

## A Case Study of Classroom Cultural Aspects Affecting Discussions and Discourses: A Conceptual Ecological Approach

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### ABSTRACT

This paper presents a case study of the student's culture as a component of conceptual ecology that affects discussions and discourses in the science classroom. The present study was conducted using a naturalistic approach, mainly through observing a science class of a middle school in Seoul, Korea, and through semi-structured interviews. The case showed that the science classroom culture can be identified in four aspects: (1) knowledge; (2) the teacher; (3) classmates; and (4) self. These cultural aspects were strongly related to each other and functioned as constraints in discussions and discourses of the science classroom. For successful discussions and discourses, it is necessary to consider students' cultural aspects: epistemological views on knowledge, the teacher-student and student-student relationships, and the role of self in the discussions and discourses.

**Key words:** classroom culture, discussion and discourse, case study, conceptual ecology

### I. Introduction

The Conceptual Change Model, which was developed by Posner, Strike, Hewson and Gertzog (1982), has two constructs: the status of a conception and the conceptual ecology (Hewson, 1981, 1982; Posner, Strike, Hewson, & Gertzog, 1982; Strike & Posner, 1985, 1992). The status of a conception (i.e., intelligibility, plausibility, fruitfulness) means the degree to which the concept satisfies the condition of the conceptual change. The conceptual ecology provides a context for the conceptual change, and affects the change (Hewson, Thorley, & Beeth, 1998). The conceptual ecology is composed of numerous components and includes their interactions in individual epistemological and psychological context of the conceptual change, while the conceptual change means the status of a conception rises to a higher level. Therefore, from the conceptual ecological approach in conceptual change learning, we can have more comprehensive understanding of learners and their learning processes.

Research on conceptual ecology has revealed that the conceptual ecology influencing the conceptual change consists of numerous components including anomalies, analogies and metaphors, exemplars and images, epistemological commitments (e.g., consistency or generalizability), metaphysical beliefs, past experience, and other knowledge (Hewson, 1985, 1988; Posner, Strike, Hewson, & Gertzog, 1982; Strike & Posner, 1985, 1992). In the earlier period of the research on conceptual change, the focus was on

epistemological commitments and metaphysical beliefs. What was important was not which commitments or beliefs students had, but the degree to which the students had them, and it was related to consistency or generalizability, as individual conception can be stabilized on the basis of such factors. However, earlier critics (Demastes, Good, & Peebles, 1995; Pintrich, Max, & Boyle, 1993; Strike & Posner, 1992; Vosniadou & Ioannides, 1998) argued that psychological as well as epistemological contexts of learning should be included in the research on conceptual change. They argued that teaching for conceptual change should understand all aspects of individual learning to address the facilitating and debilitating components. The research on conceptual change needs to refine the components of conceptual ecology and their interactions, because individuals learning should involve a complex and interactive approach.

A science classroom is a space for interactions between the teacher and students, and among the students. Personal and social constructivists of conceptual change view knowledge as what is personally constructed but socially moderated (Tobin & Tippins, 1993; Cobb, 1994; Hewson, Beeth, & Thorley, 1998). According to them, students construct their conceptions individually and modify them through communications with others in the classroom, home, and the social environment.

Classroom teaching based on this perspective and aimed at conceptual change therefore adopts discussions and discourses as a main activity, because in the first step of the conceptual change learning, the discussions and discourses reveal the students' concepts and thus provide the basis for change (Hewson, Thorley & Beeth, 1998). Through classroom discourse or discussion, students can be exposed to alternative conceptions and think reflectively about them. Additionally, through the process of interaction, negotiation, and sharing, students may be encouraged to identify the stability of existing conceptions, to generate weak conceptual change (e.g., integration or differentiation), and to experience strong conceptual change, such as paradigm shifts. Although teachers can use various strategies such as quizzes, questionnaires and others as the first stage of a teaching strategy for conceptual change, students can recognize their conceptions when they express them in their own language.

Classroom discourse and discussion cannot be fully understood without understanding the culture of the classroom. Students' voluntary and active participation in class discussions, which is necessary for effective teaching, is affected by the culture that involves the students' beliefs, values and attitudes. Since culture is a general concept, its specific aspects should be identified for analysis and description. Bullivants (1981) definition of culture provided the necessary subcategories: communication, behavior, skills (including cognitive styles), beliefs, values and attitudes (Krugly-Smolska, 1995). In the present study, classroom culture, which is a component of conceptual ecology, will be defined as (1) ways of thinking, talking and acting, and (2) the ideas, customs, skills of a people or group that are transferred, communicated in the classroom. This culture, which has a significant effect on students' behaviors, includes the educational tradition of the society in general, and the classroom dynamics and the interaction culture in particular.

The purpose of this study was to present a case of the student's culture as a component of conceptual ecology that affects the discussion and discourse in the science classroom. The study is part of efforts to understand cultural aspects for discussions and discourses in the science classroom for conceptual changes.

## II. The study

### 1. The Context of This Study

This investigation was conducted in a science class of a middle school in Seoul, Korea. At that time, the third year students were learning 'oxidation and reduction'. There were 31 students: 21 females and 10 males. The students had already studied, in their second year, combustion as a pre-concept related to oxidation. During the three weeks of this research, the students learned the following: definition and examples of oxidation, and experiments related to it; and definition and examples of reduction, and experiments related to it.

The science teacher used discourse and discussion to elicit and articulate students' conceptions and explanation. He had about 10 years of science teaching experience. He had been taught science in a traditional lecture style in his school days and had not learned conceptual change as a teaching and learning model. He naively thought that discussion and discourse were important in science classes. His students had group discussions about the phenomena of oxidation in the first two classes and had discourse in the classroom as well as two experiments after that. In the classroom discourse, the teacher asked his students about the definition and examples of oxidation and their reasons. Students were asked to answer immediately or after group discussions.

While most traditional science classes in Korea teach the contents of science in a lecture style using OHPs and other materials, this class is oriented towards group discussion and discourse. Identification of the culture including the students' thoughts, responses, values, attitudes towards this type of class will enable us to design strategies for a successful class focusing on discussion and discourse.

## 2. The Research Method

This study employed a naturalistic approach of classroom observation and semi-structured interviews over the period of three weeks. Each week, three class periods of 45 minutes each were observed. Six students (3 males and 3 females) participated in the study voluntarily.

Data were collected from videotapes of the classes and interviews. Students' activities such as teacher-students and students-students interactions from videotapes were transcribed. Each participant was interviewed individually twice: at the beginning and the end of the research. During the interviews, the following questions were asked: "What do you do in discussions?", "Why do or don't you engage in discussions or discourse?" "What do you think of your science class?" Each interview took about 45 minutes, and the audiotape was transcribed.

The data analysis consisted of three phases. For the validity of data analysis, we read the transcripts respectively and came to an agreement after discussing their results together at each phase. In the first phase, we knew that most students expressed negative attitudes towards discussion and discourse. The discrepancy between the teacher and the students regarding their ideas of discussion and discourse can be addressed in terms of classroom culture. In phase two, four aspects of classroom culture within the framework of the conceptual ecology were identified: A dichotomous view of knowledge; the teacher as the authority in knowledge; viewing classmates as competitors in class and playmates in playgrounds; and low self-confidence. The four categories are not mutually exclusive, but have close interrelationships among them. In phase three, we chose Sera as a representative case to show effectively what students' cultural aspects were. Although the participants differed from each other in minor ways, they shared many common characteristics. These common characteristics were best articulated by a student named Sera. In what

follows, brief descriptions of the characteristics of the classroom culture and excerpts from the interview with Sera will be presented.

### III. FINDINGS: THE CASE OF SERA

In this paper, we examine a student's cultural aspects affecting discussions and discourses in a science classroom. We have chosen the student, Sera, as a telling case because she was a representative case. To understand Sera's cultural aspects in discussions and discourses, the context of the classroom and the students including Sera were observed and described as follows.

The observed science classroom demonstrated a mixture of traditional and constructivist strategies. In a class period of 45 minutes, there were two or three opportunities for group discussion, which appeared to be too frequently to the students, as they did not have much to discuss in relation to the given topic. Although the teacher repeatedly emphasized the importance of discussing the topic in their own words instead of citing the words in the textbook, most students simply made notes of the textbook content, or spent time chatting about their personal lives. This reveals the different perceptions that the teacher and the students had regarding the purpose of discussion. The students tried to cite scientific terms correctly from the textbook, whereas the teacher expected the students to think about the topic and communicate with each other about their own conception. In classroom discourses, simple questions were asked only by the teacher, and students' responses were equally simple.

At the time of this study, Sera was an active student in a sense. During the interviews, Sera told the interviewer that, as the class leader, she took the responsibility of promoting good relationships with the teacher and the students, and of solving some problems as they occurred in her class. She stated that she tried to understand her classmates' thoughts and the teachers', as well as her role in the class. In group discussions, she sometimes took the initiative in discussing the topic that the teacher posed. However, it seemed that it was hard to continue to discuss the topic in her group. She sometimes had a joke with the others of her group. In much the same way that other students did, she usually tried to search for the words related to the topic in the textbook, take some notes, and prepare for making sentences to be presented.

#### 1. A Dichotomous View of Knowledge

Sera views scientific knowledge as true, abstract and logical, while she sees her knowledge as uncertain and unstable. This dichotomous view seems to greatly direct the nature of the discussions and discourses. When discussing a given topic (whether a natural phenomenon or a case presented by the teacher) in small groups, Sera tended to simply cite the words or expressions she found in textbooks rather than expressing her own thoughts or explanations. In other words, she seems to receive the content of the science textbook without finding evidence to support her argument or thinking critically. She considers scientific knowledge as true and correct, and as a logical, explanatory framework. She thinks of science and math as different from literature and ethics by the criterion of solving problems: problems in science and math have correct answers, but those in literature and ethics depend on different interpretations of them. Therefore, she tends to accept the definitions of scientific terms and the explanations written in science textbook without

thinking reflectively during discussions. As she thinks the nature of scientific knowledge is different from her knowledge, it seems to be meaningless to represent her conceptions in discussions on the topics of science. An excerpt from interviews with Sera demonstrates this tendency (S: Sera; I: interviewer):

S: Scientific knowledge... is logical, systematic... and it requires deep thinking. Anyway, it's like that.

I: What do you mean by logical?

S: It is consistent ... systematic, and at the same time it requires meticulousness and quick thinking to even think about exceptions. In such subjects as ethics, there are no correct or incorrect answers. However, in the subjects like science and math, there is always a logical, correct answer, which is derived according to the principle of cause and effect. Therefore, if the teacher, who knows well about the content, says this or that, we simply accept it. The science subject which we are learning now always has a correct answer. ... In literature, one can have one's own ideas about a novel and have different interpretations of a poem. One can add one's thought to those of others. In science, however, if I say my own explanation or opinion about a phenomenon, and if my account for the phenomenon is incorrect, I lose face before others. I present only the answer that is certain to be true, and I can't add my own ideas to it. The science that we are learning always has a correct answer.

During the interviews, Sera added the comment: "*I can not think about and explain everyday phenomena scientifically because I have never learned or experienced them before*". Therefore, as shown in the following cultural aspect, Sera accepts the authority of the textbooks or the teacher for accuracy in scientific knowledge, instead of trusting her own reasoning or explanation.

## 2. The Teacher as the Authority in Knowledge

In group discussions or discourses, the teacher presented a topic and asked the students to say whatever they thought about the topic. He tried to create an open environment with an eye to inducing the students into discussions or discourses. He encouraged the students to give their own opinions, without caring too much about whether or not they were true. Sera, on the other hand, usually thought that the teacher might put more value upon the right answer than on the students' opinions. She thought that the teacher, an adult with completed scientific knowledge, paid attention only to the correct answers and ignored incorrect opinions. She believed that she could tell whether her responses were right or wrong from the teacher's implicit feedback. Sera thought that the teacher reacted more to the correct answer cited from the textbook than to the personal opinions of students. More excerpts from the interview:

I: What do you think is the purpose of the teacher in adopting the discussion task?

S: I think... if we search for the meaning of a scientific concept repeatedly, we can remember it better when the teacher presents us with the correct meaning. ...I think our teacher wants us to implement the procedure of investigating the topic for discussion, and then he teaches us the content of the topic. It is our teacher's method of teaching science. After we find the content related to the topic in the textbook, we share it with others in discussion, and then the teacher adds more explanations.

...

I: However, your teacher doesn't judge your accounts as right or wrong, does he?

S: No, he doesn't. But the textbook shows what is right. Even though he doesn't say so, there is a right answer.

I: Why is it that he doesn't judge?

S: I don't think that he doesn't care about the right answer. Although he emphasizes that saying a right answer is not so important in discussion, we think we should understand the correct meanings of scientific terms for ourselves to get good grades. If I write long about my opinions that are not right, the teacher can't possibly give me a good grade. Our goal in taking the science subject is to get a good grade. So, we students have to know the right answer for the test. That's what most students do. The teacher says this and that, and the students simply accept them.

When Sera does not understand the teacher's explanations, she cannot but accept the teacher's words. She commented, "*Because it is right. He is right. I am not the type of person who digs in deep. He knows the correct meaning of it*". Additionally, she said that young people should listen to adults according to Korean tradition. She thought that most students should not criticise the teacher much older than them. She explained:

It's been like that since we were little kids. When we pressed our moms for further explanations, they used to say, "its so becasuse it's so. No more questions". Well, that's what Koreans are like. So we simply accept the words of the grown-up, especially of the teachers.

As we have just seen, Sera thought of the teacher as an adult expert in the content of science and also the authority in knowledge. Her thoughts centered around the teacher comprise one of the cultural aspects that prevent her from representing her conceptions or opinions in discussing the science topics.

### 3. Viewing Classmates as Competitors in Class and Playmates in Playgrounds

For Sera, classmates are "*friends to play with, talk with, and share ones feelings with*". Students are good friends in their social life. However, if the topic is related to academic affairs, students seem reluctant to talk about it, both inside and outside the class, because they are competitors in getting good grades. Because of this dual relationship among the students, they feel it is burdensome to discuss academic things in the classroom. In classroom discussions and discourses, few students explicitly countered or supported others' opinions. Some superior students thought that it is more efficient to study science subject alone. Some inferior students did not want to lose their face by asking their classmates, while superior students felt that helping out their friends may be perceived as a showing off of their superior knowledge. Sera's account follows:

I: Why do students resort to the textbook during a discussion?

S: Because we have to present something, as we are now evaluated for our performances. In the past, we could get a good grade simply by studying hard alone and doing well on the test. Now, things have changed, and we have to perform well during the class discussions and discourses. In order to perform well, we have to find the correct answer quickly and present it to the class. It is said that process is more important than product. However, if the product is slow and inaccurate, the performance is not rated high. Getting a good grade is important. And

also it can become silly to discuss among us. For example, if one of us asks about the cause of oxidation, others often make fun of it.

I: Why?

S: Because we don't like being serious. We interpret the teacher's direction to discuss as a direction to find out, write down, and report the correct answer. During a discussion, there are several types of students. For example, if there are two superior students and two inferior students, the students all know their roles even though they are not spelled out. The superior students don't say to the inferior ones to sit back, because they want to maintain their friendship. However, the superior students know that the inferior ones will not actively participate in the discussion, and the inferior students know that the superior students will do the work after all. And there are intermediate students. They may want to take part in the discussion, but what can they say? We are not trained panelists like those on a TV debate program like "Mr. Jungs 100 Minute Debate" (A popular TV debate program at time of the interview).

I: Are there situations where you don't say anything even when you have a lot to say?

S: Yes, there may. I myself had such an experience. For example, in an Ethics class, where there can be found more than one right answer, we still don't do a real discussion. For example, even when we are asked to discuss the topic, "Why should we obey the traffic laws?" we still don't say much. We feel awkward to discuss anything, so we simply play and continue our discussion.

According to Sera's expression mentioned above, students feel awkward to discuss something with their classmates. And Sera thought that they wanted to have good friendships with their classmates, and to get good grades on performance assessment as well. This dual relationship seems to affect students' activities such as finding right answers in textbook, rather than talking their conceptions or opinions about the given topics in discussions.

#### 4. Low Self-Confidence

Sera was not motivated to get involved in discussions and discourses actively. When instructed to discuss in groups, students including Sera did discussion perfunctorily. Sera wanted to hear explanations and experience phenomena and experiments; however, she wanted these to be given to them by the teacher. She thought that the teacher is the authority of knowledge and that the teacher's duty is to deliver the knowledge. In comparison, she considered herself as ignorant and uncertain of scientific knowledge. As a result, Sera thought it to be embarrassing to openly discuss a science topic in front of the teacher or other classmates. That fear discouraged her from actively participating in discussions. Therefore, the time for discussion was wasted looking for the answer in the textbook, or talking about personal interests. Sera continues her account:

I: What do you think is the principal reason for the unsuccessful discussions?

S: For one thing, we don't know anything about the given topic. And even if we do, it's not deep enough to have a meaningful discussion. The teacher assumes that we would do as well as he does. So, he sometimes gets mad if we don't perform up to his expectation. He distributes the experiment equipment and expects us to conduct experiments with the help of the textbook, but we don't do it because it's a nuisance and because we

don't know how to do it. Frankly speaking, we are afraid to make use of our own knowledge, because we are not sure whether it is correct or not, especially if it is not in the textbook. If I want to talk about it, as I have seen it in the book, then I am not sure whether my memory is correct or not.

I: You don't feel inhibited when you talk about the concepts in the subjects of the Korean Language or Ethics. Then why is it that you feel difficulty in talking about scientific concepts?

S: More than any other subject, science is a difficult subject. Furthermore, I run out of knowledge if the discussion continues.

It should be clear from the excerpt above that Sera had low confidence to represent her knowledge in discussions. Her low self-confidence had the consequence of impeding her active participation in discussions.

#### IV. Conclusion and implications

In this paper, we presented the case of Sera as a representative case to understand students' cultural aspects as they are manifested in discussions and discourses in science class. This case study showed that the science classroom culture is identified in terms of four aspects: (1) knowledge; (2) the teacher; (3) the classmates; and (4) self. These cultural aspects are strongly related to each other and function negatively in discussions and discourses in science classrooms.

Sera was not motivated to express and present her thoughts and knowledge. She believed that scientific knowledge should be accurate and true; but she held the belief that students' scientific conceptions were usually inaccurate and incorrect. Sera considered the teacher to be competently versed in science knowledge and expected the teacher to give them the right answers. She thought many students in groups did not like being serious as discussing the science topics, so inferior students followed the answer superior students presented to get good grades. And her lack of self-confidence explained her passiveness during the group discussions.

Kim(2001) categorized four factors as classroom cultures for reflective argumentative communication: flexible conception of knowing and learning; open classroom climate; active participation in the argumentation; and cooperative relationship. It seems that his categories are relative to our findings in this study.

For conceptual change learning to be successful, it is necessary that students understand fully and change these cultural aspects, such as the epistemological views on knowledge (Hofer & Pintrich, 1997), the relationship between the teacher and students, and among the students, and the role of self in a discussion or discourse. Therefore, the teacher should make the classroom environment to be conducive to lively interactions. The teacher, on the other hand, should employ appropriate strategies to help the students regard him not as an absolute source of truth but as an adviser and helper. He should also help the classmates to become learning partners instead of competitors.

Classroom environments including the teacher-student interactions and between-students interactions are significant in facilitating discussions and discourses. Especially, interactions of peers should be activated to promote cognitive apprenticeship in science classrooms. Vygotsky argued that peers are sometimes more



effective than teachers or adults in helping individual learners construct meanings because peers are at similar developmental levels (Jones & Carter, 1998). That is, they are in the same zone of proximal development. In classroom, a peer may be successful in assisting a confused student by rewording the teacher's explanation.

Thus, the findings of the present study present some educational implications in science classes. First, the teacher needs to be more sensitive to the sociopsychological atmosphere of the students. Since Korean students are particularly concerned with saving their faces, structured or semi-structured discussions and discourses might be more conducive to the students than completely open discussions. In the structured discussion, it will be sometimes necessary for the teacher to lead the students step by step, so that they can be prepared psychologically and cognitively to venture into a higher level of discussion.

Second, the teacher needs to be able to demonstrate that different processes can indeed lead to different interpretations of the same phenomenon, and that the consequences of a scientific phenomenon can also be different, depending on the interpretations. By doing so, the teacher can encourage the students to explore different possibilities, without worrying about the truth value of the interpretation. They will also see the importance of the thinking process itself.

Third, the teacher needs to prepare good teaching aids that can help attract the students' attention to the content of the lesson. If students see that the topic of the question is comprehensible and solvable with the help of the teaching aids, and if students perceive the topic interestingly presented, they will be stimulated to give a try.

Finally, the teacher needs to enhance the students' self-confidence by giving positive feedbacks and generous praises. In too many classes, the students are punished more often than they are praised, although the punishment may be very subtle and sometimes unnoticed. The students, especially during the adolescent period, need constant assurance from their teacher.

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