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A Picture Book as a Prompt for Mathematical Thinking by Kindergartners: When Gaby was read ›Being fifth‹

Although there is evidence that picture books can support young children's mathematical development, little is known about the immediate processes that are evoked when children are read picture books. The present paper reports about a book reading session with a kindergartner and describes the mathematics-related thinking that was elicited when this child was read ›Being Fifth‹. This case study is a spin-off of the Dutch PICO-ma project and formed the start of the international PALM project, in which researchers from different countries investigate children's mathematics-related cognitive activity prompted by picture books (cf. [5]).

1. Picture books as supporters of the learning of mathematics

The contribution that children's literature can make to the development of mathematical concepts and skills has been emphasized since the nineties, especially in the USA (see e.g. [6]). The underlying thought of using picture books for mathematics education is that they can offer a meaningful context for learning mathematics (e.g. [1]) and can offer a 'cognitive framework' with 'cognitive hooks' to explore mathematical concepts and skills ([3]). Picture books are also ascribed an important role for the development of mathematical language ([4]). What it comes down to is that picture books provide an informal base of experience with mathematical operations, objects and structures that can be brought to a higher, more formal, level of understanding through instruction. This view on the role of intuitive and informal knowledge in learning mathematics corresponds with the current, internationally accepted, theoretical basic principles of mathematics education (see [2]).

2. Research question and method

The leading question for this case study was: *Can reading a picture book to a young child evoke mathematics-related cognitive activity even when the book is not focused on teaching mathematical concepts?* The rationale behind this research question is that eventually we want to know more about the power of picture books as a contributor to children's learning of mathematics.

The book chosen for this study is ›Being Fifth‹, written by Ernst Jandl and illustrated by Norman Junge. It was first published in Germany by Beltz & Gelberg, Weinheim, in 1997. The book is of high literary quality and won several awards. The story is about a waiting room. Five patients are sitting in a row.



Fig. 1: Cover Dutch version of ›Being fifth‹

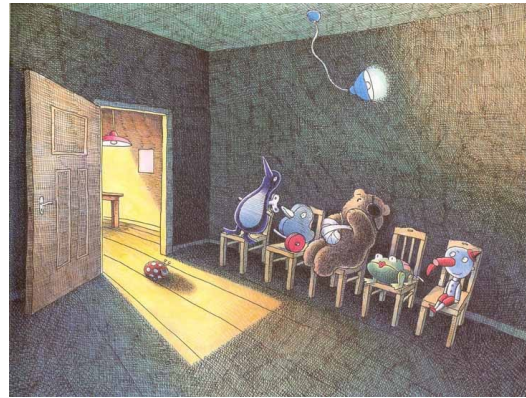


Fig. 2: Page 2 of ›Being fifth‹

Every time a patient is coming out of the doctor's office, the next patient is going in. Although the book is not meant to teach children mathematics, we judged the book as having the potential to evoke thinking about numbers. Contrary to what the title suggests, the Dutch version of the book does not explicitly deal with ordinality and ordinal numbers, but focuses on resultative counting ("still four now"; for further differences see [5]).

This paper reports about the book reading session with Gaby. She is the niece of one of the authors and was interviewed on her ideas about picture books in the beginning of the PICO-ma project. At the time the book reading session took place she was 5;8 year old, in kindergarten Year 2 and not yet able to read (in the Netherlands reading education starts in grade 1). The book was read to Gaby individually. When a page was turned, the reader read out the text and then waited for Gaby's reaction. The general procedure in the PALM project is that the reader holds back when reading the book and just shows an inquiring expression on the face when the children do not react. In the case of Gaby there was more probing. The reading session was videotaped and transcribed. The analysis was done on the video and the transcript. The focus was on identifying Gaby's utterances that were evoked during the reading session and that might indicate "cognitive activity", such as questioning what is happening in the story or shown in the book.

3. Results

The utterances that came up during the book reading session can be distinguished into story-related, number-related and spatial orientation-related utterances. The third type of utterances was not expected when the book was analyzed. The pages on which the responses were found are given between parentheses.

The story-related utterances: Gaby was very engaged with the story and the pictures. She asked several questions (e.g. where the toys went once they had visited the doctor; p. 3), made predictions (e.g. that the frog is now looking happy again, but not any more later on; p. 14), noticed differences between the toys on different pages; p. 8), made assumptions about the story (e.g. that the

wooden puppet wept because he is alone; p. 13), and gave her opinion about the book (e.g. she did not like the repetition of the title; title page).

The number-related utterances: Gaby showed a large number of number-related responses. She noticed that the title ›Being Fifth‹ has something to do with the five toys on the cover page. She spontaneously started counting after the title was read out (cover page). On other pages Gaby also showed that she was quite capable of counting resultatively and handling the cardinality aspect of numbers (front cover, p. 4, p. 6, p. 9, p. 12, endpaper back after probe). She demonstrated the ‘2-2-1’ structure with her fingers when looking at the five toys in a row (front cover) and recognized the five-structure of the chairs (back cover after probe). Gaby also gave evidence of understanding the ordinal aspect of numbers. She understood that if someone or something is fifth, there have to be five of something. Gaby mentioned that the puppet with the broken nose is fifth and she counted the chairs (p. 12). She understood that this toy was fifth at the beginning of the story, is second when the frog is in the doctor’s office, and that it will be its turn later on (p. 12). She even understood that the puppet with the broken nose might be called sixth when the ladybird came out of the doctor’s office (p. 2, after probe; see Figure 2).

[Gaby is looking at page 1 of ›Being fifth‹ which shows five toys in a row (similar to cover page).]

Gaby: If there was one more there would be six ...

[Reader turns to page 2 ›Being fifth‹.]

Gaby: And now there are six. Look!

Reader: Who is fifth now?

Gaby: You mean, who is sixth now!

The spatial orientation-related utterances: Gaby spontaneously took the waiting room perspective (p. 2) which means that in her view ‘out’ refers to out of the waiting room.

Reader: Door open. One out.

Gaby: And that is the penguin, I guess. And then that one can go in [points at the ladybird] and that one [points at the penguin] out.

One page later (p. 3), she uttered “And one out” after the text “One in” had been read out. It was as if Gaby was saying: Okay, the ladybird got in, but don’t forget to mention that the penguin is going out! Later on (p. 5), after being asked “Is it in or out?”, she took the doctor’s office perspective and continued to keep this perspective on the next page (p. 6). To avoid misunderstanding Gaby spontaneously used words to indicate direction, saying things like, “... out of that room”, “... in here” and “... in that direction” (p. 5).

4. Concluding remarks

The results show that ›Being Fifth‹ (and the questioning by the reader) made Gaby cognitive active. The book prompted much mathematics-related thinking and acting such as counting and structuring numbers, using cardinal and ordinal numbers, and reasoning about spatial orientation. All these mathematics-related activities are connected to the context of the book and emerged naturally from the story.

Although spatial orientation and ordinal numbers are two different domains of mathematics, in both domains relativity plays a key role. How we perceive space depends on the perspective we take. The same is true for ordinal numbers. In the case of space the perspective you take determines whether you go into or out of a room. In the case of ordinal numbers, the place in a row depends on where you start counting and changes over time. Moreover, if you include the patient that was already in the doctors' office before the story started a more appropriate title would be ›Being sixth‹. If we go by the findings of this case study, young children know how to handle relativity quite well. While textbooks often try to avoid this kind of confusing situations, picture book authors do not care. They just like to tell a compelling story. By doing so they unintentionally provide children with a rich context for mathematical thinking.

Literature

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