The Impact of Climate Change SSI-STEAM Classes on Students' Knowledge, Perception, and Action regarding Climate Change

Su-Yeon Choi[1], A-Rang Won[1], Hye-Eun Chu[2], Hyun-Jung Cha[1] and Chan-Jong Kim[1*]

[1] Seoul National University (*chajokim@snu.ac.kr), [2] Macquarie University

APHESE
Advancing Practice & Horizon Expansion of Science Education

INTRODUCTION

- The topics covered in the SSI class have an interdisciplinary character in which diverse elements are organically intertwined. The goal of science education is difficult to achieve with knowledge or mere thinking ability and STEAM education is required to integrate the characteristics of various subjects.

- In the context of climate change becoming serious, the SSI-STEAM class on climate change is expected to develop students' problem-solving skills and practical capacity for climate change.

- The study aims to develop and apply a Socio-Scientific Issue (SSI) based teaching program infusing a STEAM (arts-integrated STEM) approach to improve students' climate-change literacy, to examine students' knowledge, perception and action/behavioral changes in climate change.

[Research Questions]

1. Develops classes for climate change SSI-STEAM.

2. Examine the impact of climate change SSI-STEAM classes on students' knowledge, perception, and action regarding climate change.

THEORETICAL BACKGROUND

1. Climate Literacy

- A climate literate person understands the essential principles of all aspects of the Earth system governing climate patterns, and makes scientifically informed and responsible decisions regarding climate(Miléř, T., & Sládek, P., 2011).

- The climate change education stresses that students should Act to cope with climate change through responsible decision-making based on their knowledge and perception of climate change.

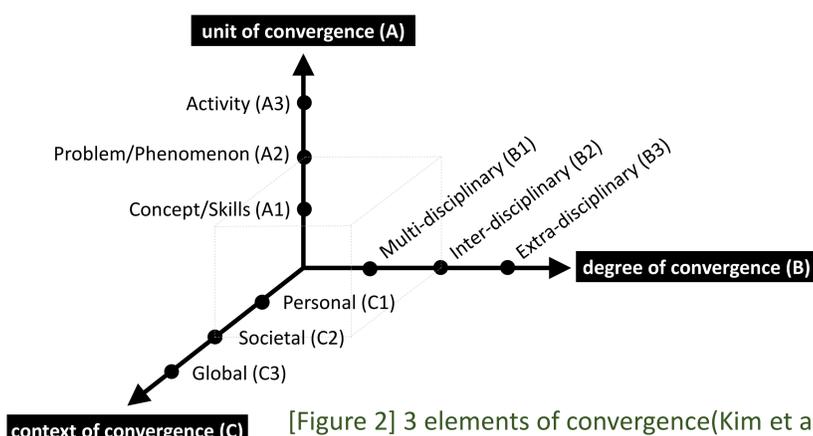| Knowledge	Content	Details of content
	Causes of Climate Change	Increasing the greenhouse gas
		Waste of energy
		Urbanization, Industrialization, Indiscriminate development
	Impacts of Climate Change	Environmental (Glaciers, Sea levels, Abnormal climate, Ecosystem)
		Social (Social issue, An increase in disease)
		Economic (Economic problems of individuals and enterprises)

Perception	Content	Details of content
	Susceptibility	The sanctity of life, Individual empathy perspective
	Issue Recognition	Recognitions of different values on climate change problems/issues
	Attitude to choice	Attitudes to choose your position on climate change issues
	Control Point	The individual's perception of whether the result of personal behavior is by oneself or not

Action	content	Details of content
	Individual level	Energy conservation in individuals and families
		Individuals/Families efforts to respond to climate change
	Community, National, and Global level	Policy investigation and engagement
		Participation in campaigns and demonstrations
		Own role within the community, national, and global level
		Community, National, and Global Efforts

[Figure 1] Climate change Knowledge, Perception, and Action Analysis Framework

2. SSI-STEAM Classes

- In this study, we developed SSI-STEAM classes that STEAM approach based on the SSI theme. The overall theme of the class is 'climate change', one of the representative themes of SSI, and STEAM was applied in line with the 3 elements of convergence in Kim et al(2012).

unit of convergence (A)

Activity (A3)
Problem/Phenomenon (A2)
Concept/Skills (A1)

Multi-disciplinary (B1)
Inter-disciplinary (B2)
Extra-disciplinary (B3)

degree of convergence (B)

Personal (C1)
Societal (C2)
Global (C3)

context of convergence (C)

[Figure 2] 3 elements of convergence(Kim et al., 2012)

METHODS

1. Development and Application of Climate Change SSI-STEAM Classes

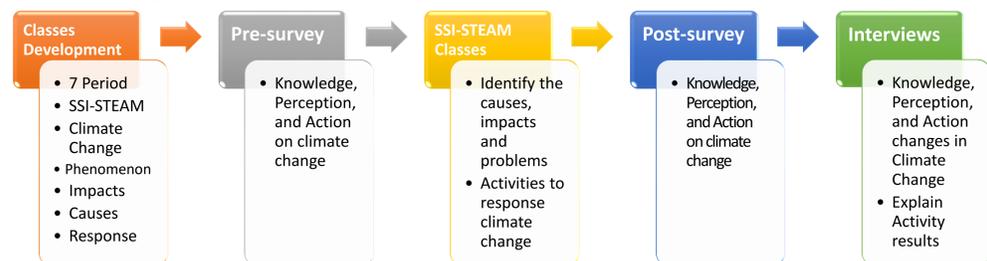#### A. Details of Climate Change SSI-STEAM Classes

Period	Elements of convergence	Content	Details of content	Class materials
1-2	A1/B1/C3	Motivation	- Video Meeting with Australian Students (Sharing Climate Change Experience) - Climate Change Storytelling: Weather, Climate, Stability Collapse, Greta Thunberg's Speech, Protest in Korea	Skype, Greta Thunberg's Speech Video
3	A1/B2/C3	Phenomenon and Impacts of Climate Change	- Organization of Climate Crisis Countermeasures Headquarters(CH) : Prepare presentation data by investigating climate change phenomena and impacts of each continent based on satellite data (continent: Korea, Australia, Polar Regions, Asia, America, Africa)	Satellite data, Internet (using laptops and smartphones)
4	A1/B1/C1	Causes of Climate Change	- Presenting Data from the Climate Crisis CH by Continent - Causes of Climate Crisis (Teacher Description: Greenhouse Gas, Jet Airflow), Climate Crisis response (Teacher Description)	Video materials
5-7	A2/B2/C2	Response of Climate Change	- Causing awareness through CO_2 emission Flash activity (teacher) - Making climate crisis stickers (creating drafts using 4 elements of mark design) - Presenting photos of climate crisis stickers attached for purpose	Flash Program, Climate Crisis Sticker Photographs

- "Elements of convergence" were prepared according to [Figure 2].

B. Outline

- **Participants**: 31 Korean, Year 8 students.

- **Schedule**: 7 periods (45minutes per period)

C. Research process

Classes Development
- 7 Period
- SSI-STEAM
- Climate Change
- Phenomenon
- Impacts
- Causes
- Response

Pre-survey
- Knowledge, Perception, and Action on climate change

SSI-STEAM Classes
- Identify the causes, impacts and problems
- Activities to response climate change

Post-survey
- Knowledge, Perception, and Action on climate change

Interviews
- Knowledge, Perception, and Action changes in Climate Change
- Explain Activity results

### 2. Data Collection and Analysis

- We collected pre-/post-survey, activity results every periods, and interviews.

- After analyzing the collected data using triangulation method, we examine how the SSI-STEAM classes impacts students' knowledge, perception and action.

CURRENT PROGRESS

1. Pre-/post-survey

- A total of 48 items focusing on Knowledge, Perception, and Action scales were devised and implemented as a pre-/post-survey.

- Students' Knowledge, Perception, and Action on climate change have generally improved after the SSI-STEAM classes.

	pre	post
Knowledge	136.5	141.5
Perception	120.7	125.1
Action	88.4	99.8
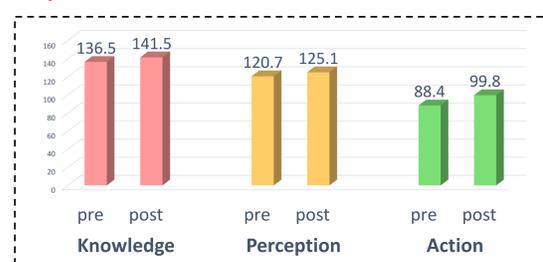
[Figure 3] students' Knowledge, Perception, and Action changes in climate change

2. Activity results of Climate Crisis Countermeasure headquarters/Stickers

- Based on the analysis framework of [Figure 1], we will analyze the results of the activities of the Climate Crisis Headquarters and the climate crisis sticker making activities, and then add qualitative data based on the interviews of students.

- We will be able to grasp qualitatively how students' Knowledge, Perception, and Action on climate change appeared during SSI-STEAM classes.

[Figure 4] Activity results of Climate Crisis Sticker-making

[Figure 5] Activity results of Climate Crisis Countermeasure headquarters

3. Future Plan

- The validity of the analysis is enhanced by using the triangulation method with the pre-/post-survey, the activity results, and interview data.

- Based on the collected data, we will analyze how climate change SSI-STEAM classes affected students' Knowledge, Perception and Action on climate change.