

URBAN AND RURAL PRIMARY SCHOOL PUPIL'S CONCEPTIONS ABOUT THE RESPIRATORY SYSTEM AND SMOKING

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Abstract: An important objective of primary school teaching is to make children learn scientific contents and for this teachers must know their pupils' previous ideas in order to provoke effective conceptual changes. We analysed primary school pupils' conceptions and their learning difficulties by carrying out a cross-sectional study. Conceptions of respiration and smoking of young pupils (5/6 to 8/9 year old) were analysed before the first formal teaching of the topic and we followed their conceptual change immediately after teaching and one year after. We focused on the anatomo-physiology of the respiratory tract as well as on the unhealthy effects of smoking. The aim was to identify not only patterns of children's previous ideas about breathing and smoking unhealthy effects but also epistemological and didactical obstacles to learning.

Several patterns on the passage of tobacco in the smoker's body were created from children before teaching. Significant differences ($p < 0.05$) between urban and rural schools as well as between year sub-samples of either urban or rural schools were found. After formal teaching, about 90% of 3rd and 4th year pupils represented the correct anatomo-physiology of the respiratory tract ($p < 0.05$). However no significant differences regarding smoking effects were found ($p > 0.05$). The use of these patterns of children's previous ideas about breathing and smoking may be relevant for teachers to use them in the process of pupils' conceptual change.

Keywords: Primary school, Respiratory System, Smoking, Urban and rural pupils.

INTRODUCTION

Children coming to primary school have their own conceptions that have been built from their daily life and some personal learning from parents' education, children's books, TV and other media. An important objective of primary school teaching is to make children learn scientific contents and for this teachers must know their pupils' previous ideas in order to provoke effective conceptual changes (Driver *et al.*, 1989; Pozo & Crespo, 1998; Canavarro, 1999; Giordan, 1999; De Vecchi & Giordan, 2002). Two types of pupils' learning obstacles have been identified: (i) epistemological obstacles, related to children's conceptions gained from their everyday life, and (ii) didactical obstacles, related to inadequate formal teaching (Clément 1994, 2003). Previous reports have described pupils' conceptions on digestion from their drawings (Carey 1985, Turner 1997, Giordan, 1999, Teixeira 2000, Psarros and Stavridou 2001, De Vecchi & Giordan, 2002, Reiss *et al.* 2002, Author, 2004) but on the respiratory system little has been investigated. In the present study we analysed primary

school pupils' conceptions and their learning difficulties by carrying out a cross-sectional study. Conceptions of respiration and smoking of young pupils (5/6 to 8/9 year old) were analysed before the first formal teaching of the topic and we followed their conceptual change immediately after teaching and one year after. We focused on the anatomo-physiology of the respiratory tract as well as on the unhealthy effects of smoking. The aim was to identify not only patterns of children's previous ideas about breathing and smoking unhealthy effects but also epistemological and didactical obstacles to learning.

METHODOLOGY

In this study the data collection instruments included a questionnaire, which consists of an iconic part and a text. In this collection, we applied the technique of expression in the form of design because the children, in this age group, express better their ideas and their knowledge through the iconic representation (Giordan e de Vecchi, 1988). The design avoids the embarrassment of the child and the design is an alternative way for students who have difficulty expressing their ideas verbally (Rennies e Jarvis, 1995). The use of drawings is a technique that identifies the students' conceptions.

This is a transversal study applied to pupils of the four earlier school years of primary school (5/6 up to 8/9 years old). The teaching of the respiratory tract (and the others human systems) occurs at the 3rd year in the Portuguese curriculum. The schools were from urban and rural areas of Braga District, 191 and 201 children, respectively. We applied a short questionnaire, interviewed the children, and also analysed their textbooks. Children from the 3rd year were questioned one week after the teaching. They had to answer to the questions by making drawings as well as writing captions and any notes they thought could explain their drawings. Younger children of the first and second school year (5-7 years old) were helped by the researcher in the writing.

The questionnaire was composed of 5 simple questions:

- i) Draw where the breathing air goes in your body.**
- ii) Look at your drawing and explain where the air goes in your body.*
- iii) Draw where the tobacco goes in the body of a smoker.*
- iv) Look at your drawing and explain where the tobacco goes in the smoker's body*
- v) What are the tobacco effects?**

Categories were created from the children's drawings and writings (Marshall & Rossman, 1999; Bardin, 2000). Each drawing and writing was then allocated to a given category and data were treated by using the Qui-square method at the significance of 95%. The Statistical Package for the Social Sciences (SPSS) program was used.

RESULTS AND DISCUSSION

Several *drawing categories* about the passage of tobacco in the smoker's body (**question i**) were created out of the drawing of 1st and 2nd year children, before teaching (Fig.1). A larger variety of drawing categories could be found in urban (Fig. 2a) than in rural (Fig. 2b) schools. Some 1st and 2nd year pupils drew only one lung ("L1") or two lungs ("L2", Fig.1a) with no connecting tube; one or two lungs with a single tube ("L1t/L2t", Fig.1b) and there were cases of two lungs with two tubes in parallel ("L2L", Fig.1c). The correct representation of two lungs with two tubes joining a single tube (L2T) (often darkened, highlighting the tobacco

injury, "L2Td", Fig.1d) were also present in a proportion around 20% before teaching, in both urban and rural schools (Fig.2).

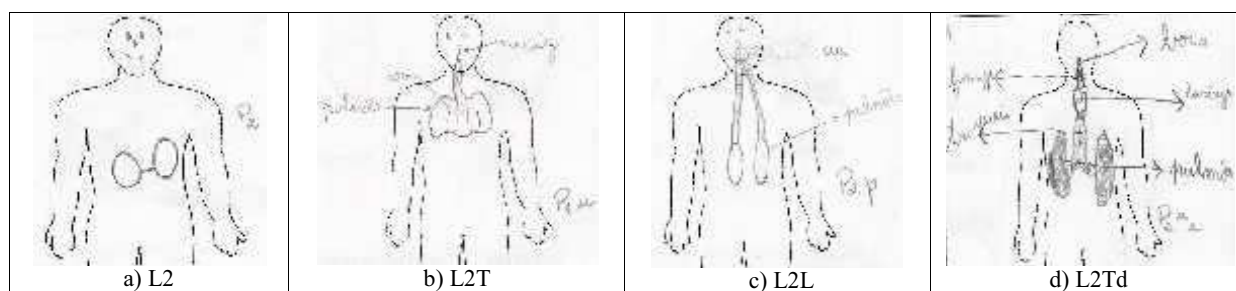


Figure 1: Examples of drawings of four categories found in pupils' drawings before (a to c) and after (d) teaching.

After the formal education the category "Lungs" increases in the 3rd year to 92% and there is a regression in this category, the following year (83%) in favour of other minor responses, namely the category "not known" where 13% of the students proved difficult to explain and name the organs through which the tobacco smoke, confounding them with organs of other biological systems. We can then infer that after a year of these learning, students in fourth grade did not retain concepts and knowledge about the category "Lungs".

Significant differences ($p < 0.05$) between urban and rural schools as well as between year sub-samples of either urban or rural schools were found (Fig.2). After formal teaching, about 90% of 3rd and 4th year pupils represented two lungs with two tubes joining a single tube ("L2T"), where above 20% of urban (Fig.2a) and above 10% of rural (Fig.2b) pupils darkened the lungs, "L2Td", highlighting the smoking harm. The formal teaching in this case is clearly evident, which is confirmed by statistical analysis, $p < 0.05$.

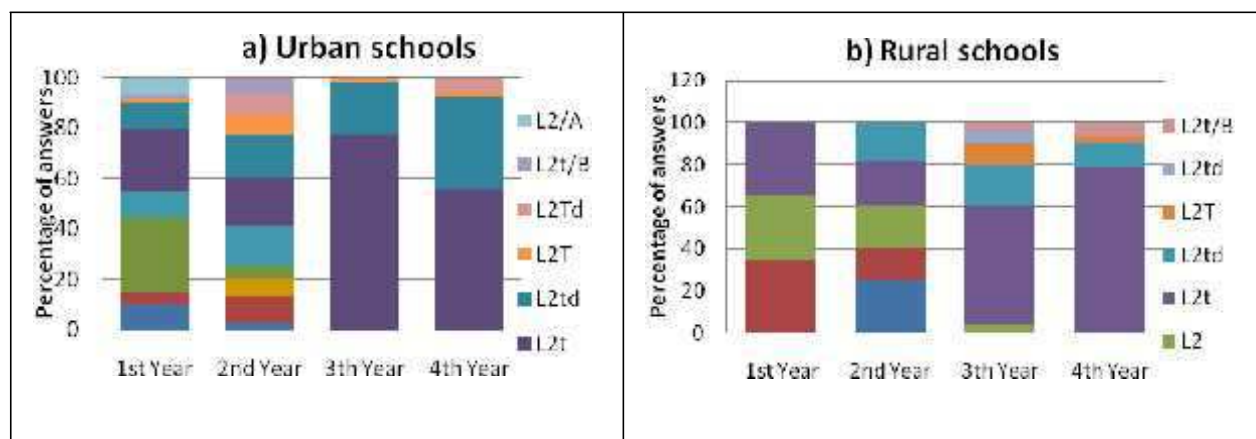


Figure 2: Categories frequencies on the tobacco passage through the body in urban (a) and rural (b) schools.

$P < 0.05$ between urban and rural samples, and between sub-samples of urban and rural samples.

The writing categories "Disease/Lungs" and "Disease/Death" concerning tobacco smoking (question v) were the most frequent ones in both urban and rural children (Fig. 3). No significant differences were found among samples ($p > 0.05$): neither between urban and rural samples nor between year sub-samples within each urban and rural sample. These results

show the breathe teaching at year 3 caused no significant effects on children's conceptions regarding the effects of smoking. However the category "Disease/Lungs" tend to decrease from the 1st to the 4th year in the urban school (Fig 3a) in contrast to the rural schools which tended to increase slightly (Fig.3b), though this being not significant at the level of 95%.

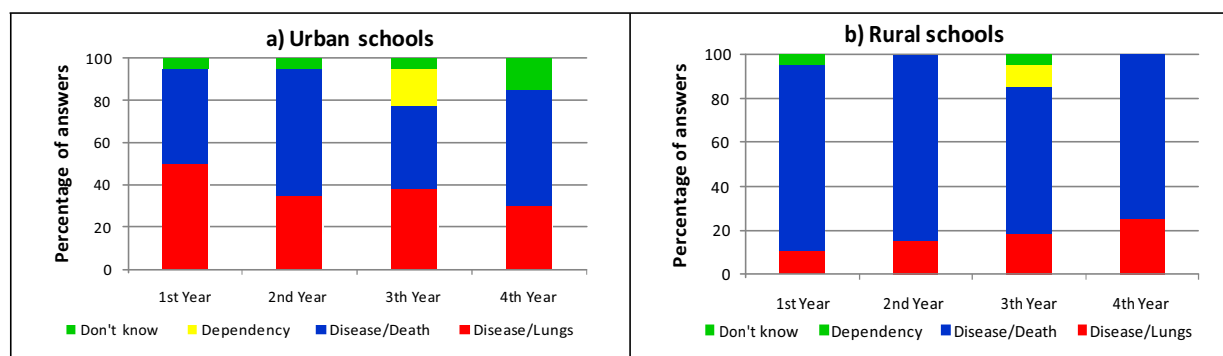


Figure 3: Categories frequencies on the tobacco effects in urban (a) and rural (b) schools.

P>0.05 between urban and rural samples, and between sub-samples of urban and rural samples.

It is interesting to note that in Urban Schools (Fig. 3a), before the formal education and more specifically in the 1st year the category "Lung Diseases" predominates with higher percentages (50%), contrary to the 2nd year that highlights the first option in the category "Diseases / Death" (60%), associating death to several diseases caused by tobacco smoke, followed by the category "Lung Diseases" with 34%. These children, in the process of informal learning, are aware that tobacco smoke has adverse effects in some organs of the human body. For them, this substance is very harmful to health and particularly to the lungs because they are darkened, the smokers have more difficulty breathing, and also because it causes various types of diseases in certain organs, including lungs, including some lung cancer. Analysing the results from the two areas (Urban and Rural) we notice that in the 3rd year the children have also revealed more formal knowledge about the dangers of tobacco, to discover that a small percentage of students (16%), refer to the category "Addiction" as one of the main effects caused by tobacco smoke in humans.

In the category "Disease/Death" children allude to death and various diseases or injured organs caused by tobacco smoking (cancer, cough, cholesterol as well as throat, stomach, breast, liver and heart illnesses). Interestingly is the fact that smoke addiction is only referred by the 3rd year pupils (1 week after teaching) from either urban or rural areas. However, as mentioned before, this was not found to be statistically significant ($p>0.05$).

In the iconic representation of the respiratory system there is, before the formal education, the presence of very simple concepts on the respiratory process, being almost always present the main body of this unit (lungs) or the presence of other organs that do not directly relate to breathing (Heart, stomach, intestines ...) and that, although out of context seem to be relevant for these children. By drawing schematically the child represents what he knows and what he feels through similar situations with their reality. After the formal learning, there is very significant development with regard to the anatomy and physiology of the respiratory tract, in the sense that certain simple representations gave way to more complete and scientific conceptions. In fact, in this age group, the similarity of real objects, (Lowenfeld, 1977), represent what we actually observe, learn and think (Mèridieu, 1974). Associated with this conceptual evolution in relation to the iconic representation of the anatomy of the respiratory system, there is still the presence of conceptual ideas a bit incomplete in terms of scientific.

The diagrams are produced to the lungs and from here there is no continuity of the rest of the process, relating to respiratory function. We can thus infer that the children in their answers "break" the continuity of the respiratory system, neglecting the interrelationship between the respiratory and circulatory.

So we may say that the patterns of children's previous ideas can be created (like in Fig.1) and that teaching was particularly effective in children's conceptual change regarding the respiratory tract (like in Fig. 2) but not relevant in healthy issues (Fig. 1), suggesting that teaching was not addressed to healthy, just like the pupils' textbooks. The use of these patterns of children's previous ideas about breathing and smoking may be relevant for teachers to use them in the process of pupils' conceptual change.

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