

## “THINGS WE KNOW ABOUT THE COW”: CONCEPT MAPPING IN A PRESCHOOL SETTING

*Maria Figueiredo, Ana Sofia Lopes, Rute Firmino, Salomé de Sousa*  
*Escola Superior de Educação de Viseu, Pólo de Lamego, Portugal*  
*Email: mfigueiredo@esev.ipv.pt*

**Abstract.** An experience of concept mapping with preschool children is presented. Some of the potential advantages of the tool for the preschool setting are discussed. To implement the project, some adaptations were necessary since the children we worked with didn't know how to read yet. We address the issues of reading pictures and graphical representations by children from three to six years old and expectations of hierarchical structure in their maps. The planning and teaching processes are described with special focus in the assessment tasks and results. When asked to build their own maps with an already drowned structure, the children were able to organize ideas in a hierarchy. Without any help the results were different: the group wasn't able to establish any hierarchical relationship between the concepts. Some ideas about future work are stated in terms both of work with the children and research questions.

### 1 Introduction

Concept maps have been widely used to promote meaningful learning in various disciplines and in different contexts. Previous research suggests that concept mapping is a highly flexible tool that can be adapted for almost any group of learners in education. In our study, we worked in a preschool setting. The positive outcomes we anticipated and the good indicators from the studies by Ontoria *et al.* (1994) and Fleer (1996) led us to carry out an experience with the group of children we worked with in our teaching experience as preschool teacher education students.

We were aware of both the advantage and difficulty of working with knowledge representations with preschool children. The benefits from using visual aids are long known to the preschool teacher: visual links and relationships between ideas promote better understandings (Campbell, Campbell & Dickinson, 1996). The project approach, for example, suggests the use of representations along the work process (Katz & Chard, 1989). A conceptual map can assist the discussion about the concepts being taught since it is a concrete representation, a visualization of the network of related ideas. As an aid that represents the structure of students' ideas with emphasis on the relations between concepts, the maps can also help them relate their previous ideas with the ones they are processing. Concept mapping is also important for the planning process. In Portugal there is no curriculum for preschool. Since 1997 there are *Curriculum Guidelines* (Ministério da Educação, 1997) but there is no guidance for the structuring of the learning contents. The use of maps by the teachers could help overcome this difficulty.

### 2 The planning process

We worked in a preschool classroom with a group of thirteen children, seven boys and six girls, whose ages ranged from three to five years old. In our teaching experience, we had a session a week with this group. The project lasted a month, which means we dedicated four sessions to it. The school was in a rural setting. The children had pigs, ducks, chickens and rabbits in the farms they lived in, but they knew little about the cow. This came to our attention when we taught about food and nutrition – the students established no relationship between dairy products and milk and between milk and the cow. Thus we decided to use the concept map to teach about the cow. First, register in a group map, placed in a wall in our classroom, the changes in our knowledge about the cow. Second, and most important to us, teach the children to build their own maps.

Based on previous studies with preschool children, we adapted the concept map process for children who can't read yet and who are constructing their fundamental concepts about the world around them. In that process of adaptation to our setting, we started by addressing the replacement of words by pictures in the construction of the maps. Replacing concepts with pictures seemed more suitable than using real objects. It was important for the group to understand that the map was a representation of ideas. Following the study of Deloache, Uttal e Pierroutsakos (1998) we tried to make sure that the child read the symbolic meaning of the object instead of focusing the object in itself. We were also careful about not imposing meaning to any picture and to negotiate with the children what was represented in each one.

Having worked with a schematic representation of the family some time before, we knew that our group understood the meaning of arrows and that the position in which an image was in relation to another could have a meaning. Therefore, we decided to use arrows to represent the relationships between concepts. Also, no linking words were used. Instead, meaning was attached to each row: what the cow eats, where she lives, what she gives us, etc.

A fourth issue was the hierarchical structure and integration of new concepts, which are seen as indicators of an elaborated map (Novak, Gowin & Johansen, 1983; Novak & Gowin, 1984). In preschool, relating concepts is an important step in the construction of new concepts. To know that *cheese*, besides tasting good and being yellowish, is made from milk that comes from the cow represents brand new territory in the mapping of the concept *cheese*. Although in the study by Fleer (1996) about light, the map built had only two hierarchical levels, in our study it was a main objective to have the child consider second or third level concepts.

### 3 The teaching process

To introduce the topic, we had a first discussion about animals and what they give us. The cow came up in the conversation and all that the children remembered about it was written down in a list. After that we told a story about the cow *Estrela* which had some information about the animal. The first map we built – the wall map – was used for organizing these starting ideas about the cow. Based on their experience with the representation of the family, we asked the group to build a map about the cow. At this time their job was to remember what they knew and to agree or not with the pictures selected and tell us where they should be placed in the wall map.

During the following work, the group map reflected the changes that occurred in the children's ideas. We visited a dairy where we saw the cowshed, the cows being milked and their food, among other things. We made cheese from the milk we brought from the dairy. We built clay cows and painted them. We ate a lot of yoghurt! With each session came the need to reflect about the map – *Does it show what we know? Is it all there? Have we got it right or do we know better now? How do we fit what we found today? Do we know how this happens? How do we represent that?* – and to make changes – new pictures for new ideas, moving pictures to other places, sliding in pictures in already established relations, etc.

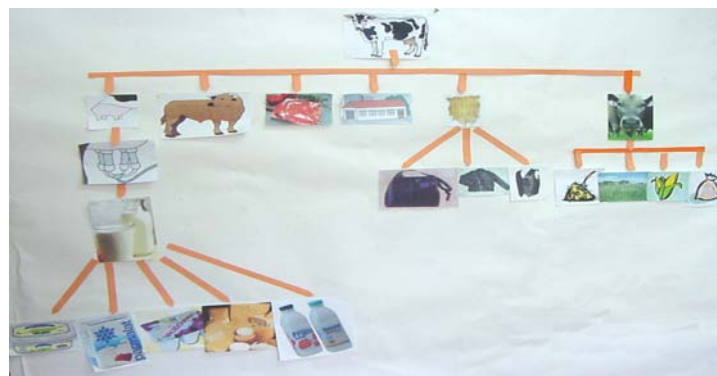


Figure 1. The wall group map (final version).

Lack of time was the reason for stopping this reconstruction of the map. At the end, our group map (Figure 1) had nineteen related concepts about the cow, organized in two to five levels. The cow: a) is “married” to the ox; b) has *milk in the teats* which is *milked with the help of a machine*, so we have *milk* from which we make *yoghurt, liquid yoghurt, butter, cheese* and *cream*; c) also gives us *skin* from which we make *leather jackets, shoes* and *handbags*; d) *meat* we eat; e) lives in a *dairy*; f) eats different things like *grass, corn, hay* and a *special mixture for cows*.

### 4 The assessment process

Both for assessing children's learning and the use of maps with preschool children, during the sessions we implemented three assessment procedures. The first started with a task of sorting and organizing around 40 pictures about the cow. All the ideas that the child had dealt with were represented in more than one way – two pictures for each concept. We also introduced some ideas that had not come up in our sessions but were closely related to the ones that did: the *butcher* when we knew that the cow gave us meat, for example. The children had

to place the images they chose in an empty structure that allowed for three levels (the same as the wall group map the day before the assessment). Seven children performed this task. Three students reproduced the group map: they chose the same pictures and placed them in the same place (Figure 2). One student represented the group map but replaced one of the food pictures with the cowshed – where she had seen the food stored when we visited the dairy that day. The other three added a level to the map representing something they saw at the dairy: the cow being milked before the milk that leads to the dairy products. From the analysis of these first maps built individually by the children we can conclude that they were able to reproduce the hierarchical structure of the concepts depicted in the map.

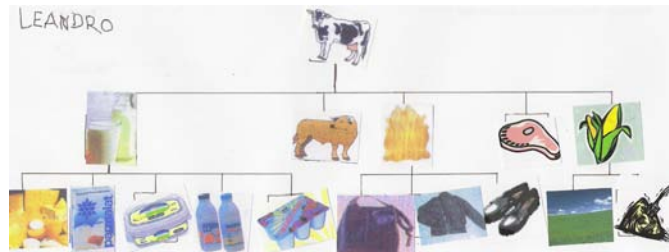


Figure 2. Example from the first moment of assessment: map built on drowned structure

A second moment of assessment was based in an individual talk (Figure 3) with the four children present that day. The answers to “what do we know about the cow?” were written down. Three of the children were able to talk about hierarchical relationships between concepts: “the cow gives us milk from which we make yoghurt, cream and cheese” and “we can make jackets from leather that comes from the cow”. They also identified what the cow eats and that it gives us meat that we eat. The fourth child only made reference to this last aspect and talked about the cow’s “house”: the dairy.

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 vaca VACA  
 → A VACA TEM PELE PARA FAZER CASACAS.  
 -A VACA DÁ CARNE.  
 -Quando não têm leite, dá carne.  
 -Quando a vaca é velhinha, dá mais leite, tem isso da carne.  
 → A VACA COME ERVA E FEJO.  
 → A VACA DÁ LEITE E COM LEITE FAZ -SE MATA E IOGURTES E QUEIJO.

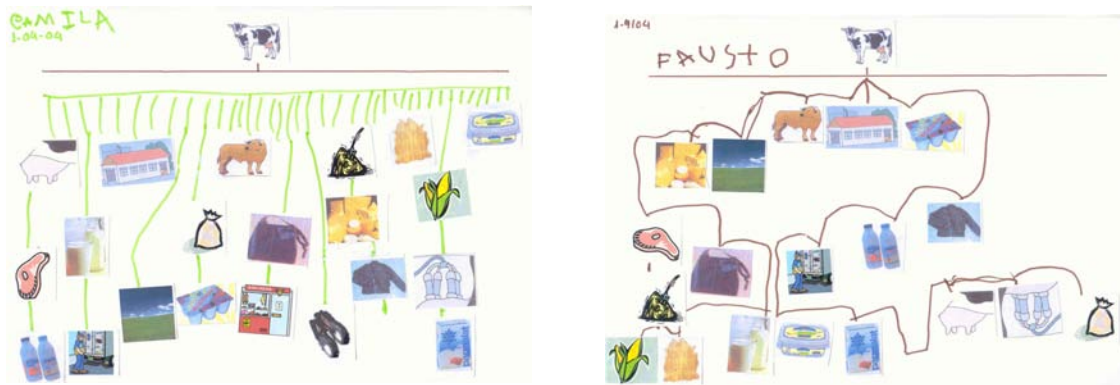


Figure 3. Maria João (student) answering what she knows about the cow and her written words and drawings.

The third moment (at the end of the sessions) was intended to assess the understanding of the map in itself: “What do these images here represent? What is this scheme for?” Two groups emerged from the analysis of the ten students’ answers to those questions. A first group (five children) identified the map as a scheme, a whole, an organized structure of concepts that helps us to “know what we know about the cow”. The second group (five children) described the concepts in the map. From this group, only one child talked about the relationship between the pictures. To these children the map was about “looking at all the pictures”. The first group makes a metacognitive statement: the map helps to know and to monitor what we know. The second group doesn’t see pass the elements depicted, does not relate them.

We were also interested in knowing what maps the children would build on their own – with no boxes or lines and without reference to the wall map. A blank sheet with the image of the cow and 25 pictures of the concepts learnt were given to the eight children present that day. All the students placed relevant images. A total of six children missed some concept about the cow: two missed two concepts and four missed only one. Only two children forgot to mention that people use cow’s skin to make jackets and shoes and that the ox is the cow’s “husband”. Even with the visit to the dairy, two children didn’t place the correspondent picture in their maps. Half the group (four children) didn’t choose the meat image for the construction of the map. The whole group represented what the cow eats and the fact that it gives us milk. The group draw lines that linked different

concepts (Figure 4) but no map represented correct hierarchical relationships between concepts. From the previous assessments we can conclude that the group had some understanding of those relationships. Still, there was difficulty in representing the hierarchy between concepts without any visual aid.



**Figure 4.** Examples of maps built by the students without visual aid.

## 5 Conclusions

No doubt the limited time we had to work with concept mapping had an impact in these results. We spent very little attention to several concepts that came up in the children initial talks: the leather, the meat, where we can buy dairy products, etc. Even the ideas about the milk – in which we invested the most – needed more time and activities to be fully understood by the children. Also, the children were frequently absent from school so we cannot compare the results from the different assessments. Even if we cannot conclude about it, it would be interesting to study a possible relationship between seeing the map as a whole and representing hierarchies in the children's speech about the concept.

The limitations of our present experience help us to set new goals. A prolonged work with concept maps is our future project. We are interested in studying if with simpler concepts, the children are able to represent the hierarchies in their own maps. Also, whether they are able to use concept maps to solve problems or represent their ideas without suggestions from the teacher. We would also like to start building the maps with pictures drawn by the children themselves and see if that would make a difference in their interpretation of the map as a whole. It also makes sense to us to use the maps as a representation of hypothesis stated by the children about relationships between concepts, latter checked and changed in the process of making sense of the world around them.

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