Argumentation, Inquiry and Hot Cognition: A Study of Children's Judgment on the Rationality of Scientific Explanations

Developed at 2010 EASE Summer School
National Taiwan Normal University
Taipei, Taiwan
July 18~23, 2010

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Information about the author

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Abstract 1/3

- It is important to cultivate the student with scientific literacy that can distinguish evidence-based argument from personal opinions.
- It is also crucial to empower the student's ability to conduct inquiry and develop understanding about scientific inquiry
- However, there are many factors affecting judgment.
- Motivation can be defined as any process that initiates and maintains learning behavior. Hot cognition is the behaviors that are motivation/emotion-loaded and affected by need and feelings, causing judgment to be colored by goals or emotions.

Abstract 2/3

- The purpose of this study
  - to investigate student's situational interest in inquiry-based learning and concept cartoon argument instruction
  - to explore the differences of children's judgment of scientific explanations after inquiry-based learning and concept cartoon argument instruction
  - to understand the mental model and self-perception of hot cognition on children's judgment of scientific explanations

Abstract 2/2

- The quasi-experimental method was adopted in this research.
- The subjects would be about 300 upper graders of eight classes at the eastern Taiwan elementary school.
- The self-designed instruments “rationality on scientific explanation test” and “situational interest test” were adopted in this study.

Contents

- Background and Purpose
- Research Rationale
- Method
- Implication

Background 1/5

- An important goal of science education
  - "cultivating school children with science literacy".
- Science literacy
  - To distinguish evidence-based conclusions from personal opinions is one of the core elements in science literacy (OECD, 2008).
- How to teach argument?
  - Teacher could use concept cartoon to incite students' discussion and induce their participation in argumentation (Keogh & Naylor, 1999)

Background 2/5

- Ministry of Education.(2003)
  - Engaging students in inquiry-based learning is a cornerstone of current efforts at science education reform in Taiwan.
- National Research Council. (1996)
  - It is crucial to empower the student's ability to conduct inquiry and develop understanding about scientific inquiry.
- Many researchers had focused on the pupils' development of inquiry skills and explanation abilities in inquiry-based learning environment.
- Different from the other studies, this study is to investigate situational interest in inquiry-based learning.

Background 3/5

- Motivation can be defined as any process that initiates and maintains learning behavior.
- Driver(1989)
  - learning is viewed as an active process which requires effort on the part of the learner
- Palmer (2009) argued that
  - “situational interest” is a short-term form of motivation which occurs when a specific situation stimulate the focused attention of student.
  - the interest arousal was substantial but did fluctuate throughout the lesson

Background 4/5

- The traditional concept of rationality in science reveals that knowledge/judgment is impersonal.
- While the modern rationality believes that science concepts are no longer independent of person.
- There are many factors affecting judgment while arguing and discussing with others.
- Much of the social interaction behavior/cognition concerned that the way we representing, reason about, and retrieve social knowledge.

Background 5/5

- Hot cognition refers to those mental processes that
  - are driven by our desires and feelings—those cases where our goals and moods color our judgment (Thargard, 2006, 1989; Kunda, 2000).
- Solomon (1994) founded that
  - children might change their own ideas in order to agree with others' opinion even though their answer were correct.

Purpose

- There are three main purposes in this study:
  - to investigate student's situational interest in inquiry-based learning and concept cartoon argument instruction
  - to explore the differences of children's judgment of scientific explanations after inquiry-based learning and concept cartoon argument instruction
  - to understand the mental model and self-perception of hot cognition on children's judgment of scientific explanations

Research Rationale

- Argument and Inquiry are two important issues in science learning and science education research.
- However, there have been few studies of situational interest and its potential to motivate students in science classrooms.
- Argument can be viewed as a process of “Minds-on task”, inquiry can be viewed as a process “Hands-on task”.
- Inquiry could be viewed as an implicit argument.
- In the science classroom, children tend to “say what other says”.
- Studying the hot cognition aroused by children’s aggregated status, should help children’s science learning, and cultivate them to judge independently.

Method 1/8

- Research design

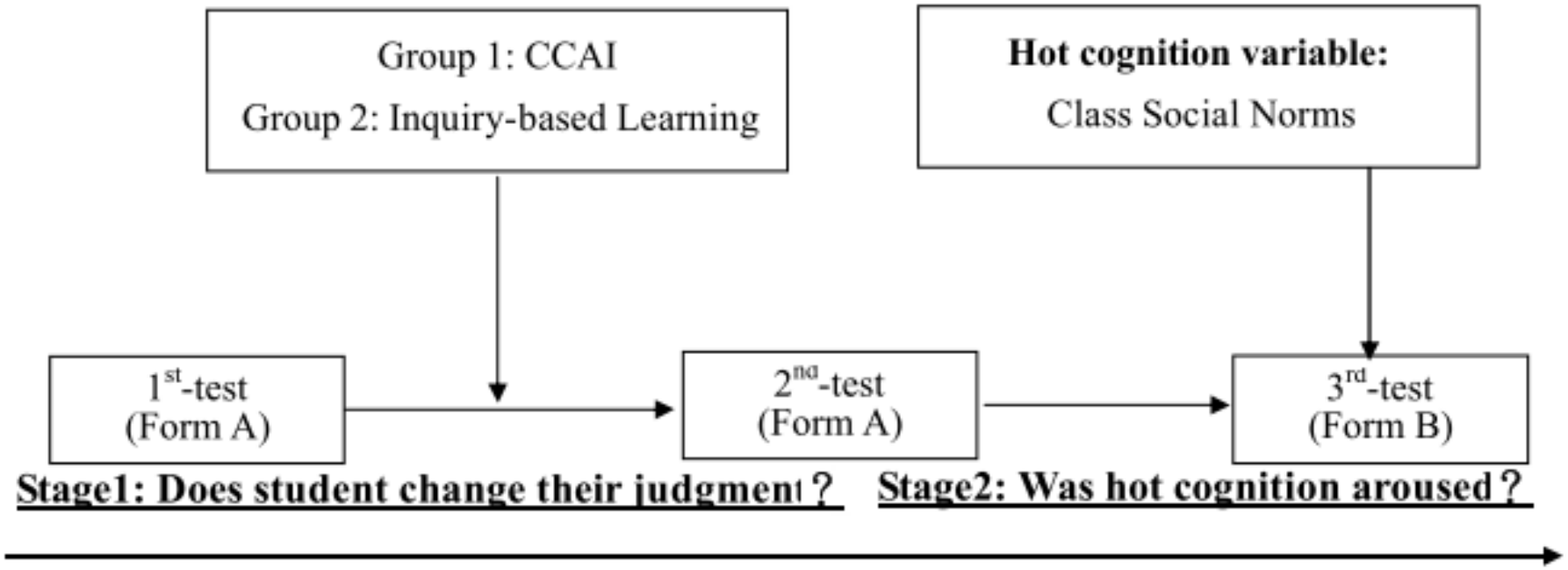

Fig.1 Research Design

Method 2/8

- There are three tests of rationality of science explanations in this study
- There sre two stages in this study
  - stage1 is consisted of first and second test, and stage 2 is consisted of second and third test.
- The experimental group and contrast group were conducted all the three test of “rationality of scientific explanations test”
- In stage1, experimental group one performed concept cartoon argument instruction, and experimental group two performed inquiry-based learning activities.
- In stage2, the personal factors (such as class social norms) were attached in each question of 3rd-test.

Method 3/8

- **Participant**
  - The subjects would be about 300 upper graders of eight classes at the eastern Taiwan elementary school.
  - Six classes were selected as experimental group, the other two classes were assigned as contrast groups.
  - In order to explore children's mental model on judgment of scientific explanations, 24 students (4 per class) from experimental groups would be chosen to conduct interviews.

Method 4/8

- **Concept Cartoon Argument Instruction (CCAI)**
  - According to the teaching materials designed by Chen et al. (2009), three units which student had learned before were selected to perform the concept cartoon argument instruction.
  - There are four main phases in each unit: (1) demonstration of issue; (2) discussion in pairs; (3) discussion in/between group; (4) report and whole class discussion.

Method 5/8

- **Inquiry-based Learning Activities**
  - According the research design of Palmer (2009), the lesson was designed to facilitate inquiry skills by using a structured sequence which consisted of four main phases: (1) demonstration; (2) proposal; (3) experiment; (4) report.

Method 6/8

- **Instruments**
  - "rationality of science explanations test"
    - consisted of 8 science question
    - two different response explanations for each science question (TAP-form & Non-TAP-form)
    - Students were asked to judge which one was reasonable, then to rate the relative rational scores (0~10) of each explanation
  - The "situational interest test",
    - translated from Palmer (2009), only one item was used to measure interest level.

Method 7/8

- **In CCAI,**
  - students responded to this item immediately after each of the phases, first copying notes, demonstration of issue, discussion in pairs, discussion in/between group, report and whole class discussion, and second copying notes.
- **In inquiry-based learning activities,**
  - students responded to this item immediately after each of the phases, first copying notes, demonstration, proposal, experiment, report, and second copying notes. So instantaneous interest was measured on six occasions throughout the lesson.

Method 8/8

- Data analysis
  - “rationality of science explanations test ”
    - the difference in number of people agree with item A or B is analyzed by the **(χ2) significance test**.
    - The difference of reasonableness judgment in item A and B is analyzed by the **significant t-test**.
  - “situational interest test”
    - using a one-way analysis of variance (ANOVA) with post hoc comparisons using the Tukey HSD test
  - relational framework (Roschelle & Greeno, 1987)
    - to present the mental model and reasoning process of children making judgment.

Implication to science education 1/2

- To understand the student's situational interest in CCAI.
- To understand the student's situational interest in inquiry-based learning environment.
- To help teacher to notice the student's situational interest distribution when performing CCAI and inquiry-based learning.
- To understand the differences of children's judgment of scientific explanations after concept cartoon argument instruction.

Implication to science education 2/2

- To understand the differences of children's judgment of scientific explanations after inquiry-based learning.
- To understand the arousal of hot cognition on children's judgment of scientific explanations after concept cartoon argument instruction.
- To understand the arousal of hot cognition on children's judgment of scientific explanations after inquiry-based learning.
- To understand the student's mental model of hot cognition on children's judgment of scientific explanations.

Thanks for your attention.

I appreciate for any comment !

A sample question in the test of rationality of scientific explanation

【Question】John's mother uses a damp cloth to serve hot soup. He is curious, so he asks others for an answer. Which of the following answers is more reasonable?

A: The mositure in the damp cloth can reduce the temperature of the soup pot. It is less hot and easier to hold.

B: Air conducts heat faster than water. After the cloth is dampened, the heat will be conducted to the hands in a slower speed.

【Answer】 ☐ A ☑ B

Reasonableness of A	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Reasonableness of B	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

A sample of situational interest test

	very boring		In-between		Very interesting
I thought this part was	1	2	3	4	5