Learning Unit 1: Sorting

Children in kindergarten and first years of primary school are expected to "sort, classify, and order objects by size, number, and other properties" (NCTM, 2000, p. 90) and to "sort and classify objects according to their attributes and organize data about the objects" (p. 108). Sorting at this age is about grouping everyday objects based on shared characteristics like color, shape, size, or function (Huber & Lenhoff, 2006). These (so-called pre-numerical) activities are considered as prerequisites for the acquisition of number concepts (e.g., MSB NRW, 2021). It is assumed that kindergarten children's ability to solve classification tasks may be related to better performance in arithmetic tasks in grade 1 and 2 (Grégoire, 2005; cited in Desoete et al., 2009). In addition, sorting in early stages of mathematical learning contributes to the development of problem-solving abilities (Masarwa et al., 2024). Accordingly, it seems important to investigate these skills in children for the early identification of children at risk of developing mathematical difficulties (e.g., Desoete et al., 2009).

Definition: Sorting and Classifying

The terms "sorting" and "classifying", which are often used synonymously when referring to tasks involving the grouping of items or objects (Platz, 2004), are explained below.

- *Sorting:* "Simple sorting" is an initial type of grouping task in which children are given the way in which the items or objects are to be sorted, i.e., children are given the "grouping pattern" for items or objects (Platz, 2004).
- *Classifying*: When "classifying", children are not instructed to group items or objects based on an attribute. Children have to work out for themselves how a particular group of objects can be grouped, i.e., they need to determine the "grouping pattern" for items or objects themselves (Platz, 2004). To do this, children need to be able to sort objects based on similarities and to abstract differences (Desoete et al., 2009).

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Good to Know

At the beginning of sorting, it is advisable to use real objects (e.g., fruits) or representations of real objects that have meaning to young children. Later, more abstract objects can be used for advanced sorting or classification tasks that are more figural (e.g., building blocks), requiring classification by shapes and colors, for example (Platz, 2004).

Many children usually learn to sort objects according to a certain attribute and form categories. While sorting, they may change the attributes they sort by. By the age of 5 or 6, children can usually sort objects consistently according to a single attribute and re-classify these objects according to different attributes (Clements & Sarama, 2009).

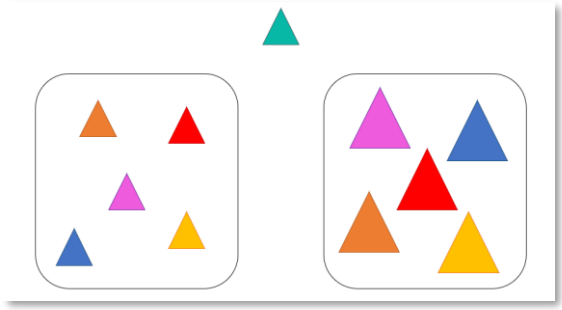
Difficulties and Strategies

Performance of students in the first years of primary school may differ when it comes to classification tasks (Desoete et al., 2009). Even though classification is seen as a prerequisite skill for primary school mathematics (e.g., MSB NRW, 2021), students in Grades 1 and 2 oftentimes show difficulties in solving classification tasks (Desoete et al., 2009). In a study about predictors for under-achievement in mathematics in primary school, one fourth of the children in Grade 2 had difficulties in solving classification tasks correctly (Desoete et al., 2009). Possibilities to simplify such tasks are, for example, to present items or objects that differ greatly in their appearance, or to reduce the number of items or objects presented to the children (Platz, 2004).

Tasks to Develop Sorting Skills

In early childhood education, it is essential for children to develop the ability to sort by color, shape, and size. So, it is important for example that children can find a shape that doesn't match others (example 1) or find the group to which a shape belongs (example 2).

Example 1



Example 2

There are a variety of effective ways to help children practice sorting skills. Here is a small selection of ideas that can provide initial inspiration:

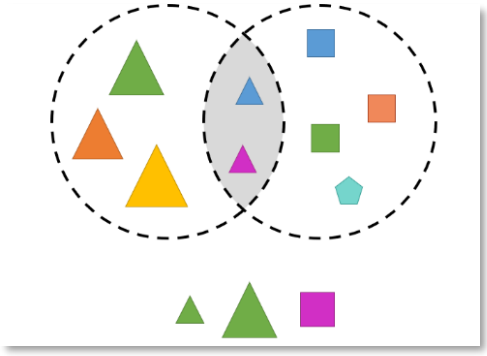
For **color sorting**, you can provide a selection of multi-colored objects (such as pom-poms, buttons, toy blocks, or even snacks like fruit loops) along with several bins or sections on a mat. The children can then be encouraged to place the items into the designated containers according to their color.

For **shape sorting**, you might use a range of shape cutouts or attribute blocks. Children can be guided to sort these materials based on their geometric shapes (e.g., circles, squares, triangles).

For **size sorting**, you can offer a collection of items in different sizes, such as toy animals, buttons, or spoons. Children can sort these objects into groups such as “big,” “medium,” and “small,” or arrange them in order from smallest to largest.

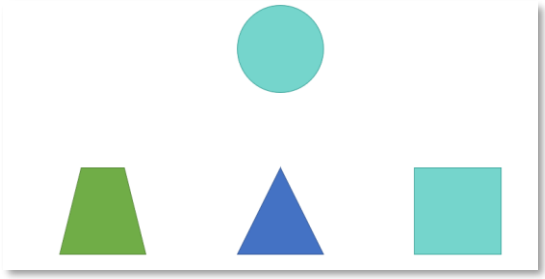
There are also more difficult sorting tasks: 

For example, children can learn to find commonalities between groups of shapes (intersection) and to choose the criterion by which the objects of a group can be classified into sub-groups (size, shape of color) (example 3).



Example 3

Finally, it is also difficult for some children to find the shape that differs in only one aspect (example 4). So, they must choose a shape that has only one difference from the previous shape.



Example 4

To support children in developing their sorting skills, the MADITA app highlights the aspects mentioned above and encourages children in these areas.

The next learning unit deals with the topic of patterns.

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