

Content Analysis of Argumentation in Middle School Science Textbooks in Korea, Mainland China, and Taiwan

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Introduction

Background and Motivation

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- The Role of Science textbook
- Argumentation in Science Education

The Role of Science Textbook

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- assist in the development of a scientifically and technologically literate society
- provide curriculum balance which stresses fairly equal proportions of knowledge, investigation, thinking, and the interaction between science, technology and society.

Wilkinson, J. (1999).

Background and Motivation

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- The Role of Science textbook
- **Argumentation in Science Education**

Argumentation in Science Education

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- The importance of argumentation
 - ▣ developing conceptual understanding, making cognitive processes public, developing investigative competence and critical thinking, achieving scientific literacy, understanding the epistemology of science, and understanding science as a social practice.
- Highlighted by science educators

Jimenez-Aleixandre, M., & Erduran, S. (2007).

Newton, P., Driver, R., & Osborne, J. (1999).

Lee, Wu & Tsai (2009)

Argumentation in Science Education

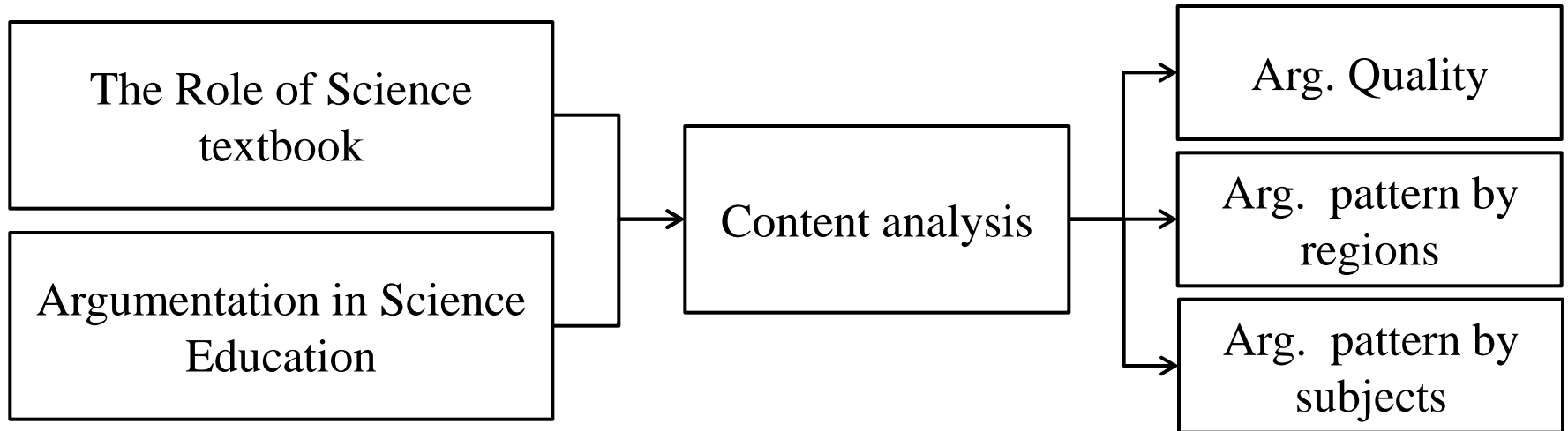
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- Policy level
 - ▣ to argue with evidence
- TIMSS & PISA
 - ▣ the ability to coordinate evidence and claims.

Jimenez-Aleixandre, M., & Erduran, S. (2007).

Research Questions

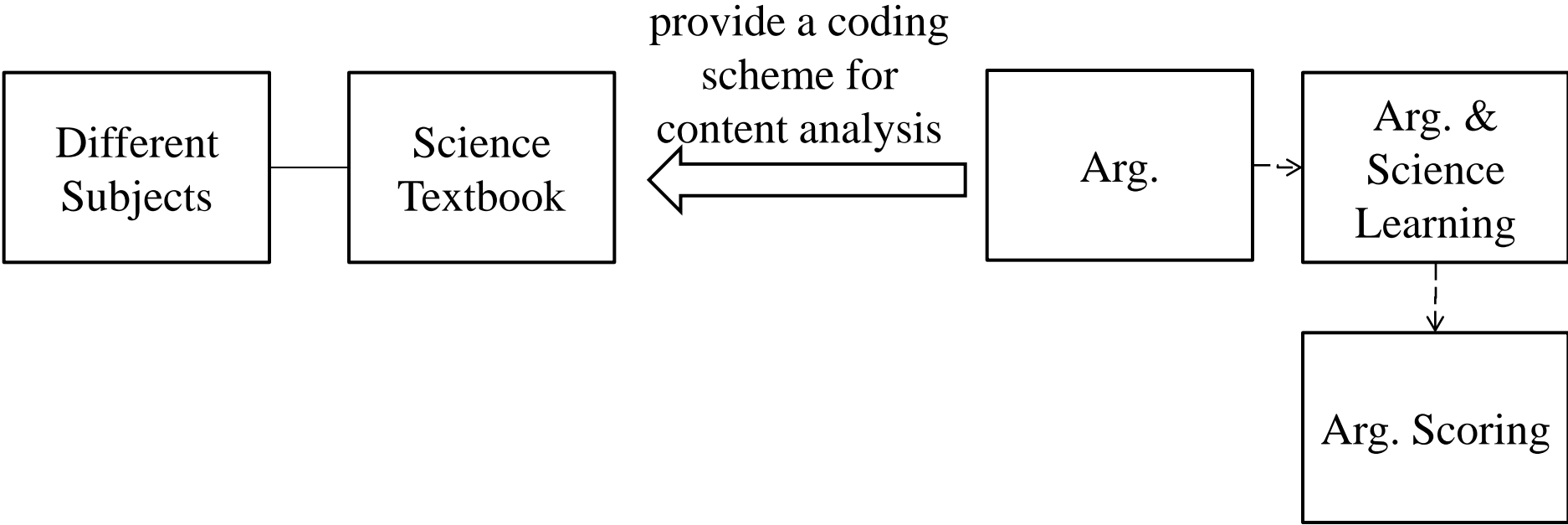
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- How is argumentation quality in middle school science textbook in Korea, Mainland China, and Taiwan?
- What is the pattern of argumentation in middle school science textbook in Korea, Mainland China, and Taiwan?
- What is the pattern of argumentation in middle school science textbook by difference subjects?

II

Literature Review



Argumentation Theory

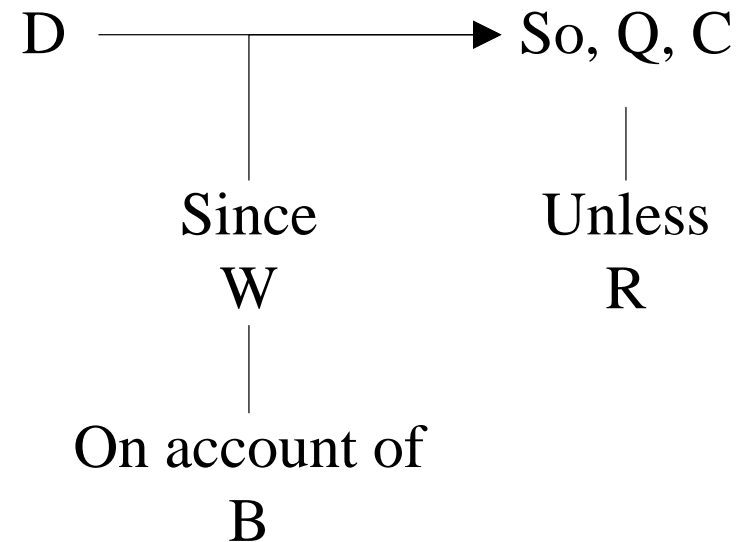
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- Argumentation is the process from data to claim (Toulmin, 2003).
- Argument refers to the substance of claims, data, warrants, and backings that contribute to the content of an argument (Simon, Erduran, & Osborne, 2006).

Toulmin's Argument Patterns (TAP)

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- Data
- Claim
- Warrants
- Backing
- Qualifiers
- Rebuttals



Toulmin, 2003, p.97

Implications From TAP Studies

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- appropriated and explicitly taught through suitable instruction
- coding schemes of the qualitative and quantitative outcomes

TAP scoring

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- Simon, S., Erduran, S., & Osborne, J. (2006)

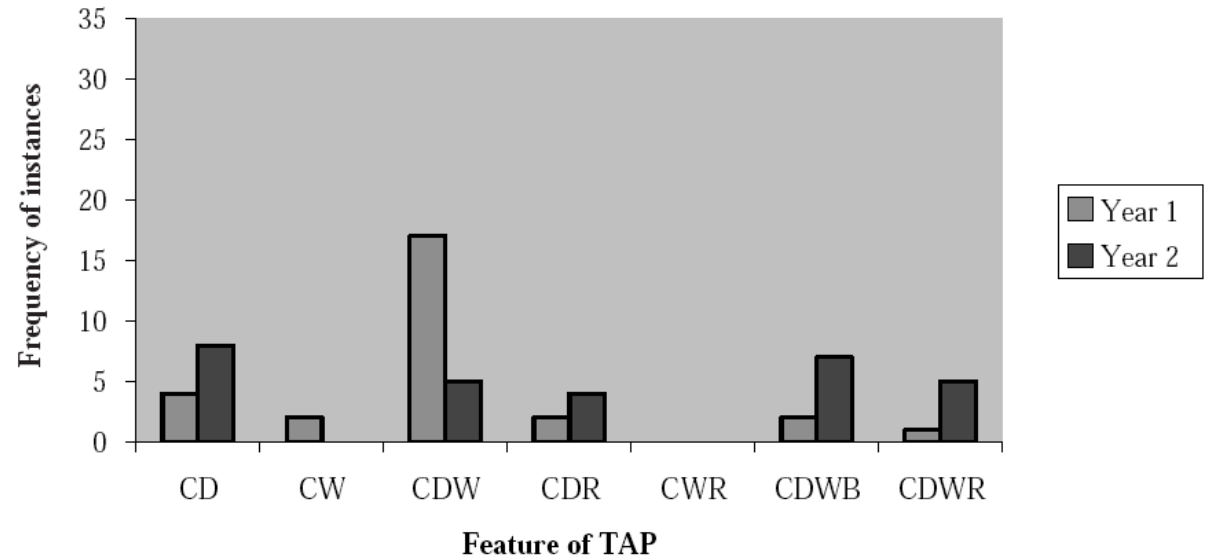
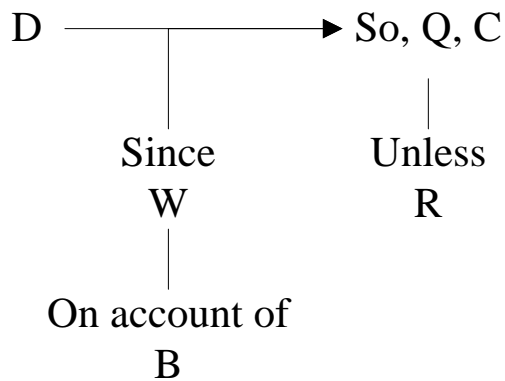


Figure 2. Sarah, Year 1 versus Year 2

TAP scoring

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- Hung, Chang & Lin (2008)
 - correct warrant: W_n (non-warrant), W_p (pseudo-warrant), W_g (genuine-warrant) .
 - aspects of rebuttal: R_D, R_W, R_R .
 - complete of structure
 - the number of claim

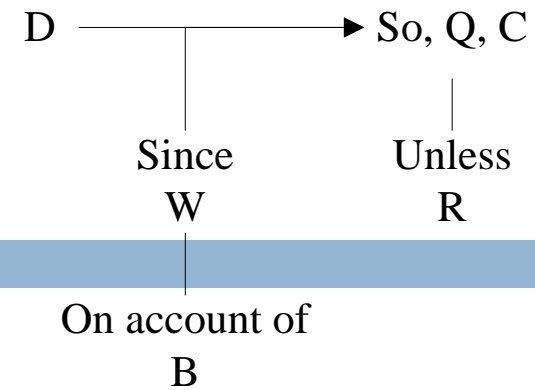
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Design and Method

Data Analysis

- Most popular middle school science textbook in Korea, Mainland China, and Taiwan.
- Units of analysis: complete paragraphs, questions, figures, tables, marginal comments, and complete steps in laboratory or hands-on activity.

Coding Schemes



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Dimensions	0	1	2	3
Correct Warrant	X	non-warrant	pseudo-warrant	genuine-warrant
Aspects of Rebuttals	X	R_D	R_W	R_R
Complete of Structure	Not $D+W+C$	$D+W+C$	$D+W+C$ +any of 1	$D+W+C$ +any of 2
Number of Claim	X	1	2	2+

IV

Two Examples

Analysis Example.

Korea Textbook

Grade; 7th

Chapter. Force and Moving

Data: It is difficult to skate on ground.

Claim: I can move smoothly on ice because there is no friction

Warrant: When we skate on ice we can move smoothly because friction between skate and floor is smaller than ground.

까끌까끌 마찰력

얼음 위에서 스케이트를 타는 선수들의 움직임은 땅 위와는 다르게 우아하고 아름답기까지 하다. 만약 땅 위에서 스케이트를 탄다면 어떨까? 땅 위에서는 스케이트가 잘 미끄러지지 않아 스케이트를 타기 어렵다. 이처럼 땅 위에서 스케이트가 미끄러지지 않도록 방해하는 힘은 무엇일까?

물체가 어떤 면과 닿아서 움직일 때 물체의 운동을 방해하는 이러한 힘을 **마찰력**이라고 한다. 우리 주변에 있는, 표면이 매끄러워 보이는

물체라 하더라도 그 표면을 현미

경으로 확대해서 보면 울퉁불퉁

해 보인다. 이처럼 울퉁불퉁한

면과 면이 맞닿을 때 물체의 운동을

방해하는 힘이 마찰력이다. 마찰력은 물

체가 운동하는 방향과 반대 방향으로 작용하

며, 접촉면이 매끄러울수록 그 크기는 작아진다. 얼

음 위에서 스케이트를 탈 때 스케이트와 바닥 사이의 마찰

력은 땅에서 보다 작기 때문에 잘 미끄러지는 것이다.

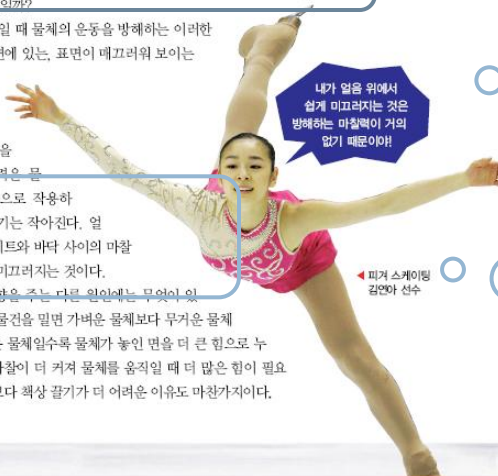
그렇다면 마찰력의 크기에 영향을 주는 다른 원인에는 무엇이 있

을까? 수평으로 놓인 평면 위에서 물건을 밀면 가벼운 물체보다 무거운 물체

를 밀 때 힘이 더 필요하다. 무거운 물체일수록 물체가 놓인 면을 더 큰 힘으로 누

르게 된다. 그 결과 물체 사이의 마찰이 더 커져 물체를 움직일 때 더 많은 힘이 필요

하기 때문이다. 청소를 할 때 의자보다 책상 끌기가 더 어려운 이유도 마찬가지이다.



내가 얼음 위에서 쉽게 미끄러지는 것은 방해하는 마찰력이 거의 없기 때문이야!

피겨 스케이팅 김연아 선수

Analysis Example.

Taiwan Textbook

Grade 8th

Chapter 1-1. Material Change

Claim: Material change is everywhere in our daily life.

Data1: Glass can be made into devices of different shape.

Data2: Fireworks can be turned into the glorious lighting.

Data3: The emitting hot lava when the volcano erupted.



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