

The Risk Equation

Objectives:

- Get to know the risk equation
- Understand how to intervene for risk reduction

STEP BY STEP

BEFORE STARTING

The teacher introduces the risk equation, i.e. the equation that allows us to identify the elements that, when multiplied, result in risk.

$$R = H \times V \times E$$

H = Hazard

Hazard is the probability that a phenomenon of a given intensity will occur in a given period of time, in a given area.

V = Vulnerability

Vulnerability is the propensity to suffer damages from an event. In other words, it indicates the propensity of people, buildings, infrastructure and economic activities to be damaged as a result of the stresses induced by an event of a certain intensity.

E = Exposure (or exposed value)

Exposure is the number of people and elements (or 'value') at risk in a given area.

You can read the definitions in the [glossary](#) or find the full definitions in the Sendai Framework Terminology on Disaster Risk Reduction ([link](#)).

RISK IN NUMBERS

The class now tries to give numerical values to each element to see how it increases or decreases as changes occur.

THE ROLE OF CAPACITY

After this step, the teacher leads the discussion by asking the class:

Which elements do you think we can intervene on and which we cannot?

The correct answer will be: *if dangerousness cannot be changed, exposure and vulnerability can.*

This is where **Adaptive Capacity** comes in, the ability to find strategies to adapt to a situation, i.e. the ability to take action to reduce vulnerability and exposure and increase the resilience of a community.

The following activity is now proposed in order to empirically observe what happens in the event of an earthquake to structures and people and thus test the risk equation.

SIGNS OF VULNERABILITY AND CAPACITY

On a desk, 6 paper cups arranged in a pyramid (3 below, 2 in the middle, 1 above) and 10 marker caps of different colours are placed standing upright and are simulated two different scenarios:

- **Scenario 1:** the pyramid is formed by placing the glasses very close together and the caps are placed as follows: 2 are under the pyramid, 3 are further apart and the others near the edge of the bench.
- **Scenario 2:** the pyramid is formed by placing the glasses as far apart as possible and the caps are placed half below the pyramid and half further apart, but not near the edge of the bench.

It is established that the seismic hazard is 10 in both scenarios.

The class shakes the desk and sees how many glasses and caps will fall and notes them down on a sheet of paper. The falling glasses and caps are the vulnerable ones. The reason for the vulnerability is established, for example:

- Pyramids are built with different materials and techniques.

- Some caps do not know where the collection point is.
- Some caps did not follow the directions of the emergency manager.
- A cap has a motor disability
- And other possibilities.

At this point the **Adaptive Capability** intervenes, i.e. the tape. Everyone can choose where to intervene and how. Each intervention will mean sticking one or more elements with the tape to the bench.

The experiment consists of 'stopping' as many as possible with the tape and entering new values into the equation each time. You can establish that you are safer at the collection point and therefore stop 5 caps with the tape all close together. Or that an earthquake-resistant structure is strong and therefore put all the caps underneath. This activity can be done in small groups. The only value that cannot be changed is the hazard value 10.

CONCLUDING THOUGHTS

Capacity plays a fundamental role. Indeed, it allows in all phases of the emergency to intervene to lower the risk by reducing exposure and vulnerability. In the final phase, the class discusses the choices made and how the capacity of each and every one of us can change the outcome and lower the risk. For example, the class can reason about the difference it can make to follow the teacher's directions in the event of an evacuation; to know where the assembly point to be reached is located; or about the difficulties that people with disabilities may have in an emergency. To stimulate discussion, the teacher can propose a real-life scenario familiar to the class (e.g., the Covid-19 pandemic) and reason about the role of skills in that context.