A Developmental Model of Self-regulation Skills

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Abstract
The purpose of this paper is to explore the relationship between a tutor's advice and a student's questionings, and the way in which it develops a student's self-regulation skill. Firstly we offer that a tutor's advice is one component that trains a student's self-regulation skill. Through analysis of interactive learning opportunities between academic departments, we discovered that a tutor's advice transformed a student's questionings. This transformation indicates an appropriation by the student of the tutor's self-regulation skill. We propose a model for further development of a student's self-regulation skill, which is based on the appropriation by the student of the tutor's self-regulation skill.

Introduction
Currently, a new paradigm of learning incorporating three distinct theories is emerging - social constructivism, Soviet socio-cultural theories, and situated cognition. This new paradigm brings these social issues to the foreground as a central phenomenon for study (Koschmann 1996 p.11). Under this new paradigm, the emphasis in research on collaborative learning has shifted from the study of the conditions under which group members learn more effectively, to the collaborative interactions themselves.

Considering the study of collaborative interaction, some research has shown that specific kinds of interactions may engender specific kinds of outcomes (Chi and VanLehn, 1991). Additionally, collaborative learning research has shown that interaction must be structured in order to promote effective discourse (Cohen 1994).

Some researchers have focused on structuring or controlling the interaction in order to force the group members to mediate each other's learning. For example, in Reciprocal Teaching (Palincsar & Brown, 1984), the interaction is structured to promote a specific discourse pattern: questioning, summarizing, clarifying, and predicting. Reciprocal Teaching has been found to improve the ability of understanding prose. The ASK to THINK – TEL WHY (King 1999) model of peer tutoring also relies on structuring the interaction which consists of a question and answer component. In the ASK to THINK – TEL WHY, tutor and student have clearly differentiated roles. When in the tutor role, tutors only ask five types of questions. When they are in the student role, students provide answers but do not ask questions.

On the other hand, effective discourse has a common factor. It involves metacognitive processes such as mutual regulation and reflection (Brown 1987). This indicates that effective discourse plays the role of controlling a group member's knowledge or causing him to reflect upon his knowledge. In other words, effective discourse temporarily supersedes a student's self-regulation skill.

From this, we can see the possibility that structured interactions composed of specific utterances can fulfill the metacognitive processes of interlocutor-regulation skills and self-regulation skills.

The purpose of this study is to explore structured interactions, which train a student's self-regulation skill. In this paper, we propose that a tutor's advice is one of the interactions that train a student's self-regulation skill. We will first focus on the discourse pattern: a question-answer methodology using structured interactions. We describe how the use of appropriate questions trains a student's self-regulation skill. Next, we will describe how a tutor's advice trains a student's self-regulation skill. Finally, we will describe a training model for developing self-regulation skills.

2. Developing self-regulation skills through the use of appropriate questioning

In both the Reciprocal Teaching method and the ASK to THINK – TEL WHY model of peer tutoring, students were trained to use appropriate questions. This is indicative of a students' self-regulation skill training.

In the Reciprocal Teaching method, students as well as teachers take on the role of guiding other members in a group through the processes required to understand texts. In the initial phase, the teacher modeled effective monitoring strategies and feedback. In the intermediate phase, students became much more capable of playing...
their role as dialogue leader, and by the final phase they provided sophisticated paraphrases of the text and asked sophisticated questions (Brown 1987). One reason for this effect is that the teacher introduced students to their role as a dialogue leader through explicit instruction about appropriate strategic directives (Wertsch 1998).

In the ASK to THINK – TEL WHY model of peer tutoring, the student who is in the tutor role also constructs a more accurate student model through the student’s feedback. And the tutor could select the appropriate question on the basis of the student model. If the student’s answer to the tutor’s question is incomplete, the tutor asks another question. This methodology of training using appropriate questions causes the tutor to construct a model of the student’s knowledge and to control the student’s acquisition, integration and organization of knowledge through asking appropriate questions.

From these analyses, we can conclude the following.

- Through explicit instruction in appropriate questioning technique as described in Reciprocal Teaching, the group leader could be trained to see an interlocutors’ knowledge structure as an object of his cognition. Also, this method implies that the teacher causes students to mimic proper self-regulation skill.
- The students who are in the tutor role or group leader role can construct a student’s knowledge model and control his knowledge. This method indicates that the interlocutors’ knowledge structures would become an object of the tutors’ cognition.

It should be emphasized that these processes indicate that the tutor took the meta-level role for the student’s cognition. In other words, the tutor’s ability to use appropriate questioning indicates the [interlocutor]-regulation skill. During a period of utilizing this [interlocutor]-regulation, a student gradually internalizes it as a self-regulation skill. At this point the student’s self-regulation skill will be operative. This process is identical to Vygotsky’s general genetic law of cultural development theory (Vygotsky, 1978).

“Every function in the child’s development appears twice: first, on the social level, and later on the individual level; first, between people (inter-psychological) and inside the child (intra-psychological)”.

3. A Tutors’ advice transforms student’s questions

Now we are ready to consider our main problem. We regard both Reciprocal Teaching and the ASK to THINK – TEL WHY model of peer tutoring as an indirect training of self-regulation skills. In this section we will analyze research of student’s spontaneous questionings and a tutor’s advice. We will consider that a tutor’s appropriate advice can directly train a student’s self-regulation skills.

We analyzed the interaction between advisers and students during tutoring sessions among different academic departments. And we observed that the students’ questionings prior to receiving a tutor’s advice were different from questionings after receiving advice.

In the initial phase of the tutoring, all students asked similar questions such as “What is a modem?” However, tutor’s advice transformed some of the students’ questions into a confirmation-question or another what-question. The former students were asking for justification of their own assumptions that were based on an explanation encountered in their reading. The latter students were asking for information to integrate their understanding of what they read. For example:

Confirmation-questions:

“I suppose that all information is represented as one or zero. If so, is hiragana or katakana represented as one or zero?”

What-questions:

“Let us know more information about it, for example, the merits or the demerits and so on.”

3.1 A classification of user’s questions

In order to account for this transformation of students’ questionings, we categorized the various questionings. As there were many factors encountered in students’ questions, it was very difficult to determine their classification. Moore (1995) classified students’ follow-up questions according to previously given explanations and communicative goals. As student’s questions are spontaneous and random, we decided to follow her classification. Our adaptation of this classification is shown in the following table.

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>PREVIOUSLY GIVEN ADVICE</th>
<th>COMMUNICATIVE GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>What?</td>
<td>Make uncertain things clear</td>
<td>Acquisition</td>
</tr>
<tr>
<td>Is it true?</td>
<td>Make uncertain things clear</td>
<td>Comprehension</td>
</tr>
</tbody>
</table>

Table 1

As table 1 shows, the communicative goal of student’s questions was changed. This transformation of the user’s communicative goal leads us to consider the student’s knowledge transformation. The initial questions: What-question (Goal: Acquisition) indicate that a student was only cognizant of an unknown thing in the subject matter. Also he did not regulate his knowledge. However the communicative goal of questions after receiving advice, which is Comprehension or Integration, was changed. The latter questions indicate the student’s attempt to regulate their knowledge.

On the other hand, it is known that low ability performers are deficient in both knowledge and the resources for controlling that knowledge. And knowledge differences reflect processing differences. Poor learners are
deficient in knowledge because of poor learning skills, in particular, the self-regulation skill (Campione 1987).

Furthermore, there are many degrees of self-regulation skill but the distinction has not been made as clear. And conscious awareness and direction of thought rank lower than self-correction and regulation that can proceed below the level of consciousness (Brown 1987).

From this, we can see that the transformation of students’ spontaneous questions indicates how they regulate their knowledge structures. This transformation is mainly because of the change from a spontaneous self-regulation skill to a higher-level self-regulation skill that the tutor’s scaffold as a coach causes students to engender spontaneously.

4. A tutor’s advice trains students’ self-regulation skills

Here we will describe how a tutor’s advice trains students’ self-regulation skills from the viewpoint of the relationship between advice and the transformation of students’ questionings. Before describing this claim, we will analyze the relationship between advice and the students’ transformed questions.

4.1 What is advice?

There are three typical advice patterns in response to students’ questions in the initial phase of tutoring.

Advice #1: You should be more specific when you ask somebody a question.
Advice #2: You should be more specific when you ask somebody a question. There are explanations about CPU’s in magazines. Please read them. If you have questions after reading them, I can help you.
Advice #3: You should be more specific when you ask somebody a question. If you make the things you don’t know clear, you will be successful and will enjoy learning.

This advice is representative of a tutor’s own self-regulation skills, which are informed by the student’s questionings and which regulate student’s cognitive activities (Kayashima and Okamoto 1999a). This is made clear when we see that all of the advising statements include the same phrase: "You should be more specific when you ask somebody a question." This phrase means that students should perform conscious cognition of their knowledge structures. In other words, this phrase gives students insight into how a tutor regulates a student’s knowledge structures.

4.2 The relationship between advice and the transformation of students’ questionings

Here we describe the relationship between the advice and the transformation of student’s questions. We claim that the transformation was triggered by the student’s appropriation of a tutor’s advice. This claim is not new and can be found in various studies (Rogoff 1991, Wertsch 1998).

The tutor’s advice indicates his monitoring and control: i.e. how the tutor monitored the student’s knowledge structure, and how the student should regulate his knowledge structure if the roles were reversed.

What is important is whether students engage in conscious cognition when they receive this advice (Kayashima and Okamoto 1999b). This is important because metacognitive experiences are most apt to occur whenever one engages in conscious cognition (Flavell 1981). By engaging in conscious cognition, the student’s knowledge structures can become an object of his cognition. Some students, who engaged in conscious cognition, were aware of their deficient monitoring and then appropriated the tutor’s regulation itself. Others did not appropriate it. Although the former student was transformed, the latter was not transformed in the light of questionings. The appropriation of a tutor’s regulation might lead to modification of the student’s knowledge structures, which then might transform his questioning. In other words, the transformation of students’ questions does not necessarily mean that the student’s self-regulation skills have developed. However, the development of self-regulation skill requires the appropriation of a higher self-regulation skill.

5. The developmental model of self-regulation skill

Now we shall describe how a student appropriates a tutor’s self-regulation skill, using the following description:

Monitoring: monitoring (Agent, Target, Level) (1)
Control: control (Agent, Target, Level) (2)

Here we describe how a learner (Agent) monitors his own or another’s cognition (Target) through some monitoring level (Level) as shown in (1) above. Additionally a learner (Agent) controls his own or another’s cognition (Target) at some control level (Level) as shown in (2) above. The agent is a person who monitors or controls. The target is knowledge structures that are monitored by the Agent. The value of Agent or Target is shown as 'T and L, in which “T” refers to tutor and “L” to learner. The value of Level is “L,” meaning that monitoring level is i, and “L,+i” means that monitoring level is higher than “L-i”.

We describe a learners’ questionings and a tutors’ advice as follows:

Questioning: tell (Agent, Others, To do) (3)
Advice: want (Agent, Others, To do) (4)

We describe that a learner (Agent) asks a tutor (Others) a
uestion as shown in (3) above, because a learners’ questionings imply that they tell tutors their immediate necedent cognitive actions (To do). As tutors (Agent) want learners (Others) to engage in proper cognitive actions (To do), they advise. Therefore we describe advice as (4).

As students’ questions at the initial phase of the tutoring show their awareness of incomprehensible concepts, we write them as (5). This monitoring level is “” , because students were only cognizant of incomprehensible concepts. The advice received from their initial questions represents that tutors want learners to regulate their knowledge structures in the same way the tutor regulates learners’ knowledge structures. It is a higher level than one that was initially seen in their questionings. We describe it as "Lv"(i>0). This we also indicate as (6).

tell (L, T, monitoring(L, L, L0))  (5)
want ( T, L, control (T, L, L0))  (6)

Now, we describe how a learner appropriates a tutor’s self-regulation skill; especially regulation as follows. We describe that the learner appropriates the tutor’s regulation skill as shown in (7) below. That is to say, the learner appropriates the tutor’s regulation skill: control (L, L). It should be noted that “control (T, L, L0)” is the same s “control (T, L, L)” in “want (T, L, control (T, L, L0))”. Thus the appropriation might engender the learner to modify his knowledge structures. The transformation of his knowledge structure leads the learner to ask a question that is a different communication goal from that of his initial expression. This is shown as (8) below.

tell (L, T, monitoring (L, L, L0))  (5)
<tell (L, T, monitoring (L, L, L0))  (5)
& want (T, L, control (T, L, L0))  (6)
& control (T, L, L)  (7)

This model of training self-regulation skill indicates that learners use appropriate questions by the appropriation of the student’s self-regulation skill. ITS systems should advise a user on a level appropriate to a skilled adviser’s self-regulation skill. Also, an ITS system could evaluate through the user’s follow-up questions whether the user adequately appropriates it.

6. Conclusion

We propose a prototype model for training self-regulation skills. This model is based on question-answer dialogue, and is also based on the view of a user’s internalization of another’s self-regulation skills as users appropriate them.

If we develop the model, we can create a new, effective advice discourse and improve learning through changes in a student’s self-regulation skills.

In further work we intend to explore what advice encourages a students’ appropriation of a tutor’s self-regulation skills, specifically, what advice becomes the object of conscious cognition. Solving this issue, we could then utilize more effectively this model for training self-regulation skills.

References


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