臺灣的學校防災教育

Disaster Prevention Education at Schools in Taiwan

Disaster Risk Reduction Education (DRRE)

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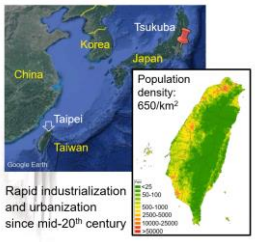
OUTLINE

1. Introduction about Taiwan environments and disasters
2. Progress of Disaster Risk Reduction Education (DRRE) in Taiwan
3. DRRE in the current national curriculum
4. DRRE in the high school textbooks
5. Summary

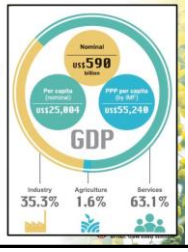
Location & basic statistics of Taiwan

- Area: 36,197 km^2
- Population: 23,451,837 (2021)



Rapid industrialization and urbanization since mid-20th century

Snapshot of GDP (2018)

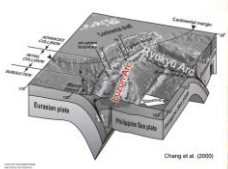


Example of man-made disaster

On 31 July 2014, underground gas explosions occurred in the Cianjhen and Lingya districts of Kaohsiung City in southern Taiwan.
32 people were killed and 321 people injured.
~https://www.cw.com.tw/article/5060147

Natural environmental settings of Taiwan

❖ **Tectonism, geology, geomorphic settings**

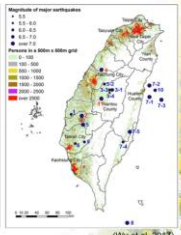


★ Volcanic magma chamber
☆ Active Volcano

- active tectonics
- fractured bedrocks
- high relief + drainage density

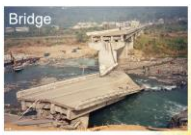
Major earthquake disasters and population distribution in Taiwan in 20th century

No.	Earthquake	Date	Magnitude (M$_L$)	Depth (km)	Casualty	
					Deceased	Injured
1	Double	1904/11/06	6.1	7.0	145	158
2	Meishan	1906/03/17	7.1	6.0	1,258	2,385
3	Nantou Series	1916/08/28	6.8	45.0	71	285
		1916/11/15	6.2	3.0		
		1917/01/05	6.2	0.0		
		1917/01/07	5.5	0.0		
4	Hsinchu-Taichung	1935/04/21	7.1	5.0	3,276	12,053
5	Chingpu	1941/12/17	7.1	12.0	358	766
6	Shinhua	1946/12/05	6.1	5.0	74	182
7	Longitudinal Valley Series	1951/10/22	7.3	4.0	>85	>1,000
		1951/10/22	7.1	1.0		
		1951/10/22	7.1	18.0		
		1951/11/25	6.1	16.0		
		1951/11/25	7.3	36.0		
8	Hengchun	1959/08/15	7.1	20.0	17	85
9	Paiho	1964/01/18	6.3	18.0	106	653
10	Hualien	1980/11/15	6.5	15.0	13	45
11	Chi-Chi	1999/09/21	7.3	8.0	2,405	11,305



(Wu et al, 2017)

by C.-Y. Lo (羅正義), 1 October, 1999



by C.-Y. Lo (羅正義), 23 January, 2000

by K.-F. Huang (黃國鋒), 24 September, 1999

By H.-Y. Lee (李小哈), 1 October, 1999

From 水土保持局歷史影像平台（https://photo.swcb.gov.tw/Repository/Database）

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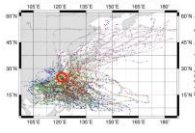
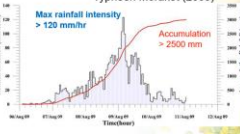
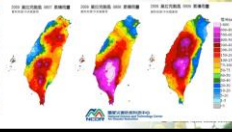
❖ Climate, weather and related natural disasters

Typhoon tracks in NW Pacific



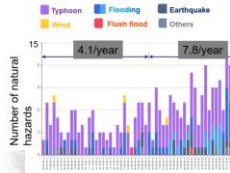
Typhoon Morakot (2009)





Example of land reclamation in a hazard-prone area

Occurrence and types of natural hazards in Taiwan



Number of natural hazards in Taiwan from 1958 to 2017

Figure adopted from NCDR website
Source: National Fire Agency, Ministry of the Interior, ROC (2018)

Major types of natural hazards

Typhoon:	236 (66.48%)
Flooding (heavy rainfall):	78 (21.97%)
Earthquake:	30 (8.45%)
Others:	11 (3.10%)

Debris flow induced by Typhoon Toraji in 2001

- One of the humanity's greatest challenge (arguably) : **how to live safely on an overpopulated planet** at constant risk of disaster
- Nature can wreak devastation in an instant, yet **mankind persists in rebuilding communities where disaster has struck**

(Kieffer, 2013)

Trigger of a comprehensive and systematic DRRE in Taiwan

- Domestic demand

  Catastrophic Chichi earthquake on 21 September, 1999 urged Taiwan government to invest great efforts in developing and promoting disaster relief and prevention by conducting many research projects.

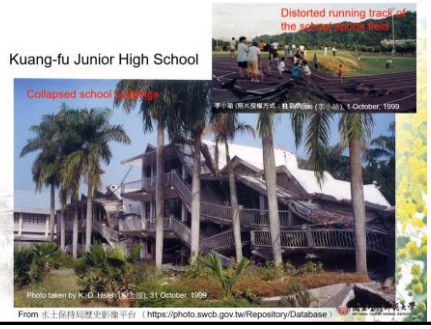
- International call

  the call for the global cooperation to face the increasingly devastating disaster issues such as United Nations initiatives for Disaster Risk Reduction (UNDRR)

- Disaster loss of schools caused by 921 Chichi earthquake (M=7.3)
  - number of casualties: 62 teachers and students killed, 17 injured…
  - damage to school buildings : 371 schools in 15 counties and cities
- It was said that 921 Chichi earthquake "fortunately" occurred in midnight, when the campuses were empty.

from Chronology of main educational events, MoE website
https://history.moe.gov.tw/milestone.asp?YearStart=81&page=13

Kuang-fu Junior High School



From 水土保持局歷史影像平台（https://photo.swcb.gov.tw/Repository/Database）

Disaster Prevention and Protection Act
（災害防救法）

- At the time of the Chi-Chi Earthquake, Taiwan's disaster rescue missions were carried out by ordinary fire fighters of the fire brigades. (Lin et al., 2019)
- In response to the catastrophic impact of the Chi-Chi Earthquake, the central government by passing the island's first fundamental disaster management law, the Disaster Prevention and Protection Act (災害防救法).
- The Act was promulgated and implemented in July 2000, and was amended several times including in 2010, following another deadly disaster, Typhoon Morakot, and more recently in 2019.

Laws and Regulations Database of The Republic of China
https://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?pcode=D0120014

Disaster Prevention and Protection Act
（災害防救法）

- Chapter Two: Disaster Organization / Article 7
  …Central regulating authorities of disaster prevention and protection shall manage disaster resources, organize information, perform disaster prevention and rescue tasks, and cooperate with relevant agencies to conduct disaster prevention education for all citizens.
- Chapter Four: Disaster Prevention / Article 22
  …various levels of governments shall implement following mitigation affairs:
  1. Draft, budget preparation, execution and review of the disaster prevention and protection plans;
  2. Education, training and propaganda of disaster prevention and protection; …

https://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?pcode=D0120014

White Paper on Education of Disaster Prevention published in 2004

Concept of Education of Disaster Prevention

- Embed Concept of "**Prevention is better than Rescue**"
- Lead to continuous education of Disaster Prevention
- Establish Active and Vigorous Safety Culture
- Stride to " Zero Disaster " Goal (MoE, 2004)

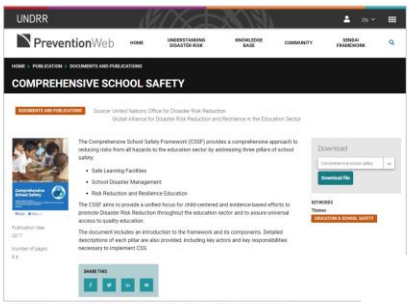
The second White Paper on Education of Disaster Prevention was published in 2015.

United Nations Office for Disaster Risk Reduction (UNDRR)

- Hyogo Framework for Action (HFA) 2005-2015
- Sendai Framework for Disaster Risk Reduction 2015-2030

https://www.undrr.org/

https://www.preventionweb.net/

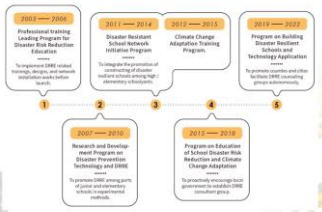


https://www.preventionweb.net/publication/comprehensive-school-safety-0

Three Pillars of Comprehensive School Safety

- **Safe Learning Facilities**
  involves education authorities, architects, engineers, builders and school community members in **safe site selection, design, construction and maintenance** (including safe and continuous access to the facility).
- **School Disaster Management**
  is established via **national and sub-national education authorities and local school communities** (including children and parents), working in collaboration with their disaster management counterparts at each jurisdiction, in order to maintain **safe learning environments** and **plan for educational continuity**, conforming to international standards.
- **Risk Reduction and Resilience Education**
  should be designed to develop **a culture of safety and resilient communities**.

The Progress of DRRE in Taiwan



- **Program-based approach**
- **Top-down process**
- **All schools and all-level education involvemen**

Special exhibition of disaster-resilient schools around Taiwan at Taipei Main Station in 2019

20th anniversary of Chichi Earthquake

Vice President Minister of Education Minister of Interior …

https://english.moe.gov.tw/cp-117-22499-C9939-1.html

In the schools

Administration Division
(Task Grouping in response to emergency)

Disaster Management

- Mitigation
- Preparedness
- Response
- Recovery

- ✓ Campus disaster prevention and rescue plans
- ✓ Campus disaster prevention map
- ✓ Drill: twice a year

Teaching Division

DRR Education

- **Cognitive Domain**
  Understanding the Causes of Natural Disasters
- **Psychomotor Domain**
  Ability to manage and prevent disaster risk
- **Affective Domain**
  Responsibility, Attitude and Practice for Prevention and Rescue

Disaster Risk Reduction Education Website

Log in

(Chinese version)

Schools of all levels can easily prepare and submit the annual 'Campus disaster prevention and rescue plan', through this website in which school basic statistics of students & teachers, facilities, equipment, maps of potential hazards and activities (such as dri are required.

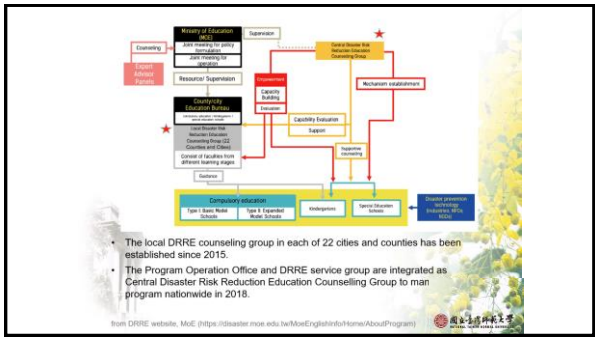
from DRRE website, MoE (https://disaster.moe.edu.tw/MoeEnglishInfo/Home/AboutProgram)

School Campus Disaster Prevention Map (Earthquake & Fire)
Syuejia Elementary School, Tainan City

Evacuation and Emergency Escape Route

Earthquake Drill on the National Disaster Prevention Day
Syuejia Elementary School, Tainan City, 21 September, 2016

Note: The images are from a video clip.
https://schoolweb.tn.edu.tw/~sjaes_evaluation/modules/tad_web/index.php?WebID=12



- The local DRRE counseling group in each of 22 cities and counties has been established since 2015.
- The Program Operation Office and DRRE service group are integrated as Central Disaster Risk Reduction Education Counselling Group to man program nationwide in 2018.

from DRRE website, MoE (https://disaster.moe.edu.tw/MoeEnglishInfo/Home/AboutProgram)

DRRE integrated into Tayal language teaching at kindergarten

School gymnasium as evacuation shelter

DRRE – Follow Me

E-Journal (bi-monthly)

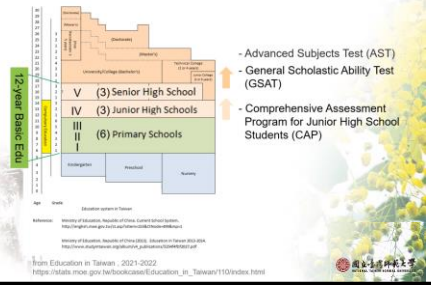
Pursuit the goal of 'Every School is a Disaster Resilient School'

- Set up space for disaster management works
- Develop innovative disaster management tools and/or teaching tools
- Promote disaster management knowledge
- Share DRRE courses with community
- Simulate scenarios and conduct disaster drills

- It was firstly launched under the "*Disaster Resistant School Network Initiative Program*" in 2011.
- All schools are encouraged to apply for the basic level of the dis
resilient school and some will be promoted to the advanced leve

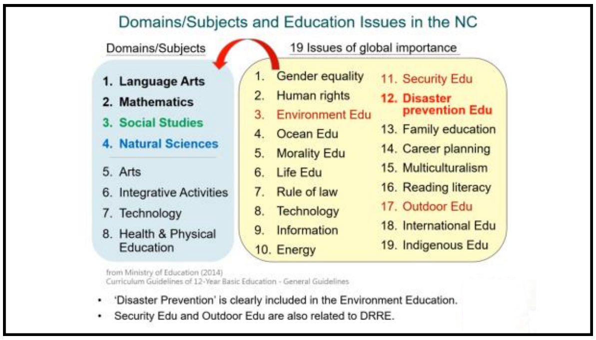
from DRRE website, MoE (https://disaster.moe.edu.tw/MoeEnglishInfo/Home)

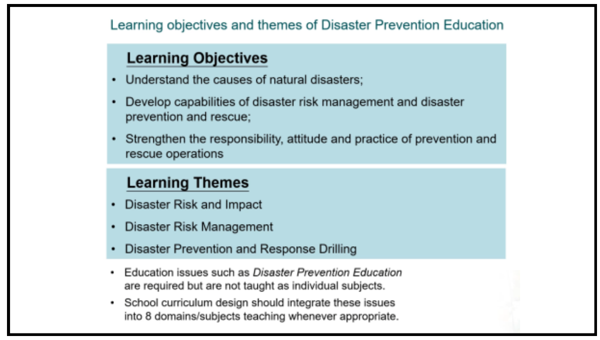
Education system in Taiwan

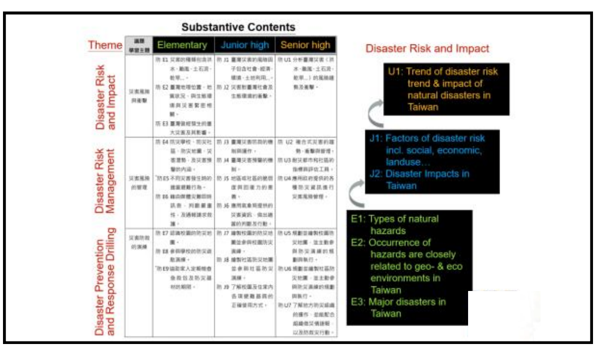


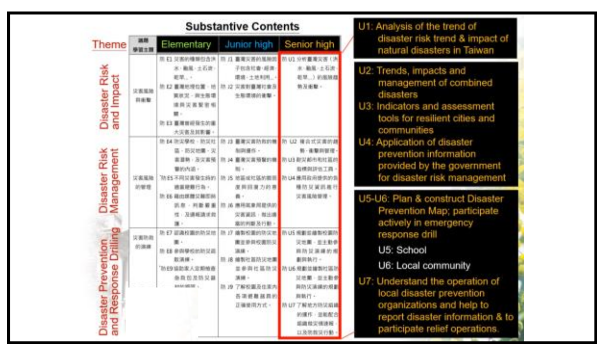
from Education in Taiwan , 2021-2022
https://stats.moe.gov.tw/bookcase/Education_in_Taiwan/110/index.html

- General speaking, school education in Taiwan has been regarded solid and successful.
  - ✓ 9-year Compulsory education was launched in 1968: compulsory & tuition-free
  - ✓ 12-year Basic Education was firstly applied in 2019: voluntary & tuition-waiver
- High Enrollment Rate (Net Enrollment Rate, School year: 2020-21) Elementary - 94.06%, Junior High - 97.40%, Senior High - 99.69%
- All schools (age groups of 6-18) have to follow the national curriculum.
- The current national curriculum, emphasis on core competence, has been implemented since 2019. This curriculum provides more flexibility so that schools can design school-centered and student-centered classes especially at the senior high school level


Domains/Subjects and Education Issues in the NC
Domains/Subjects
19 Issues of global importance
1. Language Arts
2. Mathematics
3. Social Studies
4. Natural Sciences
5. Arts
6. Integrative Activities
7. Technology
8. Health & Physical Education
1. Gender equality
2. Human rights
3. Environment Edu
4. Ocean Edu
5. Morality Edu
6. Life Edu
7. Rule of law
8. Technology
9. Information
10. Energy
11. Security Edu
12. Disaster prevention Edu
13. Family education
14. Career planning
15. Multiculturalism
16. Reading literacy
17. Outdoor Edu
18. International Edu
19. Indigenous Edu
from Ministry of Education (2014)
Curriculum Guidelines of 12-Year Basic Education - General Guidelines
• 'Disaster Prevention' is clearly included in the Environment Education.
• Security Edu and Outdoor Edu are also related to DRRE.


Learning objectives and themes of Disaster Prevention Education
Learning Objectives
• Understand the causes of natural disasters;
• Develop capabilities of disaster risk management and disaster prevention and rescue;
• Strengthen the responsibility, attitude and practice of prevention and rescue operations
Learning Themes
• Disaster Risk and Impact
• Disaster Risk Management
• Disaster Prevention and Response Drilling
• Education issues such as Disaster Prevention Education are required but are not taught as individual subjects.
• School curriculum design should integrate these issues into 8 domains/subjects teaching whenever appropriate.


Substantive Contents
Theme
Elementary
Junior high
Senior high
Disaster Risk and Impact
Disaster Risk Management
Disaster Prevention and Response Drilling
Disaster Risk and Impact
U1: Trend of disaster risk trend & impact of natural disasters in Taiwan
J1: Factors of disaster risk incl. social, economic, landuse…
J2: Disaster Impacts in Taiwan
E1: Types of natural hazards
E2: Occurrence of hazards are closely related to geo- & eco environments in Taiwan
E3: Major disasters in Taiwan


Substantive Contents
Theme
Elementary
Junior high
Senior high
Disaster Risk and Impact
Disaster Risk Management
Disaster Prevention and Response Drilling
U1: Analysis of the trend of disaster risk trend & impact of natural disasters in Taiwan
U2: Trends, impacts and management of combined disasters
U3: Indicators and assessment tools for resilient cities and communities
U4: Application of disaster prevention information provided by the government for disaster risk management
U5-U6: Plan & construct Disaster Prevention Map; participate actively in emergency response drill
U5: School
U6: Local community
U7: Understand the operation of local disaster prevention organizations and help to report disaster information & to participate relief operations.

Major domains/subjects related to DRRE

❖ Elementary School Level

- Natural Sciences Domain
- Social Studies Domain
- School developed curriculum

❖ Junior High School Level

- Earth Sciences (1 teaching hr/week at Grade 9) in Natural Sciences Domain (Physics, Chemistry, Biology, Earth Sciences)
- Geography (1 teaching hr/week for Grade 9-12) in Social Studies Domain (History, Geography, Civics and Society)
- Alternative curricula (a few teaching hrs/week) may address cross-curricular content or integrate various topics, developing course content with theme-, project-, and issue-based inquiry and strengthen students' knowledge integration and application in the real-life context.

e.g., Class such as '*My Local Community*' is highly promoted and history and geography teachers usually involve.

❖ Senior High School Level

➢ **Ministry-mandated required courses**

- **Earth Sciences** (2-4 credits) in Natural Sciences Domain (Physics, Chemistry, Biology, Earth Sciences)
- **Geography** (6 credits) in Social Studies Domain (History, Geography, Civics and Society)
- **National Defense Education** (2 credits) (required at high school level but not part of 8 learning domains)

➢ **School-developed required courses**: 4-8 credits

e.g., '*My Local Community*' - geography teachers usually play important role.

➢ **Enrichment and expanded elective courses** (Ministry)

- **Earth Sciences** (2-4 credits) in Natural Sciences Domain
  - ✓ Geology and the environment
  - ✓ Ocean, Atmosphere and Astronomy

*These elective courses are not always available for students to take.

- **Geography** (8 credits) in Social Studies Domain
  - ✓ Geospatial Information Technologies (3 credits)
  - ✓ Global Social-Environmental Issues (3 credits)
  - ✓ Inquiry and Practice: Geographic Perspectives in the Humanities and Social Sciences (2 credits)

*Usually students with Humanities and Social Science Majors will take at least 2 courses.

Framework of learning contents - Natural Sciences

Themes

1. Composition and characteristics of the natural world
2. Phenomena and the mechanism of the natural world
3. Sustainable development of the natural world

Cross-subject Concepts	Topics	Sub-Topics
Science and daily life (INf)	Science, technology, society, and humanities (M)	Relationship between science, technology and society (Ma) History of science development (Mb) Application of science in daily life (Mc) Natural disasters and prevention (Md) Environmental pollution and prevention (Me)
Resource and sustainability (INg)	Resources and sustainable development (N)	Sustainable development and utilization of resources (Na) Climate change impact and adaptation (Nb) Development and utilization (Nc)

from Ministry of Education (2018) Curriculum Guidelines of 12-Year Basic Education for Elementary School, Junior High and General Senior High Schools - The Domain of Natural Sciences

Learning Contents of **Natural Sciences** related to Disaster Prevention Education

❖ Elementary School Level

- Learning stage II (age 8-10)
  - Human activities will affect the environment.
  - Earthquakes can cause serious disasters; advance preparation and earthquake protection can normally reduce the damage.
- Learning stage III (age 10-12)
  - Major natural disasters and disaster prevention and refuge in Taiwan.
  - It is extremely difficult to recover when the natural landscape and environment are changed or destro

❖ Senior High School level (stage V, age 16-18)
MOE-mandated required courses

Natural disasters and prevention (Md)

- There are necessary conditions and mechanisms for the generation of a typhoon.
- The structure of a typhoon consists of spiral cloud bands with the lowest pressure in the center.
- The paths of typhoons invading Taiwan are mainly guided by the Pacific High Pressure factor.
- Different typhoon paths produce various degrees of influence in the wind and rain across Taiwan.
- Taiwan is located at an active tectonic plate boundary.
- **Earthquakes caused by fault activities often result in disasters that cause huge damages and losses.**

❖ Senior High School level (stage V, age 16-18)
Enrichment and expanded elective courses (not always available)

Natural disasters and prevention (Md)

- There are close relationships between landslides, mudflows, geological environments, and meteorological conditions.
- **Soil and water conservation have the function of disaster prevention and mitigation.**
- Using techniques such as field surveys, remote sensing, and drilling to identify geologically sensitive areas.

Climate change impact and adaptation (Nb)

- Using various research and climate change models to infer the consequences; taking into account both factors of nature and humanity.
- There is significant uncertainty about the inference and the impact of climate change in the future.
- The extents and types of climate change that occur around the world are different.
- **The response and adaptation of human beings to th changes in the global environment may prevent dis**

Learning Contents of **Social Studies** related to Disaster Prevention Education

❖ Elementary School Level - Learning stage III (age 10-12)

Thematic Strand: **Interactions and Relations**

Aspect: **People and Environments (Aa)**

Item: Natural environments, natural disasters and economic activities are contingent on the utilization methods of living spaces.

Learning Contents of **Geography** related to Disaster Prevention Education

❖ Junior High School Level (stage IV, age 13-15)

Theme: Basic Concepts and Taiwan (~ *Geography of Taiwan*)

Aspect: **Taiwan's Landform and Coast**

Items: **Problem-based inquiry : land use or geomorphic hazards and environmental ethics**

Aspect: **Taiwan's Climate and Water Resources**

Items: **Problem-based inquiry : Typhoon and life**

Field Observation: … observe the characteristics of the natural environment near the school.

Theme: Regional Characteristics (~ *World Geography*)

* Natural hazards are often introduced in the textbook bas on the items of the natural environmental settings of Chin and 7 major regions around the world.

❖ Senior High School level (stage V, age 16-18)
MOE-mandated required courses

Theme: Geographic systems (Grade 10)

Aspect: **Geomorphic systems**

Item: **Geomorphic agents**

Item: **Problem-based inquiry: landforms and human life**

Theme: Geographic Perspectives (~ *Regional Geography*) (Grade 11)

Aspect: **Taiwan and the World**

Item: **The characteristics of Taiwan's natural environment**

* Natural hazards are often introduced in the textbook based on the items of the natural environmental settings of major regions/countries around the world, such as tornado in US & haze in SE Asia.

❖ Senior High School level (stage V, age 16-18)
Enrichment and expanded electives

Course 1 - Global Social-Environmental Issues

Theme: Natural Disasters and Land Degradation

Aspect: **Taiwan and the World**

Item: **What is a natural disaster?**

Item: **What is the relationship between natural disasters and human life?**

Item: **How to avoid or reduce the impact of natural disasters and land degradation ?**

*Usually students with Humanities and Social Science Majors will take this course.

❖ Senior High School level (stage V, age 16-18)
Enrichment and expanded elective courses

Course 2 - Geospatial Information Technologies

Theme: Applications

Aspect: **Environment and Disaster Prevention**

Item: **Environmental quality inquiry and evaluation**

Item: **Query of the disaster potential maps**

Theme: Practice

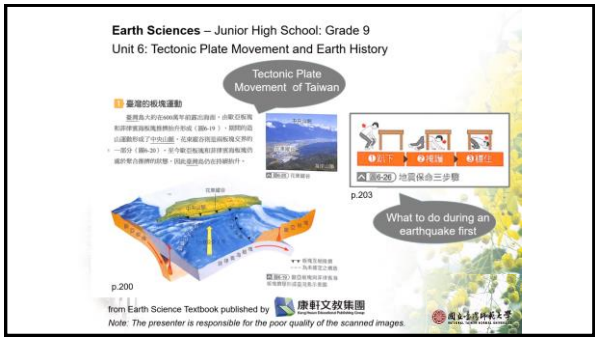
Aspect: **Inquiry and Practice**

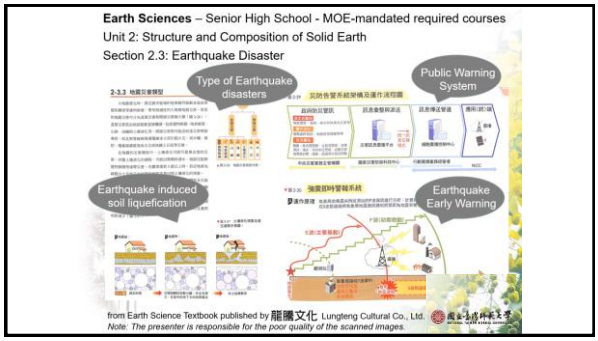
Item: **Use the web map as a platform to participate in the planning of the school or community space**

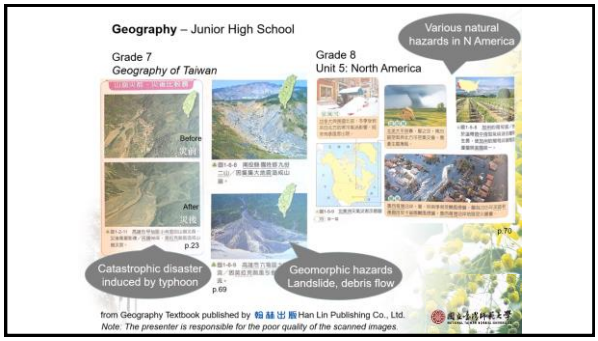
Item: **Specific space issues of your hometown**

Item: **Overlay the layer of active faults in Taiwan and the layer of an important facility to asse disaster risk**

*Usually students with Humanities and Social Science Majors will take this cour


Earth Sciences – Junior High School: Grade 9
Unit 6: Tectonic Plate Movement and Earth History
Tectonic Plate Movement of Taiwan
What to do during an earthquake first
p.203
p.200
from Earth Science Textbook published by 康軒文教集團
Note: The presenter is responsible for the poor quality of the scanned images.


Earth Sciences – Senior High School - MOE-mandated required courses
Unit 2: Structure and Composition of Solid Earth
Section 2.3: Earthquake Disaster
Type of Earthquake disasters
Public Warning System
Earthquake induced soil liquefaction
Earthquake Early Warning
from Earth Science Textbook published by 龍騰文化 Lungteng Cultural Co., Ltd.
Note: The presenter is responsible for the poor quality of the scanned images.


Geography – Junior High School
Grade 7
Geography of Taiwan
Grade 8
Unit 5: North America
Various natural hazards in N America
Catastrophic disaster induced by typhoon
Geomorphic hazards Landslide, debris flow
p.23
p.69
p.70
from Geography Textbook published by 翰林出版 Han Lin Publishing Co., Ltd.
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Geography – Junior High School: Grade 9
Unit 4: Global Environmental Issues
from Geography Textbook published by 翰林出版 Han Lin Publishing Co., Ltd.
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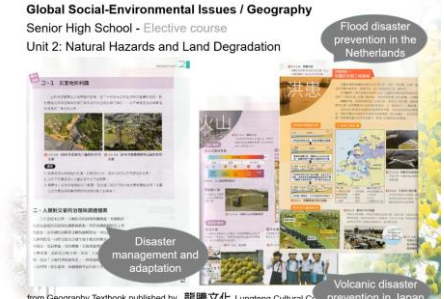
Global Social-Environmental Issues / Geography

Senior High School - Elective course

Unit 2: Natural Hazards and Land Degradation



from Geography Textbook published by 龍騰文化 Lungteng Cultural Co., Ltd.

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Global Social-Environmental Issues / Geography

Senior High School - Elective course

Unit 2: Natural Hazards and Land Degradation

from Geography Textbook published by 龍騰文化 Lungteng Cultural Co., Ltd.

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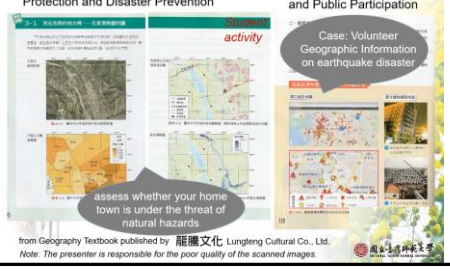
Geospatial Information Technologies / Geography

Senior High School - Elective course

Unit 3.1: Application on Environmental Protection and Disaster Prevention

Unit 3.3: Spatial Decision and Public Participation



from Geography Textbook published by 龍騰文化 Lungteng Cultural Co., Ltd.

Note: The presenter is responsible for the poor quality of the scanned images.

Summary

- **The progress of the DRRE in various aspects in Taiwan has been significant through a top-down process along with a series of programs executed by MoE over last two decades.**
- **Around 3000 schools have participated the project of Disaster Resilient Schools up to 2020.**
- **Challenges remain in pursuing the goal of '*Every School is a Disaster Resilient School*' in Taiwan.**
- **An advantage is that Disaster Prevention Education has been included as one of 19 important Education Issues in the current National Curriculum.**
- **Earth Sciences and Geography are two subjects address natural hazards or natural disasters directly in school education in Taiwan.**
- **Geography addresses more on the interaction between human and environments and usually within the specific contexts, regions or places.**
- **It is suggested that disaster prevention experts, geography teachers and earth sciences teachers shall work together to develop student-centered, school-centered and place-centered courses with inquiry and practice activities so that students will feel connected to the local environment and attached to the local community. It is believed it will help to achieve the affective objectives of disaster prevention education.**