

# First images in primary school textbooks as didactical obstacles in the construction of science concepts: the example of digestion

Graça S. Carvalho and Rui Silva

LIBEC/CIFPEC, Child Studies Institute, University of Minho, Braga, Portugal

## INTRODUCTION

School textbooks have been defined as printed instruments created with two main goals: to help teachers to prepare and implement their teaching activities and to help pupils to construct their learning (Gérard & Roegiers 1998).

In our previous studies we found that primary school pupils (Carvalho, Silva & Clément 2003; Carvalho et al. 2004) as well as pre-service and in-service primary school teachers (Carvalho, Dantas & Clément 2004) show difficulties in three main concepts of the digestion process – (i) sequence of the digestive tube representation, (ii) absence of blood absorption, and (iii) lack of relationship between digestive, circulatory and urinary systems – suggesting didactical obstacles, such as the use of inadequate textbooks. In order to find out whether there might be some association between these three digestion misconceptions and textbook digestion approaches, we analysed this topic in 10 primary school textbooks.

## METHODOLOGY

The criteria for textbooks selection was those mostly used in the Northern region of Portugal where the previous studies on pupils and teachers conceptions had been carried out (Carvalho, Silva & Clément 2003; Carvalho et al. 2004; Carvalho, Dantas & Clément 2004). The selected 10 books belonged to four Publishers “Edições Nova Gaia”, “Galilivro”, “Livraria Arnado” and “Porto Editora”, which were all published in 2001, except T7:

- T 1 – Leite, C. & Pereira, R. (2001) *Aprender a Descobrir*. Porto: Edições Nova Gaia.
- T 2 – Reis, J. & Campos, H. (2001) *As Minhas Descobertas*. Porto: Edições Nova Gaia.
- T 3 – Letra, C. (2001) *Aprender Brincando*. Porto: Galilivro.
- T 4 – Freitas, M. (2001) *Pequeno Mestre*. Porto: Galilivro.
- T 5 – Monteiro, A. (2001) *Caminhar*. Porto: Galilivro.
- T 6 – Monteiro, A. (2001) *Saber quem somos*. Coimbra: Livraria Arnado.
- T 7 – Monteiro, A. (2003) *Saber quem somos*. Coimbra: Livraria Arnado.
- T 8 – Pinto, M. & Carneiro, M. (2001) *Bâmbi 3*. Porto: Porto Editora.
- T 9 – Marques, C. & Temóteo, N. (2001) *Pequenos Curiosos*. Porto: Porto Editora.
- T10 – Dinis, C. & Lima, F. (2001) *Aventura no Meio*. Porto: Porto Editora.

The textbooks were analysed in terms of the digestive system presentation, as follows:

- i) its proportion in relation to the other human systems in the same book;
- ii) the proportion between the space occupied by images and texts in the digestive system topic;
- iii) the image message (captions present or not, clear or confused sequence of the digestive tract, indication/reference to blood absorption and or other human systems);
- iv) the text contents (anatomy and/or physiology, reference to blood absorption and to other human systems).

## RESULTS

The general comparative analysis of textbooks is shown in Table 1. Of the 5 human systems that are indicated to be taught by the National Programme (Digestive, Respiratory, Circulatory, Urinary and Reproductive systems) the digestive one corresponds indeed to about 1/5 (or 20%) except in T2 and T10 which are in a lower proportion, 12% and 6%, respectively.

Table 1. General comparison of 2001-2003 primary school textbooks.

	Edições Nova Gaia		Galilivro			Livraria Arnado		Porto Editora		
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
Dig/others <sup>1</sup>	20%	12%	27%	33%	25%	17%	17%	17%	17%	6%
Ima/text <sup>2</sup>	25%	25%	25%	33%	25%	25%	25%	33%	33%	12%
Images <sup>3</sup>								a)		
- captions	Yes	Yes	No	Yes	Yes	Yes	Yes	---	Yes	No
- confusion	Yes	+/-	No	Yes*	Yes	Yes*	Yes	---	Yes	Yes
- absorption	No	No	No	No	No	No	No	---	No	No
- other syst.	No	No	No	No	No	No	No	---	No	No
Text <sup>4</sup>										
- An / Ph	An	An	An+Ph	An+Ph	An+Ph	An+Ph	An	An	An	An
- absorption	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
- other syst.	No	No	No	No	No	No	No	No	No	No

Dig/others<sup>1</sup> - Proportion of digestive system to other human system.

Ima/text<sup>2</sup> - Proportion between the space occupied by images and texts in the digestive system topic.

Images<sup>3</sup> - The image message: captions present or not, clear or confused sequence of the digestive tract, indication/reference to blood absorption and/or other human systems.

Text<sup>4</sup> - Text contents: anatomy (An) and/or physiology (Ph), reference to blood absorption and other human systems.

a) No biological structure represented, just a dressed up girl.

\* See Fig.1 and Fig.2.

With exception of T10, the images occupy about 25% of the total space dedicated to the digestive system (Table 1). Most of the images represent a mass of small intestine mixed up with the stomach and the large intestine, showing no clear sequence of the digestive tube as in examples shown in Fig.1 (T4) and Fig.2 (T6).

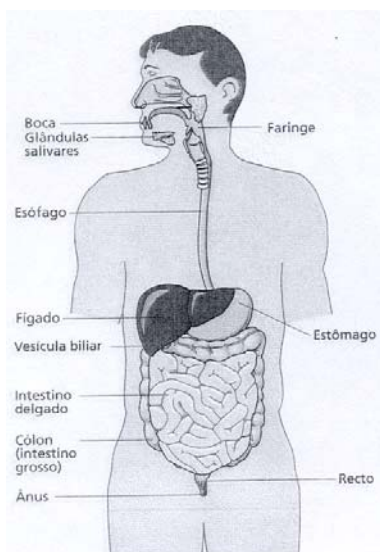


Fig.1: Monteiro, A. (2001) *Saber quem somos*. Coimbra: Livraria Arnado (T4).

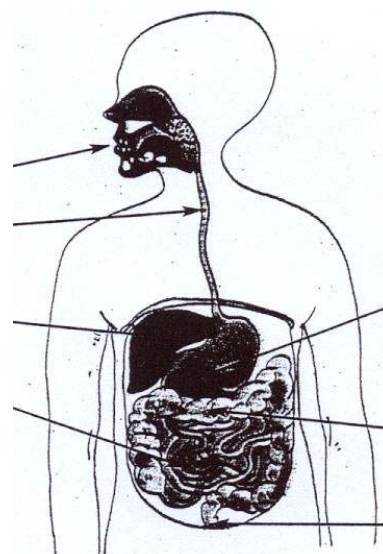


Fig.2: Freitas, M. (2001) *Pequeno Mestre*. Porto: Galilivro (T6).

Although these textbook images never represent blood absorption, most of the texts mention it, as the following examples of the same T4 and T6 textbooks:

T4: *“In the small intestine, food is reduced into very small substances, due to bile action, pancreatic juices and also its movements. Some of these substances pass to the blood”.*

T6: *“The small intestine is a very long tube where the useful substances to the body pass to the blood”.*

Six of the textbooks analysed (T1, T2, T7, T8, T9 and T10) describe only the morphology of the digestive tract, whereas four (T3, T4, T5 and T6) refer to the physiology of the digestion, although in a very simple way.

In addition, no relationship between digestion and other human systems was found in any textbook, either by images or text. In fact each topic is included in a different chapter of the textbook.

## **DISCUSSION**

The digestive system is presented without any link to the other human systems. Similarly, pupils and teachers of our previous studies, never or rarely made the link of the digestive system with the circulatory and the urinary ones.

The results of the present study also showed that in general the schoolbooks **texts** describe clearly the sequence of the digestive tract (mouth, oesophagus, stomach, small intestine, large intestine and anus) as well as mention the blood absorption. In contrast, the respective **images** generally show great confusion after the stomach (where connection with small intestine are not clear nor is the connection of this one with the large intestine) and never represent the nutrients absorption to the blood.

On the other hand, our previous studies (Carvalho, Silva & Clément 2003; Carvalho et al. 2004; Carvalho, Dantas & Clément 2004) primary school pupils and teachers in general drew a mass confusion after the stomach and did not represent the blood absorption of nutrients.

Altogether these findings suggest that the images may have a stronger influence in learning rather than the text. Therefore unclear images, such as the confusion after the stomach, may be a didactical obstacle that may endure all life along, like in the case of in-service teachers as reported before (Carvalho, Dantas & Clément 2004). In short, the present results reinforce our previous studies suggesting that inadequate textbooks, essentially images, may be a didactical obstacle.

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