APEC - Tsukuba International Conference:

Innovation of Mathematics Education through Lesson Study

Challenges to Emergency Preparedness for Mathematics

February 14-18, Tokyo, Japan

PhD. Raimundo Olfos
raimundo.olfos@ucv.cl
Pontifical Catholic University of Valparaíso
Math Educator Specialist
Project Emergency Preparedness Education:
(APEC HRD 04 11A)
Collaborators: Sergio Morales & Soledad Estrella

Emergency Preparedness Lesson Plan in Math for Grade 5

Introduction

The present writing provided a lesson plan in math for grade 5 referred to "Emergency Preparedness" which will be discussed with a group of teachers for optimization and spread into the framework of lesson study in the context of this project (APEC HRD 04 11A).

Curricular relevance of lesson plan

In case of earthquake, children and adults in charge should assess the risk of being exposed to a heavy or cutting object, they should keep away from windows, shelves, heavy lamps, and so on.
If the tremor is prolonged, should be evaluated the possibility of falling walls, cornices, fragments of trees and power lines, making it necessary to identify escape routes and safety zones. If you are on the coast should take into account a tsunami.

Mathematical lesson can help identify and promote the proper use of escape routes and safety zones, helping to save lives in case of earthquakes.

In grade 5 students are expected to achieve some learning (Annex), that are appropriate to connect with Emergency Preparedness, for examples:

Unit 1 Numbers Communicate information concerning situations represented by numbers over six figures Solve problems involving • addition, subtraction and multiplication • divisions, from the ratio between the dividend, the divisor and the rest of these divisions Geometry Unit 4 Estimate areas of plane figures, with different strategies (concrete, pictorial and symbolic) Develop and implement strategies for calculating areas of rectangles and figures are broken down into rectangles, and express the result in meters, centimeters or millimeters square

The lesson plan presented below is at stake this learning in a class focused on mathematical modeling. Other lessons, such as those listed below, included in the Unit Number and Algebra can be treated in a second class.

Unit 3 Number and Algebra Calculate algebraic expressions and replacing letters with numerical value. Represent numerical situations with lyrics Using the reduction procedure similar

Finally, note that some of the learning associated with the Unit Data and Chance, as shown below, can be addressed in a lesson plan referred to tsunamis.

Unit 2 Data and chance Construct bar graphs multiple, manually or using technological tools, from data organized in tables Recognize how they behave certain variables, whose relationship is illustrated in a bar graph multiple lines Express the probability of an event in simple language

Ç

Adjustment policies National School Safety

In 1970 the National Emergency Office Home Office designed a comprehensive plan Evacuation and School Safety, known as DEYSE plan that gives the frameworks for the natural disaster evacuation, each educational institution appropriate to their facilities, under the concept of "ACCEDE" Alert, Communication, Coordination, primary Evaluation, Decisions, and secondary Evaluation.

During an earthquake is suggested to remain in buildings, under a table or desk, under a door frame, attached to a corner, away from windows and glass.

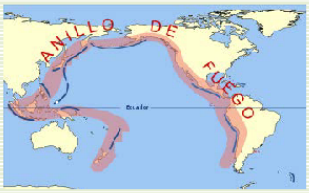
Suggestions to the threat of tsunami

1. If you live on the coast and you feel an earthquake like to crack walls, or to prevent stand, it is likely that in the next 20 minutes a tsunami happen.
2. If you are alerted to the approach of a tsunami, a notice of authorities, seeking refuge at altitudes above 30 meters.
3. If you see that the sea is collected, get away to safety at height. Within minutes the tsunami will arrive with speed and you can not escape.
4. If you are in a boat, please contact offshore, given that a destructive tsunami is about 3 miles and a depth of 150 meters

5. A tsunami can be penetrated by a river or creek several miles, stay away from rivers and estuaries.
6. If there is sufficient height near a lush forest or upper floors of a building can be an alternative protection.
7. A tsunami can have 10 or more waves in a span of 12 hours, try to carry blankets.
8. Do not ever threatened locations until directed by an authority.
9. Make your family escape plan in case of being on the coast

Escape routes to a possible earthquake

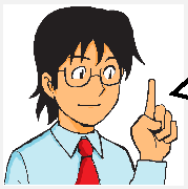
"The ring of fire"



The largest earthquakes recorded in all written history of humankind precisely originated somewhere in its course, with Chile being the world champion of occurrence of such phenomena.

Earthquake:: is the sudden movement of the Earth, caused by the abrupt release of stored energy for a long time.

Note: The last earthquake in Chile lasted about 2 minutes 45 seconds and occurred in the Bio Bio region, reaching a magnitude of 8.8 degree. As a result of earthquake coasts of southern Chile was hit by a tsunami. The death toll reached a total of 525 deaths. About 500 thousand homes ended up with severe damage and estimated a total of 2 million homeless, is considered the worst natural disaster experienced in Chile since 1960.

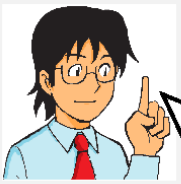


Camilla, Chile is long and narrow, with a total area of 2,006,626 km2, being in the "line of fire" in the Pacific is one of the most active seismic and volcanic planet zone. At the beginning of 2010 Chile experienced one of the largest earthquakes recorded in the history of our planet, which caused numerous human and material losses.

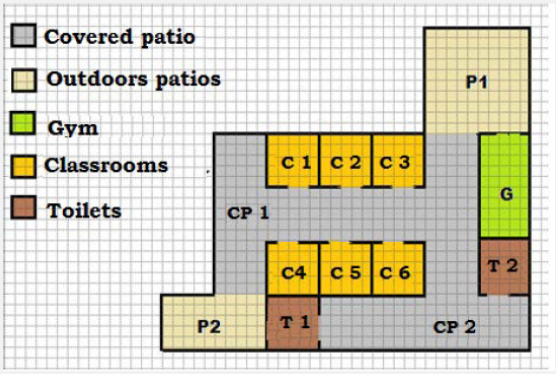
Teacher, are earthquakes dangerous for people?

Absolutely, but an earthquake itself can kill a few people. The real problem with an earthquake corresponds to the collapse of buildings, namely:

- Collapse of houses and buildings
- Falling Walls
- Falling objects such as shelves ornaments, statues, etc.
- Side effects such as explosions and fires



The diagram below corresponds to the plane of a school located in the city of Concepcion in southern Chile. This plane was designed to indicate escape routes before a possible earthquake while students are in their classrooms, however, responsible for drawing plans forgot to include escape routes for students who are in the rooms C1, C2, C3, C4, C5, and C6, each of 25 square meters.



Can you help me to complete what is lacking at the school?

Sure!

Activity:

- What are the safest areas to evacuate students in an earthquake?

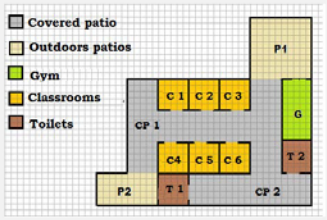
- What are the escape routes that belong to the 25 students in each classroom knowing that safety zones can be a student per square meter?

LESSON PLAN	
Goal(s) of Learning:	Students identify areas without a roof as the safest to evacuate in case of earthquake, and are able to draw escape routes for students in every classroom by comparing the area occupied by students and the area available in areas without roofing.

LEARNING ACTIVITIES	TEACHER INTERVENTION
Presentation of the class topic	Presents the central theme of the class "earthquake evacuation using mathematics".
Reading and discussion from page 1 **Activity:**	Ask students to read individually dialogue between teacher and Camilla.

"Escape routes to a possible earthquake"

Plan a school of Design



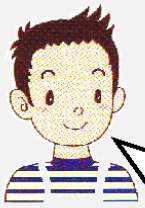
- What are the safest areas to evacuate students in an earthquake?
- What are the escape routes that belong to the 25 students in each classroom knowing that safety zones can be a student per square

Students form groups of 3 people and work in their notebooks to record in them the ideas that arise in the group. Students present their strategies on the board resolution stating the answers to each question. **Possible strategies:** • Students in the classrooms C1, C2 and C3 are in the area CP1 and the room C4, C5 and C6 are the CP2 area. • Students in the rooms C1, C2 and C3 are the P1 area of the room, and C4, C5 and C6 are to Zone P2 • Students the rooms C1, C2, C3 and C6 are to P1 and the area of the room C4, C5 will Zone P2.	Walk through the stalls of the students listening to group conversations and observing strategies listed in the notebooks. If necessary ask questions back as indicated in the table below. Select from the previous observation some students to present their work. **Return Possible questions:** What are the characteristics required of a safety zone in case of earthquake? How the major accidents occur during an earthquake? How many students can evacuate the area P1, why? What if it is the number of students in the P1 or P2 (the amount exceeds the total number of students that can be located in that area) would be some students in the area covered?
It discusses the characteristics of the security zones and the importance of using math to make good decisions.	The teacher guides the discussion and making them reflect on the previous situation and relating it to the reality of the establishment where they are (what are the safe areas and the escape routes?)

Escape Routes and Safety Zones

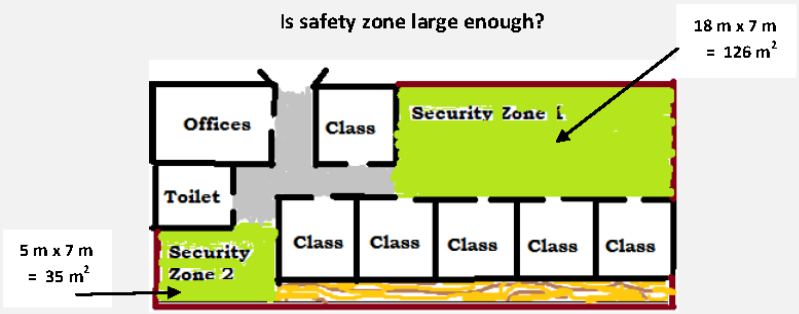
Safety Zones are areas free or low-risk and evacuation routes are the selected paths to reach the Security Zones?
What is safer to stay in your room or move to a safety zone during an earthquake?

If the approach is safe, could move. But it is safer to move after an earthquake.
Aftershocks can cause damage



While there are areas safer than others, it's dangerous move because the pathways may involve greater risk.

Is safety zone large enough?



Activity:

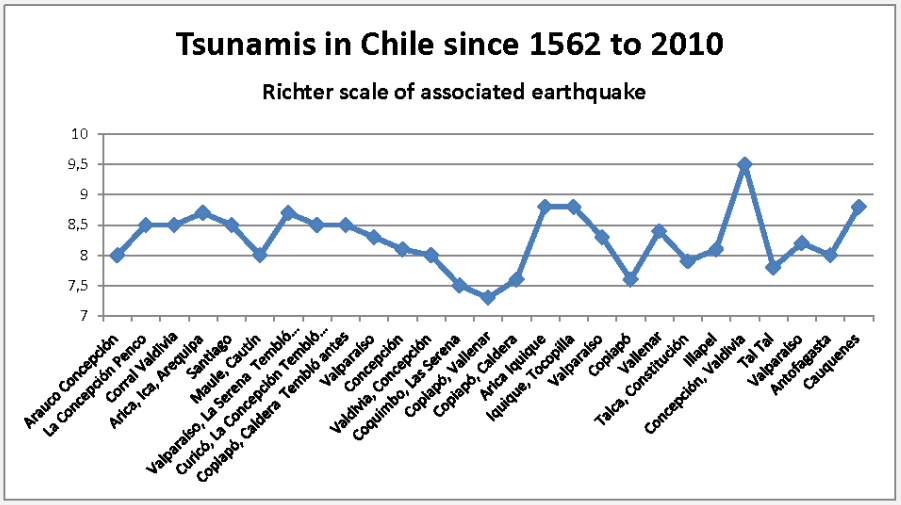
Limit: How many students would be comfortable in a safe area of 2m x 2m?
Problem: The rooms are for 35 students. How many rooms evacuate to each Security Zone?
Explain how you did. If you vary the limit of students per m^2, how do you get to the answer?
Represent it.

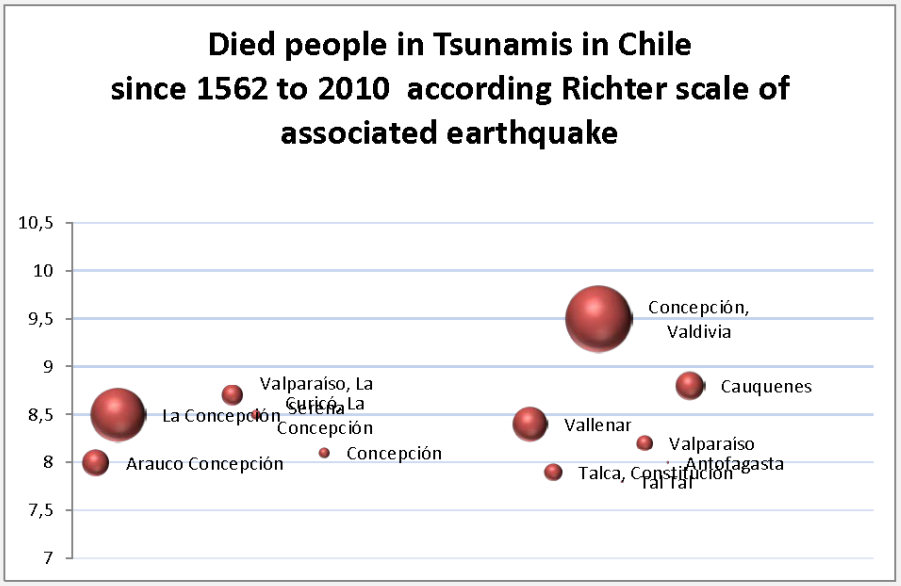
One answer: If every m^2 is located on a student, may place students in 3 rooms in zone 1. So 3 x 35 is 105, less than 126 m^2 in Zone 1. If you place 2 students per m^2, it is double rooms.

Register of tsunamis in Chile

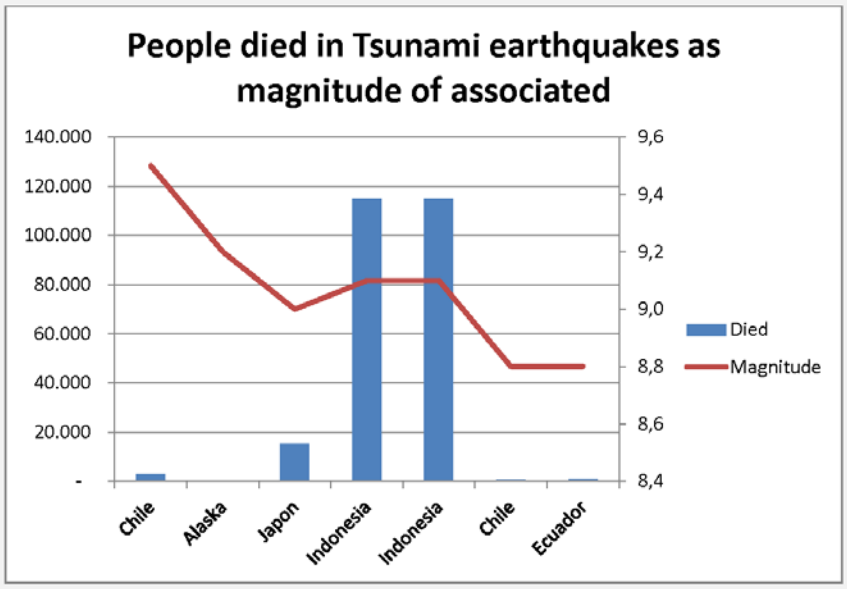
By extension of its coasts and mountain ranges in Chile, you can save many lives preparing to make good decisions before a possible tsunami.

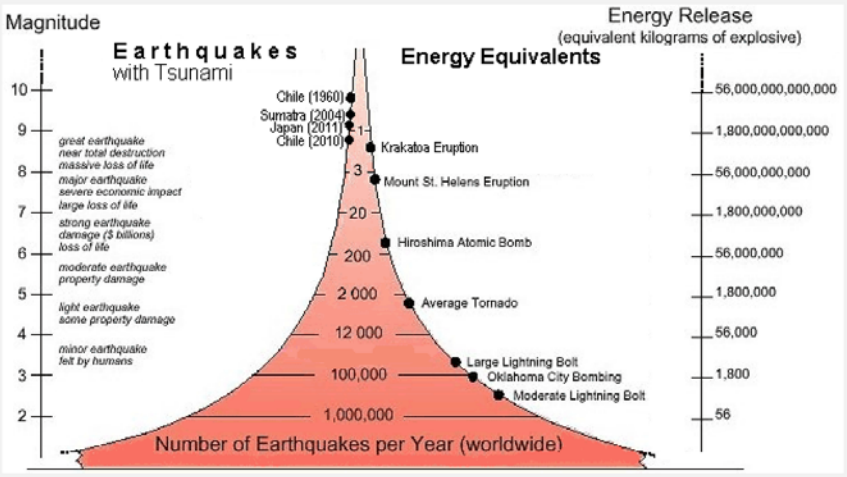
City of Tsunami	Year	Richter	Died	Sea high
Arauco Concepción	1562	8	500	4 m
La Concepción Penco	1570	8,5	2000	
Corral Valdivia	1575	8,5	cientos	4 m
Arica, Ica, Arequipa	1604	8,7		16 m
Santiago	1647	8,5		
Maule, Cautín	1657	8		4 m La Concepción
Valparaíso, La Serena	1730	8,7	300	16 m La Concepción
Curicó, La Concepción	1751	8,5	65	3,5 m
Copiapó, Caldera	1819	8,5		4 m
Valparaíso	1822	8,3		3,5 m Valparaíso
Concepción	1835	8,1	80	13 m Quiriquinas
Valdivia, Concepción	1835	8		2 m Chiloé
Coquimbo, Las Serena	1849	7,5		5 m Coquimbo
Copiapó, Vallenar	1851	7,3		3 m Huasco
Copiapó, Caldera	1859	7,6		6 m Caldera
Arica Iquique	1868	8,8		20 m Arica
Iquique, Tocopilla	1877	8,8		21 m Mejillones
Valparaíso	1906	8,3		1,5 m Valparaíso
Copiapó	1918	7,6		5 m Caldera
Vallenar	1922	8,4	800	9 m Chañaral
Talca, Constitución	1928	7,9	225	1,5 m Constitución
Illapel	1943	8,1		1 m Los Vilos
Concepción, Valdivia	1960	9,5	3000	15 m Ancud
Tal Tal	1966	7,8	3	0,8 m Caldera
Valparaíso	1985	8,2	175	1,2 m Valparaíso
Antofagasta	1995	8	3	2,8 m Antofagasta
Cauquenes	2010	8,8	525	10 m Constitución


Tsunamis in Chile since 1562 to 2010
Richter scale of associated earthquake
10
9,5
9
8,5
8
7,5
7
Arauco Concepción
La Concepción Penco
Corral Valdivia
Arica, Ica, Arequipa
Santiago
Maule, Cautín
Valparaíso, La Serena Temblб...
Curicó, La Concepción Temblб...
Copiapó, Caldera Temblб antes
Valparaíso
Concepción
Valdivia, Concepción
Coquimbo, Las Serena
Copiapó, Vallenar
Copiapó, Caldera
Arica Iquique
Iquique, Tocopilla
Valparaíso
Copiapó
Vallenar
Talca, Constitución
Illapel
Concepción, Valdivia
Tal Tal
Valparaíso
Antofagasta
Cauquenes


Died people in Tsunamis in Chile
since 1562 to 2010 according Richter scale of
associated earthquake
10,5
10
9,5
9
8,5
8
7,5
7
Concepción,
Valdivia
Cauquenes
Valparaíso, La
Curicó, La
La Concepción
Serena
Concepción
Concepción
Vallenar
Valparaíso
Antofagasta
Arauco Concepción
Talca, Constitución
Tal Tal

Biggest Tsunamis in the Planet





Annex
Overview of learning expected Mathematics Curriculum 5 ° Grade
Ministry of Education of Chile, Curriculum and Evaluation Unit, June 2011

Números	Datos y azar	Números y algebra	Geometría
1. Escribir, ordenar y comparar números naturales de más de seis dígitos 2. Comunicar información relativa a situaciones representadas por números de más de seis cifras 3. Reconocer números primos de una, dos y tres cifras y resolver problemas matemáticos donde ellos intervienen 4. Calcular el mínimo común múltiplo y el máximo común divisor de números naturales 5. Descubrir regularidades entre divisores, factores y múltiplos de números naturales al descomponer estos en factores primos 6. Reconocer regularidades en la multiplicación por potencias de diez con números naturales 7. Resolver en forma oral y escrita los procedimientos utilizados en la multiplicación y en la división 8. Resolver problemas con: • adición, sustracción y multiplicación • divisiones, utilizando la relación entre el dividendo, el divisor y el resto de esas divisiones	1. Extraer información a partir de datos organizados en gráficos de líneas y barras múltiples 2. Comparar información extraída de datos organizados en gráficos de líneas y barras múltiples y responder preguntas a partir de la información obtenida 3. Construir gráficos de líneas, manualmente o con herramientas tecnológicas a partir de datos organizados en tablas. 4. Construir gráficos de barras múltiples, manualmente o usando herramientas tecnológicas, a partir de datos organizados en tablas 5. Reconocer cómo se comportan ciertas variables, cuya relación se ilustra en un gráfico de barras múltiples y de líneas 6. Expresar la probabilidad de que ocurra un evento con un lenguaje simple	1. Calcular expresiones algebraicas y reemplazar las letras por el valor numérico. 2. Representar situaciones numéricas con letras 3. Utilizar el procedimiento de reducción de términos semejantes 4. Demostrar y comprender las fracciones utilizando representaciones concretas y pictóricas para: • escribir grupos de fracciones iguales • comparar fracciones con igual y distinto denominador 5. Describir y representar decimales (décimos, centésimos y milésimos) en forma concreta, pictórica y simbólica 6. Relacionar decimales con fracciones (hasta centésimas) 7. Utilizar estrategias para representar y ordenar fracciones y decimales positivos en la recta numérica 8. Emplear procedimientos escritos para efectuar adiciones y sustracciones con fracciones 9. Recurrir a procedimientos de cálculo mental y escrito para efectuar adiciones y sustracciones con decimales positivos 10. Resolver problemas en contextos diversos, utilizando fracciones y decimales	1. Estimar áreas de figuras del plano, con distintas estrategias (concreta, pictórica y simbólica) 2. Elaborar y aplicar estrategias para calcular áreas de rectángulos y figuras que se descomponen en rectángulos, y expresar el resultado en metros, centímetros o milímetros cuadrados 3. Diseñar y usar estrategias para obtener áreas de triángulos y aplicar ese cálculo para obtener áreas de paralelogramos 4. Formular y verificar conjeturas en casos particulares de cómo cambia el área de paralelogramos al variar uno o más de sus lados y la superficie de triángulos al modificar sus lados y su altura 5. Resolver problemas en contextos diversos que incluyen áreas de triángulos y paralelogramos, por medio de diversas estrategias