consider"

"How is it possible to collect water, if it does not rain very frequently in the area?"

"In fact, I'm aware of water conservation I bathe myself with buckets, in a case of scarcity of water, I could bathe myself with a 20-liter bucket. Maybe some questions (like that one of the buckets) could be more specific."

We consider all of these, samples of the positive feedback from the participants, to encourage us to continue developing gamification activities to involve water conservation on them, accessible for all public.

#### 5. ACKNOWLEDGEMENTS

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