



**IARTEM *e-Journal*  
Volume 3 No 2**

**Volume 3 Number 2**

---

**Understandings and misunderstandings of  
metaphors and images in science textbooks among  
minority students  
in Norwegian primary schools**

Norunn Askeland and Bente Aamotsbakken  
Vestfold University College  
Norway

**Abstract**

On the basis of ongoing research on student's reading of textbooks in natural science we want to discuss how metaphors and images are understood and not understood by students from cultural and linguistic minorities in primary school. Our literacy project is financed by the Norwegian Research Council (NFR) and conducted in a primary school with more than 75 % students from cultural minorities.

We will give some examples from observations in the classrooms and interviews of students in pairs in order to show how the use of images and language, and especially verbal and visual metaphors create understanding and/or confusion. We will also discuss how textbooks can be improved to communicate better for students in general as well as for students from ethnic and linguistic minority cultures.

We draw upon literacy theories (Bråten, Kress & van Leeuwen), functional linguistics (Halliday, Maagerø) and a variety of theories of metaphor (Lakoff & Johnson, Littlemore, Cameron, Deignan).

**Key words: Literacy, Metaphor, Multimodality, Communication**

**Introduction**

In this paper we will investigate the reading of science texts in a classroom where more than 80% of the students come from ethnic and linguistic minority cultures. Our findings are the result of a research project – “The Reading of Expository Texts as a Basic Skill in School Subjects” – conducted at Vestfold University College, and financed by the Norwegian Research Council. The aim of the researchers working within the project has been to study the use of textbooks and educational material across four subjects: religion and ethics, mother tongue, mathematics and natural science – the latter being the focus of this paper. The methodological framework for the project was classroom observations and interviews with students, their teachers, school principals and parents. The research has been conducted across second, fifth and eighth grade classes (i.e. students of 7, 10 and 13 years of age) in the Norwegian education system. The wider project is qualitatively oriented and has been conducted at five different schools, with observations in 30 classrooms, 60 students have been interviewed in pairs, and teachers and school leaders have been interviewed in focus groups at each institution. Four of the schools represent a homogenous ethnic and linguistic Norwegian majority culture whereas the fifth school have more than 80% students from ethnic and linguistic minority cultures, as mentioned above. The reason for concentrating on this school in this article is that problems related to the reading of science textbooks seem to be more or less the same for students from minority and majority cultures, even though they are more frequent among minority students, due to lack in linguistic competence (Golden 2005). Furthermore, the interviews with students in our study has shown that high achieving minority students point to the same problems with understanding science textbooks as majority students do, and they are often more aware of their own lack of understanding. Consequently, it is important to study what problems minority students encounter in reading science textbooks and textbooks in general.

Textbooks, as well as other educational material and media, need to consider linguistic preparation and degree of access when reading is on the agenda. This is particularly important in the case of students from a minority background, who have possibly had only a few years study of the majority language. Observations are always useful in studying interaction between the reader and the text, but in the part of the research project that was related to minority students, the interviews have proven to be the most revealing. During these interviews, students were asked to read aloud from both familiar and unfamiliar texts. In the process, the researchers became aware of a range of understandings and misunderstandings of metaphors and images, along with structural difficulties implied in the texts: for instance, the relation between the body text with the various illustrations, captions, exercises, tables and textual elements. Through these interviews, and follow-up discussions with students, the researchers were given the opportunity to pose questions and elicit suggestions for improvements in future textbooks.

### **The language of textbooks and science in general**

The act of reading a textbook out of pure curiosity or for amusement is not all that common (Selander, 2003). Textbooks and other educational material tend to have a certain ‘intentionality’ implied in their structure. This intentionality can be traced in the way an author approaches the reader. The approach may be characterized by the use of the personal pronoun ‘you’, a strategy that assumes a certain familiarity. The

asymmetric relationship present in all educational texts is concealed in this way, but nevertheless, the fact that the reader is supposed to learn something new, or have the “already known or read” confirmed, might be said to be the main characteristic of this kind of text. Intentionality is most explicit in the various exercises; these have an obvious intention of teaching something to somebody. This is done in various ways: by repetitions, searches for correct answers, philosophical questions, suggestions to participate in an interpretive community, etc. (Bråthen, 2007).

The language used in textbooks and educational material needs close attention. Since educational texts tend to be synonymous with expository texts or enquiry based, the author of the texts must take into consideration that verbal expressions should be understandable and, at the same time, develop knowledge and competence during reading. In other words, the language should be challenging and precise simultaneously. This is a hard task to fulfil: students are as diverse as any group of individuals. Some textbooks try to solve the linguistic problem by using rather simplified language with short sentences and frequent subtitles. However, such books can seem fragmented and incoherent. Indeed, books with so-called ‘easy reader’ texts can turn out to be the opposite; the shortened sentences and paragraphs can give a staccato impression, and lack words that help sentences fit together. Short sentences without the necessary cohesive mechanisms tend to create isolated entities of meaning, and the connection between sentences may be hard to trace..The erasing of cohesive words is not an effective practice. Finally, it is not the length of sentences that create obstacles for students who have trouble reading, but rather the lack of coherence that makes the text incomprehensible (Reichenberg 2007) .

Coherence is not only verbal but visual too, as shown by Kress and van Leuween (1996, 2006). In *Reading Images: The Grammar of Visual Design*, the authors demonstrate how the reading of images in Western society is governed by a left-right structure, a structure that leads the reader to connect certain elements with certain other elements to create meaning through visual design. If textbooks break these laws of composition, it may be difficult for students to make the correct connection between elements of meaning.

Abstract language is often blamed for creating obstacles for students studying expository texts. A lot of information is wrapped in a noun instead of being spread out via verbs, adjectives and adverbs. Michael Halliday has used the term ‘grammatical metaphor’ to describe this phenomenon (Halliday, 1994, Maagerø, 2006, 2007). Grammatical metaphors are necessary tools for meaning-making in textbooks, but the author should be aware of the problems that might evolve. Explanations and exemplifications are needed in texts that are packed with such expressions. Texts characterized by a great quantity of grammatical metaphors and abstractions need concretisation to be understood. Such concretisation can be presented in the form of experiments for the students to carry out. Further in this paper, we will investigate one such experiment that was conducted in a second grade classroom.

Another type of concretisation is achieved through the use of metaphors. Metaphors can both promote and prevent understanding, depending on the context (Cameron, 2002, 2003, Littlemore, 2001). Further on we will examine an excerpt from a science

textbook where the lack of visual coherence, together with the use of metaphors, creates problems with understanding.

### What is a metaphor?

Metaphors can be both linguistic and visual. We will deal with the linguistic metaphors first. According to Gerard Steen (2007), there are a number of distinct models of metaphors in cognitive science (Lakoff, 1980, 1999, Fauconnier, 1997). These models require conceptual analysis of at least two conceptual structures and the relationship between them. In Steen's view, the conceptual analysis needs to be complemented by a linguistic analysis. What is important to Steen is discussing methods in general for finding metaphors in grammar and usage, "a distinction which has not been thematized sufficiently systematically in these models" (Steen, 2007, p.57).

Our project is directed towards metaphors in actual discourse and metaphors in usage. Our understanding of metaphors is thus taken from the *Metaphor Analysis Project*, on how to find metaphors – "a device for seeing something in terms of something else" – in discourse. ([http://creet.open.ac.uk/projects/mataphor-analysis/What%20is%20metaphor\\_files/htm](http://creet.open.ac.uk/projects/mataphor-analysis/What%20is%20metaphor_files/htm), accessed: 23-08-09). The definition of metaphor in the discourse related part of the project is taken from Kenneth Burke (1945:503). This is an open definition that allows for different metaphor models and also different kinds of metaphors. What we speak of is the target domain, and what we speak in terms of is the source domain (Lakoff and Johnson, 1980, 1999). In the metaphor 'Teaching is a Journey' *teaching* is the target domain and *journey* the source domain.

Metaphors can be grouped according to different criteria. Alice Deignan (2005) uses a corpus-based classification built on degrees of metaphoricity, which we have found useful in our project. The categories are: 'innovative metaphors', 'conventionalized metaphors', 'dead metaphors' and 'historical metaphors'. Innovative metaphors are rare in a corpus and might be compared to what Cameron names deliberate or explanatory metaphors (Cameron, 2003). An example from the science textbook is: *Pollen is the flowers' sperm cells*. Conventionalized metaphors have a metaphorical sense that is dependent on a core sense by semantic criteria. These metaphors are more frequent in a text. Examples from the science texts are "The ground frost loosens its *grip*" and "leaves and flowers will *spring out*". The third group, the dead metaphors, have a metaphorical sense that is not dependent on a core sense. We think that metaphors such as *catkins* and *coltsfoot* belong to this group, and will come back to these in the discussion later. The last group, the historical metaphors, have a former literal sense which is so different in meaning that it is homonymic for current speakers. An example from the science text is *allergic*, which comes from Greek and means "another energy", a meaning that is not available for most speakers today.

These four categories of metaphors are closely related to the students' understanding and misunderstanding of metaphors in science textbooks that we will examine. The categorization adequately covers the kind of metaphors we have found in the actual texts, regardless of whether the students commented on them or not.

The concept 'visual metaphor' comes from Kress and van Leeuwen (2006) who, inspired by Halliday, develop a social semiotic theory of representation. Their example of sign-making is a three-year-old boy sitting on his father's lap and talking about a drawing as he is doing it. The boy draws four circles and after that he says it is a car. A 'car' for him was defined by the criterial characteristic of 'having wheels', and his representation focused on this aspect. Wheels represent the car and are, in turn, represented by circles. Kress and van Leeuwen see the process of sign-making as a process of the constitution of metaphor in two steps: "a car is (most like) wheels" and "wheels are (most like) circles". Signs thus result from a double metaphorical process in which analogy is the constitutive principle. Analogy, in turn, is a process of classification: X is like Y (in criteria ways) (Kress and van Leeuwen, 2006, p. 7).

Kress and van Leeuwen stress that children and adults are ceaselessly engaged in the construction of visual metaphors. However, children are less constricted by pre-existing metaphors than adults, and since children have less power, their visual metaphors are less likely to carry the day. We will see an example of this later, in the science exercise from second grade.

### **Metaphors and understanding**

According to Cameron (2002, p. 676), three main sources of children's difficulties with linguistic metaphors have been identified. The first is that children might not realize they are dealing with a metaphor, and should therefore be assisted by more explicit marking of metaphors, as in similes. There are also several other tuning devices to suggest to a listener or reader how to interpret a metaphor, such as: just, like, sort of, imagine, really, so to speak, if you like, and so on (Cameron and Deignan, 2003). Another source of difficulty, again according to Cameron (2002), is when children do not have knowledge of the conceptual domains in the metaphor. Knowledge of the source domain is very important. As an example, Cameron uses the metaphor: "The atmosphere is like an invisible shield of air surrounding the Earth". A child who knows nothing about 'shields' will not be much helped by its application to 'the atmosphere' (Cameron 2002, p. 676). A third source of difficulty has to do with the connections between the target domain and the source domain. Children might have knowledge of both domains, but could still have problems in selecting appropriate concepts to connect between the target domain and the source domain.

The problems mentioned above are likely to occur with children in general, and are closely connected to knowledge of the world, culture and language. Children from minority backgrounds are thus likely to meet more problems than majority children in interpreting metaphors (Golden, 2005) and might need more explicit tuning devices and support in general to understand metaphors in textbooks. Not only children but also university students can misinterpret metaphors, as discussed by Jeanette Littlemore (2001). Littlemore shows how metaphors can be stumbling blocks for international students. When trying to follow lectures at universities, they may not only misinterpret the information conveyed, but also the attitude of the lecturer toward this information (Littlemore, 2001). When the lecturer uses for instance the metaphor 'parent company' it is interpreted in different ways by British students and oversea's students in the way that the two groups highlighted different aspects of the metaphor, the control aspect versus the support aspect. There is reason to believe that these

stumbling blocks are also present in science textbooks for minority students in grades two and five. In our project two of the minority students aged 11 with Muslim background interpreted the metaphor 'bare mountain' as 'nude mountain' and found the language not very appropriate.

Children not only make more – or less – sense *of* metaphors, they also make sense *with* metaphors, both linguistic and visual. When seeing children's drawings as visual metaphors, one might interpret this information as *their* understanding of a certain topic or situation. A study carried out by Jewitt et al (2001) shows how four students in a seventh grade science class were able to understand the teacher's use of the metaphor 'building block' when referring to cells in an onion. Following the teacher's explanation, the students were asked to draw cells. Their drawings showed four different types of building blocks, or stones – old ones, new ones, blocks in the country, blocks in the city – and all were meant to correspond to onion cells. The drawings were promoted by the teacher's use of the metaphor 'building block'. These conceptions could again be looked upon as a sign of what the students thought about cells as a phenomenon – i.e. if they were familiar and part of their urban neighbourhood, or something faraway in the country. The experiment shows that a metaphor can challenge students to make sense of it from their own experience, and help students learn by functioning as a link between new and familiar knowledge. It also shows that metaphors can be effective in teaching: it doesn't matter if students construe metaphors differently, as long as they understand the relationship between the target domain and the source domain. Last but not least, the experiment tells us that students' visual metaphors are a valuable source for testing their understanding of metaphors, and school subjects and topics in general.

In the following section, we will examine how children make meaning with visual metaphors, and also how they understand and misunderstand linguistic metaphors in written texts.

## **The science experiment in grade 2**

We visited a second grade classroom where the students were going to learn about water. Earlier in the week they had learnt about air: now they were to hear about all the basic elements (earth, fire, air and water). The teacher did not use an ordinary textbook, instead she made use of sheets copied from a natural science exercise book. The sheets contained drawings and designated lines for the students to fill in their answers to various tasks. Below are three examples:

- Du trenger:
- 1. sugerør
- 1. glass med vann
- Det du skal gjøre:
- Blås i sugerøret ned i vannet.

Hva skjer?

dakamer Det ut bobe

Hvorfor?

fardi vi blaser vannet

Tegn det du gjorde:



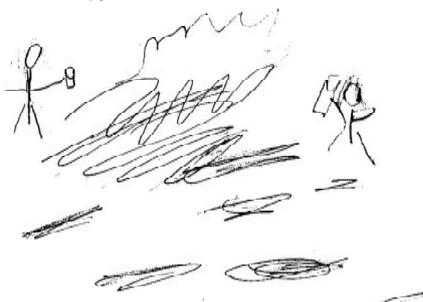
Picture 1

det kom masse alger  
det var gøy

Hvorfor?

fordi vi tok vann krige

Tegn det du gjorde:



Picture 2

## Forsøk:

- Du trenger:
  - 1. sugerør
  - 1. glass med vann
- Det du skal gjøre:
  - Blås i sugerøret ned i vannet.

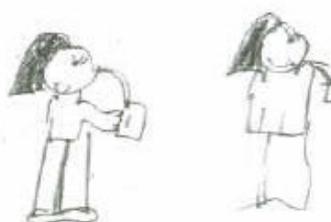
Hva skjer?

da kommer det bobler ut

Hvorfor?

Fordi vi blaser vannet

Tegn det du gjorde:



Picture 3

On the top of the sheets the students were instructed to collect a glass of water and a straw in order to blow air into the water. Then there are two questions: What happened? And why? In other words the students were asked to explain what happened during the process. There were 20 students in this class. Most of the students interpreted the experiment like the students in picture 3, and we will comment on this later on. Picture 1 and 2 show another way of understanding the experiment. The girl in Picture 1 wrote: "Bubbles were created"; the two boys in Picture 2 wrote: "There were a lot of waves. It was great fun." When asked to answer the question 'why' and explain the process a bit further, the boys wrote that it was great fun because they "had a water fight". At the bottom of the sheet all the students were asked to draw what they had done in the experiment. Most of the students made a drawing like the one in picture 3, with the so-called 'correct' understanding of what they had done. The girl in Picture 1, however, drew a picture of herself as a princess. No water was in sight: the focus was solely on her as the subject. In contrast, the boys' drawing (Picture 2) shows the splashing of water and the movement it created. Two figures are also visible in the drawing: presumably they have illustrated themselves performing the task.

According to Kress and van Leeuwen, these drawings could be interpreted as visual metaphors, where the experiment with water is, or is represented by, the water fight. It is harder to find meaning in the girl's drawing as there is no water represented. Instead, we see only a princess-like figure. These representations reveal an

interesting, gender-related phenomenon: the boys draw an action while the girl draws a person. Earlier observations of students' drawings have shown that when asked to draw a house, girls placed a person – usually a girl – in front of the building. However, boys mostly equipped the house with a car on the outside.

As mentioned above, the experiment is a central part of science as a curricular subject in the way that scientific processes are explained, or made concrete, through experiments. When the children were asked to draw what they had done, they did not draw the experiments as such, but their comprehension of the *meaning* of the experiment. Picture 1 represents the princess, Picture 2 the water fight, while Picture 3 shows yet another visual metaphor and another understanding of the experiment. We observed these two girls (Picture 3) during the experiment. They were standing close to each other blowing air very carefully into the glasses of water, making sure that no water was spilled and probably having a good time. It seems that this visual metaphor highlights friendship and intimacy as part of the experiment.

It is worth noticing that all the students include themselves in the drawing, seeing science as something personal and humanized, whereas images or drawings in science textbooks for higher education are mostly objective, e.g. abstract diagrams which focus only on the experiment and not the performer (Kress and van Leuween, 2006, p.149).

The drawings as visual metaphors show children's' understanding of what they had done in the lesson. The first focuses on the person alone, the second on the water fight and the common action, while the third focuses on both persons, the common action *and* on telling the 'right' story. The drawings also show that understanding science includes understanding of the point of a scientific experiment, but also that these 2. graders understand themselves as a central part of the experiment .

The textbook is a central source for learning science. In the following section we will take a look at students' reading of an excerpt from a textbook (*Yggdrasil 5*) about trees and flowers in spring. The reader is advised to take a look at the following excerpt before reading the section.

## Spring is here

"Woods are awakening from their winter slumber now. And hills are turning green."

When the ground frost thaws and the ice and cold loosen their grip on nature after a long winter, the trees begin to extract water and nutrients from the soil again. We say that the sap is starting to rise up through the tree. Soon, buds will burst open, leaves will unfold and flowers will spring out.

Alder trees have male flowers that look like little sausages hanging down from the branches. They are called catkins. The Alder tree has male and female flowers on the same tree. The female flowers are small and reddish in colour. Early in the spring, male flowers blossom and release clouds of pollen into the air.



The Alder Tree



The Female Goat Willow

### The Goat Willow Tree

Goat Willows have flowers called *Pussywillows*, which bloom early in the spring when frost is still a threat at night. Before Pussywillows have opened entirely, they are greyish-white in colour and velvety to the touch. These flowers are produced on the male Goat Willow. When the flowers have fully opened, they turn bright yellow. The female trees have flowers which are more subtle and greyish-green in colour.

The Male Goat Willow

### Coltsfoot

Coltsfoot thrives in areas where there is a lot of clay in the soil, which is why in some places it is called *clay weed*. The flower buds are formed in advance in the autumn. This means that coltsfoot is an early bloomer in the spring. Its bright, yellow flowers spring out even when there is still snow and ice on the ground. Later in the spring, the Coltsfoot's flowers wither, and then a large leaf, resembling a colt's hoof, grows out of the root.

### Did you know?

- Many people are allergic to pollen from Alder trees. They can get itchy eyes and start to sneeze. Some people also get asthma, which makes it difficult for them to breathe.
- All species in nature, both plants and animals, have Latin names beside their common names. The Latin name for Coltsfoot is *Tussilago farfara*.



**Ground frost:** frozen ground  
**Pollen:** the fine, yellow dust found inside flowers – a flower's sperm cells.

## **The science textbook: trees and flowers in spring in grade 5**

When students reach grade five, science texts tend to become more complex. Our example is from a science book dealing with the seasons. Spring is on the agenda, and the students were working with a double-faced text containing illustrations, texts and exercises. The double-faced text is divided into three columns of text, together with two informative texts. The illustrations include two photos of alder trees (male and female) and three drawings of a goat willow, a coltsfoot and a large leaf with a root.

This double-faced text reveals how important coherence is. We could argue that science texts are more dependent on coherence than most expository texts due to the fact that these texts contain a variety of expressions with a high degree of scientific commentary. These expressions are mixed with ordinary, everyday language. In this way, the subject of natural science is situated between the linguistic subjects and mathematics. The text often contains formulas, numbers and tables – as in mathematics texts – whereas explanations and longer texts may accompany the illustrations. Eva Maagerø underlines that “Texts in natural science seem to be characterized by a high degree of technical terms. It is the very nature of science to try to describe phenomena in our surroundings in a precise and accurate way” (Knudsen et al, 2007, p. 179). The text from the textbook *Yggdrasil 5* confirms Maagerø’s view..The informative texts placed on yellow background may contain numerous scientific expressions; the body text may be characterized by a vast array of explanations. We will refer to this later when dealing with metaphorical expressions.

## **Data and methodology for the interviews in grade 5**

The minority group students interviewed were two grade five boys, both with parents from Kosovo. The interviews were conducted in pairs and videotaped, and later transcribed. Since we focus on a common understanding of the text in dialogues with teachers further on in the project, we have not included overlapping, breaks and intonation in the transcription. The interview concerns a text in a science textbook written for grade five students.

Before the interviews, the students read through the text on their own and jotted down words and expressions they considered difficult for younger students. After this, we asked them to reflect upon whether the text was appropriate for students a year or two younger than themselves. In this way, the students were given an opportunity to talk directly about their own trouble in understanding the text.

The choice of methodology was inspired by a study of Cameron (2002: 677) entitled *Goal-Directed Interactive Think-Aloud (GITA)*. Cameron’s research on metaphors in the learning of science is carried out within a socio-cognitive paradigm, where participation in shared talking-and-thinking is being investigated. Cameron states, with reference to Rogoff, that within this paradigm it is also important to consider the role of the researcher. As researchers/interviewers, we followed Camerons’s advice: taking part in the discussion in order to keep the conversation going, while at the same time keeping a certain distance and intervening only when our contribution could solve a comprehension problem.

Before reading texts for the first time, it is beneficial for teachers to establish a dialogue with students to find out how much they know about the topic in question. In our case, the students were already familiar with the text since they had read it both at school and for homework. Therefore, they were able to go straight to the task of jotting down words and sentences that they would have to explain to younger students. In the following section we will look closer into two 5. grade students' understanding of the text. The students, both boys, were chosen by the teacher and regarded as high achieving students, also compared to majority students. The actual excerpt from the textbook was read in Norwegian but is translated into English for the purpose of this article. The same goes for the dialogue between us and the students.

### **The students' comments**

The boys did not assist each other during the reading; they did not look at each other's sheet of paper until the reading and writing was finished. One of them wrote complete sentences, while the other focused on isolated words. Here is what they wrote:

Student A:

"When the ground frost thaws after a long winter, the trees are able to draw water and nutrients from the ground again."

"We say that the sap rises up the tree."

"Soon after, the buds will burst open and leaves and flowers will spring out."

He also noted that the images were confusing. It seems he spent a considerable amount of time writing complete sentences and trying to understand the relationship between images and text.

Student B had chosen a different strategy, possibly because he ignored the images. The words he wrote show that he managed to read through the text:

"thaws, ground frost, sap, alder tree, the Coltsfoot, buds, pollen"

After the boys had read their notes to us, we asked them to continue talking while they were being videotaped. When we finished filming, we transcribed their conversation. As noted earlier, breaks and overlaps were not transcribed, as our aim was to use these interviews as topics of discussion with teachers at a later point. In this project, we will focus on what teachers can do to help students read and learn from textbooks.

In the following interview, the students are referred to as A and B. The numbers refer to turns taken in the dialogue.

We started the interview by asking the students to comment on words or expressions or images they would like to have explained.

<b>Interview with two boys in the 5th grade about trees and flowers in the spring.</b>		
1	A	They should have explained better...words like <i>ground frost</i> , <i>loosens its grip</i> ...they should have explained better.
2	B	<i>Thaw</i> and <i>ground frost</i> are words that are not much used.
3	A	They should have explained better about the Coltsfoot and about the large leaf that grows out of the root.
4	B	Yeah, and I heard that everything about Goat Willows, Coltsfoot and Pussywillows is written for kids in the 7th grade.
5	A	They should have explained about the older tree, and is it a flower, a tree or a sausage? The sausages are not bent down, but upwards. "What are catkins? Another name for <i>kittens</i> ?"
6	B	But if we look at the pictures of the female Goat Willow, we see the flowers, ourselves. Then they don't have to tell us about it.
7	A	And then it's the explanations of pollen. The dust inside flowers. Pollen is a flower's sperm cells.
8	B	They go right to the point.
9	A	But male flowers and female flowers. You can't see the difference. And the Pussywillows are the Goat Willow's flowers. What is a Pussywillow <i>willow</i> ? Does the picture tell us anything about it, really?
10	B	I didn't understand it myself. Not the thing about the Coltsfoot either. Why is it called Coltsfoot?
11	A	Maybe this is part of the reading. Maybe we should have known this because we've read it before?
12	B	But did you <i>know</i> it? It should have been explained in the first place. If they had done that, I would have been willing to read...
13	A	The male Goat Willows don't look like sausages. Which picture and text are suppose to go together? They stand up and don't hang down? <i>The interviewers intervene by explaining what is meant to illustrate what.</i>
14	B	Why is one of the photos smaller?
15	A	It's a mixture of a photo and a drawing. It's better with a real picture, a picture with life in it. When there is a photo you can see the background, too.
16		<i>The interviewers ask about the headline, which is a quote from an old Norwegian traditional song: What do you think is the meaning of the headline? . B: I'm no good at dialects in writing – it's easier when people talk.</i>
17	A	It's not a very good idea to use dialects in the headline...
18	B	It's not a bad idea for those who live in the North – it looks like it's taken from a fairy tale. It's about flowers and leaves.
19	A	<i>The interviewers explain that these are the first lines of a traditional Norwegian song, and that it is written in New-Norwegian, not in dialect.</i> A (rather irritated): A song? Why doesn't it deal with the song then? The title should tell us what it is about. What is it with this song? Does it have anything to do with flowers?
20	B	They don't think about...
		<i>After this we went back to the beginning of the text and asked about the meaning of expressions like "the sap rises", "flowers will spring out" and "male and female flowers". The students doubt the fact that the large leaf on the Coltsfoot resembles a real colt's foot.</i>

21	B	<i>The interviewers ask: What do you think of the explanation of Goat Willow?. It is the colour that explains it.</i>
22	A	But they should have explained a little more about what it is. Everybody doesn't know this. And... <i>allergic to pollen?</i> What does that mean?

### Misunderstandings due to visual representations

The interview with the two boys shows how the illustrations of the Pussywillow and the Goat Willow create confusion and misunderstandings. The relationship between the two photos is not clear, and the explanation of the colouring of the flowers is insufficient. In other words, coherence is lacking. This also applies to the paragraphs, as the connection between them is unclear. The paragraphs with the subtitles: Alder, Willow and Coltsfoot, and the first paragraph, are placed directly after the main title. Problems arise when illustrations, informative texts and body texts are seen together.

Coherence is created by linguistic choices at micro and macro levels in texts. At the text's micro level, the choice of connectors and referents are of tremendous significance. If we look at the paragraph with the title "Alder tree", it starts with the sentence: "For the alder tree, the male flowers look like small sausages hanging down from the branches." This text is placed to the left of the first page, and in the second column a photo of "Female Alder" is shown. We might ask if it would have been better to place the Alder photo differently. Beneath the text dealing with the alder tree, there is a drawing of the so-called sausages. In this text, the reading direction is not well attended to. The students also commented on this during the interview: the sausage metaphor created confusion. Similarly, it could be argued that coherence is broken between the first paragraph, dealing with spring in general, and the rest of the text. This paragraph closes with the sentence: "Soon after, the buds will burst open and leaves and flowers will come out." The paragraph about the alder tree mentions "male flowers" in the first sentence, but this concept has not been introduced earlier, as the pages before deal with the life of birds in Norway.

The paragraph with the title "Willow" is placed under the picture of "female willow", while the photo of "male willow" is placed before the paragraph about "Coltsfoot". The illustrations that were supposed to accompany the coltsfoot paragraph are seen to the right in the form of a drawing. In addition, the second bullet point in the informative textbox with the title "Did you know?" deals with the coltsfoot plant. In our opinion, the text contains several problems connected to logic and fundamental coherence. The way illustrations and photos are placed may cause confusion for students with reading problems. Kress and van Leeuwen focus on the significance of the placement of illustrations in relation to textual elements in textbooks. What is placed to the left is often regarded as 'Known' or 'Given', and what is placed to the right is seen as 'New' or 'Unknown'. The authors state that: "[...] the *New* is therefore 'problematic', 'contestable', 'the information *at issue*'; while the *Given* is presented as "commonsensical, self-evident" (p. 187). From this perspective, in the text from *Yggdrasil 5*, the direction of reading is troublesome due to the fact that all the elements can be regarded as *New*. For students having trouble with reading, this text may be problematic because the illustrations do not correspond to the textual parts.

## Understandings and misunderstandings of linguistic metaphors

As previously mentioned, Cameron links three sources to problems with metaphors. Perhaps, students do not understand what a metaphor is, or they do not understand the source domain for the metaphor, or they do not know what should be transferred from the source domain to the target domain. If we look closer at the understanding of a metaphor in the interview dialogue, we see that the metaphor 'catkin' is actually interpreted incorrectly, perhaps because of inadequate language skills. In addition, we see that the metaphor about pollen as a flower's sperm cells has limited explanatory possibilities by the very fact that making the connection between the two areas is handed over to the student. We also see examples where insufficient knowledge of the topic may create difficulties in understanding, for instance with 'ground frost', which seems to be an unknown word for the students.

If we look for the specific metaphors that caused problems for the two students, we would first of all be concerned with the conventionalised metaphors connected to everyday language, where 'ground frost' is understood to be a person who 'fights with thawing' and who, finally, 'loosens its grip'. Here we have an example of insufficient knowledge of the topic: the student does not understand the purpose of a metaphor, which then creates problems with understanding. Even simple metaphors such as flowers that are blossoming, or male flowers releasing clouds of pollen into the air may be misunderstood. The linguistic metaphor of male flowers that look like 'little sausages' is not a complicated metaphor in itself; it is an innovative image as well as one marked with tuning devices. However, what *is* difficult is that the cohesion of the text is lacking. One of the metaphors that truly created problems was the concept of catkins: "Catkins are the flowers on the Goat Willow tree." We consider this metaphor a dead metaphor – where there is no longer any connection between the source domain and the target domain. We also notice that the same applies to one of the boys who is not able to understand the connection when he asks in (5): "What are *catkins*? Another name for *kittens*?" In Norwegian, catkins are called *gåsunger* (the gosling of a goose), but the student does not see the connection between how the flowers look and a gosling.

We have conducted some research based on the concept of catkins and have discovered that the word has an ambiguous meaning. According to Knut Nedkvitnes *The Goat Willow in Norwegian Nature and Traditions (Selja i norsk natur og tradisjon)*, published by the Norwegian Forestry Museum (Nedkvitne 1990), there are numerous names for the flower species of the Goat Willow. Nevertheless, 'catkins' is the name that is most widespread, according to an investigation carried out in 1969. Some sources referred only to male flowers as catkins, while other sources called Goat Willow flowers 'ducklings', 'kittens', 'pussy cats' and 'cat paws'. Moreover, such concepts as 'Goat Willow sheep', 'palms' and 'palm cats' were used. In any case, catkins have an older name in sources where geese were not well-known farm animals. When a certain flower species is called catkins, the reason may be that the flower species is cat-like, much like a kitten. Perhaps, such expressions could have been explained in the margin of the text in question. It *is* actually explained with the Coltsfoot in the text, but the students were not able to take advantage of that explanation (10) perhaps because the explanation is too brief. Detailed explanations could be beneficial in other concepts as well: this has been found to be a need of

many students and teachers (Aamotsbakken et al. 2005). We would also like to add that the concept of 'catkin' is not as obscure in English as it is in Norwegian, because of the lack of connection between the source domain and the target domain in Norwegian in this case.

In the text, when we closely examine formalised concepts or ideas in the subject matter, we notice that they, too, are metaphors. In regards to female and male flowers, the explanation is very innovative, or it is a metaphor, e.g. that pollen is the flower's sperm cells. These metaphors are taken for granted in context, but the direct correlation from human life to plant life should definitely be commented on. We observed that one of the students comprehended the use of 'sperm cells' in the explanation of a flower's pollen as "to go straight to the point" (8), even though the concept was presented impartially. The problem with the misunderstanding here seems to be that the students do not know what should be transferred from the source domain. They might well have gained some knowledge about human reproduction by knowing how flowers propagate themselves. It is interesting to note here that the textbook author seems to *assume* that students have knowledge about human reproduction and uses that as the starting point for an explanatory metaphor about how plants propagate themselves. Our interview with the students confirmed the assumption that this metaphor was understood and commented on with a slight embarrassment.

The interview shows that some metaphors are understood and that other causes problems. Many metaphors in this text could have been introduced by tuning devices. One can use comparative words ('like', 'just like sperm cells'); analogy ('in the same way', 'like a sperm cell'), or one can use semantic meta-language ('we call it pollen'). Other ways to indicate metaphors can be to use hedging ('kind of like sperm cells'), or signalling through processes ('imagine that pollen is like sperm cells'). A very common way to draw attention to part of the text is to use quotation marks, placing the thematic concept in a frame. Such signals, or markers, help the student recognise metaphors in the text, and then suggest that they follow that train of thought back toward the one who is doing the writing or explaining (Cameron 2003). In light of this, it is thought-provoking to see that there are so few markers in use in this text and, for that matter, in many other textbooks as well. There seems to be a lack in consciousness around linguistic settings in textbooks and their significance for learning. This demonstrates the need for new strategies in the writing of textbooks and advanced reading education in school. Without doubt, it shows the importance of the teacher's role as mediator between the student and the textbook – for students in general and for ethnic and linguistic minority students in particular.

## Conclusions

In conclusion, we believe both the observations of visual metaphors and the GITA method to be most beneficial. Visual metaphors in students' drawings show that understanding science is a process, including understanding the point of a scientific experiment. The GITA method allowed the students in our interviews to perform the role of consultants to improve the text for younger students. Along the way, they admitted that they *themselves* had not understood the text and gave the impression of being annoyed about the situation. We, on our part, promised to report back to the publishers about the shortcomings of the text for its end purpose. We have also

reported our findings to the teachers at the school, drawing particular attention to the important role of metaphors in teaching a subject. There appears on the one hand to be a need for such awareness for the benefit of both minority and majority students. As mentioned before the results from the wider project show that high achieving minority students point to the same problems with understanding science texts as the majority students do. On the other hand our study has its limitations as it is a qualitatively based study with relatively few observations and interviews and with no quantitative survey connected to it.

The school connected to our research project places reading as their key area of focus. The students at this school have traditionally scored poorly on national reading tests, and it is the aim of teachers, parents and school authorities to improve the students' reading skills in order to increase their level of competency in all subjects. Those students with a first language other than Norwegian receive extra instruction by mother tongue teachers. Here students work through difficult words and concepts in both their first language and Norwegian, in order to prevent the types of misunderstandings we have discussed in this paper.

The students who took part in our interviews read a familiar text, a text that may also have been covered in sessions with their mother tongue teachers. However, from our observations, there seems to be a need for increased help, from teachers and others, to assist such students with their understanding of the texts, the subject, and perhaps also with the concept that all subjects have their own language. Within the Norwegian education system, reading has traditionally been seen as the sole responsibility of the Norwegian language teacher. However, the last (2006) teaching syllabus, Kunnskapsløftet (Knowledge Promotion), emphasises that all teachers of subjects with texts involving concepts and metaphors need to engage in reading education. This suggests a need for increased co-operation between Norwegian teachers; teachers of mother tongue; teachers of other subjects – and the minority students themselves. With such co-operation, we can more easily help minority and majority students to master a subject, its mindset and its metaphors.

## References

- Aamotsbakken, Bente., Askeland, Norunn, Maagerø, Eva., Skjelbred, Dagrun & Torvatn, Anne Charlotte. 2005. *Vurdering av læremidler med fokus på flerkulturelt perspekti*, [The evaluation of educational media with a focus on multicultural perspectives], Vestfold University College, Tønsberg.
- Bakkeli, Kirsten Ruud, Kari Gran & Nordbakke, Roy. 1997 *Yggdrasil. Natur-og miljøfag 5*, [Natural science, grade 5]. Oslo: Aschehoug.
- Bråthen, Ivar (ed.). 2007. *Leseforståelse. Lesing i kunnskapssamfunnet - teori og praksis*, [Literacy. Reading in the competent society - theory and practice], Cappelen Akademisk forlag, Oslo.
- Cameron, Lynne. 2002. "Metaphors in the learning of science. A discourse focus", *British Educational Research Journal* 28, 5. pp 673-688.

- Cameron, Lynne & Deignan, Alice. 2003. "Combining large and small corpora to investigate tuning devices around metaphor in spoken discourse", *Metaphor and Symbol* 18, pp.149-160.
- Deignan, Alice. 2005. *Metaphor and Corpus Linguistics*. Amsterdam and Philadelphia: John Benjamins.
- Fauconnier, Gilles. 1997. *Mappings in thought and language*. New York: Cambridge University Press.
- Golden, Anne. 2005. *Om å gripe poenget med metaforer. Forståelse av metaforiske uttrykk fra lærebøker i samfunnskunnskap hos minoritetsspråklige elever i ungdomsskolen*, [To catch the point about metaphors. The comprehension of metaphorical expressions in textbooks in social science by minority cultural students in secondary school], PhD thesis. Oslo University, Oslo.
- Jewitt, Carey, Kress, Gunther, Ogborn, Jon & Tsatsarelis, Charalampos. (2001)"Exploring learning through visual, actional and linguistic communication: the multimodal environment of a science classroom", *Educational Review* 53 (1), pp. 1-15.
- Knudsen, Susanne V., Skjelbred, Dagrun & Aamotsbakken, Bente. (eds.) (2007) *Tekst i vekst. Teoretiske, historiske og analytiske perspektiver på pedagogiske tekster*, [Text in growth. Theoretical, historical and analytical perspectives on pedagogical texts], Novus forlag, Oslo.
- Kress, Gunther & van Leeuwen, Theo. 2006. 1996.) *Reading images: The grammar of visual design*. London: Routledge.
- Lakoff, George & Johnson, Mark. 1999. *Philosophy in the Flesh. The embodied mind and its challenges to Western thought*. New York: Basic Books.
- Littlemore, Jeanette. 2001. "The use of metaphor in university lectures and the problems that it causes for overseas students", *Teaching in Higher Education* 6, pp. 333-351.
- Maagerø, Eva. 2006. "Om å lese på setningsnivået", [To read on the sentence level], In Maagerø, Eva & Seip Tønnessen, Elise (eds.) *Å lese i alle fag*, [To read in all curricular subjects]. Oslo: Universitetsforlaget.
- Maagerø, Eva. 2007. "Finnes det et naturfaglig språk? Om noen typiske trekk ved pedagogiske tekster i naturfag", [Is there a scientific language? Some typical features in pedagogical texts in natural science], In Knudsen, Susanne V., Skjelbred, Dagrun. & Aamotsbakken, Bente. (eds.) (2007) *Tekst i vekst. Teoretiske, historiske og analytiske perspektiver på pedagogiske tekster*, [Text in

growth. Theoretical, historical and analytical perspectives on pedagogical texts]. Oslo: Novus forlag,

Metaphor Analysis Project <http://creet.open.ac.uk/projects/metaphor-analysis/procedure.cfm?subpage=discourse-data>, accessed 16 March 2010.

Nedkvitne, Knut. 1990. *Selja i norsk natur og tradisjon*, [The Goat Willow in Norwegian Nature and Traditions]. Elverum: Norwegian Forestry Museum.

Reichenberg, Monica. 2007. La det bli et eventyr å lese lærebøker! [Make reading textbook into an adventure!] In Bråten, Ivar (ed.) *Leseforståelse. Lesing i kunnskapssamfunnet – teori og praksis*. [ Literacy. Reading in the knowledge society – theory and practice]. Oslo: J.W.Cappelens Forlag AS

Selander, Staffan. 2003. "Pedagogiska texter och andre artefakter för kunskap och kommunikation", [Pedagogical Texts and other Artefacts for Knowledge and Communication], In *Läromedel – specifikt – Betänkande om läromedel för funktionshindrade*, [Special Educational Media - a Report on Educational Media for Disabled], SOU 2003. Stockholm: Fritzes Offentliga Publikationer.

Steen, Gerard J. 2007. *Finding Metaphor in Grammar and Usage. A methodological analysis of theory and research*. Amsterdam: John Benjamins.

## **Norunn Askeland is an Associate Professor, and Bente Aamotsbakken is a Professor, at Vestfold University College in Tonsberg, Norway.**

They have been involved in a wider research project on reading expository texts in primary schools that has been financed by the Norwegian Research Council.

Address: Vestfold University College  
P.O. Box 2243  
N-3103 Tonsberg  
Norway

Tel: 0047 33031425 (Askeland)  
Tel: 0047 3303 1429 (Aamotsbakken)  
Fax: 0047 3303 1350 (both)

[norunn.askeland@hive.no](mailto:norunn.askeland@hive.no)  
[bente.aamotsbakken@hive.no](mailto:bente.aamotsbakken@hive.no)