Daily Life Oriented Climate Change Education For Geography Pre-service Teachers

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1. Climate Change Education: Review

Literature review

- Climate change education (CCE) has two obvious parts: Climate and change.
- The climate part obviously falls under the umbrella of the natural sciences and has traditionally been taught in geography and earth science (McKeown & Hopkins, 2010).

The second part—educating for change

- CCE has not emerged as an independent field, but rather as an integral part of EE and ESD. In fact, CCE has only gradually developed its own identity during the last three years, and is therefore still in its infancy (Læssøe et al., 2009)UNESCO, 2012:5).
- Single-use plastic bags (SUPBs) started in the e1970s, (Clapp & Swantoon, 2009), became popularized rapidly in the last quarter of the 20th century (Sugii, 2008)
- New Calculation Method for Measurement of Recycling Rates and Influence on Recycling (Obermeier, et.al., 2017).
- Virtual water (Sepideh Ghafouri, 2015; Lim Chul-Hee, et al, 2017)

Literature review: Water concepts

- Virtual water
- Water footprint (blue, green and gray water)
- Water saving
- Virtual Water content of the main crops (Korea-Lim et al. 2017)
- Virtual water trade (Sepideh Ghafouri, 2015)
- Virtual water export, import and net virtual water export

New Calculation Method for Measurement of Recycling Rates (Obermeier, 2017)

4 methods for calculating the recycling rates

In Europe: by 2020 recycling target minimum of 50% by weight for at least paper, metal, plastic and glass

Climate change education-The Global Agendas and New Paradigms of Education

- Climate Change Education- Global agenda

- UNESCO: Education and awareness-raising play an essential role in increasing the climate change adaptation and mitigation

- UNESCO Global Action Programme (GAP) on ESD: to generate and scale up action in all levels and areas of education and learning to accelerate progress towards sustainable development.
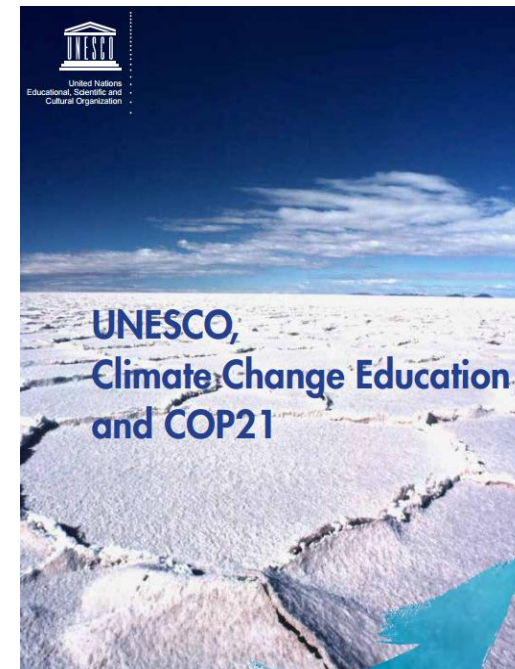
Climate change education for all

- CC is everywhere: not depends on development, location, hot and cold, dry and wet, from tropics to the pole
- CC affects to everyone: especially women and children, poor and developing countries are most vulnerability for CC
- CC affects to everything: natural and human process, food security, economy, natural hazards, tourism etc.

- Climate literacy
- Geo literacy
- CC awareness initiative
- UNESCO course for secondary teachers on CCE for SD
- 'Climate Change in the classroom'
- Youth Xchange: CC and life style
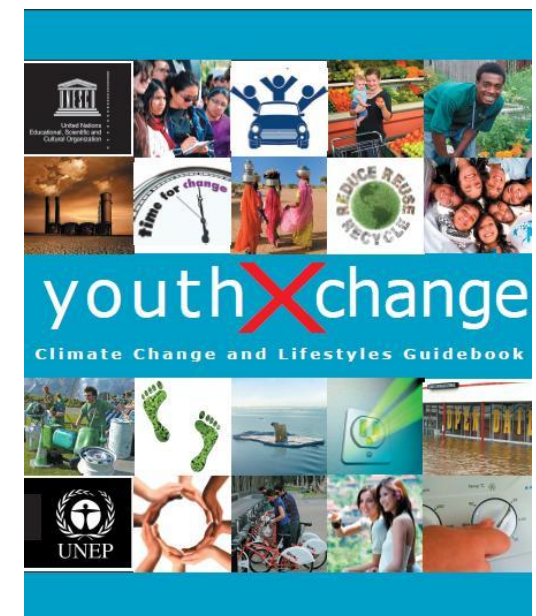
International examples

- Solar Schools in Australia-The National Solar School Initiative is a major ESD program that has CC mitigation as an element (UNESCO, 2012)

- Cross-Sectoral Programs in Korea

- CC has been considered as a key theme of ESD and included in school topics/ subjects, such as: climate (geography), energy (science) and global warming (environment).

- Eco-Schools in Japan

- Sandwatch-the network started in the Caribbean in 1999

- Desertification watch-Mongolia in 2015

- Enhance the capacity of staff in education and training sector to respond to climate change

- Integrate CC and CC responses into the Education and Training program in the national education system

- Study and propose models of climate proofing schools in the climate-affected regions

- Improvement of school equipments, and learning tools for CCE in schools

- Research for CCE in schools

CCE: New paradigm of geography education

Action themes of UN Decade ESD

-Environment

-Water

-Climate change

-Disaster reduction

-Rural development

-Sustainable consumption

-Sustainable tourism

-intercultural understanding…

International charter on GE (IGU 2016)

- Geography is a vital subject for 21st century global citizens, enabling us to face questions of what it means to live sustainably in an interdependent world. - -

- Geographically educated citizens understand human relationships in the world and their responsibilities to both the natural environment and to others.

- Geography education helps young people learn how to exist harmoniously with all creatures, including human beings.
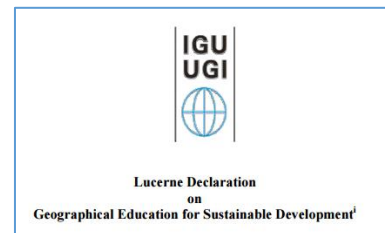
IGU UGI

Lucerne Declaration
on
Geographical Education for Sustainable Development

Lucerne Declaration on Geographical Education for Sustainable Developmen (2007)

2. Why CCE is needed in Mongolia

Climate Change Issues in Mongolia

Reasons of most **vulnerability** on CC are:

- Location (Mongolian plateau, landlocked)
- Arid continental (water scarcity, desert area, desertification)
- Great temperature amplitudes (annual and daily)
- Pastoral livestock
- All economy and life depends on the nature
- Rural-urban migration

Related **policies/legal documents**: Convention on CC
Laws: Air laws, Water laws, Soil, Minerals and Deposits
National programmes: CC, Combat Desertification, Green development, SDNP

International and domestic **projects:** Integrated water resource management, Coping with desertification, Ecosystem based adaptation etc.

**Scientific researches:** model based trends of air temperatures, precipitations etc.

Research based **books** and other materials: "CC mitigation"; "CC adaptation" books, booklets etc.

GOs and **NGOs**: research institutions, consultants, project implementator

But , public awareness is still very low. (Problem is implementation)
Education is best tool fighting climate change.

Environmental issues in Mongolia
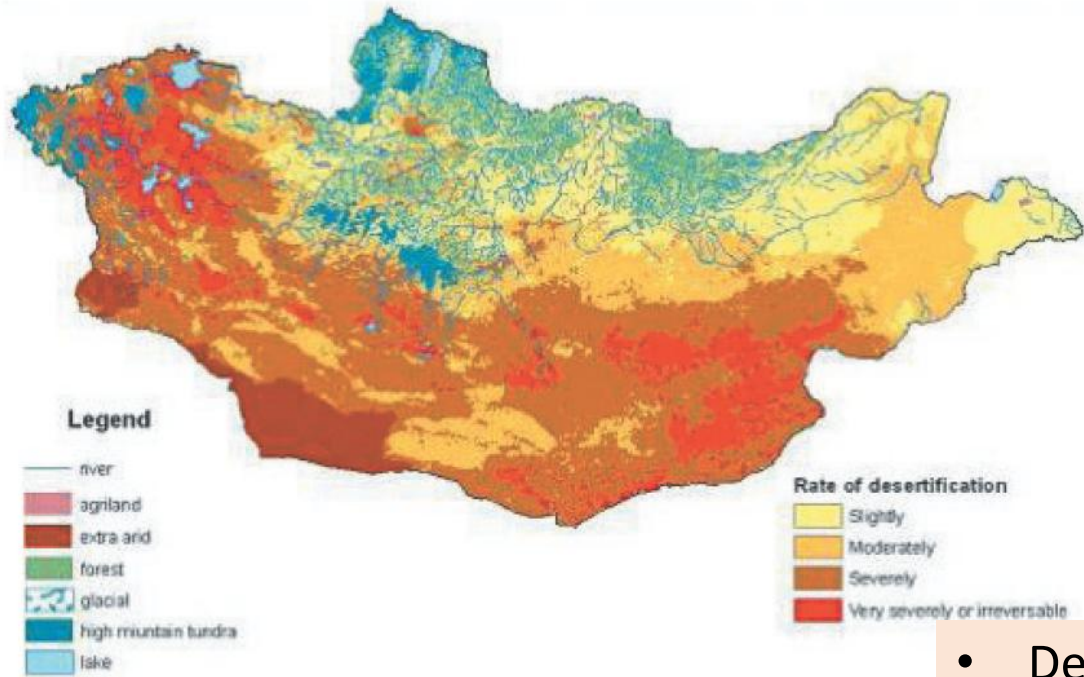
- Desertification, soil degradation
- Drought, water source depletion
- Evaporation of surface water has increased by 118.1 mm since 1961
- precipitation has decreased by 33.0 mm resulting in aridity and becoming the main cause of desertification (MARRC, 2014).
- Over 90% of pastureland depredated
- Livestock herd composition
- Goat population has increased rapidly to occupy 40% of herds
- 'Mining boom' started in 2000s
- Air pollution in UB

Indirect factors to CC: Traditional knowledge and local wisdom

- Traditional way of nomads' daily life and their basic needs are changing: food, clothing, fuel, transportation and traditional tools.

- **traditional transportation**: nomads are using cars for carrying their Ger instead of a caravan;

- using motorcycles for herding the animals instead of horse riding;

- using refrigerators for keeping meats instead of drying meat;

- **Bags for keeping foods** (animal skin bags by plastic bags)

- generating **more waste** than before etc.

- all these changes are getting closer to the western living style but **losing the sustainable traditional nomadic way of living.**

Changing and changing…

Tradition?

Climate?

Eco transportation is changing by cars, motorcycles…

3. Baseline survey on Pro-environmental attitudes/knowledge for CCE

Methodology of needs assessment survey

Review of policy: Policy analysis matrix (PAM)

- *Educational:* 12 laws, 16 national programs
- *Environmental*: Preventing from Disasters, Law on Protected Areas, National Programs on CC, and Water Resources, Coping with Desertification etc.

Review of national educational standards, curricula, textbooks

- 25 subjects' standards, curricula
- Textbooks

Review of school students and pre service teachers' knowledge/attitudes of CC

- Questionnaire (Likert scale based)
- Qualitative assessments

Pro-environmental attitudes for CCE (Selected)

Waste segregation and 3Rs
Water saving (virtual water-water footprint)
Using public transport and walk
Planting trees
Using less light
Less car and flights

Eating less meat
Energy saving
Good insulation
Using lights with less energy
Less buying
Washing the car by hand
Not too much printing
Print on two sides of the paper

Methods

1. Desk review (educational and environmental policy documents)

2. Survey questionnaires (20 items): three pars: a) general information b) knowledge on CC, c) CC attitude

3. Students were asked to use three to four point Likert styled scale which ranges from 1='strongly disagree' at the lower end to 3, 4='strongly agree' at the high end

4. Focus group discussions (20 package of questions)

5. 128 pre-service geography teachers involved

Students' knowledge related to environment, pollution and climate change (%)
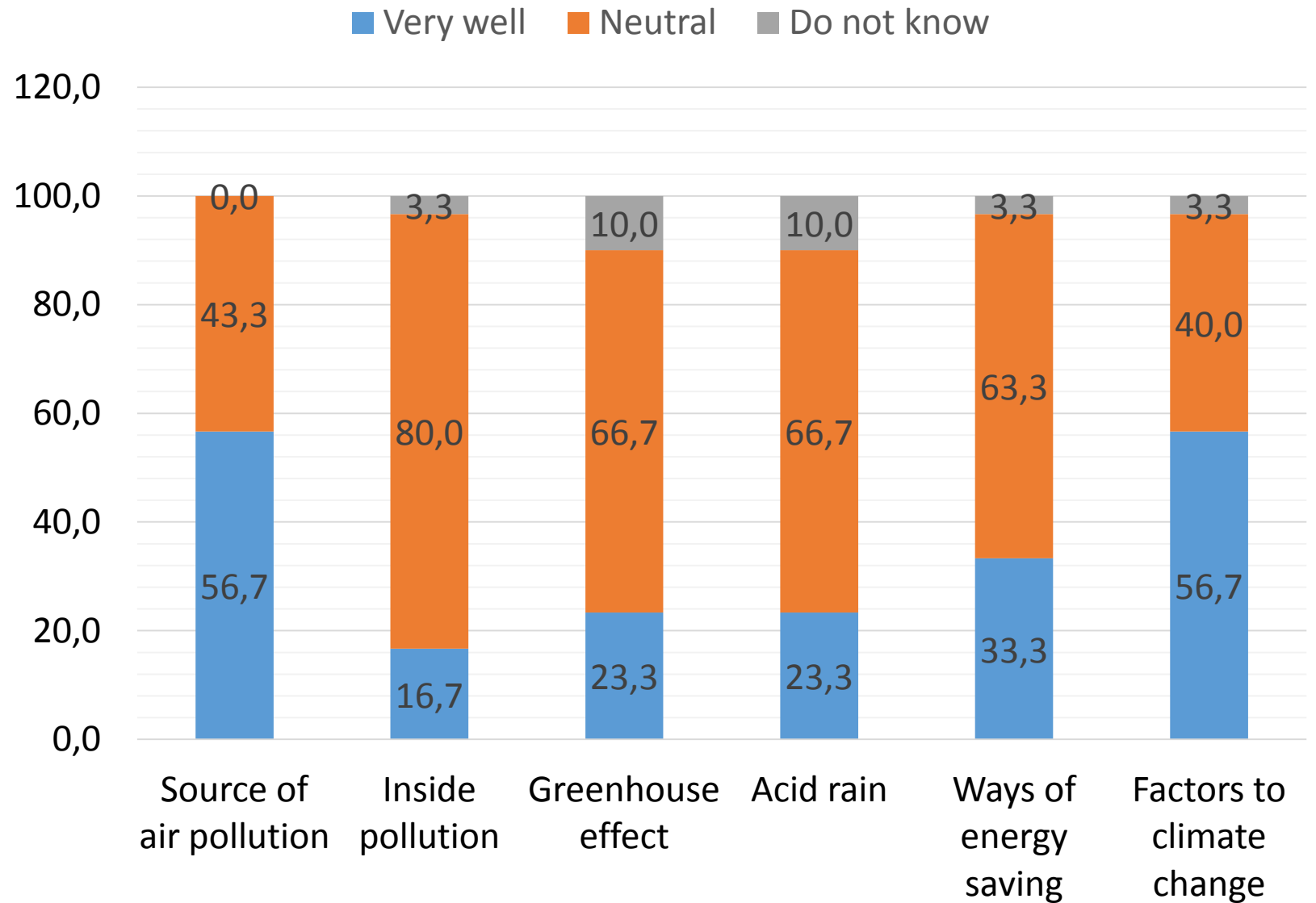
Students' attitude about the waste and segregation

Items	Decomposable	Non-decomposable	Hazardous waste	Recycling
Fruits and vegetable skin	83.3	6.7	10.0	0.0
Plastic bags	10.0	60.0	30.0	0.0
Plastic bottles	6.7	30.0	40.0	23.3
Sawdust	56.7	10.0	0.0	43.3
Battery	3.3	13.3	80.0	3.3
Glass	10.0	43.3	20.0	26.7
Chewing gum	33.3	40.0	16.7	10.0
Tetrapak	20.0	36.7	20.0	23.3
Food waste	53.3	20.0	23.3	3.3
Construction waste	20.0	40.0	26.7	13.3
Papers	26.7	10.0	6.7	56.7
Disposable syringes	6.7	20.0	56.7	16.7
Others	10.0	46.7	23.3	20.0

Students' attitude about the waste and segregation
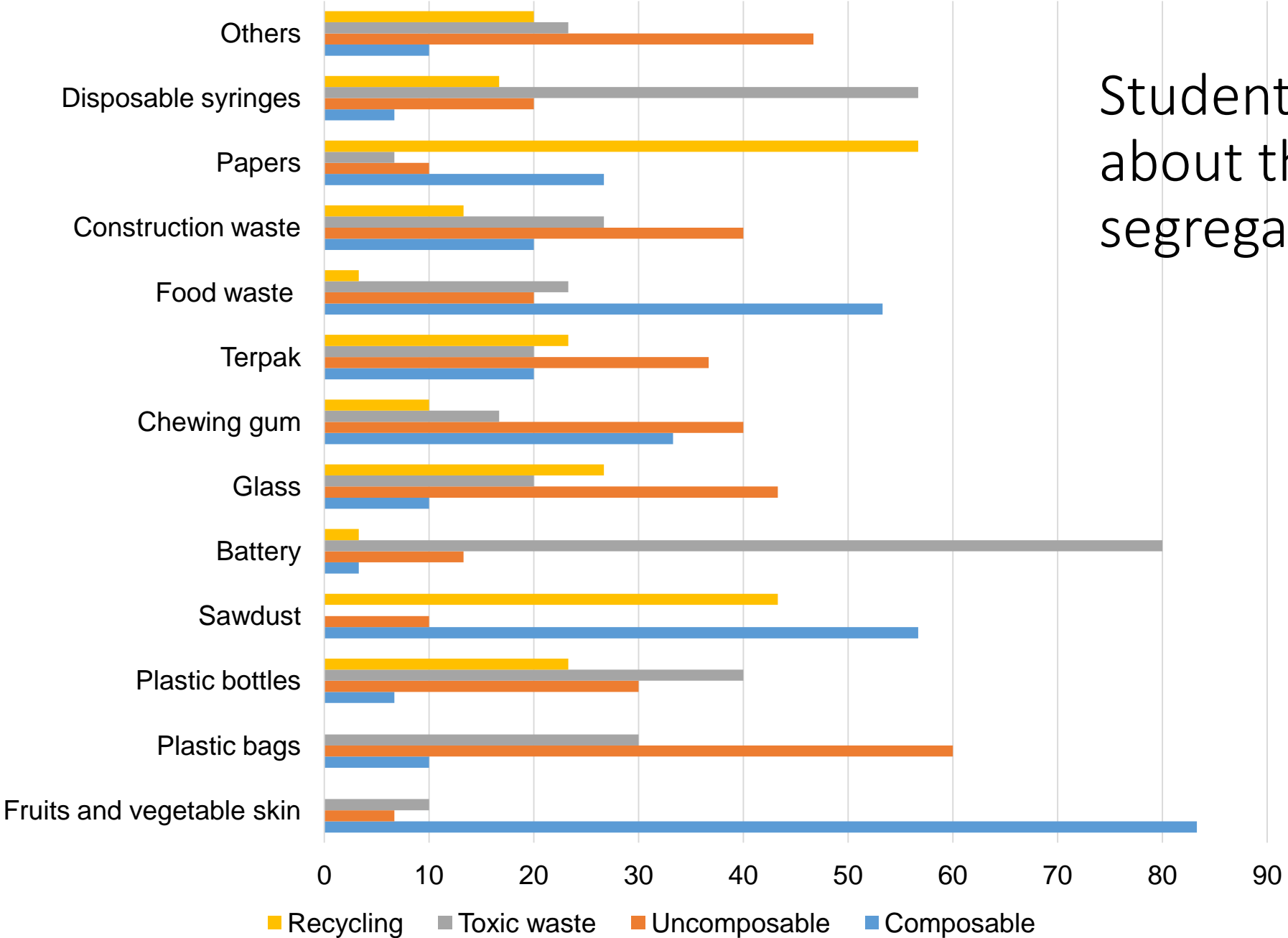
Students' attitude towards to environment
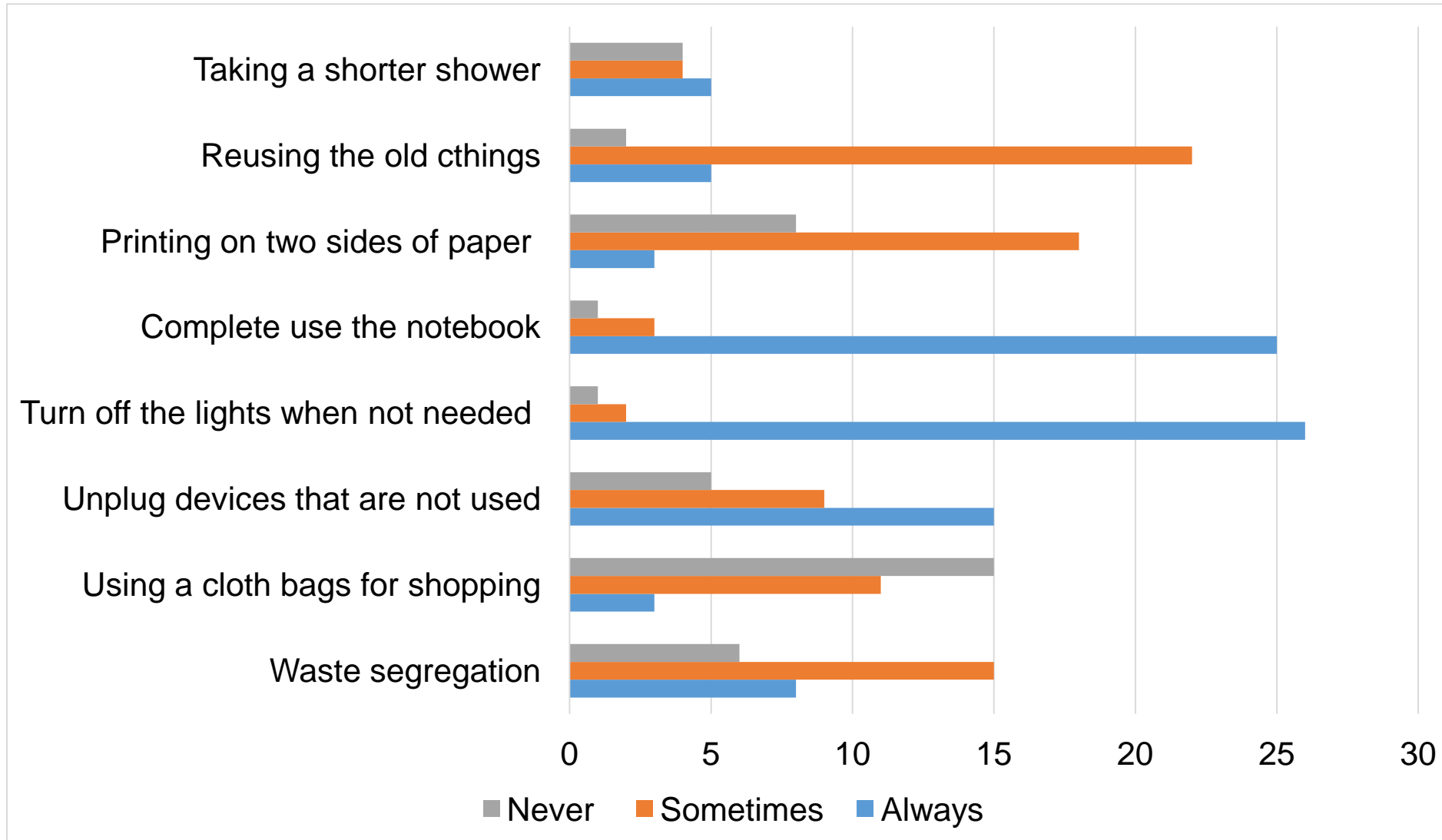
Students' environmental attitudes and activities (three different schools)

	Very much n (%)			Middle n (%)			Little n (%)			Never n (%)		
Schools number	#40	#48	#76	#40	#48	#76	#40	#48	#76	#40	#48	#76
Warming house and rooms in winter	7 (23.3)	2 (6.7)	11 (36.7)	12 (40.0)	8 (26.7)	8 (26.7)	7 (23.3)	7 (23.3)	9 (30.0)	4 (13.3)	13 (43.3	2 (6.7)
Use the public buses	6 (20.0)	4 (13.3)	11 (36.7)	9 (30.0)	9 (30.0)	10 (33.3)	12 (40.0)	13 (43.3)	8 (26.7)	3 (10.0)	4 (13.3)	1 (3.3)
Bicycling	18 (60.0)	20 (66.7)	20 (66.7)	3 (10.0)	2 (6.7)	8 (26.7)	7 (23.3)	2 (6.7)	1 (3.3)	2 (6.7)	6 (20.0)	1 (3.3)
Less use computer and cell phones	1 (3.3)	4 (13.3)	8 (26.7)	12 (40.0)	12 (40.0)	9 (30.0)	9 (30.0)	5 (16.7)	7 (23.3)	8 (26.7)	9 (30.0)	6 (20.0)
Save water	6 (20.0)	12 (40.0)	9 (30.0)	9 (30.0)	4 (13.3)	10 (33.3)	5 (16.7)	4 (13.3)	8 (26.7)	10 (33.3)	10 (33.3)	3 (10.0)
Reducing number of livestock	0 (0.0)	1 (3.3)	4 (13.3)	4 (13.3)	3 (10.0)	20 (66.7)	9 (30.0)	2 (6.7)	14 (46.7)	40 (56.7)	24 (80.0)	6 (20.0)
Printing both sides of paper	3 (10.0)	6 (20.0)	9 (30.0)	9 (30.0)	8 (26.7)	13 (43.3)	7 (23.3)	3 (10.0)	4 (13.3)	11 (36.7)	13 (43.3)	4 (13.3)
Less messaging by cellphone	1 (3.3)	0 (0.0)	6 (20.0)	4 (13.3)	5 (16.7)	5 (16.7)	13 (43.3)	5 (16.7)	7 (23.3)	12 (40.0)	20 66.7)	12 (40.0)

4. CCE curriculum development for pre-service teachers

CCE Curriculum Structure and Content

Structure is Module based:

1. CC and ecosystem

2. CC and society

3. Adaptation and mitigation of CC

(Includes 56 slides)

Needs assessment survey	Policy document
	Textbooks/curriculam
	Teacher's knowledge
Curriculum Content development	Module 1: CC and Ecosystem
	Module 2:CC and Society
	Module 3:CC Adaptation and mitigation
Methodology development	Learner-centered
	Daily life-oriented
	Life style changing
University students/Teacher training	Pre-service/ In-service TT
	Optional courses
	Self-learning

Content of the CCE Curriculum	Lectures	Seminars
Module 1: Climate and Ecosystem		
1.1 Ecosystem and Ecosystem services	2	2
1.2 The changing climate	2	2
1.3 Climate change Impacts	2	4
Subtotal	6	8
Module 2: Climate change and Society		
2.1 Climate change and population	1	2
2.2 Climate change and Health	1	2
2.3 Climate change and Ethics	1	2
2.4 Ecological Footprint, water footprint	1	2
Subtotal	4	8
Module 3: Climate Change Adaptation and Mitigation		
3.1 Cliamate change mitigation	2	4
3.2 Ecosystem-based adaptation of the climate change	2	4
3.3 Ecosystem based management	2	4
3.4 Good experiences of the CCA regional and local strategies	-	4
Subtotal	6	16
	16 hours	**32 hours**

Knowledge, skills, attitudes and assessment by the modules

	Themes	Knowledge	Skills	Attitudes (application)	Assessment
1	Module 1: Climate and Ecosystem				
	Ecosystem and ecosystem services	Natural resources and its types (air, water, soils,	- Explain of ecosystem services based on local case ……	- Advocate to other people about the ecosystem services	- Name, calculate, compare …..
	Module 2: Climate change and Society				
3.1	Climate change and Health	Environmental pollution and its impacts to the health…	- Segregate the household waste….	- To use the 5Rs….	
	Module 2: Climate change and Society				
3.1					

Contents of themes

- Goals
- Objectives
- Brief content of the lectures
- Introdution of seminar lessons
- Self-learning based Activities

Am I energy-friendly person?

Discuss about how saving energy will mitigate desertification.
How much energy we can save?
How many light bulbs do you have in your home?
In example: a lamp, kitchen light, bathroom etc.
How many of them are incandescent light bulbs, and how many are not?

It is estimated that if you use a non-incandescent light bulb over an incandescent one, you will save 68.1 kg of carbon dioxide per year.

If you change all the light bulbs to non-incandescent bulbs, how much carbon dioxide will you save?
Using a non-incandescent light bulb will save your energy consumption by 50%. How much can you save on your monthly electricity bill? How much can you save this year?

Discuss the findings:
Can you mitigate desertification by switching off unused light and changing to non-incandescent light bulbs?
Please rise the question on topic "Am I an energy saver?" and discuss it in your class.
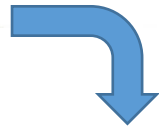
Ecosystem service

How do you get a service from the trees?

Do you give back to the tree?

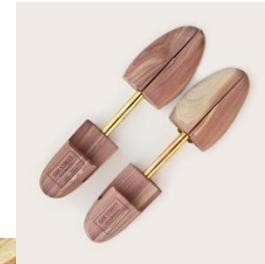**Seminar lesson 1.1. Water footprint and Virtual water** (2 hours)

Methodology:

Case study and analyses
Study of story telling
Focus group discussion
Make the save water model (car wash)
Communication and discussion

Acitivity:

5. Piloting and findings

Daily life related examples: Waste calculation

	Weekly consumption per team (10 students)	Monthly consumption per team (10 students)	Yearly consumption per team (10 students)	Yearly consumption per one million people	How many in home place or in Mongolia or…?
Disposable cups (Single use cups)	5	21	257	25,700,000	
Single-use plastic bags	46	197	2364	236,400,000	
Plastic bottles	44	188	2256	225,600,000	
Tetra packs	33	141	1692	169,200,000	
Glasses	5	21	257	25,700,000	
Plastic cards	70	300	3600	360,000,000	
Cans	4	17	204	20,400,000	
Chewing games	30	129	1548	154,800,000	

Daily life oriented example: Virtual water

	Хувцас							Хүнсний бүтээгдэхүүн									Ахуй					
	Жинс өмд	Фудболка	Кег	Пиджак	Оймс	Ботинк	Сорочка	Цагаан будаа (кг)	Жимс	Кофе	Үхрийн мах (кг)	Ундаа, цэвэр ус	Савтай сүү	Гурил (кг)	Талх (ш)	Лаазалсан бүтээгдэхүүн	1 удаагийн аяга	Машин	Утас	Компьютер	Телевиз	Дэлгүүрт худалдаа хийхдээ авсан гялгар уут
1	4	6	2	-	6	-	4	2	1,5	4	5	4	1	2	2	2	-	1	3	2	1	10
2	4	4	1	1	5	-	2	1,5	0,5	2	4	5	2	2,5	5	-	2	1	4	2	1	5
3	2	4	2	2	6	2	6	2	1	5	5	3	1	3	5	1	-	-	1	2	1	7
4	5	5	3	1	7	-	2	1	1	3	4	4	1	2	1	-	-	-	1	1	1	7
5	2	5	1	1	8	1	1	1	1	2	3	2	1	2	1	-	1	-	1	1	-	5
6	6	6	1	5	7	1	1	1,5	0,5	3	5	3	7	1	4	-	-	-	3	2	1	3
7	8	5	-	1	7	-	4	0,5	0,5	-	2	2	-	2	7	-	-	-	4	1	1	2
8	2	6	1	1	7	2	6	2	1	3	4	4	2	1	1	-	-	1	5	2	1	3
9	4	7	2	1	9	3	5	1	2	-	5	10	4	1,5	2	-	-	1	2	1	1	6
10	2	5	3	1	11	1	1	4	0,5	14	5	7	4	2	4	1	2	1	6	3	1	8
Нийт	39	53	16	14	73	10	32	16,5	9,5	36	42	44	23	19	32	4	5	5	30	17	9	46
Дам зарцуулагдах ус	429000	119250	127200	205800	69350	80000		41000	665	5800	650000	7400	23000	25000	19200			1950000	390000	25500		
Нийт (Дам зарцуулагдах ус)																						4.150.000

Virtual water for clothing

(Pieces)
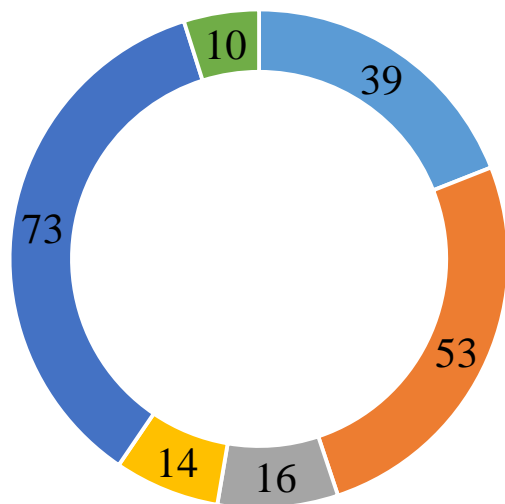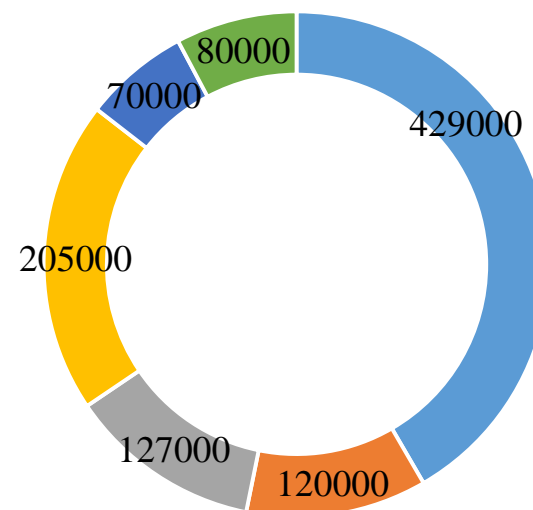
Virtual water (l)

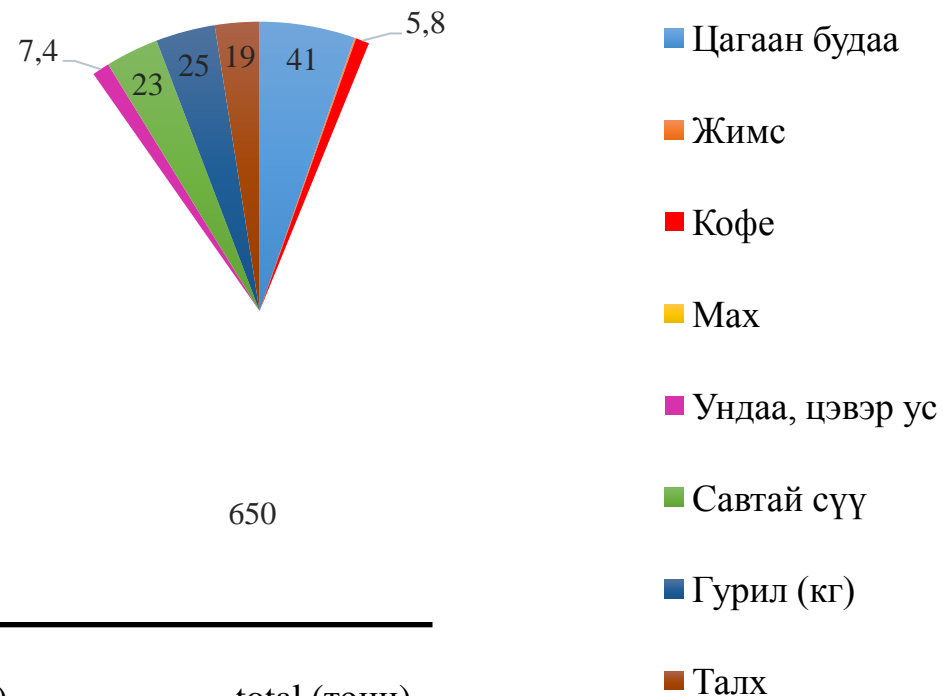| Clothing		Virtual water per..lл)	Total
Jeans	39	11000	429,000
Cottron T shirt	53	2250	119,250
Boots	16	7950	127,200
Jackets	14	14700	205,800
Socks	73	950	69,350
Shoes	10	8000	80,000

Sources:
http://www.unesco.org/new/fileadmin/MULTIMEDIA/FIELD/Venice/pdf/special_events/bozza_scheda_DOW04_1.0.pdf

Virtual water for foods

Products
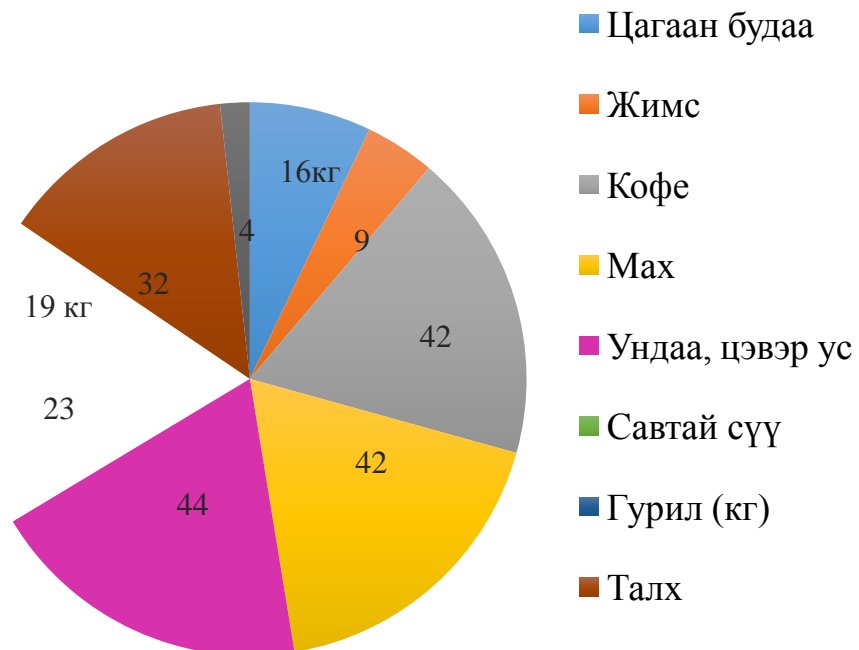
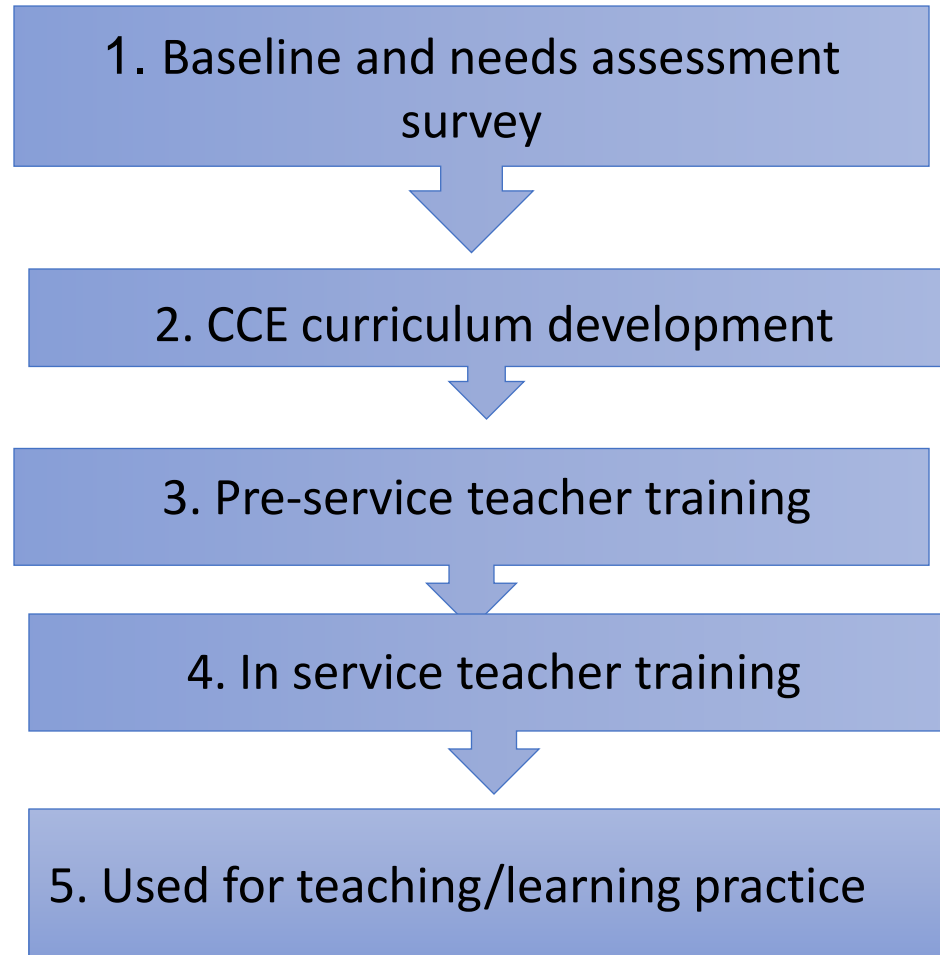| Items	pieces	Per product (л)	total (тонн)
Rice	16,5	2500	41
Fruits	9	70	0,6
Coffee	42	140	5,8
Meat	42	15500	651
Bottle water	44	170	7,4
Packed milk	23	1000	23
Floorкг)	19	1350	25,6
Bread	32	600	19

Daily life related examples: Traffic conjunction, consumption of petrol and CO2 calculation

Types	Point I	Point II	Point III	Point IV	Point V	Total	Petroleum	Price (Tg)	Petroleum per 100 km (л)	Total cost (Mon Tg)	Emission of CO_2 (kg)
Jeep	102	44	32	31	68	277	A95	1815	5540 (20 л)	10,055,000	13296
Cars	305	290	104	243	325	1267	A92	1625	20200 (16 л)	32,820,000	48480
Microbus	19	14	8	22	10	73	80	1465	1022 (14 л)	1,490,000	2452,8
Bus	9	21	4	16	5	55	Disel	2010	1925 (35л)	3,870,000	4620
Trucks	20	7	5	9	4	54	A92	1625	378 (7л)	614,000	907.2
Bicycle	1	3	2	2	1	9					
Pedestrian	115	437	187	328	325	1392					
Total						1726			29060	48,850,000	69744

Attitude Changes of Pre Service teachers on pilot testing of CC curriculum (4-good)

	4	3	2	1
CC causes	66.7	26.7	6.7	0.0
CC impact	66.7	16.7	13.3	3.3
CC adaptation and management	23.3	53.3	13.3	10.0
Waste segregation and 5Rs	46.7	33.3	10.0	10.0
Consumption management	56.7	26.7	10.0	6.7

6. Conclusions

1. Baseline and needs assessment survey

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2. CCE curriculum development

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3. Pre-service teacher training

↓

4. In service teacher training

↓

5. Used for teaching/learning practice

- Motivating learning
- Changed attitudes
- Capacity building for schools
- Contextualization of learning
- Ecosystem based CC adaptation
- Self learning oriented
- Daily life needs relevant

- Inquiry based

- Simplified

- Application oriented

- Motivation learning

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