The Textual Analysis of Online Debates and Classroom Discussion about Socio-Scientific Issues in regard to Opinion Formation and Decision-Making

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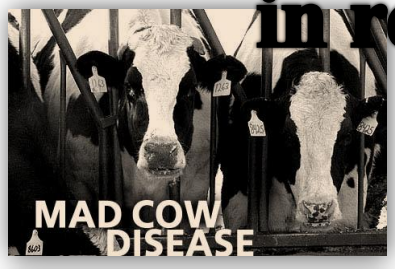

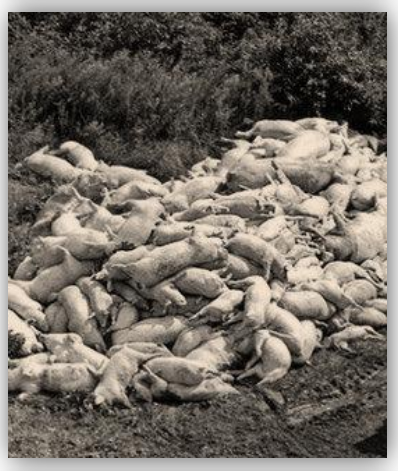

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Socio-scientific issues (SSIs) in Science Education

The definition of socio-scientific issues

"The one which has a basis in science and has a potentially large impact on society"
(Ratcliffe & Grace, 2004)

The nature of socio-scientific issue

SSI

encompass up-to-date knowledge of S & T

address personal, local, national and global dimensions

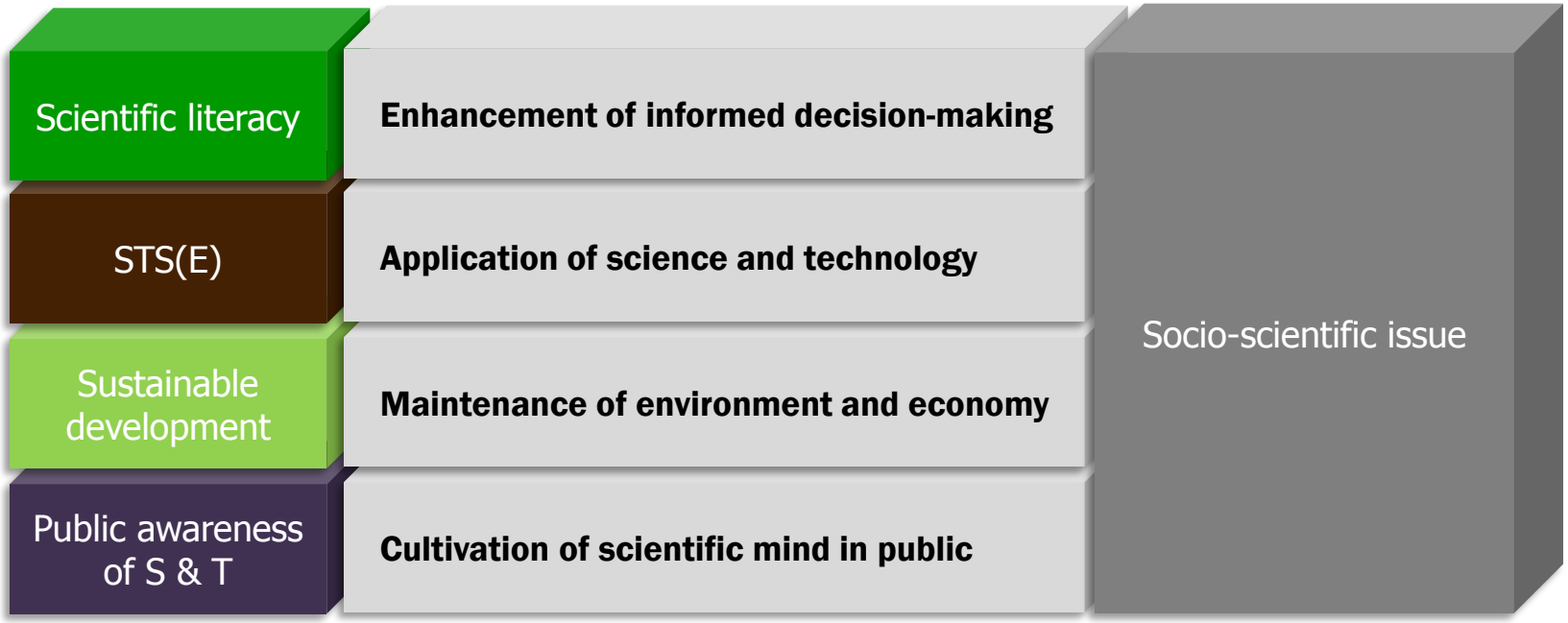
tackle incomplete information due to conflicts and insufficient evidence

involve values, ethical reasoning and decision-making

Interest in socio-scientific issues

The combination of real-life with scientific knowledge

Goals of science education



SSIs are deeply engaged in significant goals of science education

The power of the internet (online debating in socio-scientific issues)

New type of knowledge construction (e.g., Wikipedia)

Public opinion formation in the new era (from the site to the online)

Interactive communication in the internet (twitter, facebook, etc)

Dealing with socio-scientific issues in the classroom

Hybrid, electronic and fuel cell vehicle

To learn about socio-scientific issues is helpful to encourage students to link their lives with science knowledge.

This instruction is appropriate to achieve scientific literacy for individuals.

Research questions

1. How do people **manage the risks** in socio-scientific issues in regard to decision-making?

2. How does **scientific knowledge** contribute to decision-making?

3. What are **the differences** between online debates and classroom discussion **to reach the conclusion** in terms of discourse pattern?

4. What implications give us through the comparison of two different style of discussion?

Research 1: Textual analysis of online debates of mad-cow disease

Topic: the decision of Korean government to allow to import US beef

Background:

Jan, 2008 - The public began to show their opinions on the internet.
Apr, 2008 - They argued each other and formed public opinion.
May – Aug, 2008 - The online debates led them to go outside and to take a political action (candle strike).

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Mad Cow Scare

Beef Market-Opening May Stoke Anti-American Sentiment

President Lee Myung-bak unexpectedly faces impeachment calls not from politicians but from citizens less than 70 days after his inauguration. So what do they find wrong with him? A leadership crisis? Conflict with opposition party members? Or an internal feud in his own party? It's none of the above. Rather it is because of a mounting public scare over mad cow disease.

Concerns about mad cow disease have reignited in South Korea since the country decided to fully open its beef market to U.S. imports in mid-April. This time, the mad cow scare is not based on any scientific reasons or the finding of specific risk materials causing the incurable illness.

From The Korea Times

Research 1: Textual analysis of online debates of mad-cow disease

Data: 66 best articles (hot clicks, ups and downs) in 300 related-articles on the web board (keyword: mad-cow disease)

Analysis: domain analysis/taxonomical analysis (LeCompte, Preissel, & Tesch, 1993)

Domain analysis: categorization of related factors to decision-making such as science, society and politics

Taxonomical analysis: division of formal and content elements based on a paraphrase and organization of sub- and grand- categories

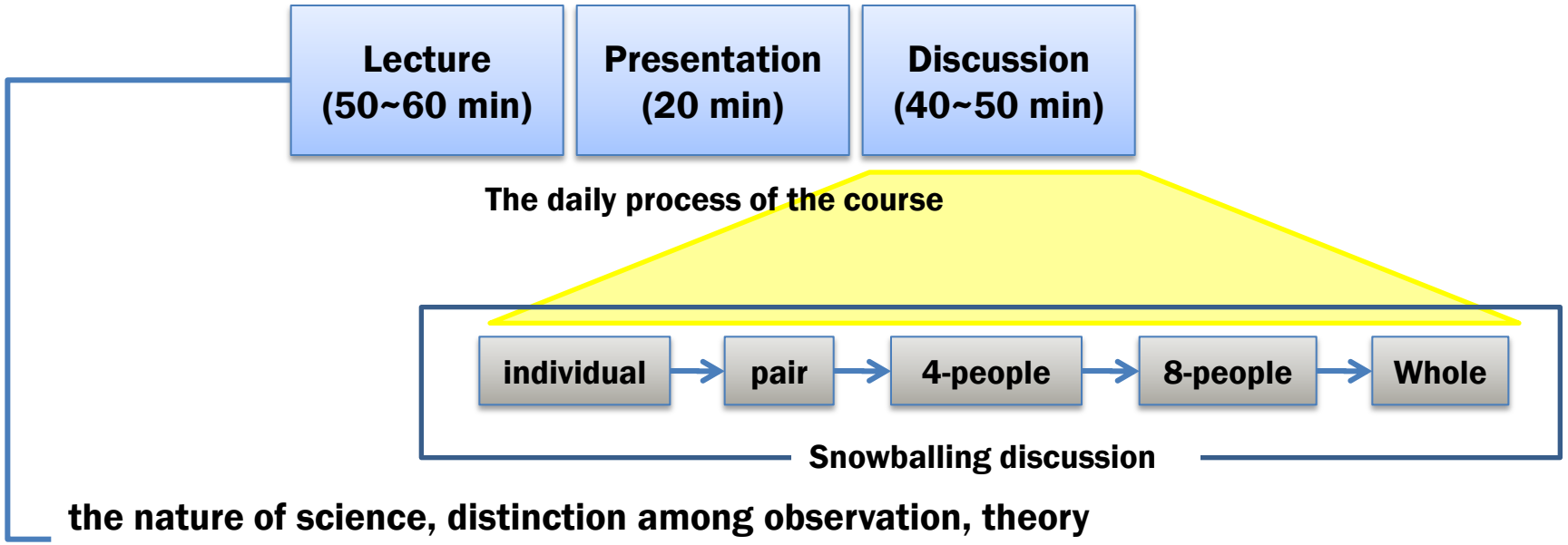
Research 2: Classroom discussion on socio-scientific issues

Topic: scientific discourse in a undergraduate course dealing with socio-scientific issues

Background:

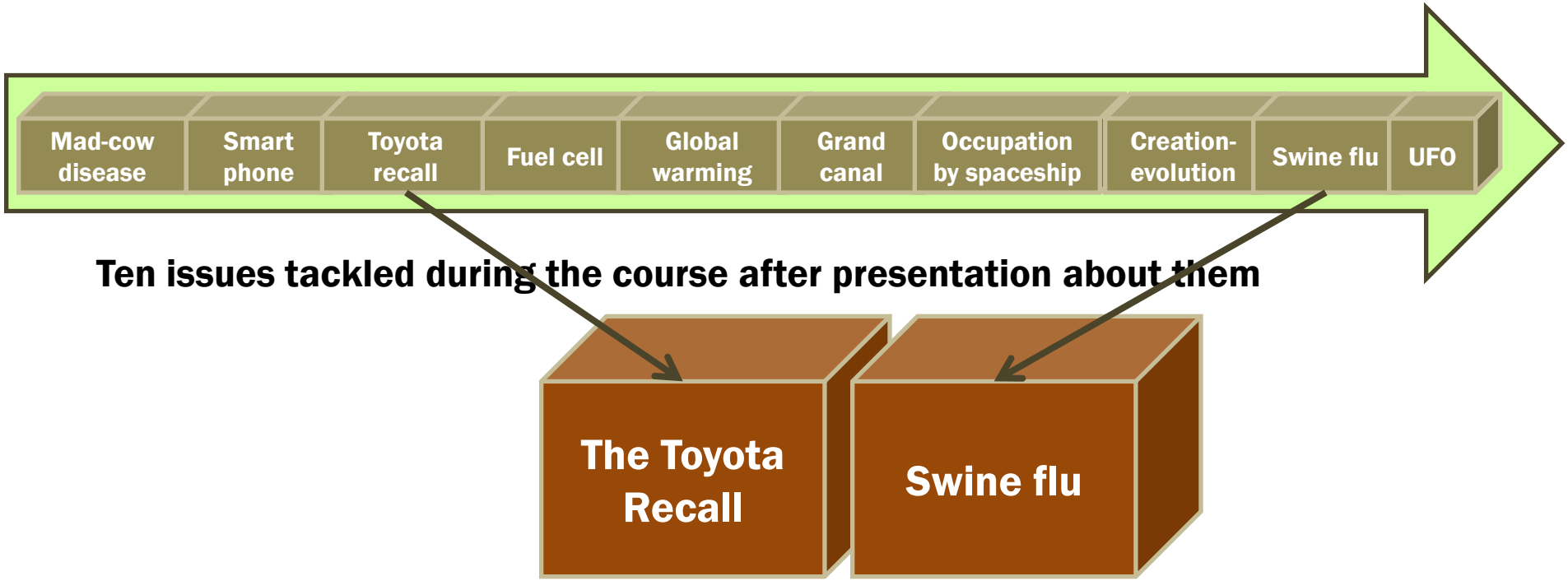
An undergraduate course for 27 freshmen (6 male and 21 female) in 2010

2 hours in a week and one-hour discussion in every lesson

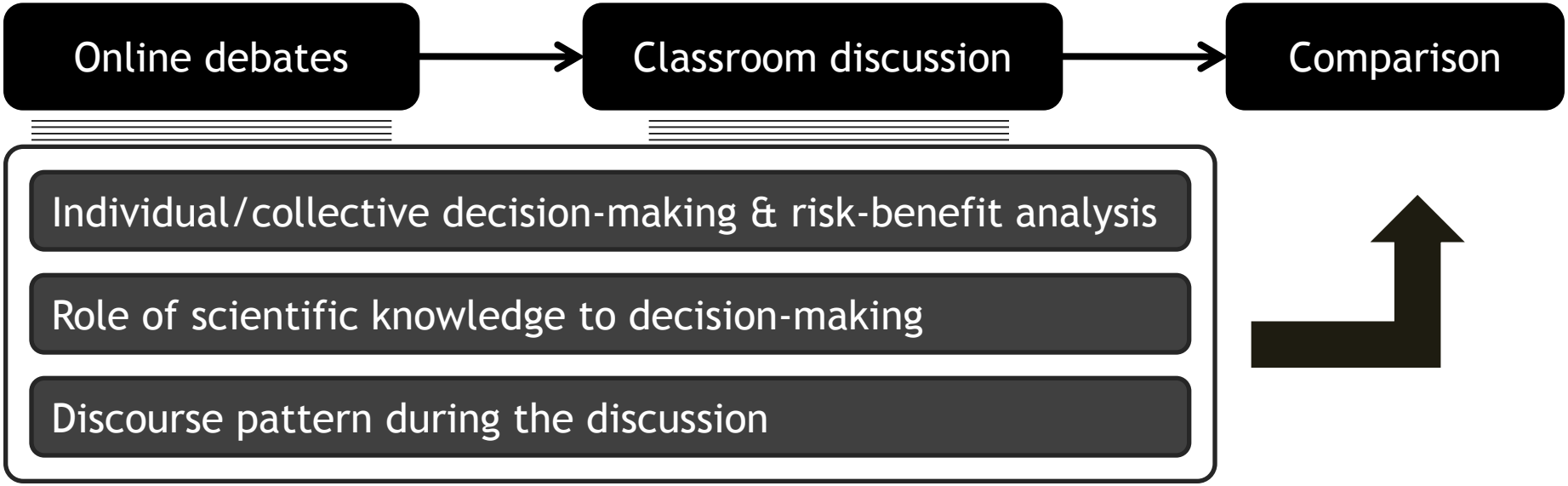


Research 2: Discourse analysis of classroom discussion in SSIs

Data: video-taped class, group interview, student's homework, activity sheet, autobiography, photos, questionnaire (VNOS + VOSTS)



The flow of research



Research 1: Textual analysis of online debates of mad-cow disease

A. Decision-making in the issue

(1) Individual and collective decision-making

Individual decision-making means how an individual take an action about an issue, whereas collective decision-making implies the argument that people consider what to do as a whole.

Not all the time, these are consistent and sometime they are conflicted.

Research 1: Textual analysis of online debates of mad-cow disease

A. Decision-making in the issue

(1) Individual and collective decision-making

Individual	collective	
consumption - Reliable on imported beef **rejection** - Avoidance of uncertainty	**Allowance of import** - Safety of import goods - Profit of domestic industry from the contract - possibility of retaliation if not - Stabilization of beef market	**Approval:** In case of agreement, people start from a societal view. They argue to import the beef to get more profit in the society. In spite of the
rejection - Skepticism about th safety - Individual damage	**Rejection of import** - Unsafe about import goods - Ripple effect of infection - Damage of domestic stockbreeding	**Rejection:** In case of disagreement, people start from a personal view. They worry about damage of themselves or their family to the health. They think more highly of health than any other value.

Figure 1. individual and collective decision-making about import of beef

On the web board, people's attitude toward an issue is related to different starting points and individual and collective decision-making is not always consistent.

Research 1: Textual analysis of online debates of mad-cow disease

A. Decision-making in the issue

(2) Risk-benefit analysis

Minimal loss	Choose the one which has minimal opportunity cost (damage)

- Human MCD is on the bottom of the list 'cause of death' and the number is so small.
- Economic profit and youth unemployment is more crucial than the risk of MCD.
- We can make more lives by preventing the car accident rather than blocking the infected beef.

Research 1: Textual analysis of online debates of mad-cow disease

A. Decision-making in the issue

(2) Risk-benefit analysis

Minimal loss	Choose the one which has minimal opportunity cost (damage)
No loss	Consider the option which has no damage

-95 % of Korean has MM-type vulnerable about MCD. We should stop importation to avoid the damage.

- We cannot trust the safety due to its stockbreeding environment such as overdose of antibiotic, meat and bone meal and unhygienic stable.

Research 1: Textual analysis of online debates of mad-cow disease

A. Decision-making in the issue

(2) Risk-benefit analysis

Minimal loss	Choose the one which has minimal opportunity cost (damage)
No loss	Consider the option which has no damage
Efficiency	Pursue the controllable or the efficiency in spite of the same cost
	- Even though we are susceptible, we can cope with the situation by reinforcing the quarantine system. - It is safer to prohibit susceptible meat to be imported.

Research 1: Textual analysis of online debates of mad-cow disease

A. Decision-making in the issue

(2) Risk-benefit analysis

Minimal loss	Choose the one which has minimal opportunity cost (damage)
No loss	Consider the option which has no damage
Efficiency	Pursue the controllable or the efficiency in spite of the same cost
Certainty (Probability)	Relies more on the certain than uncertain cases

- Smoking and drinking as dangerous as MCD. But they are more treatable since it is impossible to diagnose and cure MCD. It's better to choose the controllable one.
- Uncertain is more dangerous.

Research 1: Textual analysis of online debates of mad-cow disease

B. The role of scientific knowledge to decision-making

There are five salient arguments related to science in the issue.

cause of BSE	What causes mad cow disease (BSE)?
SRM and gestation	What part is risky about BSE? (Specified Risk Material)
	What age of cow is infected?
Cause of vCJD	How can a human being be infected?
	To what extent of prion can cause vCJD?
Vulnerability of vCJD	How long is the latent period?
	Is the vulnerability related to genetic characters?
Relation between ALZ and vCJD	Is the increase of ALZ patients in the US related to vCJD?

Research 1: Textual analysis of online debates of mad-cow disease

B. The role of scientific knowledge to decision-making

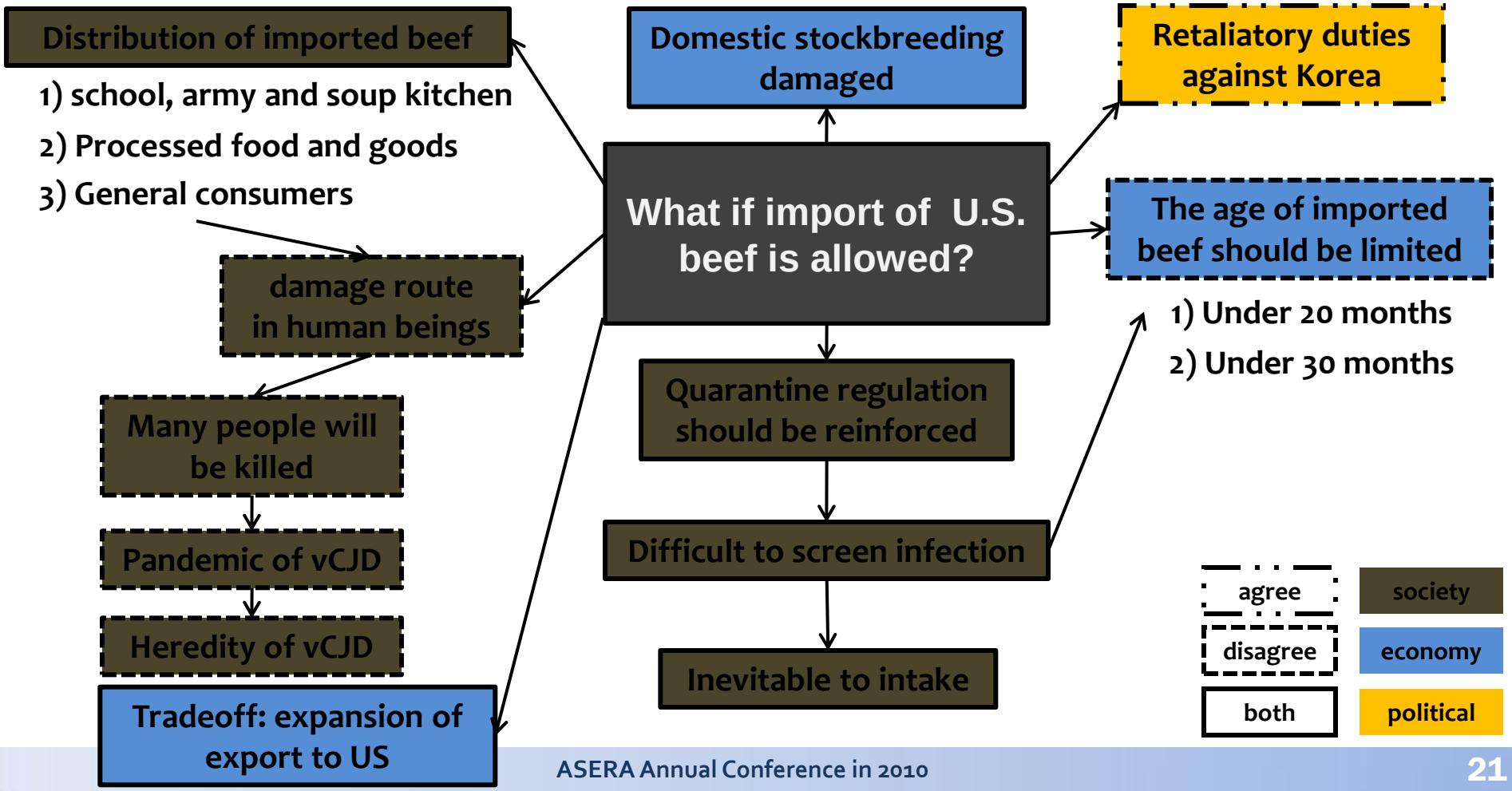
There are five salient arguments related to science in the issue.

cause of BSE	**INTAKE of:** **cattle's by-products, livestock's and plants on polluted ground**
SRM and gestation	**Parts stipulated in OIE standards** **Inclusion of flesh, bone and blood**
	Occurrence of BSE: **over 20 months / 30 months / all unsafe or safe**
Cause of vCJD	**Caused by: intake of** **Infected meat or bone, processed food, use of subsidiary goods, blood donation or transplant and butchery process**
	Permissible amount: **Infinitesimal, long-term accumulation and no limit**
Vulnerability of vCJD	**The latent period:** **5-10 yrs, 40 yrs and dependent on genetic type**
	Genetic possibility: **Significant / not significant**
Relation between ALZ and vCJD	**Significant or not**

Research 1: Textual analysis of online debates of mad-cow disease

B. The role of scientific knowledge to decision-making

Scientific information is involved in various aspects of the issue.



Research 1: Textual analysis of online debates of mad-cow disease

C. The discourse pattern to reach the negotiation

Scientific information is involved in various aspects of the issue.

Re-negotiation of import condition

- Limitation of the age of the moon (20/30)
- Part of meat (including bone)

Qualification of the place of origin

Improvement of quality of domestic beef

Reinforcement of quarantine system

Reorganization of consensus

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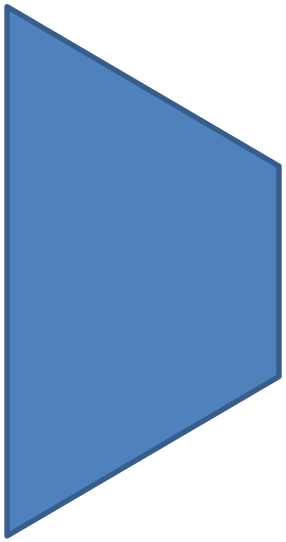

Denial of imported beef

Allowance of importation

The alternatives is converged to a few of options and the hostility of the opposed turns severe.

Research 2: Classroom discussion on socio-scientific issues

A. Decision-making in the issue

(1) Individual and collective decision-making

Individual	collective	
Trust - disease > side effect - for other weak people	**Trust** - extermination of disease - restraint of proliferation	**Trust:** The students start from a societal view. They claim a vaccination of all people to [illegible]t the epidemic from spreading [illegible]hey are willing to take risks for [illegible].
Intermediate - allowance in case of severe disease - Dependence on probability - avoidance of uncertainty	**Intermediate:** Some are cautious about the determination. Though they are suspicious about the vaccination socially, they accept the need of vaccination.	
Less Distrust - reliance on healthy immune system - Harmful chemical in the	- Increased tolerance to virus	**[illegible]st:** [illegible]udents start from a personal view. [illegible]think more highly of personal expectation rather than the disease incidence. The distrust the purpose of the companies and the government

In the classroom, people's attitude toward an issue is related to different starting points and individual and collective decision-making is inconsistent.

Research 2: Classroom discussion on socio-scientific issues

A. Decision-making in the issue

(2) Risk-benefit analysis

Minimal loss	Choose the one which has minimal opportunity cost (damage)

- The death rate of an epidemic is higher than the side effect of a vaccine, isn't it?
- I will not get a shot for all diseases. I will only take a shot for dangerous one.

Research 2: Classroom discussion on socio-scientific issues

A. Decision-making in the issue

(2) Risk-benefit analysis

Minimal loss	Choose the one which has minimal opportunity cost (damage)
No loss	Consider the option which has no damage

- I think we don't have to take a shot if we maintain healthy immune system.
- I am going to take a vaccine that verifies the absolute safety.

Research 2: Classroom discussion on socio-scientific issues

A. Decision-making in the issue

(2) Risk-benefit analysis

Minimal loss	Choose the one which has minimal opportunity cost (damage)
No loss	Consider the option which has no damage
Efficiency	Pursue the controllable or the efficiency in spite of the same cost

- Even though the vaccine is not that effective, it is easier to take care of the patients if we get vaccination to all people.

Research 2: Classroom discussion on socio-scientific issues

A. Decision-making in the issue

(2) Risk-benefit analysis

Minimal loss	Choose the one which has minimal opportunity cost (damage)
No loss	Consider the option which has no damage
Efficiency	Pursue the controllable or the efficiency in spite of the same cost
Altruism	Choose the good one for a society in spite of personal damage

- I think we should get vaccination to prevent unspecified people from taking loss even though I may suffer from the side effect of a vaccine.
- If I don't take, the damage range will increase…

Research 2: Classroom discussion on socio-scientific issues

B. The role of scientific knowledge to decision-making

Scientific evidence plays a significant role to make a decision.

Ingredient of vaccine	The component and made process
Probability	The comparison of disease incidence and side effect of vaccine
Efficiency	The efficiency of vaccination (how it works in a human body)
Regulatory	Clinical demonstration

Research 2: Classroom discussion on socio-scientific issues

B. The role of scientific knowledge to decision-making

Scientific evidence plays a significant role to make a decision.

Ingredient of vaccine	The component and made process

S5: ***Vaccine itself aims to activate our immune system by giving alive virus, so if we could die for [vaccination]…***

S7: ***The possible reason why many people died of vaccination of swine flu is eggs produced by battery hens eating antibiotics. To produce a vaccine, eggs are used. But, last year, it had to be produced so quickly and the clean eggs (without antibiotics) were insufficient and the eggs from battery hens had to be used.***

S13: ***In case of severe epidemic, dead virus is used to produce a vaccine because people could die. So you don't have to worry if you could die from vaccination.***

Research 2: Classroom discussion on socio-scientific issues

B. The role of scientific knowledge to decision-making

Professional knowledge influence on decision-making and persuasion.

S1: ***We usually consider the component of a vaccine is just deteriorated or dead virus. But in detail, it covers aluminum, formalin, benzene and so on. We don't know how much dangerous these are.***
All: How do you know that?
S2: We cannot refute your idea.

S3: ***When a pediatrician write a prescription, he follows a guideline provided by the government. In order to launch the development of a vaccine, a company should get a permission from the government… Therefore, I don't think the vaccination is not always good for our health.***
S4: Wow, that is awesome.
(Everybody stay calm)

Research 2: Classroom discussion on socio-scientific issues

C. The discourse pattern to reach the negotiation

Side effect

Qualification of production process

Rejection / Approval of a vaccine

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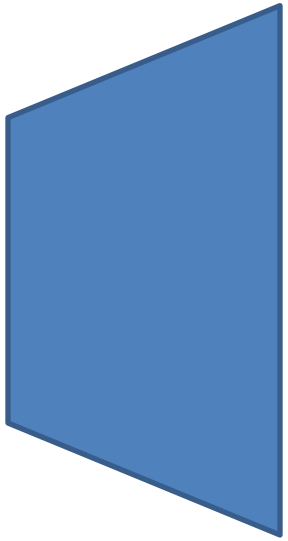


Trust of main agent of vaccination

Compensation for damage

Vaccination after long-term verification

Vaccination only if severe disease

Vaccination for others not for me

Vaccination if healthy

Avoidance of vaccination (auto-immune)

The alternative is getting diverse and some of the students shifted from one to another during the discussion. The classroom discourse may contribute to relieve the tension between the two different opinion groups.

A. Decision-making in the issue in the different context

Minimal loss	Choose the one which has minimal opportunity cost (damage)	Minimal loss
No loss	Consider the option which has no damage	No loss
Efficiency	Pursue the controllable or the efficiency in spite of the same cost	Efficiency
Certainty (Probability)		Altruism

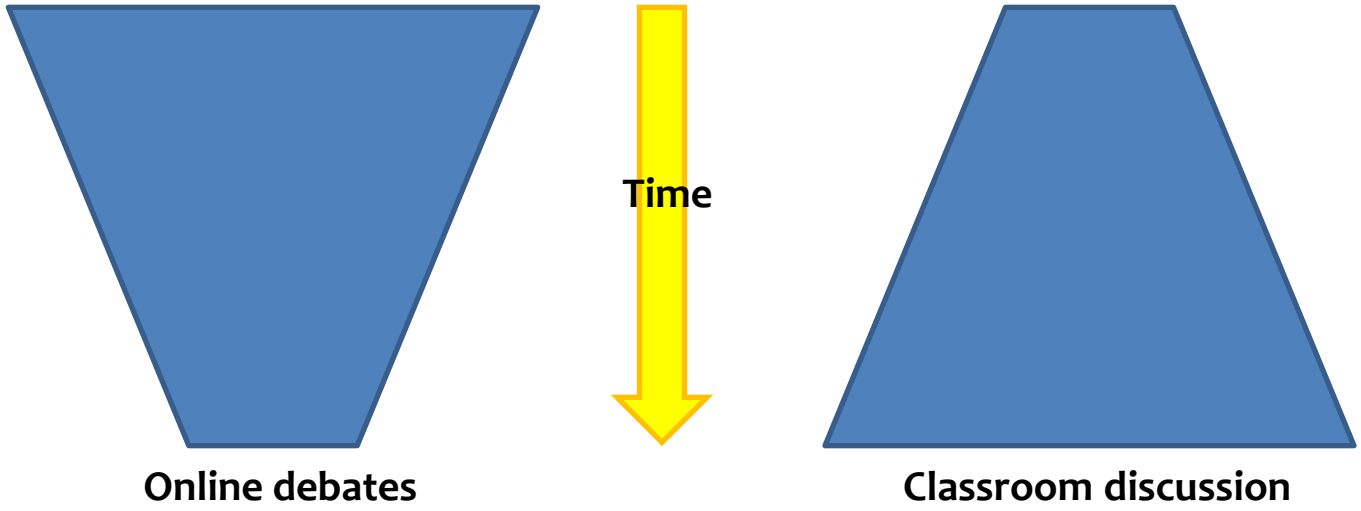
Basically, there is a tendency to consider the personal and social benefit across the context. But it is interesting to note that while internet users take an action from personal benefit, the students in the classroom are willing to take a risk for others.

B. The role of scientific knowledge to decision-making

Import of beef	Incubation period of MCD	Over 20 months	Safety uncertain - renegotion/rejection
		Over 30 months	Safety guaranteed - allowance
Vaccination	The side effect / disease incidence	Disease > side effect	Allowance of vaccination
		Disease < side effect	Rejection of vaccination

People make a decision considering various aspects including science.
At least, they evaluate the risk based on their scientific knowledge about important concepts.

C. The discourse pattern to reach the negotiation



In terms of alternative options, classroom discussion is more diverse than online debates despite in online situation, people can access more information. Therefore, decision-making may be determined not by the amount of information but by the acceptance of opposite position.

Across the context,

The attitude toward an issue is related to the starting point of discussion: The social and personal approach can get the different result. But the students in the classroom suggest we should take a risk for others, for the sake of the community profit.

As time goes by, the attitude toward an issue

Is getting neutralized and diverse in the classroom whereas it is divisive on the internet. It is conjectured that the role exchange to understand the different position is effective to get people tolerant about oppositions.

The scientific knowledge

Can contribute to people's decision-making considerably. The comparison of probability of the two options is one of the key roles. And understanding of science concept is connected to their attitude toward science.

The classroom discussion about a socio-scientific issue can contribute to help people more capable of judgment of different opinions.

To understand the starting point of one's argument is related to his conclusion. Therefore we have to provide a chance to think an issue in a different way.

Scientific knowledge is interwoven with individual decision-making. The ability to decision-making can be improved by different idea as a cognitive conflict in conceptual studies.

THANK YOU