

Illustrations In Primary Mathematics Textbooks

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If you look through a current primary Mathematics textbook you can see illustrations every where. Counting only the drawings, at least you can find one in each page and a half, all of different sizes, colours, styles. Furthermore, if we look at the role each illustration plays in the textbook lesson we can see that it varies from illustration to illustration. So, if we consider only the drawings or photographs we may think that the effort (economically and intellectually) the authors, designers and publishers put to the illustrations is considerable. So, what is the purpose of including so many illustrations? Why do they designate a considerable amount of money to include illustrations?

The authors think it helps and motivates students in learning mathematics. Publishers want to sell the book, and in order for the book to sell it has to attract the teacher's attention. Illustrations, because they are thought to be motivational, are a great tool for this matter. But we might ask, do children read the illustrations in their textbooks? Do they use the illustrations as the authors intend them to do? What role do teachers and students think the illustration has when using the textbook? Do illustrations attract or distract the attention of the students? Does the reading age of the child affect how they use or read the illustration? Does the math achievement level influence the way in which children read the illustration? Is it worth investing so much money in including so many illustrations in primary Mathematics textbooks?

In order to approach these questions it was decided to do research about the use of illustrations in primary mathematics textbooks, in order to know:

- 3) If children read and use the illustrations in their textbooks
- 4) What role children give to the illustrations.
- 3) How do children read the illustrations.
- 4) What role teachers give to the illustrations.

The first step in order to study illustrations is to classify them in accordance to their role in a primary Mathematics textbook. Illustrations are divided into two main groups: representational and non-representational. The representational illustrations are the ones that show what things look like (drawings and photographs). The non-representational illustrations are graphs, maps, pictograms and geometric representations. This research project will only focus on representational illustrations.

The representational illustrations will be divided into two types: cosmetic and relevant. The cosmetic illustrations are the ones that give a general context of the

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task or their purpose is to decorate the page. These types of illustrations are characteristic, in that they do not give any information for answering or accomplishing the task. The **relevant** illustrations give information in order to accomplish the task. This information may be only given on the illustration or may be the same information given in the text and repeated in the illustration.

Both types of illustrations play a role in the textbook lesson; the crucial point being that children acknowledge the difference between them when they see or read them. For example, if a cosmetic illustration is considered as relevant, then the student will extract information where he was not supposed to. On the other hand, if a child considers a relevant illustration as a cosmetic one, then he will disregard the illustration and this might affect the outcome of the task. In the majority of teacher's guides the role of each specific illustration is not mentioned, it only says that the illustrations play an important motivational and educational role, but how, and when is not specified. It is taken for granted that they are useful and that everyone knows the purpose of it.

One part of this research project is centred on the use of illustration in arithmetic problems, for the primary school years' three and four. Some of the results of a pilot study carried out on this aspect will follow:

Pilot Study on the use of illustrations in arithmetic problems in primary school

Purpose

Know from where do children extract the information to answer questions of an arithmetic problem; if this depends on the type of illustration used, and/or if it depends on the mathematics achievement level.

Sample

Twenty-seven students from year three and four, classified in accordance with their mathematics achievement level given by the group teacher.

Material

Six worksheets were design based on English and Mexican textbook lessons for year three and four. Each worksheet had three versions. One version was the original; the other two versions had the same information but the source of it was different. For example, Figure 1 shows the original version where the information was only in the illustration.

One summer day, the ice-cream man went to the beach to sell ice creams.
By the end of the day he had almost sold every ice-cream he had brought in his ice-cream van.



1. How many different types of ice cream are sold in that ice-cream van?
2. Which is the cheapest ice cream on sale?
3. How much do you have to pay for an ice lolly and a large cornet if you buy both?
4. How more expensive is the Choc-Ice than the Small Cornet?

Figure 1. Textbook lesson with the information only in the illustration

Figure 2 is a different version of the same textbook lesson but it has the information only in the text; in this case the illustration is considered to be cosmetic. Figure 3 shows the version where the information is in both, in the text and in the illustration; in this case the illustration is considered to be relevant.

One summer day, the ice-cream man went to the beach to sell ice creams. He sold the small cornet at 12p and the large cornet for 16p. The ice lolly was very popular and he sold it for 14p. He also sells ice-cream flake for 22p and choc-ice for 20. The ice-cream tub, which almost no one liked, was 25p.

By the end of the day he had sold almost every ice-cream he had brought in his ice-cream van.

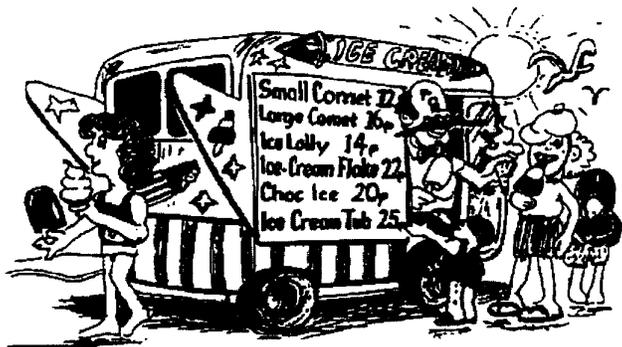


1. How many different types of ice cream are sold in that ice-cream van?
2. Which is the cheapest ice cream on sale?
3. How much do you have to pay for an ice lolly and a large cornet if you buy both?
4. How more expensive is the Choc-Ice than the Small Cornet?

Figure 2. Textbook lesson with the information only in the text

One summer day, the ice-cream man went to the beach to sell ice creams. He sold the small cornet at 12p and the large cornet for 16p. The ice lolly was very popular and he sold it for 14p. He also sells ice-cream flake for 22p and choc-ice for 20. The ice-cream tub, which almost no one liked, was 25p.

By the end of the day he had sold almost every ice-cream he had brought in his ice-cream van.



1. How many different types of ice cream are sold in that ice-cream van?
2. Which is the cheapest ice cream on sale?
3. How much do you have to pay for an ice lolly and a large cornet if you buy both?
4. How more expensive is the Choc-Ice than the Small Cornet?

Figure 3. Textbook lesson with the information in the text and in the illustration

Each student answered two worksheets per day. At the end of three days, each student had answered two worksheets with the information in the illustration; two with the information in the text only; and two with the information in both, in the text and in the illustration. They were given to the whole group together, and I mingled amongst the class. Students were asked how they answered the worksheets. This paper will only address the results of two of the worksheets, one is called the "Ice-cream van" and the other one is called "The farm".

Ice-cream van

Figures 1,2 and 3 show the three versions of this worksheet. Almost everyone got the last three questions right, regardless of their achievement level or the version they were presented with.

On the first question the answer was 'six', but 12 students answered five or nine. The strategy they used was counting the ice-creams shown in the illustration, for example the ones that the children had in their hands, or even the ice-creams drawn on the van. This might mean that the cosmetic illustration was considered as relevant. Of these 12 students' six had the version text only (Figure 2). Of the other six students, three had the version text and illustration (Figure 3) and three had the version illustration only (Figure 1).

The farm

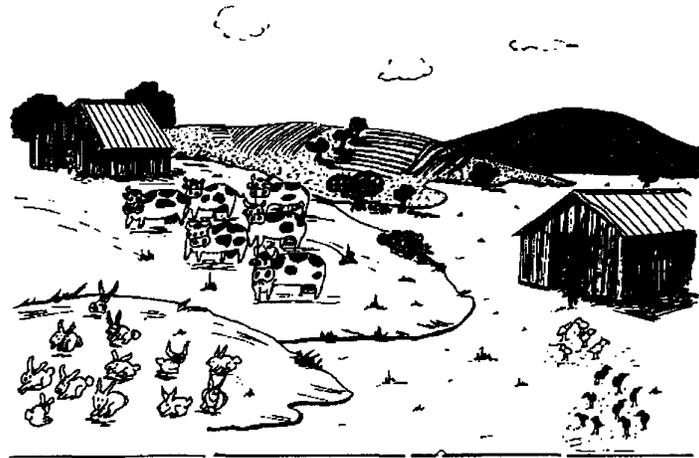
The original version had the information in the illustration only (Figure 4). A second version was designed where the information was only in the text (Figure 5), and a third version where the information was both in the text and in the illustration (Figure 6).

Children with the version's text only and text-illustration (Figures 5 & 6) had almost every question right. Several children with the illustrated version (Figure 4) considered the illustration as cosmetic instead of relevant which lead them to give the incorrect answer. This was revealed on questions one and four.

On question one six children did not use the illustration to answer the question. The answer they gave was sixteen. As well, four of them did not use the illustration on the last question, giving an answer of six.

On question three, all students used the illustration, but the nature of the question leaves almost no way out into not reading the illustration: the questions have no numbers.

This is the farm of Miss. Francis.



1. Inside the byre there are 16 cows. How many cows in total?
2. All the rabbits are outside. How many rabbits on the farm?
3. How many white chickens outside the henhouse?
How many black chickens outside the henhouse?
How many chickens are there outside the henhouse?
4. Inside the henhouse there are 6 white chickens. How many white chickens in total?

Figure 4. Information only in the illustration

Miss. Francis has a farm.

1. Inside the byre there are 16 cows. Outside there are six, how many cows in total?
2. There are 12 rabbits. All of them are outside. How many rabbits on the farm?
3. There are 5 white chickens and 9 black chickens outside the henhouse. How many chickens are there outside the henhouse?
4. Inside the henhouse there are 6 white chickens. How many white chickens in total?

Figure 5. Information only in the text

This is the farm of Miss. Francis.



1. Inside the byre there are 16 cows. Outside there are six, how many cows in total?
2. There are 12 rabbits. All of them are outside. How many rabbits on the farm?
3. There are 5 white chickens and 9 black chickens outside the henhouse. How many chickens are there outside the henhouse?
4. Inside the henhouse there are 6 white chickens. How many white chickens in total?

Figure 6. Information in the text and in the illustration

The next step in the area of arithmetic problems is the main study, which will be based on interviews in order to find out how children are reading and using the different types of illustrations. The other three areas of the research project focused on: a historical analysis of the illustration in textbooks; the use of 'talking heads' (cartoons), bubbles and clouds on textbooks; and the teachers point of view regarding the illustrations in textbooks.