Co-elaborating knowledge with external representations

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This study focuses on the collaborative construction of diagrams in argumentation-based learning by secondary school students. More specifically, we want to know how the collaborative construction of a diagram supports establishing relations and transformations in argumentative knowledge. The study offers insight into the affordances and constraints of constructing a diagram together, and shows what kind of support students need to make use of the diagram.

The goal for learners is to acquire argumentative knowledge about an open domain. Argumentative knowledge about an open domain is knowledge about an issue that has no right or wrong answers. There is not one easy solution, instead there are different sides with different argumentation. All views, arguments, decisions, facts, emotions, and consequences of an issue together make up the 'space of debate' of this issue. Most people only have knowledge of a part of a space of debate. We want students to collaboratively acquire, refine, and restructure knowledge in order to get a broader and deeper understanding of the space of debate.

Students explore the space of debate by means of discussing the issue with other students. Argumentative interaction facilitates learning because students have to explicate and exchange ideas and information, reason about viewpoints, and support or attack arguments, thus sharing, elaborating, or even constructing knowledge. Argumentation makes interaction especially active, because it is generated by reasoning instead of retrieved from memory (Andriessen, Baker, Suthers, 2003). In argumentation you cannot rely on just telling information, because you have to react on what the other person says in order to defend or persuade. Counter-argumentation is especially useful for learning, because the reaction to someone’s argument (named counter or rebuttal) enables people to move on from old to new perspectives on a topic (Leitão, 2001).

In order to broaden and deepen the space of debate students need to explore the different topics that are associated with the domain, the arguments that accompany them, and the different perspectives that can be taken. More importantly, to make meaning of the space of debate they have to relate these perspectives, arguments and topics, thus structuring the space of debate. We argue that relating knowledge happens when students collaboratively elaborate on what they know. We use the term knowledge transformation to describe this phenomenon (cf. Bereiter & Scardamalia, 1987). In knowledge transformation, previously unrelated views or arguments students bring forward in their discussion are explicitly related. This broadens and deepens understanding. Transformations can happen on the level of topic (e.g. in discussing the issue of genetically modified organisms the subtopics environment and
health are related), on the level of argumentation (e.g. an argument in favour is related to an argument against), or on the level of perspective (e.g. the viewpoint of the government is related to that of farmers). A good idea of how the different argumentative knowledge 'parts' are related helps students discover the complexity and inferences of the issue, and come to a well-supported view.

An argumentative diagram might help students in relating argumentative knowledge, because it specifically displays relations (arrows) between knowledge parts (in boxes), and can give an instant overview of the space of debate. With a diagram students can construct, research, and manipulate their own representation of the space of debate. For example, Suthers (2003) has found that students focus more on evidential relations when they discuss a scientific topic while also constructing a graph. However, the precise relation between arguing to learn argumentative knowledge and diagrammatic support hasn’t been researched yet.

Earlier studies (e.g. Munneke, Van Amelsvoort, & Andriessen, 2003) showed that students do not benefit much from the construction of an argumentative diagram to learn about the space of debate. They find out how to use the diagram fairly quickly, but do not make use of it for relating knowledge. Relations put between boxes are often arbitrary and never discussed. Diagrams are used to display bits and pieces of information, without considering their structure. This finding could be explained in several ways. Students are not used to constructing diagrams for argumentation, let alone in collaboration. The construction of an argumentative structure might be too hard for students who are used to narrative structures. They might need more guidance in organising diagrams. Individual differences in preference for verbal or visual learning might also influence the use of the diagram.

Three conditions will be set up to explore the role a diagram can play in transforming knowledge in collaborative argumentation-based learning. In the first two conditions, a diagram is used to support the chat discussion students are having. In one condition, we focus on relations between arguments (the arrows in the diagram), by asking the students to label these relations. In the other condition, we focus on the arguments themselves (the boxes in the diagram), by asking students to label the arguments. In the third condition, students use only chat to discuss the issue. Differences in individual preference for verbal or visual learning will be taken into account. We analyse both the chat and the diagram on knowledge transformation processes, and check whether they are individually or collaboratively elaborated. Students are also individually asked about their understanding of the space of debate in a post test. We expect students to show the most knowledge transformations and understanding when they labelled relations, and least transformation and understanding when they used chat only.

