Peer Collaboration and Conceptual Understanding of Speciation among Primary Pupils

Karin Stolpe
Department of Social and Welfare Studies, Linköping University, Sweden
karin.stolpe@liu.se

Johanna Frejd
Elementary and middle school teacher, Söderköping, Sweden

Abstract This study aims to investigate how peer collaboration affects individual pupils’ conceptions of speciation. Earlier research on evolution has primarily focused on children’s conceptions using individual and/or written examination. In this study, individual interviews and group discussions have been performed with eight 9-years old pupils who lack formal education on evolution. The results show that the pupils develop their conceptions on speciation in group discussions compared to individual interviews. This result suggests that also younger pupils improve their conceptual understanding in peer collaboration.

Key Words Primary Education, Peer Collaboration, Evolution, Speciation, Conceptual Understanding

1. Introduction

Research published on pupils’ conceptions of evolution focus mainly on pupils who have had formal education on evolution (e.g Wallin, 2004; Ferrari & Chi, 1998). Research on primary pupils, show that children’s conception on speciation is culturally dependent, and the society is important for the formation of children’s conceptions (Samarapungavan & Wiers, 1997; Berti, Toneatti and Rosati, 2010).

Research on pupils without formal education on evolution, and more specific speciation, is rare. Moreover, the research which we know about, have exclusively used individual and/or written examinations to study pupils’ conceptions. Added to this, there is research showing that pupils’ conceptions of photosynthesis develop through peer collaboration (Lumpe & Staver, 1995).

The aim of this study is to shed light on how pupils’ conceptions of speciation is influenced and developed through peer collaboration. More specifically, the following research question frames this study: How does peer collaboration affect individual pupils’ conceptions of speciation?

1.1 Theoretical framework

This study takes a sociocultural perspective on learning. Zone of proximal development (Vygotskij, 2001) is defined as what the pupil can handle with guidance from a more knowledgeable other (the teacher or an older and more knowledgeable pupil).

Hence, interaction between people is a central part in sociocultural theory. Peer collaboration is when novices in a particular field come together to solve a mutual problem (Damon & Phelps, 1989). Researchers in the field of science education research have also used Vygotsky’s theories to explain peer collaboration (Lumpe & Staver, 1995). Forman (1989) explains that in group works where the members are approximately equal in competence, the role of being the teacher and the pupil may vary between the group members. In this way, the
pupils may help each other to a higher level than they would reach on their own. Lumpe and Staver (1995) saw that the students in their peer collaboration study shifted roles and thereby developed their conception of photosynthesis into a more scientific conception.

2. Method

2.1 Sample
This study investigated eight 9-years old third-graders’ (four boys and four girls) conceptions and peer collaboration on speciation. The pupils have not had any formal education on evolution nor speciation. The pupils’ were divided into two groups based on the ambition to ensure a spread in level of achievements and gender in order to stimulate the proximal zone of development.

2.2 Data collection
The data were collected in three steps. In the first step was individual and the pupils were asked answer the following question in a paper/pencil-situation: “This is pictures of animals that live in different parts of the world. All animals are great cats. If you imagine that all cats were looking the same way millions a years ago, how come that they today look different from each other? Draw your answer on the white paper and write what you think on the other paper.” The four pictures of the great cats illustrated a lion, a tiger, a snow leopard and a jaguar. Moreover, the pupils had a world map. In one of the corners of the world map, there was a map showing the location of the continental plates 200 million years ago, 70 million years ago and today.

The paper/pencil-test was then followed up by individual audio recorded interviews, where the pupils communicated their thoughts about what they had written and drawn. The third step was a video recorded group interview. The groups’ task was to inform each other of once opinion on the original question.

2.3 Data analysis
The transcribed individual interviews and the transcribed group discussions have been analyzed. The first step was to form categories of the pupils’ conceptions of speciation during the individual interviews. These categories were then used to analyze the group discussion. We have compared each pupil’s individual conception (from the interview) to what they expressed during the group interview.

3. Results
In the following, we will only provide one example from the results. Markus, Sol, Lina and Kalle belonged to Group 1. During the individual interview Kalle states that species develops from one generation to the next. He establishes a relationship between sabre-toothed tiger and today’s tigers:

Interviewer: So you believe that the sabre-toothed tiger and the tiger are related to each other in some way?
Kalle: Yes, because they are two tigers. [...] It may be that some tiger did not become as a saber-toothed tiger and then there were more of them.
Interviewer: What do you mean “it may be that some [tiger] did not become”?
Kalle: That it was someone that not became saber-toothed.
Interviewer: That it didn’t have any saber-teeth?
Kalle: Yes, and then there were more of them... When the other tigers died out. Because it cannot be like the teeth just broke off because then their cubs would have had... or, yes, then the cubs would have [sabre-teeth] anyway... Yes, I think it was something inside the tummy.
In the above quotation, Kalle states that the tigers will be more frequent as the saber-toothed tigers die out. Furthermore, he says that this begins when as a sudden one of the tigers were born without saber-teeth. He also concludes that something must have happened “inside the tummy”, that is, during the pregnancy. He draws this conclusion because he rejects the possibility that breaking off the teeth would be anything that could be passed on to the cubs.

In the group discussion Kalle brings his ideas about how tigers can have developed from the saber-toothed tiger. Markus, which in his individual interview not expressed similar thoughts, follows Kalle’s reasoning:

Kalle: Some saber-toothed tiger maybe was born without saber-teeth, and he may have been the first tiger. Something was wrong with it.
Markus: A kind of malformation, or what?
Kalle: Yes (laughs), a malformation! No, but maybe it was ill. Or its mother was ill so it became a malformation.

Kalle draws on the same line as he did during the individual interview. During the group discussion Markus is able to elaborate the description by adding the word: “malformation”.

The way in which Kalle and Markus complement each other’s statements during the group discussion is a pattern seen also in the rest of the data material. The results also show that the pupils take impression from each other and develop their own reasoning with help from their peers. The main result is that the pupils seem to develop their conceptions in peer collaboration.

4. Discussion and conclusions
The results of this study lay in line with earlier research on peer collaboration (e.g. Lumpe & Staver, 1995), confirming that students are able to develop their scientific conceptions in peer collaboration. As a complement to earlier research, our results suggest that even for younger pupils, it is possible to develop conceptions further in peer collaboration than in individual situations. As the example above shows, peer collaboration is about giving and taking. Since no one is expert on the topic, the pupils had different experiences which they could share and together form a more developed conception by adding to each other. Depending on the micro-context, the pupils could take either the role as a teacher or as a pupil and the roles could change during the conversation. This is termed the bi-directional zone of proximal development (Forman, 1989).

Even though Kalle and Markus are not using the term mutation, they show a basic understanding for that phenomenon, which could be a fruitful building block in further understanding for evolution. We wish to emphasize that the dialog coming to terms in group discussions take place without the influence of any adult. We suggest that students themselves have the ability to develop each other’s knowledge.

6. References


