Annex-2

Deliverables

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2.2. Production

- 2.2a. Communications
- 2.2b. Publications
- 2.2c. Post-Graduation

2.3. Advertising

- 2.3a. Parliament Magazine
- 2.3b. EU16 profile

2.4. Policy makers

Project no.: **CITC-CT-2004-506015**

Project acronym: **BIOHEAD-CITIZEN**

Project full title: **Biology, health and environmental education for better citizenship**

SPECIFIC TARGETED RESEARCH PROJECT

SIXTH FRAMEWORK PROGRAMME
PRIORITY 7
Citizens and Governance in a Knowledge-based society

Biohead-Citizen Seminar

7 March 2008, European Commission building, Brussels

Period covered: **from 1/10/2004 to 30/03/2008** Date of preparation: **3/03/2008**

Start date of project: **1/10/2004** Duration: **42 months**

Report by:

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CONTENTS

By: Pierre Clément (UCBL, France)

Biohead-Citizen project

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BIOHEAD-CITIZEN project: Objectives, methodologies, implementation and main achievements

1. Project structure and Objectives

This report concerns the implementation of Biohead-Citizen project (CIT2-CT2004-506015) on "Biology, Health and Environmental Education for better Citizenship" which started on 01/10/2004 and lasts for 42 months.

The project **Coordinator** is Graça S. Carvalho, University of Minho (P1.Uminho), Portugal (graca@iec.uminho.pt) who has got the direct collaboration of other two Participants: Pierre Clément (P2.UCBL, University Claude Bernard Lyon-1, France) and Franz Bogner (P3.UBT, University of Bayreuth, Germany). This **Coordinator Group** is responsible for the general coordination of the project at scientific and technical level, including the coordination on the preparation of research instruments, of data analysis, of monitoring progress and of preparing the project deliveries. The other participants are the Cooperative Group and the Participant Group. The **Cooperative Group** is composed of Participants 4 (UM2, France), 5 (CNR, Italy), 6 (UCY, Cyprus), 7 (UT, Estonia), 8 (LUFP, Lebanon) and 9 (FSB, Tunisia) and collaborated in the preparation of the research instruments by giving technical and scientific support to the Coordinator group. The **Participant Group** is composed of Participants 11 (UCAM-EDUC, United Kingdom), 12 (OKI, Hungary), 13 (VU, Lithuania), 14 (UoM, Malta), 15 (UMCS, Poland), 16 (UBB Cluj, Romania), 17 (USTHB, Algeria), 18 (ENS, Morocco), 19 (UP-FCNM, Mozambique) and 20 (ENS-UCAD, Senegal) and, like the other two groups, they were involved in the adaptation of the instruments to their countries and in the application of the instruments and analysis of the data in their countries. In addition, a team in Finland is working in collaboration with the project Coordinator to gather Finish data.

This project aims to understand how Biology, Health and Environmental Education can promote a better citizenship, including their affective and social dimensions, analysing possible differences in 19 countries and associating them to controlled parameters, (*e.g.* social context, religion, gender). It is expected that this understanding may clarify the relevant challenges that the European Education Systems have to face to maximise their efficiency in order to reinforce a knowledge based society. It includes the above 19 countries (6 EU "old" member states, 7 new member states and 6 INCO Countries) in order to carry out a large transnational comparative study. In brief, and following the project planning, in the first year we constructed the instruments of research, in the second year we applied the instruments and in the 3rd year plus 6 months extension (year 3,5) we analysed the data and carried out the synthesis of data.

2. Theoretical background

The conceptions are classically studied in the research in didactics of sciences (Astolfi et al 1997), the word "conceptions" being chosen to be more adapted than the word "representations" (Clément 1994). The list of works done in this perspective was listed in Pfundt and Duits (1994) and this list is then regularly up-dated on the Duits (2007)' web site, with thousands of references of published research on conceptions of learners and teachers.

In the present work, the conceptions of some actors of the educational system are analysed as being the emergences from interactions between the 3 poles K, V and P, as proposed by the

model KVP (Clément 2004, 2006). The 3 poles are: the scientific knowledge (K), the systems of values (V) and the social practices (P). Any conception can also be analysed with other theoretical background. Nevertheless, the KVP model is useful to analyse important features of the taught knowledge: the epistemological one, to try to understand what is related to science or to values in a scientific presentation, for instance in a textbook; and also its interaction with social practices (e.g. some images come from medical practices, some other from lab of research, some others are strongly modified just for aesthetical aspects, some others are created for a pedagogical goal, …). The scientific knowledge (K) is referred to the publications coming from the scientific community. The social practices (P) are those of the actors of the educational system: the practice of teaching in their country for the teachers, the practice of the authors and publishers of school textbooks, but also their conceptions related to the actual and future social practice of their students (their future professional job but also their present and future responsibility as a citizen). The values (V) are defined in a large sense, including opinions, beliefs and ideologies. For instance sexism, racism, westernism will be considered as values, as well as the research of truth by the science and the "scientific ideologies" defined by the epistemologist Cangulihem (1977) to characterise some trends inside the biological science as for examples reductionism or vitalism or anatomism, or explications only by the genetic determinism.

We illustrate the pertinence of the KVP model with examples coming from our analyses of school science textbooks in 18 countries and from comparisons of the conceptions of in-service and pre-service teachers in these countries.

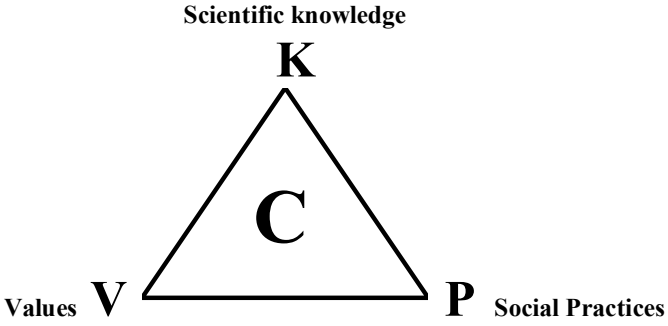

Figure 1 - The KVP Model. The conceptions (C) can be analysed as interactions between the 3 poles K, V and P

The anthropological approach defined in didactics of mathematics by Chevallard (1989), using the work of the sociologist Verret (1975), proposed three steps for the didactic transposition: at the top are the scientific references, then transformed into the knowledge to teach and then to the taught knowledge. This schema is now completed in three ways (Clément, 2006, figure 2):

(1) There are more than 3 steps, the school textbooks being one of the steps;

(2) The transposition is not linear: it involves retroactions at any level;

(3) At each step, there is not only the scientific knowledge, but also values and social practices, as proposed by the KVP Model (figures 1 and 2).

(4) The anthropological approach of Chevallard is against the analysis of conceptions. A contrario, we think useful to clarify conceptions (as KVP interactions) of the main actors of the didactic transposition, at each level of the transposition (figure 2).

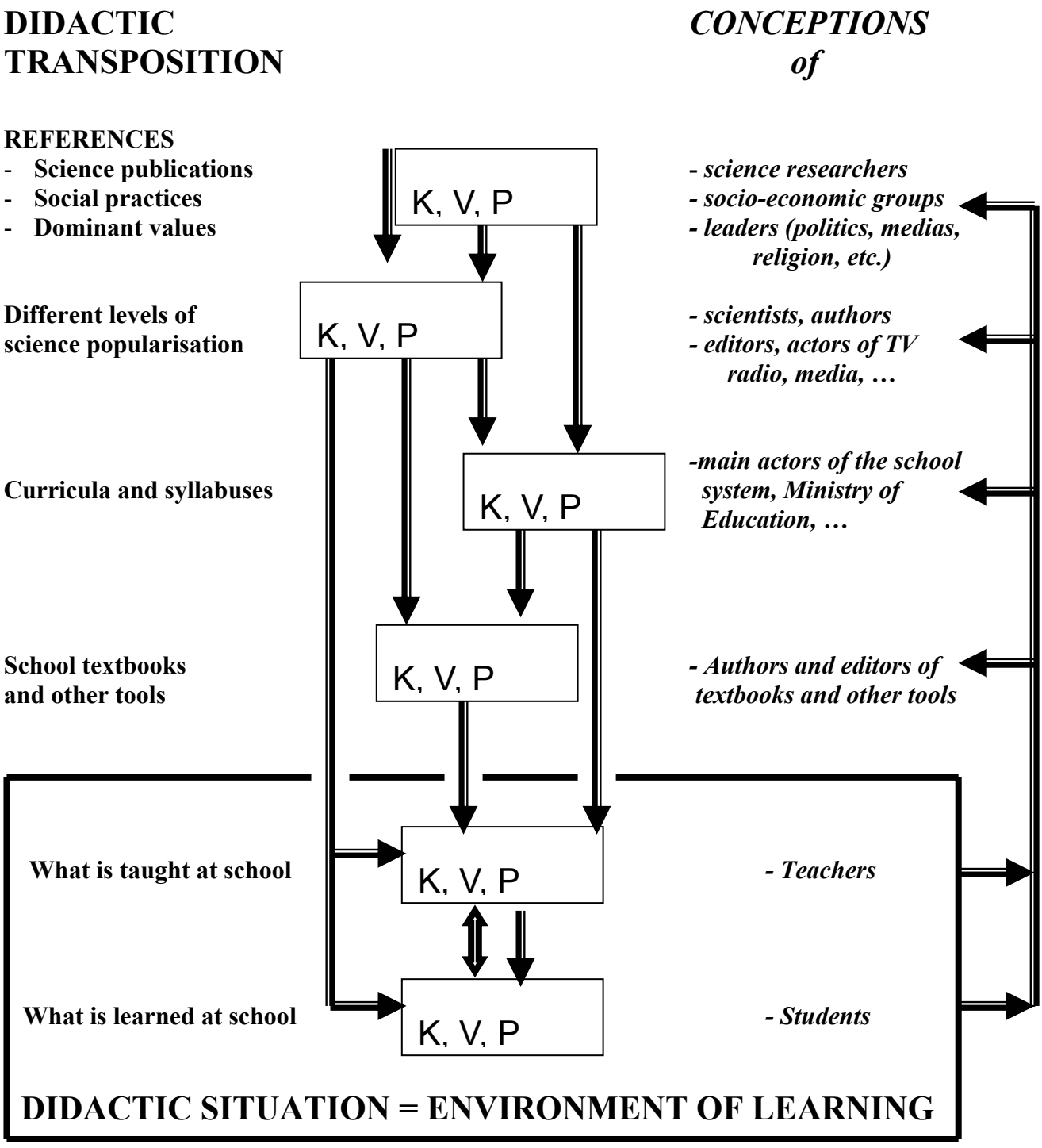

Figure 2 - *A new schema of the didactic transposition, linked to the analysis of the conceptions of the main actors of the transposition (modified from Clément 2006).*

3. General methodology

As announced in our project proposal, we have worked with two complementary methodologies:

- A comparative analysis of syllabuses and school textbooks. For each of the 6 selected topic ("Health education", "Human reproduction and sexual education", "Ecology and environmental Education", "Human brain", "Human evolution", "Human genetics") the same grid of analysis (built in the year 1) was applied in the year 2 of the project by all

countries and data analysed during the years 2 and 3 & ½. We worked on all school levels: Primary and Secondary Schools, *i.e.* from 6 to 18 years old students.

- A comparative analysis of 16 countries teachers' conceptions related to the selected topics. We worked with in-service and pre-service teachers. Here too, the same methodology was used by the 16 countries: the same questionnaire comprising the 6 selected topic was applied in year 2 after appropriate translation to the national language (during year-1). The questionnaire was common to all countries but a few questions focusing specific local needs were added in some countries. The samples were similar in the 16 countries. In the year 3,5 analysis in each country was carried out as well as comparative analysis among countries.

This project includes four Research Activities work packages (WP), and the end of all of them corresponds to the milestones of the project (Fig.1) as follows:

- WP1: Preparation of instruments …….. Milestone I - month 12
- WP2: Syllabi and textbooks analysis……. Milestone II - month 24
- WP3: Teachers' and teachers-to-be' questionnaires….. Milestone III - month 30
- WP4: Synthesis of results ……...Milestone IV - month 42

4. WP1 – Preparation of instruments: Methodology, implementation and main achievements

The WP1 was divided in 4 tasks (Fig.1): *i)* Selection of topics and *a priori* analysis; *ii)* definition of grids for critical analysis of syllabi and schoolbooks; *iii)* construction of teachers' questionnaires; and *iv)* adaptation of grids and questionnaires to every country.

WP1-i) Selection of topics and *a priori* analysis

The a priori analysis was started even before the starting day of the project (01/10/2004), during the negotiation period. Precise topics were chosen because they are exemplar of interactions between Science and Society, and challenges in Citizenship. This list has been discussed and reshaped during our successive Meetings (First Kick off Meeting in Braga for the 9 participants of the cooperative group, November 2004; the general Kick off Meeting for the 20 participants, again in Braga, January 2005; then the Regional Meetings, in Algiers and in Malta, May 2005). Finally 6 topics were definitively selected as follows. They are in ***"Deliverables D1.1 – Specific workplan of every Participant".***

Table 1. Topics selected to be used in the Biohead-Citizen project

1) **Health Education**: explicit and implicit values, nutrition, substance abuse (drugs).
2) **Human Reproduction and Sex Education**: including related health questions and sexual transmitted diseases (AIDS, other STD, contraception, abortion)
3) **Ecology and Environmental Education** (and **Sustainable Development**): explicit and implicit values, cycles, interactions, regulations, pollution.
4) **Human brain:** epigenesis, thinking, intelligence, spirit; Brain diseases; brain at the command, or brain built by individual/social life?
5) **Human Genetics**: genetic determinism of human characters, genetic diseases, interactions between the genome and its environment (epigenesis), genetic engineering, GMO.
6) **Human Origin**: theories of evolution, with a special emphasis on the origins of humankind.

Month / WP-activity	6	12	18	24	30	36	**42**
WP1 – Preparation of instruments							
WP1 – *i)*							
WP1 – *ii)*							
WP1 – *iii)*							
WP1 – *iv)*		I					
WP2 – Syllabi and textbooks analysis							
WP2 – *i)*							
WP2 – *ii)*				II			
WP3 – Teachers' questionnaires							
WP3 – *i)*							
WP3 – *ii)*					III		
WP4 – Synthesis of results							
WP4 – *i)*							IV
WP4 – *ii)*							

WPm – *i)*						
WPm – *ii)*						
WPm – *iii)*						
WPm – *iv)*						
WPm – *v)*						
WPm – *vi)*						

Fig.1. Planning of the Workpackages and their respective tasks.

I - Milestone I; II - Milestone II; III - Milestone III; IV - Milestone IV.

- WP1: Preparation of instruments:
  - *i)* Selection of topics and *a priori* analysis;
  - *ii)* definition of grids for critical analysis of syllabi and schoolbooks;
  - *iii)* construction of teachers' questionnaires;
  - *iv)* adaptation of grids and questionnaires to every country.
- WP2: Syllabi and textbooks analysis:
  - *i)* critical analysis in each country;
  - *ii)* comparative analysis and interpretation.
- WP3: Teachers' and teachers-to-be' questionnaires:
  - *i)* implementation of questionnaires and first data analysis in each country;
  - *ii)* pooling data together and carrying out multivariate analysis for comparison.
- WP4: Synthesis of results:
  - *i)* elaboration of scientific papers;
  - *ii)* elaboration of documents to be sent to national policy-makers and teachers.
- WPm: Management: general project coordination:
  - *i)* administrative coordination and communication within the project;
  - *ii)* assembling of documents from Participants and elaboration of project Reports and other documents to be sent to the European Commission.
    (Live meetings organisation):
  - *iii)* Kick off Meeting and other three general meetings (the last one:*"International Meeting in Biology, Health and Environmental Education for better Citizenship")*;
  - *iv)* six-months meetings of Coordinator and Cooperative groups;
  - *v)* targeted regional meetings;
  - *vi)* policy-informing meeting.

WP1-ii) **Definition of grids for critical analysis of syllabuses and schoolbooks, and**
WP1-iv) **Adaptation of grids to every country**

After a general description of the educational system of each country, each team worked first to identify all the matters and levels of teaching where the 6 topics are taught in their country. Doing these "syllabuses tables" (see Annexes 11, 12 & 15 of *"12 months report"*), we realised that the teaching organisation can significantly differ from one country to another. In some countries, Biology is linked to Geology, in some others Geology with Physics, in others Biology with Chemistry. Human brain is sometimes taught in Biology, or in Psychology, and Human Health can be taught by physical education teachers …

Concerning our WP1 goal, the syllabuses tables were created in order to be used to define the syllabuses and textbooks to analyse for each topic, for what matters and levels of teaching. Some topics (as human genetics, human brain and humankind origins) are located in specific levels. In contrast, other topics (as Environmental or Health Education), can be found in several matters and at diverse school levels from primary to secondary school.

We then worked to define precise grids for each of the 6 topics: the same grid, corresponding to a specific topic to be applied in textbooks of all countries. The initial grids drafts were prepared from the bibliography sources and earlier works done by P1 and P2 teams, which were exposed at the Kick off Meetings. We then decided to organise two Regional Meetings, only focused on the grids construction: one for French speaker teams (Algiers 6-10 May), and another for English speaker teams (Malta 21-25 May), having the two Coordinators, P1 and P2, worked between meetings since they were the ones present in both Regional Meetings for grids preparation.

In Malta, we decided to make a cross grid (to be applied together with the 6 topics), and specific grids for each topic: 0-Cross grids; 1-Human brain; 2-Human genetics; 3-Human origin; 4-Human Reproduction and Sex Education; 5-Health Education; 6-Environmental Education. Grids 0–3 were coordinated by P2, grids 4–5 by P1 and grid 6 by P5. Other teams (P5, P7, P8, P9, P13, P20 and Px) also collaborated actively in the grids improvement.

These grids were then tested by each team in a short textbook chapter for each topic, to get remarks from all teams in order to improve the grids. From these remarks, the coordinator of each thematic grid has adjusted the grids which are now the *"**Deliverables D1.2 – Grids for critical analysis of syllabuses and schoolbooks**"*.

WP1-iii) **Construction of teachers' questionnaires and**
WP1-iv) **Adaptation of questionnaires to every country**

The proposals of questionnaires were preliminarily constructed by the three Coordinators (P1.Portugal, P2.France-Lyon and P3.Germany) even before the starting day of the project (01/10/2004), using the works done and published before. In October and November 2004, these initial proposals were refined by coordinators to prepare the Cooperative Group Kick off Meeting, either by email or during short one-day (P1+P2+P3) live meeting.

Three lists of questions on Biology, Health, and Environmental Education respectively were sent by Email to all participants of the Cooperative Group (P1 to P9) for improvement at the Braga Kick off Meeting (21-24 November 2004). At this meeting several questions were modified, others dropped out, and some additional questions were included by some Cooperative teams. This meeting also served to discuss other issues such as the theoretical background, the sampling strategy, questionnaire translation methods and validation, standardising question format.

Based on conclusions from this Kick off Meeting, the Coordinator group revised and reorganised the questionnaires for the Braga General Kick off Meeting (Participants P1 to P20; 15-19 January). At this meeting, a good number of additional revisions of the questionnaires were made. It was also agreed that all teams would apply: (*i*) the "Traversal questionnaire" (mandatory, combining selected questions on the three topic areas: Biology, Environmental and Health Education); (*ii*) at least one of the three specific topic-based questionnaires (*iii*) a fifth "Personal Information" questionnaire (mandatory) containing questions on the responder information on age, sex, education, religious beliefs, etc. Every Participant had to declare which questionnaires would apply and this is presented in *"**Deliverables D1.1**"*.

Following this general Kick off Meeting, the teams translated the original English version of the questionnaires into their respective national languages for the beginning of March, and further instructions on translated questionnaires validation were provided for that date (using parallel translations). Once a working version of the questionnaire had been adopted, P2 coordinated, in collaboration with P1, the validation and revision of questionnaires items as well as errata lists.

Each team had to apply the questionnaires in a pilot test (at least 50 students or teachers in each country), using when possible comparison of parallel translations, as well as test/retest methodology to evaluate the reliability of items. P2 prepared a MS Excel database to be filled in by each team. P2 team centralised the pilot test data from all countries and conducted various analyses: synthesis of interview remarks; retests analysis for the validation of items; general analysis of overall data (MCA); and topic by topic sub tables (separate MCAs and Factor analysis). Although coming from limited samples (about 50 persons by country), the results are very promising, suggesting important differences between the countries. These pilot tests were not done with the focus for the results, but only to select the most appropriate way to analyse these data, and to select the most pertinent questions.

Using these different analyses, the three coordinators (P1, P2 and P3) selected the most relevant questions for the project objectives and constructed the final questionnaires (*"**Deliverables D1.3 – Questionnaires"***).

In brief, at the end of year 1, the instruments (6 grids for textbooks analysis, and questionnaires) were ready. These instruments were constructed with the collaboration of all participants and were tested in each country. During the first year, we also defined and tested the methods to analyse data.

5. WP2 – <u>Syllabuses and textbook analysis:</u> Methodology, implementation and main achievements

The WP2 was divided in two tasks (Fig.1): *i)* Critical analysis in each country; *ii)* Comparative analysis and interpretation.

WP2-i) Critical analysis in each country

A critical analysis of syllabi and textbooks was carried out in each country, primary and secondary schools in the 6 selected topics (see table 1).

Textbook analysis was carried out by all Participants with the exceptions of: P11.UK and P19.Mozambique who did not do any grid of analysis.

Several communications were presented in meetings and papers were prepared to be published by individual teams (Annex-1). The individual reports composed the *"**Deliverables D2.1: A report by each participant on syllabuses and schoolbooks analysis, in each country**"*.

WP2-ii) Comparative analysis and interpretation

The comparative analysis and interpretation of data from all countries resulted in 7 synopsis that have been submitted to the IOSTE (International Organisation for Science and Technology Education) meeting *"International meeting on Critical analysis of school science textbooks"* held in Hammamet, Tunisia, 7 - 10 February 2007. This meeting was organised by the IOSTE Southern Europe Region and the BIOHEAD-CITIZEN project. For each topic one overall BIOHEAD-CITIZEN synopsis was prepared, except in the case of "Ecology and Environmental Education" where two synopses were presented.

At the General Meeting of Vilnius the Participants P1.Portugal, P2.France-Lyon, P5.Italy and P13.Lithuania were designated to be in charge of the comparison of all grids of countries participating in the project, as follows:

- **Human brain:** Pierre Clément (P2.France-Lyon);
- **Human Genetics**: Jéremy Castéra & Pierre Clément (P2.France-Lyon);
- **Human Origin**: Marie Pierre Quessada & Pierre Clément (P2.France-Lyon);
- **Human Reproduction and Sex Education**: Sandie Bernard (P2.France-Lyon) & Graça Carvalho (P1.Portugal);
- **Health Education**: Graça Carvalho (P1.Portugal);
- **Ecology and Environmental Education**: Silvia Caravita (P5.Italy); Grita Skujiene (P13.Lithuania).

Six papers, one in each topic, have been written down involving comparison and interpretation among several or a few countries (see Annex-1). This was the matter of the ***"Deliverables D2.2: A report by the Coordinator group on the comparison of the results of all countries on syllabuses and schoolbooks analysis".***

6. WP3 – <u>Teachers' and teachers-to-be' questionnaires:</u> Methodology, implementation and main achievements

The WP3 was divided in two tasks (Fig.1): *i)* implementation of questionnaires and first data analysis in each country; *ii)* pooling data together and carrying out multivariate analysis for comparison.

WP3-i) Implementation of questionnaires and data analysis in each country

Following the validation and improvement of preliminary questionnaires (constructed previously in WP1, during the project year 1), the definitive questionnaires were applied in similar conditions in all countries in order to get comparable data.

All the 17 participants (P10.UK and P19.Mozambique had already withdrawn the project), applied their questionnaires, after translation, to teachers and teachers-to-be in their country and data were collected in appropriate Excel files. These were sent to the P2 Participant for comparative analysis.

Most of the countries have analysed their own data with or without the collaboration of the Participant P2.France-Lyon, who was designated to employ a statistician to assist the whole consortium in these matters. Work is under way but a several Communications (Xx) and Publications (Xx) have already been produced (see Annex-1).The "***Deliverables D3.1 – A Report by each Participant on the analysis of teachers' and teachers-to-be' questionnaires, in each country"*** will be the matter of the final report of this project.

WP3-ii) Pooling data together and carrying out multivariate analysis for comparison

Data in Excel files from Participants have been sent to the Coordinator Group in order to pool data together and carry out statistical analysis at P2.France-Lyon team. The work is going on at the moment and results will be produced by the month 42: ***"Deliverable D3.2 – A Report by the Coordinator group on the comparison of the results of all countries on the analysis of teachers' and teachers-to-be' questionnaires.***

Analysis has been carried out with all questions and by amalgamating the questions per topic by using either all countries or groups of countries, according to the specific research hypothesis arisen. This is a matter of endless work, since from the obtained results further research hypothesis arise and it is always possible to go back to the database to proceed with new analysis.

7. WP4 – Synthesis of results: Methodology, implementation

The WP4 was divided in two tasks (Fig.1): *i)* elaboration of scientific papers; *ii)* elaboration of documents to be sent to national policy-makers and teachers.

WP4-i) Elaboration of scientific papers

We have presented a total of 128 communications and 122 papers that have been already published or submitted (Annex-1). Many others are being prepared to be submitted soon. A total of 40 PhD thesis and Master dissertations have been produced or are about to be submitted (Annex-1).

WP4-ii) Elaboration of documents to be sent to national policy-makers and teachers

Following the present Report, a more precise document will be produced soon with the recommendations concerning each and altogether participant countries.

The last ***"Deliverable D4 – Documents of research synthesis: - publications, or manuscripts ready for publication; documents to be sent to national policy-makers and to teachers; documents for teachers' training (initial training and in-service teachers' training); master and doctoral dissertations, either finished or in a final stage of writing"*** will be produced by the end of the project, month 42.

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By Graça S. Carvalho *– P1.Uminho, Portugal*

I. Health Education topic:

Objectives, methodologies, main achievements and implication

1. Health Education approaches in school textbooks of 16 countries

1.1. Abstract

Classically, health education has been based in the transmission of knowledge about diseases and how to prevent them. This biomedical model (BM) of health education is based in the pathologic (Pa), curative (Cu) and preventive (Pr) conceptions of health. In contrast, the health promotion (HP) approach of health education intends to improve health as opposed to the focus on disease by promoting healthy habits (He) and to develop empowerment (Ep) for healthy decision-making towards environmental (Ev) challenges. The aim of the study was to compare the emphases on either model (BM or HP) given by textbooks on the topic of Health Education of 16 countries. Each country team was asked to analyse the most used textbook for each school level. Text and image analysis of all countries allowed to identify France and Italy as the countries more associated to the biomedical model whereas Germany, Mozambique and Finland were the countries more linked the health promotion approach. Data organised in four pupils' age groups (6-9, 10-12, 13-15, 16-18 years old) showed that text and images of the same textbooks gave similar results in terms of BM and HP proportion, suggesting that the indicators used (Pa, Cu, Pr for BM; and He, Ep, Ev for HP) were consistent. Furthermore, although the analysis might be subjective (depending on the researcher), it was shown to be reliable since all countries that analysed the 4 age groups or 3 age groups showed a similar tendency to evolve from HP (early ages) to BM approach (elder ages). The interesting finding that the early pupils' age textbooks were more associated to the health promotion pole whereas the elder pupils' ages textbooks were in the biomedical model pole is a matter of further deep investigation.

1.2. Methodology

The corpus of this study was composed of a total of 71 textbooks of primary and secondary school on the topic Health Education analysed in 16 countries: Lebanon (14 textbooks), Italy (11), Morocco (7), Portugal (7), France (6), Germany (5), Hungary (5), Cyprus (3), Estonia (2), Lithuania (2), Malta (2), Mozambique (2), Senegal (2), Finland (1), Poland (1), Romania (1).

Out of several questions of the long grid, only the question concerning the "biomedical model *vs* health promotion approaches" was the matter of the present study. The grid question about text, titles and sub-titles was present in the grid as follows:

1.3. Results

The text related to biology and health education issues is most of the time neutral, *i.e.* it gives scientific information which has no connotation with either biomedical model or health promotion approach. However, in general, in each book it is possible to find expressions more associated to the biomedical model (BM) and other expressions more associated to the health promotion (HP) approach. The proportion between BM and HP gives the overall health education perspective of the textbook.

Similarly the images, including their captions, can be more associated to either approach, therefore the proportion between BM and HP contribute to give the health education perspective of the textbook.

Each country team had to analyse the most used textbook(s) for each school level. For the calculation of the biomedical model *vs* health promotion proportion per country two steps were carried out. At first, each textbook was analysed for the proportion BM vs HP; subsequently the mean of the proportion BM vs HP of all textbooks of each country was calculated. Figure 1 shows that the countries with higher percentage of the BM approach were Poland (100%), France (99%) and Malta (98%). In the opposite pole – HP approach – there were the textbooks from Germany (35% BM), Mozambique (42% BM), Morocco (49% BM) and Finland (50% BM).

Data were organised in four pupils' age groups: 6-9, 10-12, 13-15, 16-18 years old. Only Lebanon, Portugal and Morocco analysed textbooks at the four age groups and Italy, Hungary and Germany analysed textbooks within three of the four groups; the other countries analysed only two or one age level only (Fig.2). When examining the evolution in the BM/HP proportion from the youngest pupils' textbooks (age 6-9 years) up to the eldest ones (age 16-18 years old) it is possible to see that there is a general tendency for the increase of biomedical model approach with age. This evolution occurs not only in countries in the Biomedical pole (ex: Italy; see Fig.1 and Fig.2) as well as in countries in the health promotion pole (ex: Germany; see Fig.1 and Fig.2).

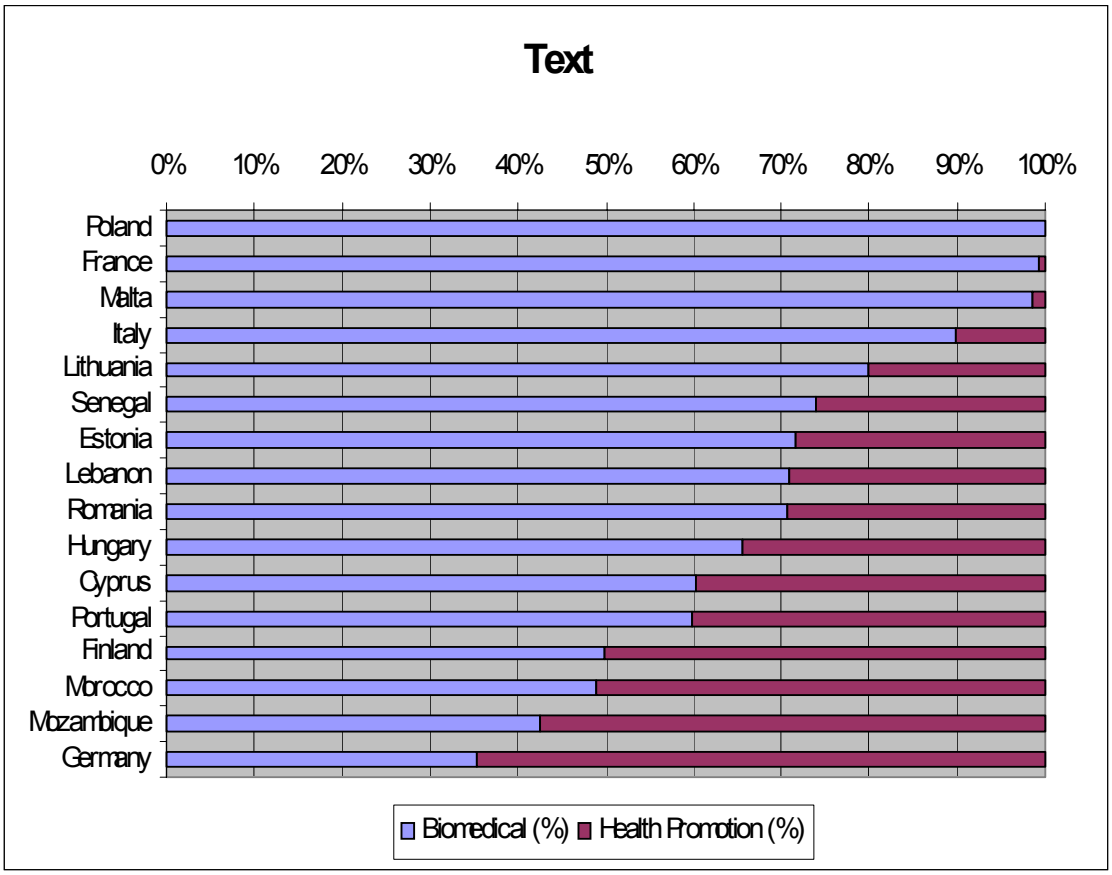

Fig. 1 – Percentage of BM and HP in text, in all countries.
Numbers represent BM percentages.

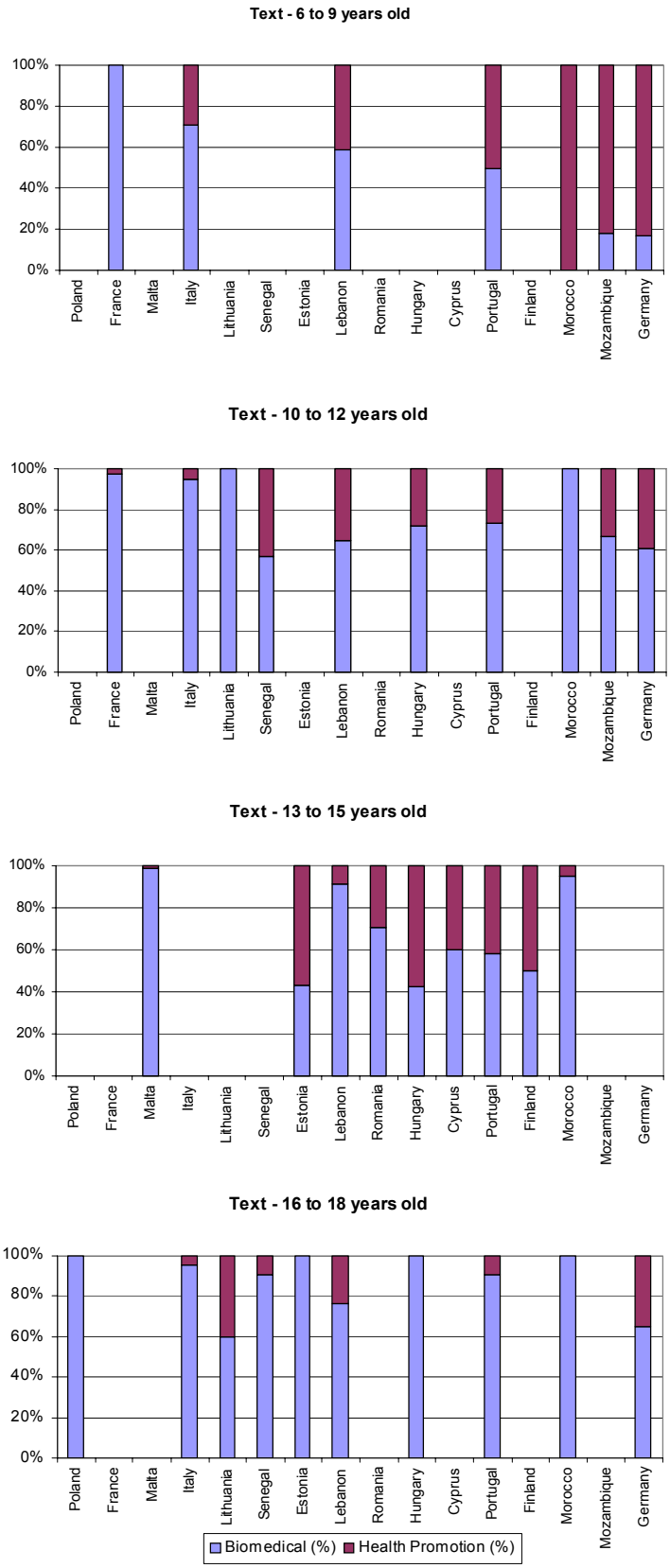

Fig. 2 – Percentage of BM and HP in text, in all countries per group age. Numbers represent BM percentages.

Like in the text, there are several images in textbooks that just give scientific information and that are not associated to either biomedical model or health promotion approaches, as it can be seen in Fig.3.

Fig. 3 – Neutral image, transmitting scientific knowledge only.
"Approximate energy requirement of an adult in different circumstances in Kj."
Eckerskorn et al. "Ikarus – Nature and techniques" F.X. Stratil (Germany); grade 5; 10/11 years-old pupils.

Biomedical model and health promotion approaches can also be interpreted from image analysis. When they transmit Pathologic (Pa), Curative (Cu) or Preventive (Pr) concepts (Fig.4; Fig.5A) they are included in the BM; when they transmit Healthy (He), the Empowerment (Ep) and the Environmental (Ev) concepts they are included in the HP approach (Fig.5B).

Fig.4. – Example of a Biomedical Model approach to health education.
"If you want to die, smoke. The cigarette kills every eight seconds, at global scale. In Portugal twenty persons die, per day, due to the tobacco abuse."
Peralta, C. R. & Calhau, M. B. (2004), Nós e a Vida. Porto Editora (Portugal); grade 6; 11/12 years-old pupils.

Figure 4 transmits explicitly the notion of the pathologic effects of smoking, leading to dead. It is clearly in the BM approach of health education. Figure 5 is an interesting picture of a Portuguese textbook (11/12 years old pupils) where on the left there is an image associated to

the BM with emphasis in the negative habit of smoking (*"prisoner of a unhealthy habit"*) and on the right there is an image associated to the HP approach where a healthy attitude is transmitted not only by the image itself but also by the caption that expresses explicitly: *"say yes to life, saying: I'm free, I don't smoke"*.

Fig. 5 – BM and HP images.
"Each person must make an option for one of the following pathways:
21: Being a ***prisoner of the smoking habit****, supporting all its consequences"*
22: ...or say yes to life, saying: ***I'm free, I don't smoke****"*
Peralta, C. R. & Calhau, M. B. (2004), Nós e a Vida. Porto Editora (Portugal); grade 6; 11/12 years-old pupils.

The analysis from all countries shows that images from Malta, France and Estonia are associated to the biomedical model pole, with percentages of 99%, 92% and 86%, respectively. In the opposite pole – the health promotion pole – are the following countries: Germany (25,8% BM); Mozambique (26,3% BM), Hungary (35% BM) and Finland (38%).

Like the text analysis (Fig.2) the image analysis by age groups shows that there is a general tendency to an evolution from the health promotion approach in the earlier pupils' ages towards a more biomedical model approach at higher pupils' ages. Again, as in the text analysis, this is very clear in countries at the BM pole (Italy), at the HP pole (Germany) or in between (Morocco, Portugal and Lebanon).

1.4. Discussion

The aim of the present study was to compare how health education in 16 countries is addressed as far as the biomedical model and the health promotion approach are concerned. In other words, it was intended to compare the emphasis given by each country to either approach, by analysing text and images of textbooks along the several school levels. The textbooks analysed in all countries were the current ones and, in the case of more than one published per school year were available, the most used one was selected for analysis.

It was possible to identify France and Italy as the countries in both cases (images and text) in the BM pole whereas Germany, Mozambique and Finland were in both cases associated to the health promotion approach.

Countries that analysed books at all 4 age groups (Lebanon, Portugal and Morocco) or 3 age groups (Italy, Hungary and Germany) showed that the earlier years textbooks were more associated to the health promotion approach and that with age they evolved to a more

biomedical model approach. These findings indicate that authors and publishers of all these countries have a similar perspective in terms that for earlier years the textbooks must be more devoted to pupils' good health and healthy habits whereas for elder ages the textbooks must give more emphasis to the knowledge transmission about diseases (Pathologic), treatments (Curative) and disease prevention (Preventive) in order to make young people aware of the unhealthy habits.

All countries were supposed to analyse textbooks from all school years where health education was taught, however some countries analysed only one or two textbooks of early or elder ages, creating difficulties in a global correct analysis. This turns to be highly relevant having in mind the finding that the way health education is presented to children and young people of these countries progresses from the health promotion approach (at early ages) to the biomedical model (at elder ages). For example, Mozambique was shown to be in the health promotion pole (just immediately after Germany, Fig.1) but only textbooks from primary school (10-12 years old) were analysed. If all school levels Mozambican textbooks present a similar progression with pupils' age from HP to BM it could be possible that in the overall analysis of all Mozambican textbooks both text and image analysis could be in total less HP and more BM. Further studies must be done to clarify this point.

In contrast to all the other textbooks analysed in this study, the French primary school textbooks (6-9 years old) were already 100% BM in both text and image analysis. At age 10-12 there was a little reduction to 98% in text and 69% in image analysis. Not only textbooks from the other age groups (13-15 and 16-18 years old) but also more French publishers must be analysed in order to confirm that the French textbooks are much more associated to the biomedical model than textbooks of the other countries of this study.

Text analysis and image analysis of textbooks gave similar results in terms of BM and HP proportion, showing that the indicators used (Pa, Cu, Pr for BM; and He, Ep, Ev for HP) were consistent. In addition, the present study showed that although the analysis may be subjective (depending on the researcher), it seems to be reliable since all countries that analysed the 4 age groups or 3 age groups showed a similar tendency to evolve from HP (early ages) to BM approach (elder ages).

The interesting finding that the early pupils' age textbooks were more associated to the health promotion pole whereas the elder pupils' ages textbooks were in the biomedical model pole is a matter of further deep investigation. This was a first study intending to compare the emphasis given to BM or to HP approaches in health education textbooks of several countries with different cultural and social contexts. Analysis of all school levels by all countries and analysis of more than one publisher (in countries where there are several publishers) is a matter of future studies to look deeper how health education is presented to pupils.

2. Conceptions of teachers and future teachers of 16 countries about Health Education

2.1. Abstract

School is an important setting for health education and health promotion, and it has been recognised that teachers' conceptions play a crucial role for the effective implementation of school health education. With the European FP6 Biohead-Citizen project on "Biology Health and Environmental education for better citizenship" we analysed the potential differences between several countries by associating teachers' and future teachers' conceptions to controlled parameters, such as level of training, religion, political view. A questionnaire was constructed during the first year of the project, and following a pilot test, the final questionnaire was applied to 6531 teachers and future teachers. We then used well-suited

statistical multivariate methods to investigate complex data featuring the conceptions of many individuals, according to many topics. We show that a prominent source of variation in teachers' conceptions is related to countries, and further suggest that there are differences in two kinds of conceptions: a) individual health responsibilities and abilities; b) social policies. Religion, academic level or training had also an impact in teachers' conceptions of health education. Another important feature is the gap between what teachers and future teachers say about their own health and what they say it should be taught in school. Results are then discussed.

2.2. Methodology

Six samples were collected in each of the 16 contributing countries: in-service (In) and pre-service (Pre) teachers of primary school (Ps) and of secondary schools (Ss) in biology (B) and national language (L).

The overall corpus includes 6531 responders. The number of responders in Europe were (from West to East): 350 from Portugal (PT), 154 from United Kingdom (UK), 732 from France (FR), 559 from Italy (IT), 198 from Malta (MT), 365 from Germany (GE), 311 from Poland (PL), 334 from Hungary (HU), 273 from Romania (RO), 316 from Lithuania (LI), 182 from Estonia (EE), 306 from Finland (FI) and 322 from Cyprus (CY). From African countries the following responders were obtained (West to East): 324 from Senegal (SN), 330 from Morocco (MA) and 753 from Tunisia (TN). From the Middle East country, Lebanon (LB), 722 responders were obtained.

We investigated 17 questions on Health Education (cf. annex): A55, A63, A67, A68, B1, B2, B6, B9, B12, B15, B16, B21, B22, B23, B25, B26, B27. All questions, except A55, A63, A67 and A68, were coded from 1 to 4, from "I agree" to "I disagree", in a Likert scale.

Similarly, we also analysed the following socio-political questions (cf. annex): A15, A29, A26, A34, A37, A42, A48, A51 and P6 to P11.
Multivariate analysis allows representing the most structuring components of variation in the individuals' answers.

2.3. Results and Discussion

2.3.1. *Health education conceptions in 16 countries: Biomedical model and Health promotion approach*

The northern countries Finland, Lithuania and Hungary as well as Cyprus (with strong British influence) are closer to the health promotion pole whereas Central Europe countries, namely Romania, France, Germany and Poland, as well as Tunisia (with strong French influence) are closer to the biomedical model perspective.

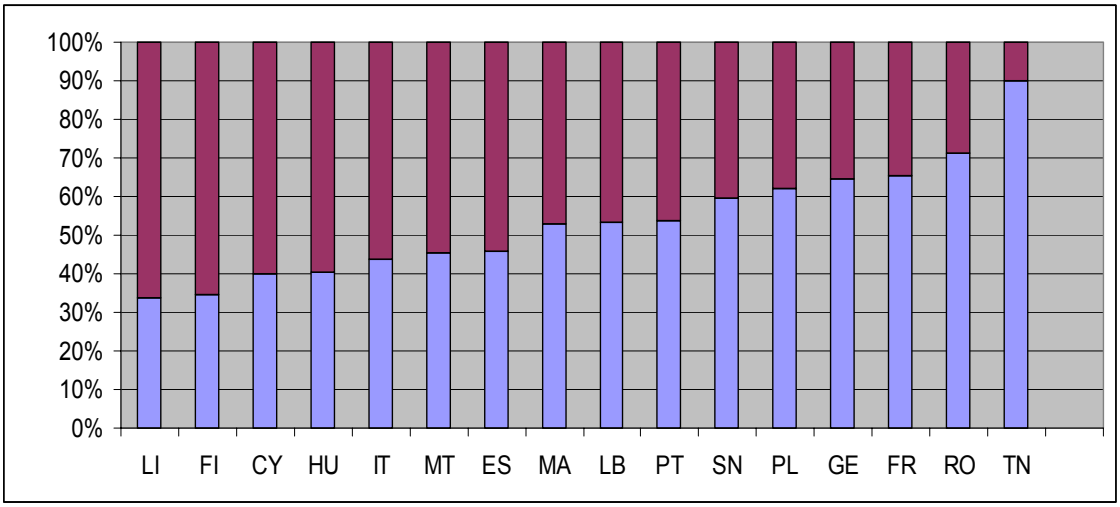

Figure 1. Percentage of BM (blue) and HP (pink) answers in the 16 countries. Numbers represent BM percentages.

In addition, the statistical analysis showed that the conceptions of Biomedical model (codes 0+1) and health promotion (codes 2+3) are more associated to the countries rather than to the responders' **religion** (question P13). However significant differences (X^2 = 149.3, df = 3, *p* value <2.2×10^{-16}) were also found, being the Christians closer to the health promotion pole than the Agnostics or the Muslims. The latter are more associated to the biomedical pole.

Significant differences (X^2 = 35.7, df = 4, *p* value = 3.246×10^{-07}) are also found in the **religious practice** (question P12), and results show that those that practice more their religion (codes 1+2) are closer to health promotion than those that do not practice it.

These results altogether indicate that the country effect is stronger than the religious effect as far as the biomedical model and health promotion conceptions are concerned: for instance Poland and Romania are Christian countries, but in the biomedical pole. In the Muslin countries, Tunisia in more biomedical than Morrocco. We also analysed how the conceptions on the Biomedical model and health promotion are associated to the **groups of teachers** (question P1): in-service (In) and pre-service (Pre) teachers, of primary school (Ps) and of secondary schools (Ss), in biology (B) and national language (L). There are statistical differences among the teachers' groups (X^2 = 55.5, df = 5, *p* value = 9.903×10^{-11}) and results show that the primary school teachers (Ps), both in-service (Ps-In) and pre-service (Ps-Pre), are more associated to the health promotion pole than all the secondary school (Ss) teachers: in-service Biology (Ss-In-B), in-service Language (Ss-in-L), pre-service Language (Ss-Pre-L) and pre-service Biology (Ss-Pre-B) teachers.

The effect of the **level of teachers' training** in both conceptions of the biomedical model and health promotion was also investigated (question P5). Since only a few responders were included in code 1 (secondary education), this was amalgamated with code 2 (university 1-2 years). Thus, for the analysis we have four groups (Fig.2): P5.1. "secondary education + university 1-2 years"; P5.2. "university 3-4 years"; P5.3. "university 5-6 years" and P5.4. "longer education". Significant differences were found among groups (X^2 = 60.5, df = 4, *p* value = 2.2×10^{-12}), and Figure 2 shows that the higher the level of university (or high school) training the closer teachers are of the Health promotion approach.

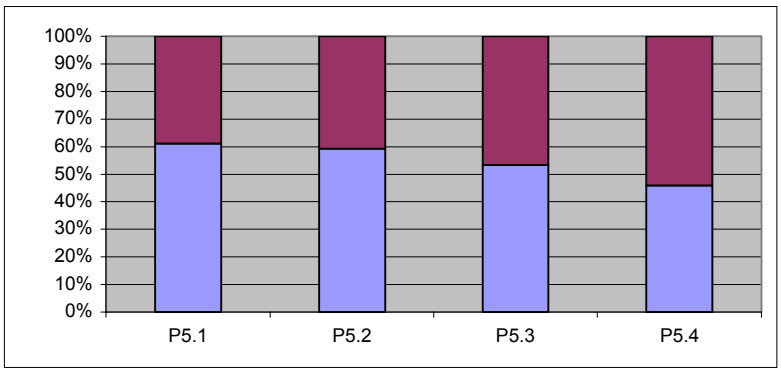

Figure 2. Percentage of BM (blue) and HP (pink) answers in each group of teachers' training level.
Numbers represent BM percentages.
P.5.1 - "secondary education + university 1-2 years";
P5.2. "university 3-4 years";
P5.3. "university 5-6 years";
P5.4. "longer education".

We further analysed the effect of the responders' **childhood environment**, *i.e*. where teachers and future teachers lived in their infancy: question P14. "Rural countryside", "Town, small city", "Centre of a large city" and "Suburbs of a large city"). No significant differences were found between groups (X^2 = 5.3, df = 3, p value = 0.148) indicating that the childhood environment is not relevant for the persons' perception about health education. This result reinforce the just above finding regarding the great importance of person's training to become more and more aware of the wide perspective of health education, i.e. towards health promotion perspective.

"**Autocratic/Democratic**" is another important axis in Health Education (Carvalho & Carvalho 2005). In the present work we asked if "Only a strong central power can put some order in my country" (question A42) to be correlated to the Biomedical model and health promotion conceptions. The differences are significant (X^2 = 25.9, df = 3, p value = 9.9×10^{-06}) and results show that those responders that are for a central power (codes 1+2) are closer to the Biomedical model rather than the health promotion approach. This is an interesting expected result since the Biomedical model is characterised by the leadership of the health professionals whereas person's empowerment underpins the health promotion approach (Jones & Naidoo, 1997; Katz and Peberdy 1997; Ewles & Simnett, 1999; Carvalho, 2002, 2006; Carvalho & Carvalho, 2006).

2.3.2. *Health education conceptions in 16 countries: Biomedical model and Health promotion approach*

Most of the Health Education questions were included in part B of the questionnaire. Only 12 countries applied both parts A and B of the questionnaire in a total of 5187 responders: Portugal (PT), France (FR), Italy (IT), Hungary (HU), Romania (RO), Estonia (EE), Finland (FI), Cyprus (CY), Senegal (SN), Morocco (MA), Tunisia (TN) and Lebanon (LB) (see "IV. Methodology" for the number of responders per country).

The analysis carried out in this section concerns 4 questions of the questionnaire A (A55, A63, A67, A68) and 13 questions of the questionnaire B (B1, B2, B6, B9, B12, B15, B16, B21, B22, B23, B25, B26, B27) making a total of 17 questions, which were applied to 5187 individuals of the above 12 countries. Similarly, we also analysed the following socio-political questions: A15, A29, A26, A34, A37, A42, A48, A51 and P6 to P11.

Figure 3 represents the between analysis on countries, where it is possible to see that axis F1 is strongly structured by the questions (by deceasing importance):

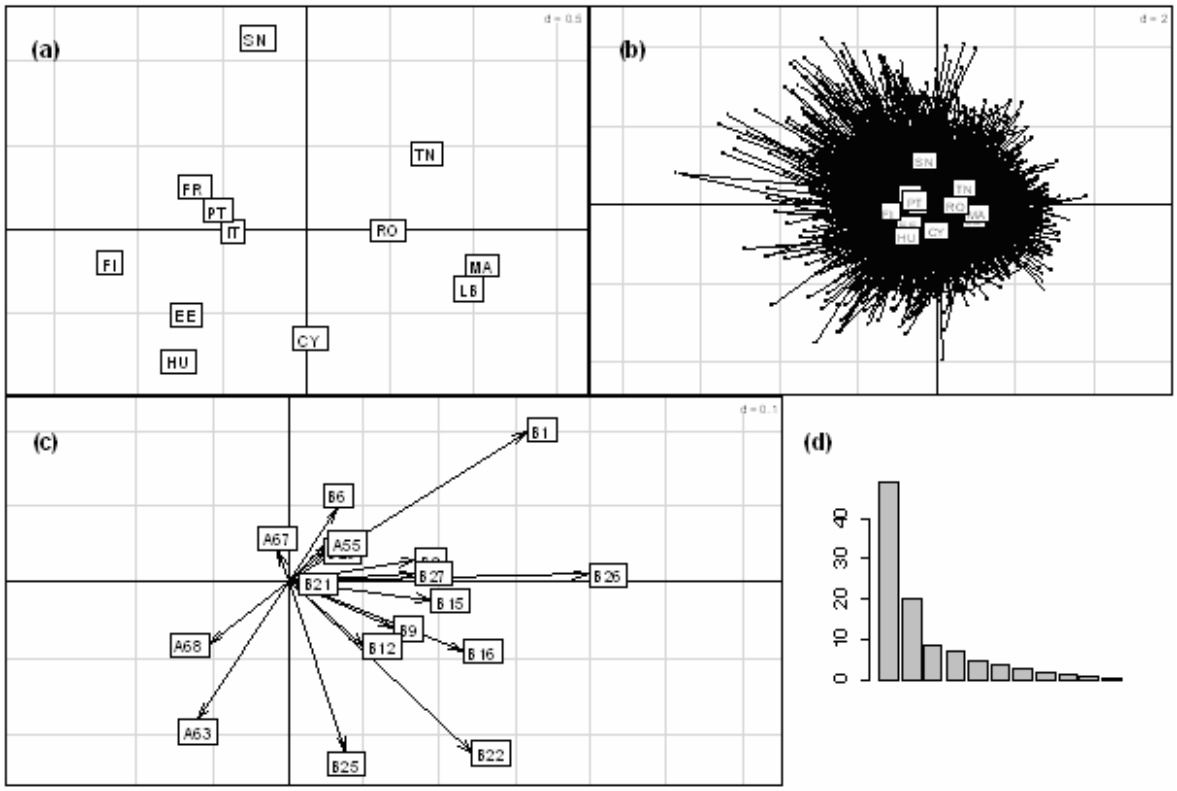

Figure 3. Between analysis applied to *Countries.*

(a) and **(b)** show the position of the gravity centre of each country on the F1-F2 axis.

In **(b),** each point is a person, linked to the gravity centre his/her country. An ellipse is surrounding the 2/3 persons of each country. The name of countries may be sometimes hidden, but it can be read on **(a)** which shows the same information but enlarged.

(c) Answers to questions are represented by vectors, where the arrow corresponds to "I agree" for the Likert scale (see "IV. Methodology"). The arrow position indicates the contribution of this question to each axis, by vector projection on either axis.

(d) Histogram of the eigenvalues, expressed as percentage of the variance of successive components. The two major components constitute the two axes of charts (a), (b) and (c).

B26: *"Health education at school mainly involves developing the personal skills of pupils such as self esteem or stress management";*

B1: *"Health Education at school improves pupil behaviour";*

B22: *"Teachers should not be obliged to teach health education if they do not feel confident";*

B16: *"I should use olive oil more often in my food"*

Questions B26, B1 and B22 are related to school health education aims, which characterises the F1 axis.

The axis F2 is structured not only by the above B1 and B22, but also by the questions:

B25: *"I should eat more fresh vegetables".*

A63: *"Health can be seen in several perspectives"* (see Annex).

Charters (a) and (b) of Figure 3 show that Finland, Estonia and Hungary (and, in a lower degree, France Portugal and Italy) responders are not associated to the idea that school health education should provide pupils' personal skills (B26) or improve pupils' behaviour (B1). In

contrast, the non-European responders from Morocco, Lebanon and Tunisia (and, in a lower degree, Romania) are in favour of developing these pupils' skills.

The analysis of the responders' distribution concerning their religion (Figure 4) shows that it is again question B26, B1 and, at lower extent, question A63, which structure the axis F1. The second axis, F2, is less important.

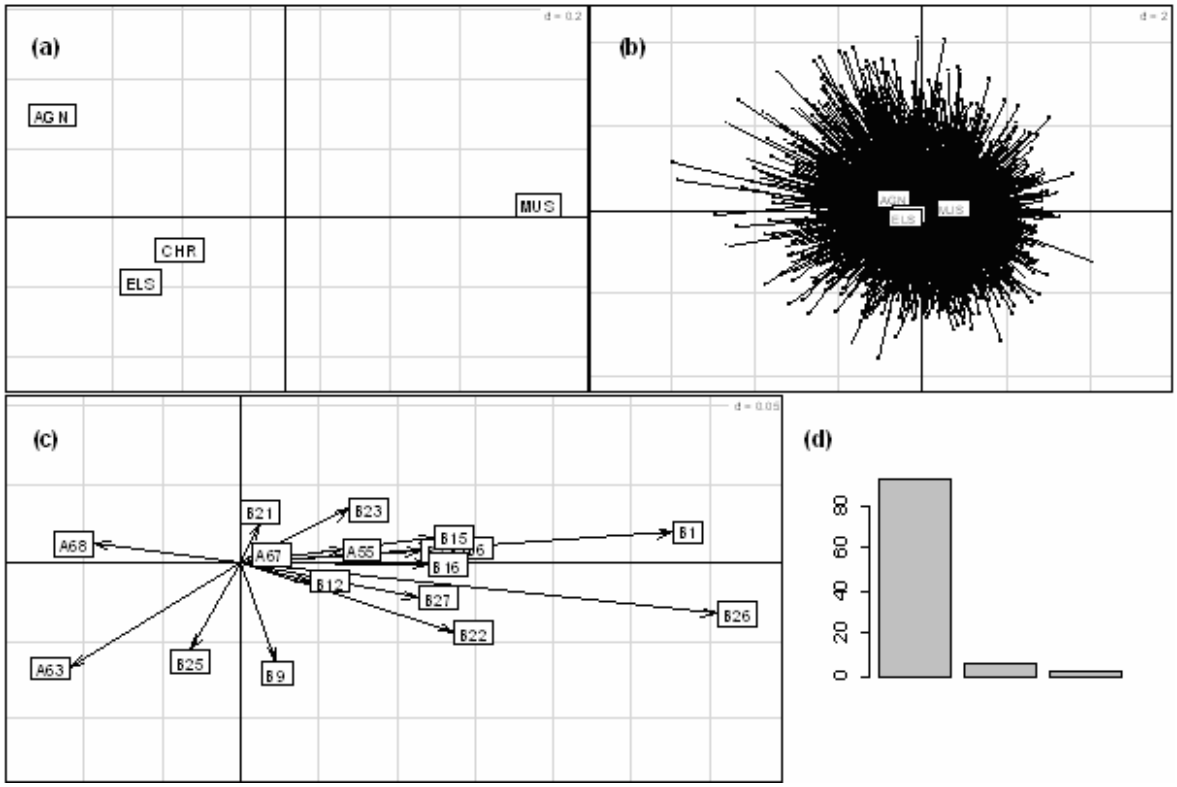

Figure 4. Between analysis applied to *Religions.*

AGN = Agnostic, CHR = Christians, MUS = Muslims, ELS = Others / no answer.

For further information see legend to Figure 3.

Comparing charts (a) and (b) of both Figure 3 (Countries) and Figure 4 (Religions), it is possible to see, through the axis F1, that the distribution of the agnostic, Christians and others (Figure 4) are located close to the European countries whereas the Muslims are closer to non-European countries (Morroco, Lebanon and Tunisia).

The distribution of countries obtained with the Religion effect (Figure 3) or without it (Figure 5) is somehow similar, although showing some differences. In both Figures 3 and 5, Finland, Estonia and Hungary are opposite to the other countries (axis F2, mainly due to questions B1 and A63). However, without religion (Figure 5), a new opposition is emerging through the axis F1 as compared to Figure 3: Cyprus joins the other Mediterranean countries (Lebanon, Morocco); Tunis joins the Latin countries (Portugal, Italy, France) and Romania (central Europe) is contrasting with Senegal (Western Africa). The latter is mainly due to question B22 where Senegal is against "Teachers should not be obliged to teach health education if they do not feel confident" as well as against the idea of needing to eat more fresh vegetables (B25) and olive oil (B16).

These results are in agreement with the above analysis (item 5.1) where we noticed that the effect of Countries on health education questions was stronger than the one of Religions.

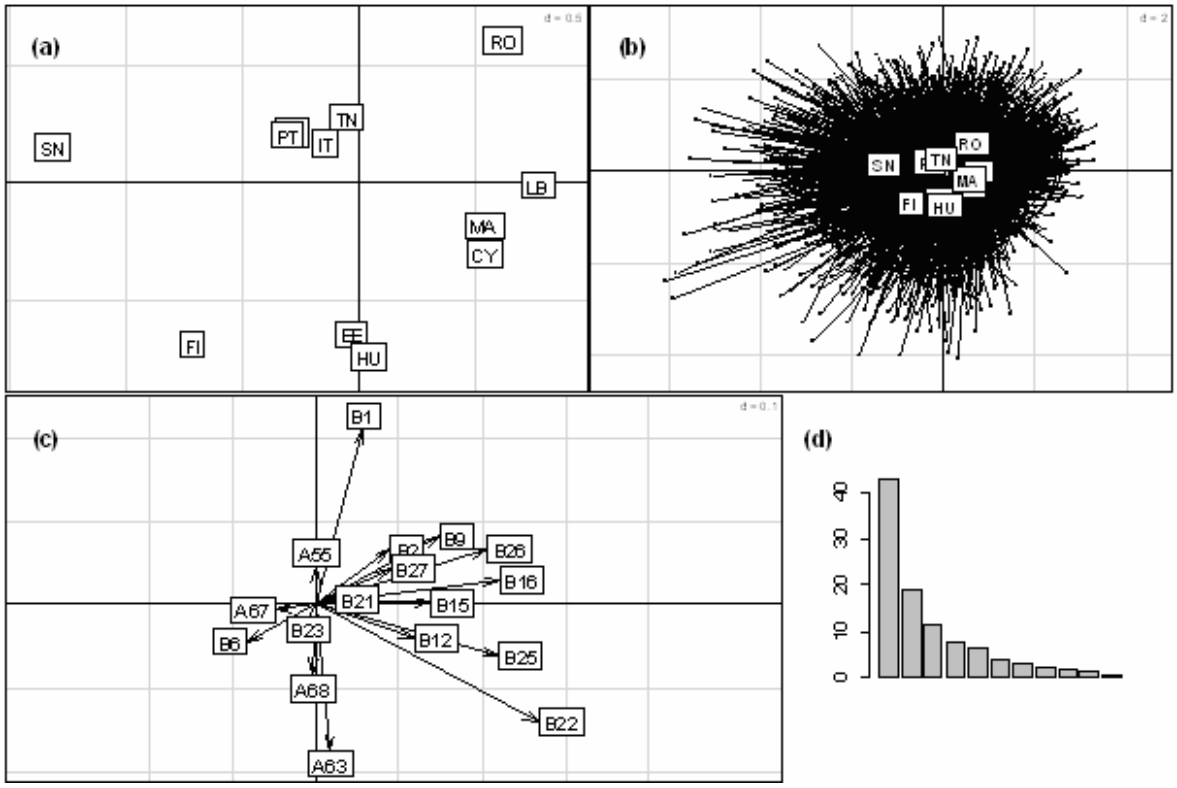

Figure 5. Between analysis applied to *Countries* after suppression of the effect of the variable religion by orthogonal PCAIV.

For further information see legend to Figure 3.

Figure 6 represents the between analysis on groups of teachers, where it is possible to see that axis F1 is strongly structured by the following 4 questions, two related to implementing health education and the other two concerning healthy food:

B22: *"Teachers should not be obliged to teach health education if they do not feel confident"*;

B09: *"I would like to eat less meat";*

B27: *"It is exclusively the family's responsibility to deal with health education"*;

B06: *"It would be good to put more fat in my food"*.

The F2 axis is structured by the following questions, one associated to policies and the other with the role of health education:

B23: *"Schools have to take into account public health policies"*;

B01: *"Health Education at school improves pupil behaviour"*.

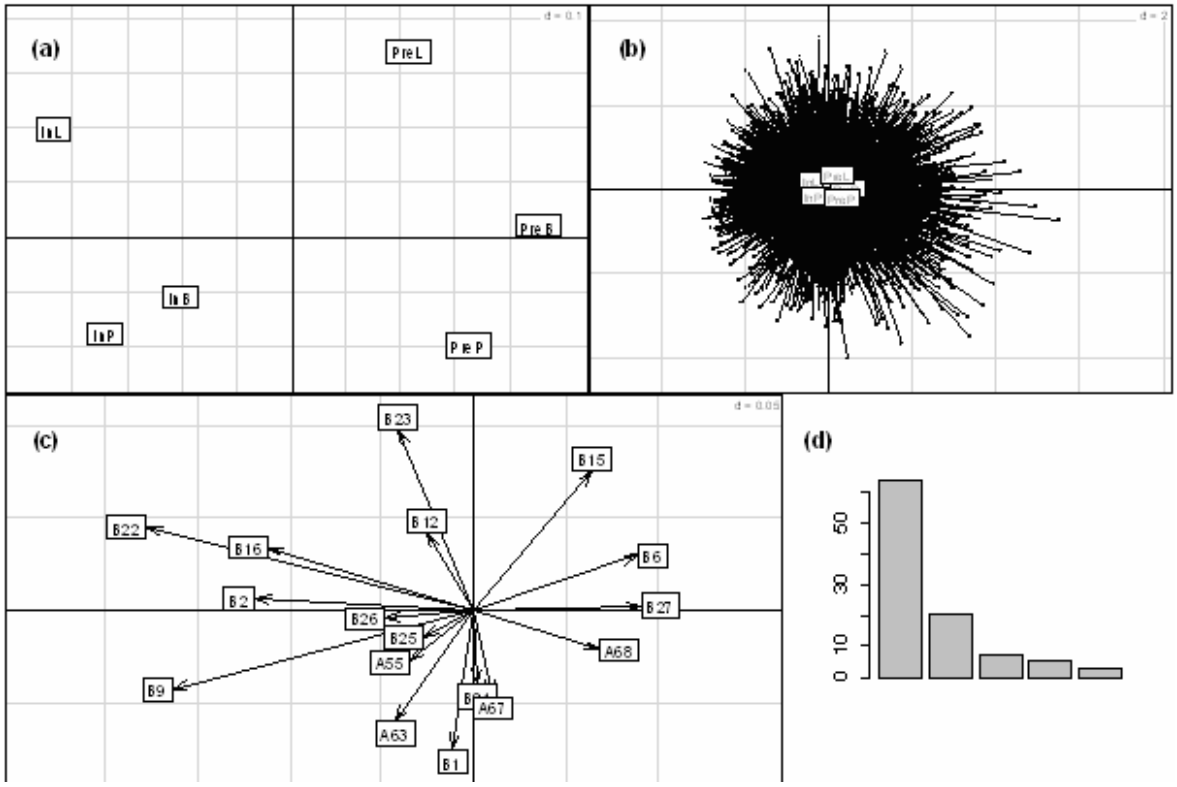

Figure 6. Between analysis applied to *Groups of teachers.*

InP = In-service Primary school teachers;
InB = In-service Biology teachers;
InL = In-service Language teachers;
PreP = Pre-service Primary school teachers;
PreB = Pre-service Biology teachers;
Pre-L = Pre-service Language teachers.
For further information see legend to Figure 3.

All the in-service teachers of Primary school (InP), of Biology (InB) and of Language (InL) are clearly separated, along the Axis F1, from all pre-service teachers of Primary school, Biology and Language, respectively PreP, PreB and PreL. The results show that pre-teachers think that health education should be taught at school, not only by the families, and that teachers should be obliged to teach it even if they do not feel confident in doing it. In contrast, teachers with teaching experience are more defensive in this respect, assuming exactly the opposite.

Comparing to Biology (PreB and InB) and Primary school teachers (PreP and InP), both language pre-service teachers and in-service teachers (PreL and InL) are more in favour that schools take into account public health policies (B23) and they do not believe that Health Education improves pupils' behaviour (B1).

The co-inertia analysis (Figure 7) allows maximizing the correlations between differences in health education conceptions and the differences on political views. This correlation is maximal at the axis F1 (Figure 7-c). The main questions that structure this axis F1 are again (chart (a) of Figure 7):

B26: *"Health education at school mainly involves developing the personal skills of pupils such as self esteem or stress management";*

B01: *"Health Education at school improves pupil behaviour"*;

And also:

A63: *"Health can be seen in several perspectives:…".* (See Annex).

A68: *"If possible, we should walk more instead of using cars because…"*. (See Annex).

The chart (b) of this Figure 7 shows that this axis corresponds to the following political positions:

A34: *"The government must make laws favouring the creation of firms to stimulate our economy";*

A42: *"Only a strong central power can put some order in my country"*.

And also:

A51: *"Science and religion should be separated"*.

A37: *"Religion and politics should be separated"*.

In contrast, the questions concerning teachers' involvement in environmental protection activities (P6, P7, P8) have little influence in structuring this axis F1, indicating that their practices in such activities is not associated to theirs health education and political perspectives.

The critical questions concerning Health Education in school (Fig.7-a), especially improving pupils' personal skills and self-esteem (B26) and improving pupils' behaviour (B1) correspond to an equivalent political point of view (Fig.7-c) of creating firms to stimulate the economy (A34) and a strong central power to put order in the country (A42). On the other hand, both questions related to health promotion (A63, A68) can be correlated to both political perspectives of separation between science and religion (A51) and separation between religion and politics (A37).

In other words, the teachers' views about improving pupils' personal skills (B26, B1) being correlated to their views about a strong central power promoting enterprises setting up to develop the country economy (A42, A34) suggests that teachers' Health Education perspective seeks for promoting individual empowerment for both self-development and economy development.

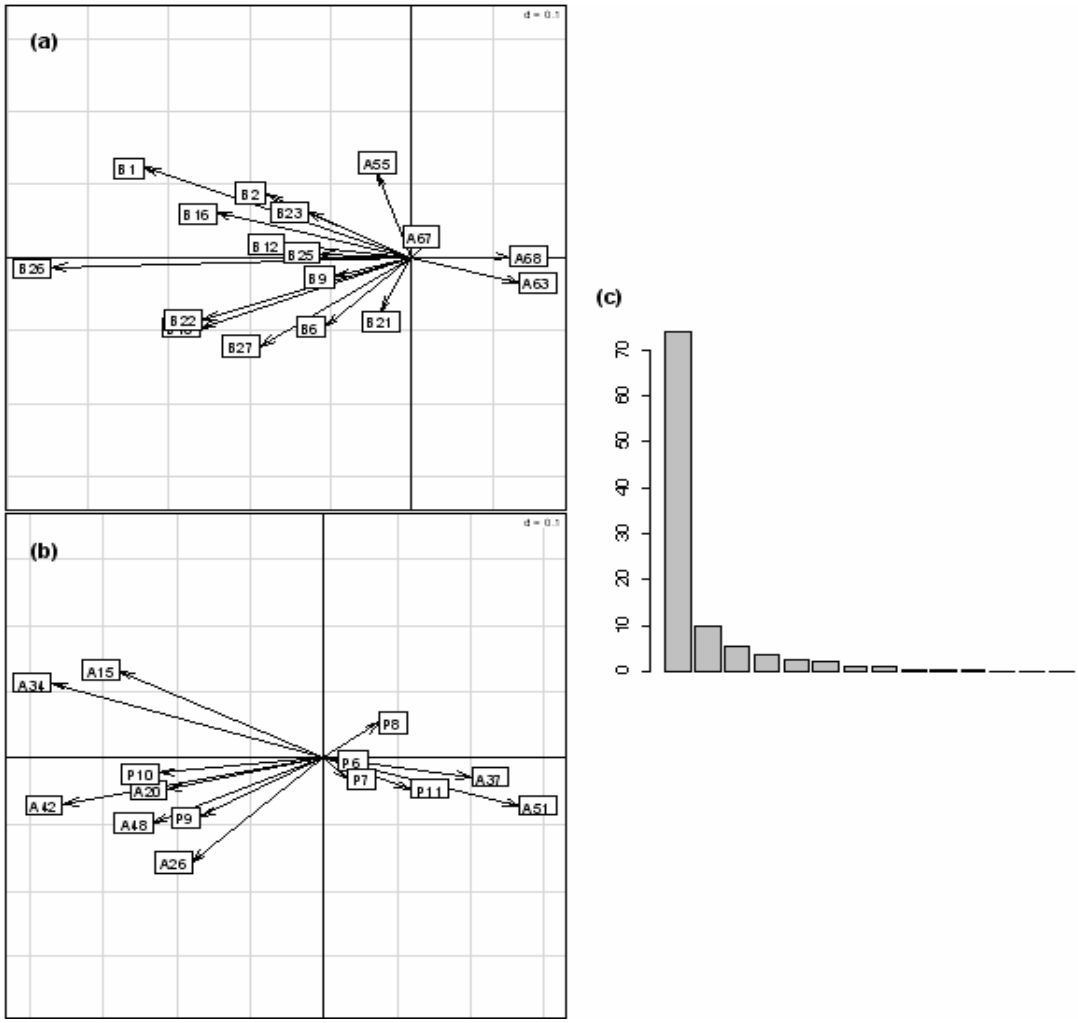

Figure 7. Co-inertia analysis applied to *Health education variables* (a) and to *Political variables* (b).

3. Conclusions of Health Education studies and Implications for the future

The fact that the primary school teachers are closer to the health promotion pole than the secondary school teachers is a very interesting finding as it is in agreement with the results on textbooks analysis showing that, likewise, primary school textbooks of the 16 countries are more linked to the health promotion concept than the secondary school textbooks. In fact, those results have examined the BM/HP proportion, in both text and the images, from the youngest pupils' textbooks (age 6-9 years) up to the eldest ones (age 16-18 years), showing a general tendency towards an increase of Biomedical Model. This has been observed not only in countries more associated to the Biomedical pole but also in countries at the Health Promotion pole.

Authors and publishers of all these countries seem to have a similar perspective in terms that for earlier years the textbooks must be more devoted to pupils' good health and healthy habits whereas for older ages the textbooks must give more emphasis to the transmission of knowledge about diseases (Pathologic), treatments (Curative) and disease prevention (Preventive) in order to make young people aware of unhealthy habits. Similarly, teachers' conceptions gathered in the present study indicate that not only the authors and publishers but also teachers and future teachers see health promotion as a perspective for health education more appropriate in primary school than in secondary school.

In the great majority of the countries, the primary school teacher is a generalist in terms that he/she is responsible for teaching all subjects and he/she is all the day with the same class children, looking after them in both learning and health caring perspectives. This holistic view about children and children's growth is rather close to the health promotion approach, contrasting to the intense knowledge teaching required in secondary school, which is strongly based in the biomedical model.

The emphasis in the Health promotion perspective, rather than in the Biomedical model, is a matter that should be taken into account in the countries national programmes/syllabuses as well as in teachers' training. In fact this study has shown that higher level of teachers' training contributes to make them to look at health education in a wider perspective rather than in the narrow view of the biomedical model, as previously found in other different studies (Jones & Naidoo, 1997; Katz and Peberdy 1997; Ewles & Simnett, 1999; Carvalho, 2006; Carvalho & Carvalho, 2006).

In contrast to Northern European countries, teachers from non-European countries were shown to be in favour that school health education should provide pupils' personal skills and improve pupils' behaviour. At first sight, these are unexpected findings since several data have shown that the European countries, in particular the northern countries (Finland, Hungary, Estonia), have a traditional closer approach to health promotion, where the pupils' personal skills are being developed. Therefore the present results deserve a further investigation to understand if these teachers' answers are associated to what it is really carried out in their country schools or, alternatively, it is what they think it should be done in contrast to what actually is being implemented in schools. This is to say that the responders of European countries (especially the northern ones) would like to see health education to include more biomedical information whereas the non-European responders would like to see more implementation of pupils' personal skills. This is a matter of further investigation.

The present study also showed that the Country effect is stronger than the Religion effect on Health Education teachers' conceptions. In contrast, the Religious effect has shown to be much stronger than the Country effect in similar Sex Education studies (Berger et al., 2007), indicating that the values associated to Religion have more influence in Sex Education views

rather than in Health Education. Therefore, it seems that the socio-political history of the Country may play a major role in teachers' conceptions about Health Education. Better clarification of the socio-cultural and political factors influencing the teachers' conceptions about Health Education and Sex Education are the matter of on going analysis.

In brief, the Recommendations/Implications for the future on the topic of Health education can be summarized as follows:

- Give more emphasis in textbooks to the **Health Promotion approach**, particularly at the higher levels of secondary school, in order to contribute:
  - to encourage pupils' healthy habits and healthy lifestyle;
  - to empower pupils' in decision making for healthy choices;
  - to improve pupils' self-esteem and stress management;
  - to develop pupils' personal and social skills.
- Take examples of some countries "**good practices**" such as:
  - some teaching modules as "home economics" and "physical education"
  - corresponding textbooks.
- In some countries arose an explicit need for c**reating their own textbooks**, instead of using those from more developed countries, as the social contexts (including values and practices) are rather different.
- **Partnership** between schools and local health services and associations (NGOs and others) must be put in practice.
- **Teachers' training** should take all the above issues into consideration.

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II. Sex Education topic:

Objectives, methodologies, main achievements and implications

1. Sex Education approaches in school textbooks of 16 countries

1.1. Abstract

We present a comparative analysis on the topic "Human Reproduction and Sex Education" of textbooks from 16 countries by using the same specific grid of analysis. The focus is on two sub-topics associated to pupils' development of responsible behaviour: the control of reproduction (e.g. choice of contraception) and the Sexually Transmitted Infections (STIs). Acquired Immune Deficiency Syndrome (AIDS) is presented in all analysed textbooks, although in different chapters: in Human Procreation (the control of the reproduction, the hygiene of reproduction or directly in chapters devoted to STIs and AIDS), in Immunology (with AIDS as example of immune deficiency) and Body Protection. Some countries, but not all, give also information about other STIs. Lower differences among countries were found than what was expected, but significant interactions between scientific knowledge (K) and values (V) could be found. Our results showed that (i) most of the analysed biology textbooks are still anchored in the biomedical model, giving a lot of scientific knowledge and disregarding the promotion of competences for healthy sex behaviour, but (ii) some of them in addition to transmit scientific knowledge of the reproductive system are today developing health promotion and sex education in their broad sense.

1.2. Methodology

Didactics of a discipline is classically focused on what must be taught and learnt in this discipline. A didactic analysis of textbooks is therefore involved in textbooks contents and pedagogical approaches, and has also to take into account their explicit or implicit messages. A contrastive method is particularly heuristic to study textbooks. It includes two stage analyses: at first the comparison of several textbooks, then the connection between the observed results and each textbook context, particularly socio-cultural context. In the framework of the Biohead-Citizen project we decided to focus primarily on the analysis of current textbooks of several countries and when possible on several textbooks treating the same content in the same country (different publishers, although in some countries only one publisher exists).

In this work 47 textbooks of 16 different countries were analysed. They are listed just after the bibliography. Four countries are outside Europe where the sex education is often a serious question: three Muslin countries (Tunisia, Morocco and Senegal) and one multi-confessional (Lebanon). The twelve other countries are in different parts of Europe: North and South, West and East, having with different cultures and religions (mainly Christian: catholic, protestant and/or orthodox).

1.3. Results

Depending on the countries, **STIs** are treated (Figure 1) in the part of textbook devoted either to Human Procreation (in the chapters about the control of the reproduction, the hygiene of reproduction or directly in chapters devoted to STIs and AIDS), or to Immunology (with AIDS in particular) and Body Protection. The present designation used nowadays by WHO (2003) STI (Sexually Transmitted Infections) is used in only 11 current textbooks in seven

countries (Italy, Cyprus, Estonia, Lebanon, Hungary, Lithuania, Morocco & Finland). In contrast, the classical designation STD (Sexually Transmitted Diseases) is used in all others textbooks.

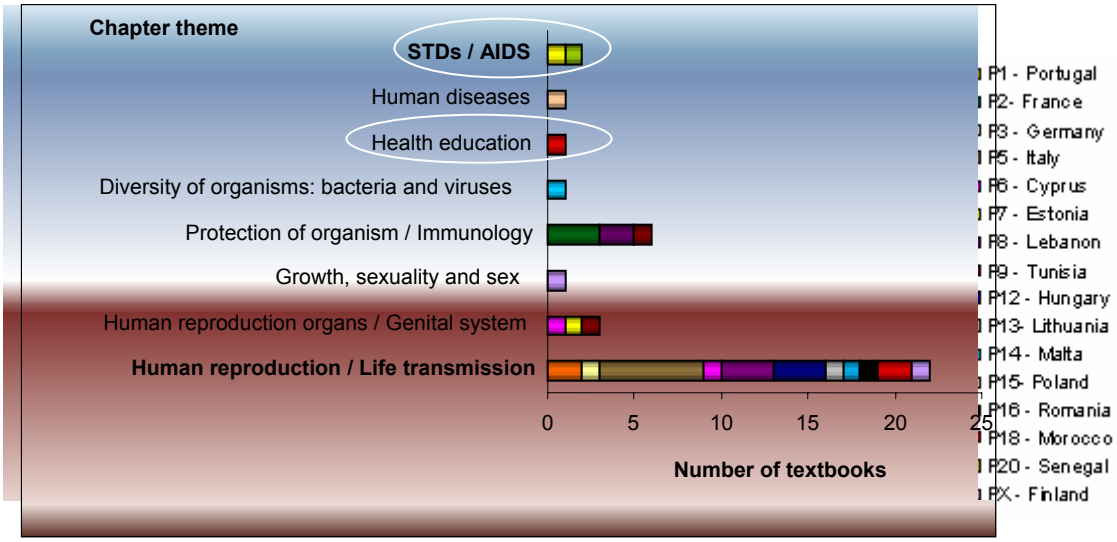


Figure 1 - Chapters dealing with STIs in textbooks.

Of the 47 textbooks, only 20 have a sub-part of a chapter dedicated to STIs or AIDS infection and in only two (Senegalese & Estonian) there is a specific chapter for STIs.
We initially postulated to find some information about STIs in chapters dealing with health education or perhaps with sex education. In fact we just found one Moroccan textbook which include STIs in the Health Education chapter whereas two textbooks (one from Estonian and another from Finland) are totally devoted to Health Education, not specifically to Biology.
We found divergences in the way the STIs issue is treated not only inter-countries but also intra-countries, i.e. between publishers. For example in Lebanon, for the same level (textbooks for 12-13 years old students) the topic in one publisher is included in the chapter Human transmission of life and in another publisher in Immunology. The latter publisher decided to treat STIs in the Immunology chapter whereas in the syllabus it was included in Human reproduction chapter.

For the prevention of STIs, some textbooks (Figure 4) use injunctive or persuasive educational style: for instance a Moroccan textbook (Natural sciences, Ifriquia Charq, 1996, pp.160) says: *'Avoid illegal sexual intercourse, use the condom, take medical controls...'*. Additionally the same textbook insists on the hygiene of the sexual organs *'Maintain your body clean especially the sexual organs by washing them with water and soap before and after each sexual relation'*. A Moroccan and a Tunisian textbook highlight the hygiene practices. In ten countries we noted both injunctive and/or persuasive styles.
In contrast, the participative educational style is almost absent whereas it might be more efficient for developing students' competencies towards health risk behaviours. Education on STIs should also support positive attitudes as we can find in an Estonian textbook and in a Maltese one:

- → *'Every person has a right to enjoy sexual life without unwanted consequences'* (Tervisekasvatus põkikoolile, Avita, Estonia, 1998, pp. 111).
- → *'With reliable methods of contraception available you might think that it's all right to have intercourse as young as you like, as often as you like and with as many people as you like. But that way you would run risks, both physical and mental, and may cause harm and distress to others. It is not always easy to cope with one's sexual feelings or to understand those of other people but parents, teachers and doctors are usually ready to help.'* (Biology for life, M.B.V. Roberts, UK edition, Malta, 1986, pp.356).

We observed what STIs are presented and how in textbooks for two ranges of age: 11/15 and 15/19 years old (Figure 2). The most common STIs estimated by WHO are found in the textual contents of earlier textbooks (for 11/15 years old students). Information about STIs are presented in the 32 textbooks analysed, some countries gave more scientific information about different kinds of STIs (France, Senegal, Finland) than others (Portugal, Germany, Tunisia). They all treat AIDS by explanation of the Human Immunodeficiency Virus (HIV).

STIs / Country	AIDS	Syphilis	Gonorrhea	Genital Herpes	Viral Hepatitis	Vaginitis	Chlamydia	Genital Warts	Chancroid	Others
P1-Portugal (3)	●●○			●	●●					
P2-France (4)	●●●	●	●	●	●	●	●	●	●	
P3-Germany (1)	●	●	●							
P5-Italy (6)	●○○○	●●●○○○	●●●○○○	○	○○	●	○			
P6-Cyprus (2)	●	●	●	●	●					
P7-Estonia (3)	●	●○○○	●	●			●	●		
P8-Lebanon (6)	●●○○○○○	●●	●○○○	●○○○		○	●○			
P9-Tunisia (2)	●○	●	●							
P12-Hungary (3)	●●○	●●○	●○	●	○	●●○		○		
P13-Lithuania (1)	○	○	○	○	○	○	○	○		
P14-Malta (2)	●○	●○	●○	●○	●○	○	○			
P15-Poland (1)	○									
P16-Romania (1)	●	●	●			●		●		
P18-Morocco (3)	●●○	●○	●○		●○					
P20-Senegal (1)	●	●	●	●	●	●	●	●	●	●
PX-Finland (2)	●●	●	●●	●●		●	●●	●●	●	
∑	36 (21/15)	27 (17/10)	26 (16/10)	16 (10/6)	13 (7/6)	11 (7/4)	10 (6/4)	8 (6/2)	3	1

( ) Number of analysed textbooks
● Textbooks for 11/15 years old students. ○ Textbooks for 15/19 years old students.

Figure 2 - Different STIs found in the analysed textbooks (included AIDS).

After AIDS, Syphilis and Gonorrhoea are also well represented in textbooks. Regardless to AIDS, few textbooks give data about the incidence of STIs correlated to the most common STIs of the country. For instance, in a French textbook, one image (Figure 6) illustrates the incidence of each STIs but in the entire world, not specifically for France. Vaginitis caused by *Trichomonas* (Figure 3) appears at the first position whereas AIDS appears at the last one, giving the idea that AIDS ("SIDA") is the less important one, as it is referenced in quantitative terms and not regarding the severe prognostic of the disease, which is more important in Public Health, therefore in Sex Education.

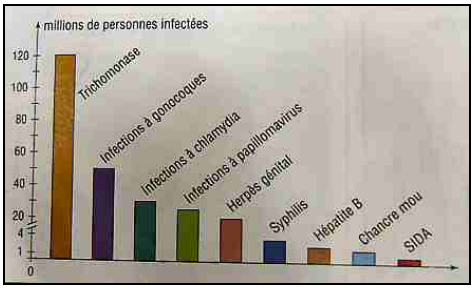


Figure 3 - Sciences de la Vie et de la Terre, Bordas, **France**, 2001, pp. 70.

It is interesting to see that for the choice of the quoted STIs there is also a very great variation intra-country among publishers for the same school level, this for France, Italy, Lebanon and Hungary (Figure 4). For example one Hungarian textbook for 12-13 years old students present five STIs whereas another publisher for the same school level present three STIs.

Country	Publisher	School Level (Years old)	STIs cited in analysed textbooks						
			AIDS	Syphilis	Gonorrhea	Genital Herpes	Viral Hepatitis	Vaginitis	Chlamydia
P5-Itlay	Zanichelli	14-18	●	●	●				
	Edizioni Scolastiche	14-18	●	●	●	●	●		●
	Loescher	14-18	●	●	●		●		
P12-Hungary	Dr. Molnár Katalin	12-13	●	●				●	
	Nagymihály Mátyás	12-13	●	●	●	●		●	

Figure 4 – STIs cited by different publishers of the same country: example for Italy and Hungary.

Focusing on the number of occurrences devoted to images of STIs in textbooks (Figure 5), AIDS (with a lot of images presenting HIV) appears as the first one.

STIs / Country	HIV	AIDS	Syphilis	Gonorrhea	Chlamydia	Genital Herpes	Genital Warts	Viral Hepatitis	Vaginitis	Chancroid	∑
P1-Portugal (3)		1				2		1			4
P2- France (4)	17	4									21
P3 – Germany (1)			1	1							2
P5 – Italy (6)		1	1	1							3
P6 – Cyprus (2)	1	1									2
P7 - Estonia (3)											0
P8 – Lebanon (6)	5	1	1								7
P9 – Tunisia (2)	9	8	6	1							24
P12 – Hungary (3)	2		1		1				1		5
P13- Lithuania (1)											0
P14 – Malta (2)			2	1	1						4
P15- Poland (1)											0
P16 – Romania (1)	2		1				1				4
P18 – Morocco (3)	7	18	4	2				1			32
P20 – Senegal (1)			3	2	1						6
PX – Finland (2)	2		1	1	2	1	2				9
∑	45	34	21	9	5	3	3	2	1	0	

( ) Number of analysed textbooks

Figure 5 - Number of occurrences of images devoted to STIs included AIDS/HIV images in the 47 analysed textbooks.

In one textbook of Senegal and another from France a complete list of STIs is presented, giving only scientific knowledge, anchored in the biomedical model with no or little connection with health promotion.

When **condoms** are mentioned in textbooks as means of contraception, we analysed both images (male or female condom) and how textbooks refer to the way of using condoms: rolled or unrolled condoms? Man's condom unrolled in erected penis? Woman's condom inside the vagina?

We found that 28 textbooks illustrate the male condom through an image of a rolled condom, however only 5 textbooks illustrate a condom in an erected penis or inside the vagina.

By comparison to the male condom, only 5 textbooks referred to woman's condom in text, and two textbooks in images (Portuguese & Estonian books). Only in an Estonian textbook

we could find a description of the mechanism of using the female condom, its advantages in STIs protection as well as how to get it.

Moreover several textbooks (Lebanon, Senegal) make confusion between diaphragm and women condom. For instance a Senegalese textbook (Géologie- Biologie, Nathan, 1996, pp.168) says: *'The female condom or diaphragm'* and a Lebanon one (Life sciences, Le Pointier, 1999, pp.25) says: '*Use of male condom: the male condom is considered as the best way to protect against STDs… The diaphragm is considered the female equivalent of male condom*.' Nevertheless both textbooks do not specify that the diaphragm does not protect against STIs.

1.4. Discussion

From our study it is not possible to estimate whether the STIs most present in textbooks are or are not associated to the level of incidence or prevalence of the respective diseases in each country (or geographical area). In fact when textbooks referred to STIs they refer them for the entire world. Apparently textbook contents dealing with STIs is not gathered within the epidemiological context of the country, except in a Finnish textbook for Chlamydia: *It is the most common sexually transmitted disease in Finland nowadays.*'(Terveydeski 1-3, Terveystietoa luokille 7-9, M.Kujala & T. Lehtonen, Werner Söderström Osakeyhtiö, Finland, 2005, pp. 75).

We observed differences between countries and within the same country on the choice of cited STIs. If for example the Senegalese textbook gives a complete list of STIs, contents occlude their incidence, even if STIs are treated in a whole chapter of this biology textbook. What are the most common STIs of this country? Does the country representative of Sub-Saharian Africa in term of incidence?

By comparison with total incidences of the 4 previous areas (Figure 13), Trichomoniasis (Vaginitis) and Chlamydia are the most common STIs, whereas 11 of 47 analysed textbooks mentioned in contents Vaginitis and 10 Chlamydia. Both STIs are less treated in images: 5 images found for Chlamydia and 1 for Vaginitis.

As referred above, textbooks mainly focus on AIDS – in text as well in images – due to the impact of AIDS regarding the severe prognostic of the disease. Moreover AIDS/HIV infection is taken as an example in Immunology (e.g. France, Lebanon) to illustrate the failure of the immune system. This is why we found high occurrences of images of AIDS or HIV in some textbooks (France, Morocco). In parallel to this analysis, one Tunisian investigation carried out in Bizerte Sciences University on the 4th year biology students showed that the STIs are known trough AIDS before the other more common diseases (syphilis, blennorrhoea) which are almost ignored.

Textbooks contents of many countries are anchored in the biomedical model, by presenting a list of each STI associated to both man and woman but forgetting the health education perspective as they do not take into account the ways in which STIs are not transmitted (especially for HIV transmission) or emphasizing on high-risk population. The list of symptoms is sometimes supplemented by horrifying images of a sick person (Figure 10). However we did not find information about how some STIs, with sometimes discrete symptoms (as compared to AIDS), can increase the risk of the HIV sexual transmission, like genital herpes, syphilis or the soft chancre.

An effective fight against STIs starts with the prevention, i.e. the exact diffusion on the less-risk sexual practices, including the correct and constant use of both male and female condoms. It seems that implicitly the sexual practices show through its absence in textbook: not quoted because less used and less integrated in practices as the male condom.

Nevertheless in some countries where it is easy to obtain free of charge female condoms (e.g. in family planning), why is it ignored?

Variation intra-country is more appreciable in images, for example in France with images of condoms. Depending of the publisher of the same level, there are images of rolled condom, unrolled condom or schema of condom inside the vagina. If the penis remains absent in these images, a photo of an unrolled condom or a schema of an unrolled condom inside the vagina is more explicit.

2. Conceptions of teachers and future teachers of 12 countries about Sex Education

2.1. Abstract

School Sex Education is nowadays an important public health issue as it concerns not only youth AIDS prevention (and other sexually transmitted infections – STI) and adolescent pregnancy prevention but also interpersonal relationships and psychosocial issues. Therefore school sex education contributes to promote better citizenship. The European FP6 Biohead-Citizen research project aims to understand how biology, health and environmental education can contribute to improving citizenship. It analyses the social representations and practices of teachers in several countries, focusing on their differences and associating them to controlled parameters (e.g. social context, religion, gender). In this communication we analyse data concerning teachers' and future teachers' conceptions on the topic of sex education derived from a questionnaire that was constructed and tested during the first year of the project. The questionnaire was completed by 5189 teachers and future teachers from 12 countries. We used statistical multivariate analyses, a method that has become standard for investigating complex data derived from many individuals that needs to be analysed according to many variables (here we have used the responses to the questions as variables). The results show that the factors that correlate most closely with the teachers' and future teachers' conceptions are religion, the level of belief in God and the level of religious practices. It was also found that the level of teaching (primary versus secondary school) is also correlated with different conceptions on sex education. Detailed results will be presented and discussed.

2.2. Methodology

Out of the 19 countries involved in the Biohead-Citizen project, 12 contributed with data on RHE/SE. Four are outside Europe and widely (Tunisia, Morocco, Senegal) or in large part (Lebanon) muslin. Height countries are Europeans members (Portugal, France, Italy, Finland, Cyprus, Estonia, Hungry and Romania) and resent different characteristics: north and south, east and west Europe, catholic, protestant or orthodox culture.

The questionnaire was elaborated in the Biohead-Citizen Project in a common work with all the research teams and translated in national language (validate by retro-translation). It was pre-tested before implementation in each country.

In each country, we have data coming from pre (PRE) and in (IN) service teachers in primary school (P) and in secondary schools in biology (B) and national language (L) in 6 balanced data groups.

The corpus include responses from 5189 questionnaires: Cyprus (CY, 322), Estonia (ES, 183), Finland (FI, 306), France (FR, 732), Hungry (HU, 334), Italy (IT, 559), Lebanon (LB, 722), Morocco (MA, 330), Portugal (PT, 351), Romania (RO, 273), Senegal (SN, 324), Tunisia (TN, 753).

Our work concerns only Sex education and 35 questions (A2, A9, A21, A 30, A31, A36, A41, A 46, A57 to A60, A65, A85 to A90, B3, B5, B11, B13, B17 to B19, B24, B30 to B32, and B37 to B41).

2.3. Results and Discussion

In this work we intended to present an overview of the first results obtained from the Biohead-Citizen questionnaire, rather than to do an exhaustive study. Therefore we show herein the most relevant results, by using only some of the variables. The schema of Figure 1 shows us three distinct groups of variables. The group of questions (A) contributes strongly to axe 1 and indicates that teachers think it is not possible to teach the social components of sexuality education to young pupils. Moreover they do not agree to teach in school before 15 years old contents as homosexuality, paedophilia, pleasure organs, abortion, incest and sex violence, orgasm and pleasure, eroticism and pornography (A85 to A90 and B37 to B41). Nevertheless, pupils found all these topics in their daily life with their peers, in the streets or in the media (press, radio, TV…).

Another interesting correlation was found in group (B) composed of questions about possibility of abortion (A57 to 59): the respondents who do not agree with abortion also think that women have not the same rights then men (A2), that it is not important to have the same number of women and men as deputies (A30), that women, biologically, have not the same intelligence as men have (A21), that homosexual couples must not have the same rights as the other couples, and that it is the hazard who determines the sex of a baby (B30).

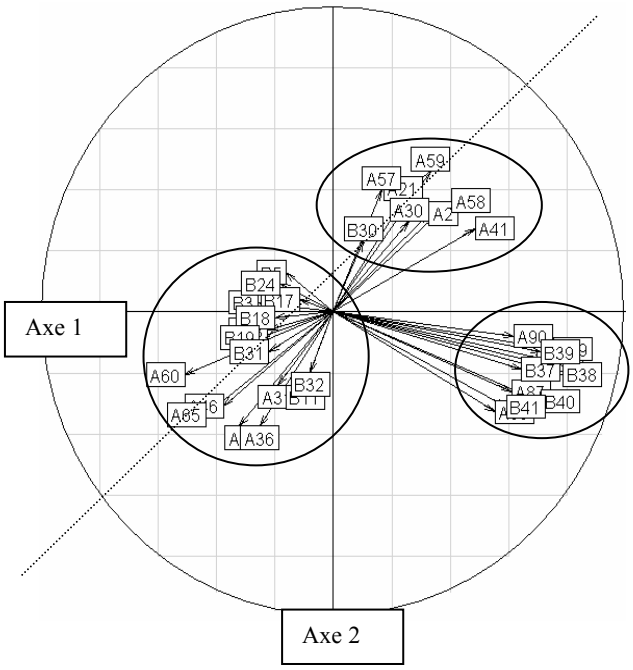


Figure 1: Principal component analysis (PCA), global correlation circle

The group (C) of questions is defining the same oblique axis as the group (B), with just opposite positions: it is possible to try to choose the baby sex by specific diet or medically assisted techniques (B31, B32), agree with the idea that abortion would be acceptable at any time (A65), men can be as sensitive and emotional as women (A46), there is no biological reason which would justify inequality between men and women (A6, A36, A46) and agree with safer sex (as a behaviour most relevant to be considered in school sexuality education).

The analysis of figure 2 shows differences between training. A PCA has been done to differentiate the six "**groups of teaching**" controlled in our sampling design: pre-service or in-service, primary or secondary level, biology or letters. In fact Biology teachers (in-service or pre-service) have conceptions based mainly on knowledge and on the conviction that they can teach the whole dimensions of sexuality education (Q A31, B5, B18 B17, B22, B3 B24, B30). They think that they have to teach biological aspects of sexuality (human reproduction and STI) and say that they are able o speak with their pupils about emotion, feelings, pleasure but they have the same difficulties as the others with safer sex (A60) and homosexual rights (A41).

In relation with the others groups, we found a clear difference between in-service and pre-service teachers, in particular in primary school teachers. The in-service primary teachers have difficulties to cope with content of sexuality education especially with social and affective issues like homosexuality, abortion, contraception, pleasure organs, paedophilia, safer sex (Questions : A 85 to A90, A 60) for example their conception is based on a false knowledge about the homosexuality origin (Question: B11).

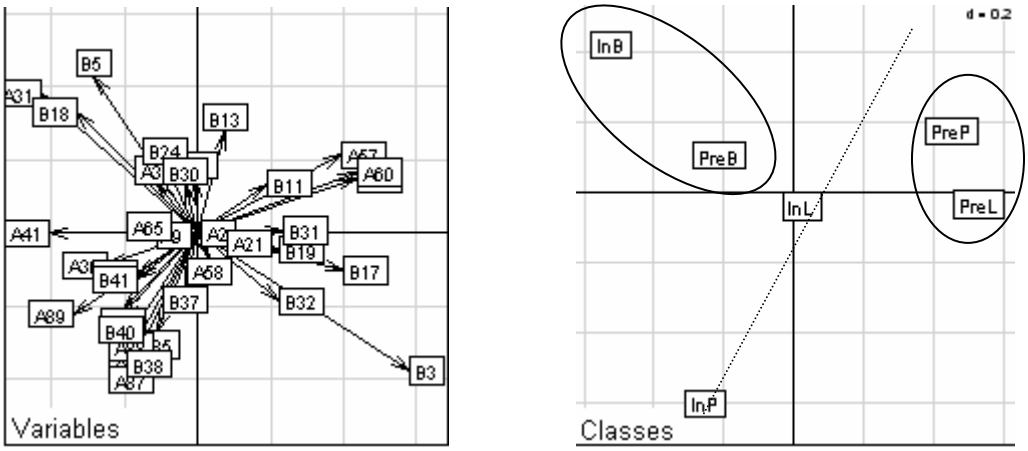


Figure 2 : teachers' statute variable

In contrast to the in-service primary school teachers, the pre-service primary teachers agree with safer sex, abortion, homosexual rights… and prefer to teach these contents early in the curriculum. There is an effect of age in the teachers' conceptions. Inside the three thematic groups (primary, secondary biology and secondary letters), older teachers (in-service; mean age = 40 years old) are always on the upper part of the axis 2 and the younger teachers (pre-service; mean age = 23 years old) are in the lower position (figure 2).

When we link the data of figure 1 with **countries** variables, the schema indicate clearly the incidence of a cultural effect (Figure 3). We have on the first axe the distribution of the countries between two poles. At one end we have Lebanon, Tunisia, Morocco and Senegal at the other end France, Finland, Portugal, Estonia and Italy. In the middle there is Hungary, Romania and Cyprus. Crossing this graphic with the figure 1, we can see that there is a correlation between countries and conceptions.

The charts are linked by axes superposition. It seems that European countries have different point of view and conceptions than south countries. Eastern European countries occupy the middle position. According to figure 1, we can see that south countries have conceptions founded on inequality between men and women and about their rights and same thing about homosexual rights. They have conservative conceptions about abortion, safer sex and sexuality education. They do not agree to teach sexuality topics in primary school or in first years in secondary school before 15 years. In opposition, around France (Fr), we can see

the correlation with open view about abortion, equality between men and women and homosexual rights.

But we have a nuance in this analysis: the opposition is also in teaching practices about topics like homosexuality, paedophilia, pleasure organs, contraception, abortion, sexual diseases (A85 to A90). France, Finland, Estonia, Portugal and Italy agree more to teach theses contents than Lebanon, Tunisia and Senegal.

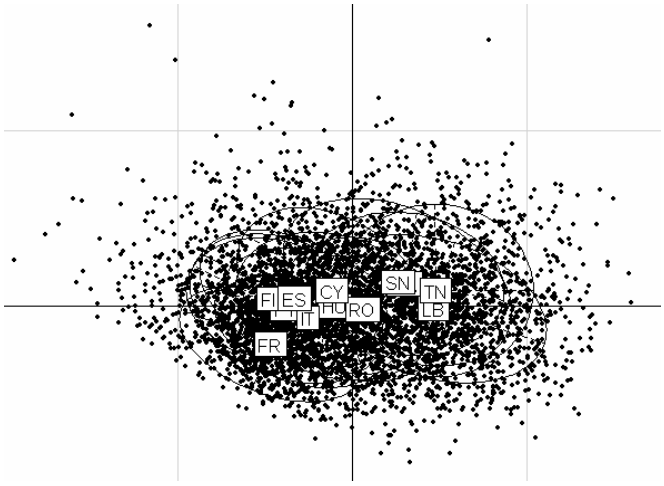


Figure 3: Between analysis to differentiate countries

Figure 4 shows that the four **religion** categories (AGN, agnostic, atheist, without religion; MUS, Moslem; CHR, catholic, protestant, orthodox ; ELS, other religions or beliefs). There are two poles on one axe: Muslims at one side and Agnostic at the other side. In the middle part, we found others religions and Christians. With a similar process; we have crossed religion and teachers' conceptions.

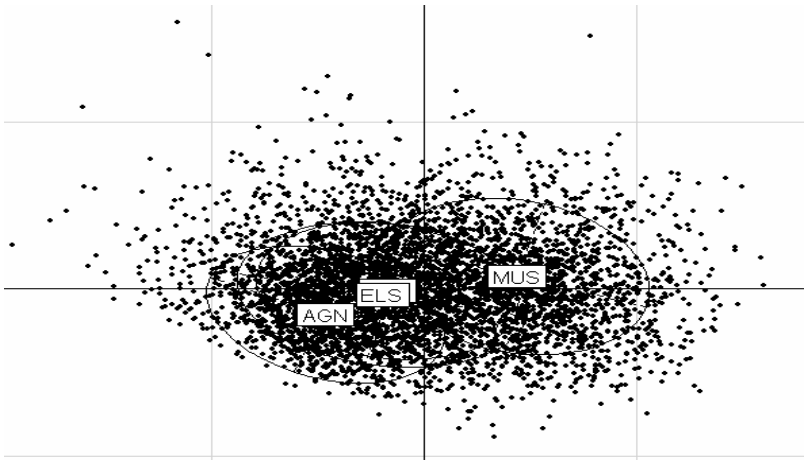
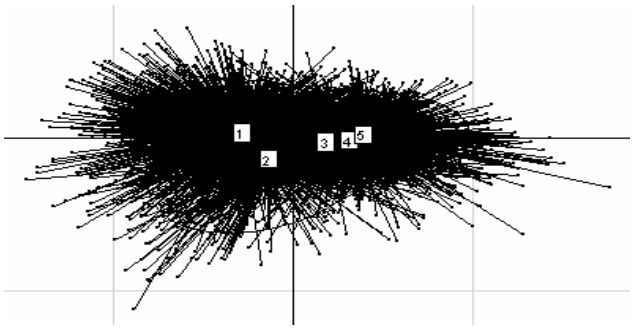


Figure 4: Religion distribution (MCA)

There is a strong correlation between religion and teachers' conceptions. Agnostics and atheists agree with the idea that abortion would be acceptable at any time (A65). They think also that men can be as sensitive and emotional as women (A46) and there is no biological reason for inequality between men and women (A6, A36, A46). For them, safer sex is the behaviour they find most relevant to be considered in school sexuality education. They agree with rights equality between men and women and with homosexual couples. At the opposite we find Muslims. This statement needs to be qualified. So, we crossed this data with the levels of beliefs in God.

The responses about the **religious practices** level are coded from 1 "I practice a religion" to 5 "I don't practice a religion". The distribution on the axis 1 indicates that the religious practices factor is also relevant (Figure 5-a). We can observe two groups. The first one composed of those who declare practising a religion (1 and 2) and the other ones characterised by low practices or no practice. These groups are also linked with teachers' conceptions. We found the same orientations about teaching practices in social components of sexuality education abortion and men and women equality and rights. The issues about abortion (A65), safer sex (A60), homosexual couple's rights (A41) and about the biological aspect of sensitivity and emotion (A46) are the most relevant ones (Figure 5-b).

a)



b)

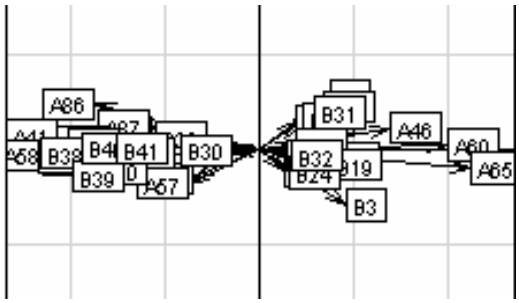


Figure 5: Between analysis, religious practices (a) and corresponding variables (b)

Teachers who have a religious practice do not agree with abortion, with homosexual couples' rights, with safer sex and with the social contents of sexuality education (A 85-90 and B37-41). In addition they think that psychological and social aspects of sexuality education should be taught by health professionals.

3. Conclusions of Sex Education studies and Implications for the future

For the topic "Human reproduction and Sex Education", in general the textbooks of most countries, at all levels show the tendency to give more emphasis to the biological process of reproduction rather that the psycho-social aspects of sexuality.

In primary school textbooks, in particular those from Portugal and Mozambique, the little information which is given, by text and images, is not new for children therefore do not contribute to improve their knowledge in this area. There are technical/scientific errors in most books, being the term vagina (internal organ) used thoroughly instead of vulva (external organ). Other similar mistakes can be found persistently or often in primary school textbooks. Therefore it is obvious that the several countries Publishers of theses books must be informed of these mistakes, as well as the countries policy makers.

At all school levels the way the issue reproduction is presented seems to be dependent of the at the moment stronger social values, as it was found in French textbooks where in 1984 the textbooks were showing more realistic images of genital organs than afterwards (1988 and 1998), and the feminine organ clitoris is no more represented in the recent textbooks, indicating an increase in shamefacedness. The exhibition of genital organs is an issue very much linked to social values and religion, thus it is an issue that requires further studies and awareness in order to recognize how far one should insist in presenting this issue in school textbooks.

The sexually transmitted infections (STIs) are a matter that is regularly present in all countries textbooks. Information about STIs are presented in all secondary school textbooks analysed; some countries give more scientific information about different kinds of STIs (France, Senegal, Finland) than others (Portugal, Germany, Tunisia). They all treat AIDS by explanation of the Human Immunodeficiency Virus (HIV) due to the impact of AIDS regarding the severe prognostic of the disease. Textbooks contents of many countries are anchored in the biomedical model, by presenting a list of each STI associated to both man and woman but forgetting the health education perspective as they do not take into account the ways in which STIs are not transmitted (especially for HIV transmission) or emphasizing on high-risk population.

There is a general absence or diminutive appearance of the psychological and social aspects of sexuality and sex education in the textbooks, as the physical/anatomic perspective is the most relevant one. This goes together with the perspective that the main emphasis is given to the biomedical view rather than the health promotion one, where personal and inter-personal skills are to be improved. Thus, it is rather evident that textbook publishers and policy makers of all countries should be warned about the inadequate attention to psycho-social aspects of sexuality in textbooks.

Similarly, in-service and pre-service Biology teachers' conceptions of the 12 countries analysed are based mainly on knowledge and they teach the whole dimensions of sexuality education (Q A31, B5, B18 B17, B22, B3 B24, B30). They assume they have to teach biological aspects of sexuality (human reproduction and STIs) and say that they are able o speak with their pupils about emotion, feelings, pleasure but they have the same difficulties as the others with safer sex (A60) and homosexual rights. The in-service primary teachers have difficulties to cope with content of sexuality education especially with social and affective issues like homosexuality, abortion, contraception, pleasure organs, paedophilia, safer sex.

There is a strong correlation between religion and teachers' conceptions. Agnostics and atheists agree with the idea that abortion would be acceptable at any time (A65). They think

also that men can be as sensitive and emotional as women (A46) and there is no biological reason for inequality between men and women (A6, A36, A46). For them, safer sex is the behaviour they find most relevant to be considered in school sexuality education. They agree with rights equality between men and women and with homosexual couples. At the opposite we find Muslims.

These first results must be considered with prudence. Deep analysis must be done to highlight precisely the variances between groups and their links with social representations and individuals' conceptions. The great challenge we have done with this study, is to identify better not only the nature of the teaching practices but also the teachers' conceptions, especially in sexuality education and their links with the practices. It must be emphasised that the early access to information is the best way not only to prevent sexual violence and sexual transmitted infections but also to promote sexual health and more largely health education.

In brief, the Recommendations/Implications for the future on the topic Reproduction and Sex Education can be summarized as follows:

- Give attention to the **accuracy of scientific information** in textbooks.
- Give **more emphasis** in textbooks to:
  - psycho-social aspects of sexuality;
  - personal and inter-personal skills.
- STIs are regularly presented in textbooks, usually in a biomedical perspective but **preventive approaches to the STIs transmission** should be enhanced, by the use of condoms and a wider perspective of health promotion.
- The textbooks authors should be plainly aware of the current **social values** implicated in Sex Education.
- **Teachers' training** should take all the above issues into consideration.

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III. Ecology and Environmental Education:

Objectives, methodologies, main achievements and implications

By Sílvia Caravita *– P5. ISTC-CNR, Italy*

1. Ecology and Environmental Education approaches in school textbooks of 19 countries

Environmental Education (EE) is present in the national syllabi from Primary School on in all the 19 countries participating in the BIOHEAD-Citizen Project as a concern for different disciplines, not as a school subject. Actually, EE lacks of a well defined, largely shared disciplinary statute and it cannot be framed within a univocal didactical and pedagogical model of practice, though international documents and research are very articulate in stating objectives and expected competences of the future citizens. This peculiar status of EE legitimates disparity of approaches and it is at the origin of its weakness in school education. Actually, it is heavily dependent on teachers' motivation and conceptions, on occasional proposals from territorial agencies and, ultimately, on school manuals.

Manuals have traditionally a disciplinary content and their aim is mainly informative. Therefore, they are not the best tools for cross-disciplinary approaches, for giving attention to the emotional and ethical aspects that are so important in the construction of persons aware of individual and social responsibilities and willing to be active social participant in the management of the environment. On the other hands, science textbooks can relevantly contribute to the construction of the adequate knowledge base that is a necessary component of EE. In the scientific arena, complex, systemic and trans-disciplinary approaches to understand the complexity of the environmental problems have driven research studies to design new methods, theoretical models and representations. Besides, the developments of the philosophical reflection on human-environment, nature-culture relationships point at overcoming dualistic perspectives.

The Decade for Sustainable Development and the recommended actions in the Agenda 21 have called the attention of the institutions on relevant cognitive and ethical aspects of EE. New themes and concepts have emerged concerning the use and distribution of resources, the search for alternative technologies, equity in economical policies, the consequences of globalization, reappraisal of the quality of life … A re-thinking of the disciplinary domains appears to be crucial for future science and for decision-making. School manuals do not seem to have accepted these challenges, but this demanding task cannot be under the teachers' responsibility only.

The general trend in EE during the last decades has been characterized by transition from natural sciences and ecology teaching to increased attention on environmental issues, mainly related with pollution of Earth components, greenhouse effect, urbanization, conservation of species. Information about the risks that environmental breakdown may cause and promoting changes in attitudes and individual behaviours seem to be considered the main goals of the school EE projects. Less attention is given to the construction of knowledge.

To which extent have the publishers of school manuals accepted the challenge of educating for a sustainable future? Do science textbooks offer an adequate base of knowledge for conceiving the environmental complexity that includes the human actions? Which image of the current science and technology endeavours does instruction convey? Does the ethical concern emerge in a process of knowledge communication or does the goal of textbooks

remain the apparently "neutral" transmission of information? Which are the values and beliefs implicitly conveyed?

The teams participating in the Project have analysed samples of school manuals from Primary School level to Higher Secondary School level. The Table summarizes the samples taken into account in each country. The differences among samples are justified by the number of science textbooks available to the teachers in each country.

The grids for the analyses concerning Ecology and EE have been the product of a collaborative work, coordinated by he Italian team. Four topics have been selected for focusing our analysis: *ecosystems and cycles*, *conservation of biodiversity*, *pollution*, *use of resources*. The conceptions that were the targets have been labelled as: *complex vs linear*, *relation of human respect to nature*, *local vs global*, *individual vs social responsibility*

(see for more details about the grids: Caravita et alt., submitted to Sci. Ed. Int. J., Sept. 2007).

1.1. Outcomes from the textbooks' analysis

Irrespective of cultural differences, the main findings of the analysis and have implications for teachers' education and for the production of manuals can be summarised as follows:

- Ecology and EE are considered as topics to be separately treated: whilst Ecology has to do with "natural" ecosystems, EE has to do with the human impact on nature that is loaded with negative consequences for nature and for humans. The planet is mainly seen as a resource for humankind instead of a resource shared with other living beings. Scarce emphasis is given to the human role in solving the problems pollution. This might instead contribute to improve pupils' motivation to citizenship. In Elementary School textbook EE topics are included in the chapters of Geography or are linked to Health Education and treated in chapters concerning the human body.
- The structural descriptions of ecosystems are in general more articulated than the relational and the dynamical ones. Mentioning of variables and conditions that modify and modulate the ecological events is not frequent in Secondary School manuals. In the illustrations of concrete cases, discussion should be added on the role of ecosystems' size and level of complexity, time, severity and persistence of factors that cause perturbations, etc. The concepts of resilience, of robustness should be discussed. The "balance of natural system" should be treated as a metaphor, a model, rather than a fact because this kind of misunderstanding has important consequences on the building of ecological knowledge (Zimmerman and Cuddington, 2007).
- In Life and Earth Sciences manuals, EE is rather marginally treated, also in terms of number of pages; environmental issues make often the content of windows inserted within the main exposition, of Cards added at the end of chapters, of proposals for tasks or class activities. The main aim of the textual exposition lies in raising or increasing the students' awareness about the issues that are object of media communication, by offering information or warnings, rather than in promoting the construction of knowledge and of reasoning competences by supporting actual experiences, critical reading of real documents, interpretation of empirical data, reflection and debate on controversial facts on which more information can be searched by the school class.
- The short-sighted scope assigned to EE is also witnessed by the absence of longitudinal perspective. In fact, limited differences in content and communication are found between the manuals for Lower and for Higher Secondary School: the level of complexity in the analysis of the environmental systems, of the problems and solutions, of the emblematic cases that are illustrated, remains almost the same. Also

the strategies for promoting the involvement of the students in citizenship do not change, either in their targets either in their cognitive and emotional load.

- In most of the analysed textbooks the concept of sustainability was not found or if introduced it is rather superficially treated. Socio-economic controversies are preponderant respect to ethical ones. In addition, nature is given importance as something that can be used by human beings. Even the biological value of biodiversity and the topic of conservation (not always treated) are presented in relation to human exploitation of resources. Even the aesthetic concern for the environment is disregarded.
- Few cases of a sustainable use of nature are illustrated, and usually they concern foreign countries or the past times.
- When the manuals envisage a more sustainable development in our over-populated Earth planet, they give much heavier relevance to the role that technologies may have rather than to the changes of individual and social behaviours. Unlimited trust in science and technology solutions generally emerges, without any reference to the principle of precaution, to potential multiple perspectives and to the possibility of alternative scientific views and arguments for supporting them. People's participation in decisions concerning environmental policies, the role of local expertise are not mentioned.
- The types of pollution, the kind of environmental breakdowns that are considered are often the same in the textbooks of different countries. Even images and schematizations tend to be similar across countries. This kind of "globalization" of EE is in contrast with the goal of rooting EE in the environmental identity of the students and it re-enforces stereotypical information from the media.
- In addition, limited number of images illustrating local ecosystems and ecological problems was found, as some of the BIOHEAD-partners have underlined, since pictures are often taken from international sources.
- In the majority of the textbooks, few references have been found to juridical norms and international agreements concerning environment protection, biodiversity and sustainability issues.
- The *quasi* absence of historical approach makes "flat", de-contextualised the facts and phenomena that are illustrated in the exposition, and this does not promote comparative analyses or the search for relationships among other facts and events in the human cultural development.

1.2. Few comments about images

Images from the textbook may have a stronger influence on students' conceptions than the text itself, and these are implicitly conveyed.

In the chapters dealing with ecology, people very rarely appear in images illustrating environments. In chapters dealing with Environmental issues the majority of the figurative images points out the "bad deeds" of humans. Drawings or photos are very rarely used to show just the beauty of nature, of landscapes.

Figurative images are the large majority but should be more diversified.

Figures reporting empirical data, statistical distribution, graphs, … are largely under-represented, even in Higher Secondary School textbooks.

Schematic representations of webs of ecological relationships are often over-simplified; representations of cycles of matter or energy tend to be linear.

1.3. Conclusive and very synthetic suggestions

About School Curricula:

- Revision of the content of the subjects (specifically of sciences) in view of educating cognitively equipped citizens for a more sustainable future, capable of understanding and critically using the knowledge that the scientific community is making available to the public.
- Improving the definition of EE in the curricula (content, values, activities, competences …)

About the quality of school manuals

- Although the manuals are not and should not be the only sources of information in the school classes, the School Authorities should give more attention to the quality of the exposition and of the images. Not only correctness and comprehensibility deserve careful assessment, but also the kind of ideological and epistemological attitudes and beliefs that are interconnected with the information, either the information that is taken into account either the information that is left out.
- Authors and publishers should be made more sensitive to the wide range of objectives that science education for better citizenship implies and the adequacy and effectiveness of the textbooks' exposition should be assessed in view of the attainment of these ones (cognitive, metacognitive, pragmatical, ethical).
- School Authorities in collaboration with Publishers should organize arenas for promoting debate among representatives of different categories of participants in the educational process and in projects that support the innovation of science teaching: teachers, supervisors, parents, publishers, researchers. The diffusion of the results produced by studies concerning science textbooks' should be discussed, the experience of their characteristics in the class practice, their pedagogical role, their use in EE, should be confronted in order to integrate perspectives in making proposals.

About teachers' education (pre- and in-service)

- Calling the attention of University teachers, responsible of teachers' formation:
    - on the inter-connections between knowledge and beliefs (ideological, epistemological) and on how this may influence educational mediation, particularly when its content concerns topics that are emotionally and culturally biased
    - on the need of re-thinking the relationship between EE and the other disciplines
    - on the need of including EE in the courses for Primary and for Secondary School teachers school levels as a coherent corpus of educational practice framed into theory.
- Promoting teachers' abilities as reflective practitioners, conscious of the importance of making their students reflective learners and critical users of resources (manuals included)

***By Franz Bogner** – P3. UBT, Germany*

2. Conceptions of teachers and future teachers about Ecology and Environmental Education

2.1. Abstract

Scientific research about monitoring and influencing environmental attitudes and behaviours yields contradictory results, pointing to sometimes positive and sometimes negative impact of for instance, affluence or religion on environmental concern. We related the two independent ecological values, Preservation and Utilisation, to religion, country pollution and per capita GNI. We clustered the environmental values of pre- and in-service teachers of all 16 participating countries. In a second step, the clusters were characterized for affluence and pollution measures as well as for indicators of religiousness. The most dominant relationship was a negative one between Utilisation of nature and per capita GNI being also related to high pollution values and to the portion of religious people within the clusters. On the country level, high Preservation scores were correlated to low ecosystem vitalities but not to environmental health, pointing to the ecocentric character of the measure. The meaning of belief in God and practice of religion within clusters was only weak, resulting in a low positive correlation between Preservation and belief in God.

2.2. Introduction

As a main cause of environmental degradation numerous authors identified the *Dominant Western (Social) Paradigm* which considers human-beings as superior to nature (Gardner & Stern, 1996). This anthropocentric world view includes the belief in economic growth building upon exploiting the seemingly ample resources and naively believing in technological progress that will solve any potential problems. This extreme paradigm is thought to be contrasted by an ecocentric worldview that gives nature an intrinsic worth and considers humans as part of nature. This so-called *New Environmental Paradigm* (Dunlap & Van Liere, 1978) or *Deep Ecology Paradigm* (*e.g.* Devall & Sessions, 1985) rejects environmentally destructive lifestyles and advocates a drastic decrease in human population.

The anthropocentric paradigm often is suspected to be rooted in basic Judeo-Christian religious tradition. White (1967), for instance, pointed to the Bible where God tells humans to "be fruitful, multiply … and subdue [the earth]" (Genesis I: 24-25). Others questioned this theory, by even linking Judeo-Christian tradition with pro-environmental values and beliefs, for instance, with the concept of "stewardship" highlighted in both, the Old and New Testaments as well (*e.g.* Kanagy & Nelsen, 1995; Whitney 1993). One of the few cross-national studies about the correlation between Judeo-Christian tradition and environmental degradation, published by Decker *et al*. (1997), compared in more than 20 nations the percentage of Christians in a population and the mean environmental concern or willingness to pay for environment protection and they did not unveil any cross-national relationship between both. Another important type of values needs the prosperity of the respective country a specific mentioning: Inglehart's (1995) postmaterialist values, for instance, may promote environmental concern. When controlling for pollution, Inglehart found a partial correlation of .47 between *Materialist/ Postmaterialist values* and support for environmental protection among the 15 relatively low-pollution societies ($p = .07$). Support for this relation was provided in part by Dekker, Ester and Nas (1997) in form of a positive correlation ($r = .45$) between willingness to pay higher prices and taxes to protect the environment and the percentage of post-materialists in 18 mainly European nations, but no correlation with environmental concern. Inglehart (1995) found a strong relationship between post-materialist

values and support for environmental protection in the respective nations. However, he also found the severity of (air and water) pollution in a country to be another important impact on the public support for the environment: the higher the degree of pollution, the more willing the population to pay for a reduction of pollution.

2.3. Objectives: What is new?

Using more-dimensional environmental attitude measures leads to analyse the relationship with values, religion and affluence. Bogner & Wiseman (1997, 1999, 2002) used an empirical approach to filter the essence from various instruments measuring environmental attitudes. They factor-analysed a large pool of items with six different European populations across five language barriers (Bogner & Wilhelm 1996, Bogner & Wiseman, 1996, 1998, 2002; Bogner 1998, 2000) and reduced it to five primary order factors. To identify a generic model of environmental attitudes, they investigated the second-order structure of their scales and thus generated their 'two-dimensional Model of Ecological Values' (2-MEV; Bogner and Wiseman 2004, 2006; Wiseman & Bogner 2003). With their own words: "*Ecological Values are determined by one's position on two orthogonal dimensions, a biocentric dimension that reflects conservation and protection of the environment (Preservation); and an anthropocentric dimension that reflects the utilization of natural resources (Utilization)*". The model, being developed exclusively with adolescents, was independently confirmed by three different recent studies (Milfont & Duckitt, 2004, 2006; Munoz *et al.* 2008).

Consequently, the specific objective was to complement the "very little multinational environmental research" (Schultz & Zelezny, 1999). First, we extended the previous research with regard to the differentiation of environmental values by applying the Preservation and Utilisation scales of Bogner & Wiseman (2006) and repeating the two-factor structure by explorative factor analysis. With cluster analysis, we applied an explorative method to construct groups of countries with similar Preservation and Utilisation scores. Last but not least, we complemented the elaborated work of the varying influence of religion and belief in God, affluence and pollution on environmental attitudes within and between cultural groups.

2.4. Methods

We analysed pre- and in-service teachers' Biology concepts and attitudes and relating these to socio-demographic variables like age, gender and religion. The questionnaires applied, consisted of total 90 items covering various topics of Biology teaching, including 15 items from the Preservation and Utilisation scale of Bogner & Wiseman (2006). Subjects were Biology secondary school teachers, native language secondary school teachers and primary school teachers and pre-service students as well. The sample included respondents from six South European nations (CY: n = 266, FR: n = 739, ML: n = 194, IT: n = 568, PT: n = 335, RO: n = 281), three North European nations (FI: n = 270, EE: n = 176, LT: N = 311), three Central European nations (DE: n = 362, PL: n = 311, HU: n = 328), and four Arab and African countries (LB: n = 725, MA; n = 322, TN: n = 722, Senegal: n = 323). According to the World Bank list of economies 2007 (Atlas method), 8 of our involved nations are so-called high income countries (per capita GNI $11,116 or more), 7 nations are middle income countries (GNIpc $906 – $11,115: LT, PL, HU, RO, LB, MA, TN), and one is a low income country with less than $905 GNIpc (SN).

Table 1: The table shows descriptive statistics (total n, % females, mean age, % teachers and students, % positive answers to "I believe in God" and "I practise religion"), scale means and mean factor scores for Preservation and Utilisation (weighted for factor loadings of the items) for each country. The number in the first column indicates the cluster the country was allocated to. No answer gender (n = 94), age (n = 168), I believe in God (n = 73), I practice religion (n = 134).

Country (Cluster No)	**N**	% fem.	Age M(SD)	% Teachers Students	Religious %beliefs / practice	Preservation M (SD)	Utilisation M (SD)	P-factor score	U-factor score
Finland	270	83.0	32 (12)	41/ 59	54/ 27	3.23 (0.37)	1.69 (0.30)	-1.00 (0.97)	-0.33 (0.49)
1 Lithuania	311	92.6	33 (13)	52/ 48	71/ 50	3.37 (0.40)	1.94 (0.39)	-0.43 (1.02)	0.11 (0.65)
1 Poland	311	93.8	31 (10)	52/ 48	91/ 79	3.46 (0.38)	1.76 (0.42)	-0.30 (0.96)	-0.28 (0.69)
2 Cyprus	266	79.0	29 (8)	53/ 47	86/ 52	3.60 (0.36)	1.79 (0.40)	0.14 (0.97)	-0.20 (0.67)
2 Hungary	328	81.5	31 (11)	52/ 48	52/ 33	3.64 (0.32)	1.49 (0.35)	0.18 (0.77)	-0.70 (0.56)
2 Italy	568	87.6	38 (13)	46/ 54	72/ 40	3.56 (0.37)	1.60 (0.38)	-0.02 (0.94)	-0.57 (0.62)
2 Malta	194	83.0	31 (11)	66/ 34	92/ 80	3.75 (0.30)	1.60 (0.40)	0.31 (0.83)	-0.50 (0.65)
2 Portugal	335	81.9	32 (12)	50/ 50	72/ 48	3.61 (0.34)	1.63 (0.39)	0.15 (0.87)	-0.47 (0.63)
2 Romania	281	88.2	29 (11)	48/ 52	87/ 79	3.50 (0.39)	1.71 (0.46)	-0.13 (0.97)	-0.32 (0.74)
3 Estonia	176	83.5	32 (12)	52/ 48	25/ 18	3.51(0.35)	1.38 (0.31)	-0.16 (0.85)	-0.88 (0.50)
3 France	739	75.2	32 (11)	50/ 50	29/ 10	3.53 (0.37)	1.45 (0.31)	-0.08 (0.90)	-0.76 (0.49)
3 Germany	362	69.3	34 (13)	53/ 47	65/ 54	3.39 (0.40)	1.48 (0.32)	-0.49 (1.00)	-0.79 (0.50)
4 Lebanon	725	81.4	31 (10)	72/ 28	98/ 87	3.76 (0.32)	2.50 (0.51)	0.50 (0.93)	1.05 (0.86)
4 Morocco	322	57.5	33 (12)	48/ 52	98/ 88	3.75 (0.32)	2.49 (0.48)	0.52 (0.89)	1.08 (0.78)
4 Tunisia	722	58.9	30 (9)	53/ 47	97/ 85	3.59 (0.39)	2.43 (0.47)	0.08 (1.02)	0.95 (0.78)
4 Senegal	323	27.9	34 (10)	50/ 50	100/ 98	3.53 (0.39)	2.25 (0.50)	0.58 (0.96)	0.69 (0.84)
Total	**6233**	**75.4**	**32 (11)**	**53/ 47**	**75/ 59**	**3.56 (0.38)**	**1.89 (0.58)**	**0 (1.00)**	**0 (1.00)**

2.5. Analysis and Results

For factor extraction a principal component analysis (PCA) with subsequent Varimax rotation was applied, resulting in a clear 2-factor solution following the screeplot. According to our expectations, 8 items were assigned to the Utilization factor and 7 items to the Preservation factor. The measures of sampling adequacy of the variables had a middling fit (KMO =.76), the fit of the Utilization items is better (MSA >.70 or >.80) than that of the Preservation items (MSA >.70 or >.60). The Bartlett test was significant, thus the premises for a PCA were given.

Figure 1: Diagram of the two components after Varimax rotation.

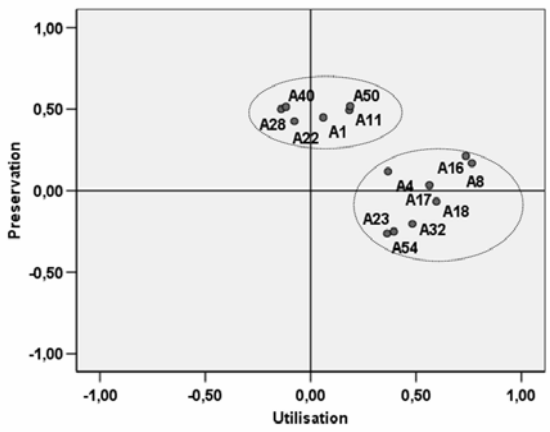


Table 2: Presents the two-factor solution of Principal Component Analysis after Varimax rotation. Shown are factor loadings >.30, communalities (*h*) and item mean scores with standard variation.

Utilization		**C1**	**C2**	***h***	***M (SD)***
A8	People worry too much about pollution.	**.77**		.61	2.13 (1.27)
A16	Our planet has unlimited resources.	**.74**		.59	1.89 (1.24)
A18	Human beings are more important than other creatures.	**.60**		.37	2.22 (1.21)
A17	Society will continue to solve even the biggest environmental problems.	**.56**		.32	2.39 (1.13)
A32	Humans have the right to change nature as they see fit.	**.48**		.27	1.42 (0.84)
A23	We need to clear forests in order to grow crops.	**.39**		.22	1.44 (0.79)
A4	Nature is always able to restore itself.	**.37**		.15	2.35 (1.10)
A54	Only plants and animals of economical importance need to be protected.	**.36**		.20	1.25 (0.64)
Preservation		**F1**	**F2**	***h***	***M (SD)***
A11	Dirty industrial smoke from chimneys makes me angry.		**.52**	.30	3.29 (0.93)
A40	It is interesting to know what kinds of animals live in ponds or rivers.		**.50**	.27	3.62 (0.69)
A28	It upsets me to see the countryside taken over by building sites.		**.50**	.27	3.35 (0.97)
A50	All contemporary plant species should be preserved because they may help in the discovery of new medicines.		**.49**	.27	3.47 (0.82)
A1	We must set aside areas to protect endangered species.		**.45**	.20	3.84 (0.46)
A22	I enjoy trips to the countryside.		**.43**	.19	3.80 (0.56)

We used the countries' mean Preservation and Utilisation factor scores in order to cluster the latter into groups with similar environmental attitudes. We extracted a four cluster solution by an agglomerative hierarchical cluster analysis by applying Ward's method (Norusis, 1993), after excluding the Finnish sub-sample which had formed an own cluster (new N = 5963). In order to determine the countries' cluster membership, we used the K-Means Cluster Analysis procedure by specifying the cluster number as four. We validated this analysis by a cluster-wise cross-tabulation of the two methods, revealing an almost perfect agreement between both (Contingency coefficient: C = .97, p =.000).
Figure 2 shows the allocation of all 15 countries to one of the four clusters, based on their location in a two-dimensional factor space, formed by their P- and U-scores. We identified three European clusters and one cluster consisting of the four non-European countries.

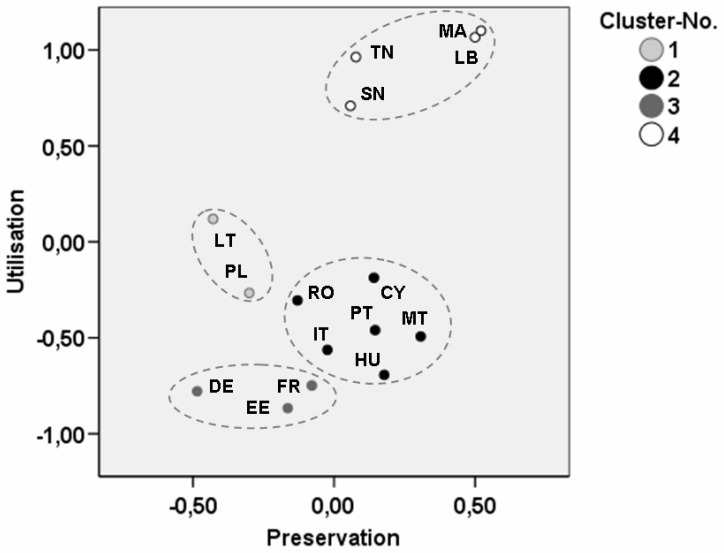


Figure 2: Allocation of 15 countries to the four clusters with similar Preservation and Utilisation factor-scores.

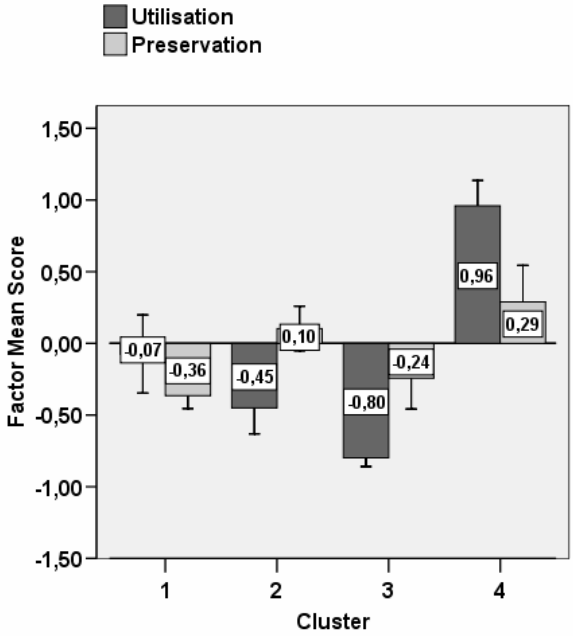


Figure 3: Preservation and Utilisation factor scores of the four clusters identified. Cluster 1 (LT, PL): U± P-; Cluster 2 (Southern Europe): U- P±; Cluster 3 (DE, FR, EE): U- P-; Cluster 4 (Arab and African countries): U+ P+

By comparison, the clusters 2 and 4, consisting of South European and Arab or African countries, are characterized by higher Preservation scores (P+). Whereas in cluster 2, the U-score is relatively low (U-), the U-score of the Non-European countries is extremely high (U+). In this aspect, it is distinct from all other clusters. In these two clusters, the correlation between Preservation and Utilisation is negative as well, but much smaller with a Spearman's $\rho = -.14$ (cluster 4, $p < .001$) and $\rho = -.15$ (cluster 4, $p < .001$).

We used the per capita Gross National Income (GNIpc 2006, World Bank 2007), determined by the World Bank with the Atlas method. Countries with similar GNIpc were grouped together in a cluster, thus the mean GNIpc of clusters varied a lot from high in cluster 3 (M = 28,193; SD =14,535) and 2 (M = 16,3272; SD = 9,185) via upper middle in cluster 1 (M = 8,030; SD = 226) to lower middle in cluster 4 (M = 2,778; SD = 2,022). According to this, we found a high and significant negative correlation between the Utilisation score and the

measure of affluence (see table 4). The correlation of the P-score with GNIpc, however, did not show a significant level. We, furthermore, considered the Environmental Performance Index (EPI 2008, YCELP, CIESIN, JRC, 2008) as developed by scientists of the Yale and Columbia Universities in cooperation with the World Economic Forum (Esty, Levy, Kim, de Sherbinin, Srebotnjak & Mara, 2008) as a measure of absolute current environmental conditions of countries being positively correlated to GNIpc, (ρ =.79***). The same is true for its two sub-measures, "Environmental Health" (ρ = .93***), informing about environmental stresses on human health, and "Ecosystem vitality" (ρ =.57*), measuring effects on ecosystems (air, water biodiversity) and on productive natural resources (fisheries, forests, agriculture). Utilisation, being highly negatively related to affluence, thus is also highly negatively correlated to the EPI and both sub-measures (see table 4). Preservation, on the other hand, being not correlated to GNIpc, is significantly related only to "Ecosystem vitality", but not to the more human-centred Environmental Health sub-scale.

Table 3: The table shows correlations of P- and U-scores with per capita GNI (2006) and Environmental Performance Index 2008. For Malta, no EPI data were available. * <.05, ** <.01, *** <.001

Correlations	N = 14	P-score	U-score
GNIpc 2006 (n = 15)		-.28 n. s.	**-.76****
EPI 2008 (n = 14)		-.50 n. s.	**-.72****
	Environmental Health	-.17 n. s.	**-.74****
	Controlled for GNIpc	n. s.	n. s.
	Ecosystem Vitality	**-.63***	**-.70***
	Controlled for GNIpc	-.69**	-.61*

We tested the relation between religious variables and environmental values, both in the total sample and for each cluster separately. First, we analysed the relationship between religious affiliation and environmental values in the total sample and within the clusters (n = 5512, see methods).

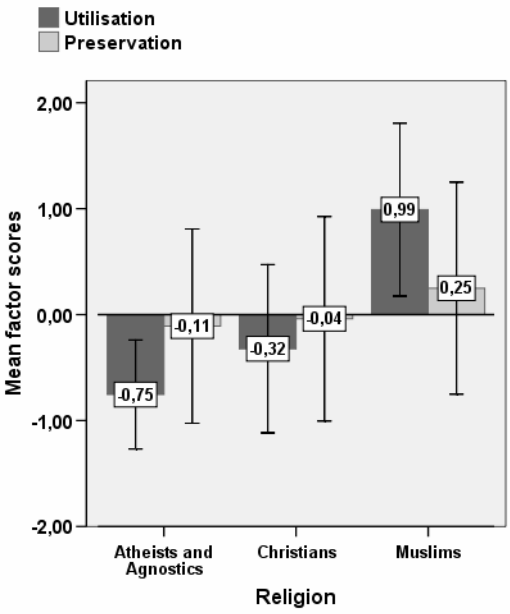
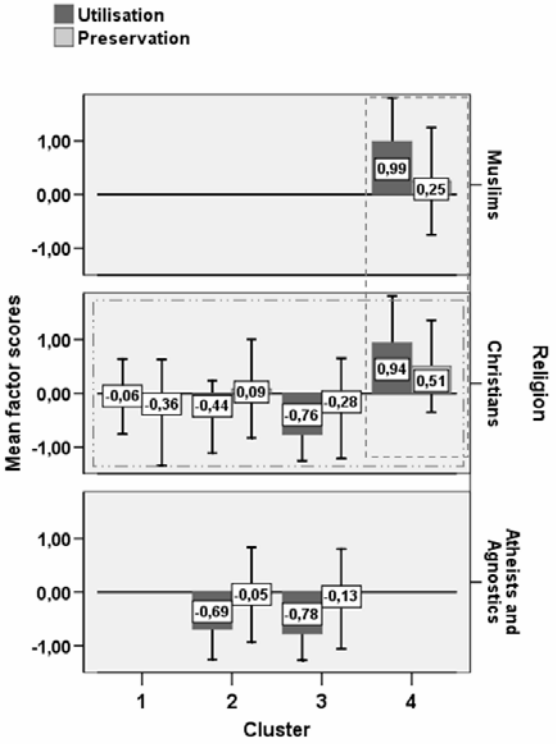


Figure 4: Means and standard deviations of Utilization and Preservation grouped for religion. *N* = 5512, *Muslims*: *n= 1758*; *Christians*: *n* = 3079; *Agnostics and Atheists*: *n* = 675.

Very high standard deviations within religious groups (U: Atheists = 0.51, Christians = 0.79, Muslims = 1.02; P: Atheists = 0.92, Christians = 0.97, Muslims = 1.00) being at least for Preservation as high as the total standard deviations of 1.00, point to the necessity to consider the effect of religious affiliation within the clusters. Figure 5 proves that cluster membership is highly associated with religion.

Figure 5: Mean factor scores and standard deviations for Preservation and Utilisation in every cluster, grouped for Religion. *Muslims: n* = 1758; *Christians: n* = 3079, in Cluster 1: *n* = 577, in Cluster 2: *n* = 1614, in Cluster 3: *n* = 638, in Cluster 4: *n* = 250; *Agnostics and Atheists: n* =675, in Cluster 2: *n* = 179, in Cluster 3: *n* = 496; *N* = 5512.



Within the same clusters, average U- and P-scores of religious groups do hardly vary. The differences in Utilisation are reduced to a somewhat lower score for atheists compared to Christians in cluster 2 (ΔM = 0.25). The Christians in cluster 3 have minimally lower P-scores than the Atheists (ΔM = -0.15, p<.01, Z -2.98), but the opposite is true for Christians in cluster 4 compared to the Muslims (ΔM = 0.26). The latter difference between Muslims and Christians disappears, if we consider only the Lebanon (the country including almost all Christians in cluster 4 (ΔM = 0.08), although the Muslims show higher U-scores (M = 1.15, ΔM = 0.17) compared to Christians (Z = -2.01, p <.05). However, even these small effects may not be rooted in being Muslim or Christian but in belief in God and religiousness in general: whereas 99% of our Muslim sample in our sample indicated to believe in God, only 82% of Christian sample did so. And whereas 90% of the Muslim sample declared to practise her/his religion, this was true for only 58% of the Christian sample. Indeed, we find a strong correlation between Utilisation and the country mean of belief of God (ρ = .87, p <.001), the same is true, however, for belief and per capita GNI (ρ = -.76, p =.001).

*Table 4: Nonparametric correlations between beliefs in God (5890), practice of religion (n = 5830) and environmental values. C = Cluster, T = total, * p <.05, ** p <.01, *** p<.001, n. s. = not significant.*

Spearman's Rho	**I believe in God**	**I practise religion**

Utilisation	C1: n. s. C2: .15*** C3: n. s. C4: n. s.	C1: .n. s. C2: .14*** C3: n. s. C4: n. s.
Preservation	C1: .09* C2: .08** C3: .06* C4: .07**	C1: n. s. C2: n. s. C3: .08** C4: .15***

2.6. Discussion

In principal, we used the Preservation and Utilization scale of Bogner and Wiseman (1999, 2002, 2006) in order to classify countries for their environmental values. In the first instance, our focus was on affluence, pollution and religion. Exploratory factor analysis yielded a clear two-factor structure. We identified four clusters consisting of at least two countries. The contribution of Utilization scores to the clustering was more important than that of Preservation, being responsible for the most obvious differentiation between European and Non-European countries. Which patterns might explain the classification of European countries? A clear tendency of North-European societies was found to score lower on Preservation compared to South-European countries. A similar north-south differentiation of Utilization scores within Europe could not been unveiled.

Table 5: Summary of the cluster characterization by Preservation and Utilisation, mean affluence, mean Environmental Performance Index (EPI), religious groups, mean belief in God and mean practice of religion.

Cluster (N)	**1** (2)	**2** (6)	**3** (3)	**4** (4)
Environmental Values	U± P-	U- P±	U- P-	U+ P+
GNI pc 2006	8,030 (226)	16,327 (9,185)	28,193 (14,535)	2,778 (2,022)
EPI	83,4 (4.0)	81,1 (5.6)	86.4 (1,3)	70,8 (6,3)
Ecosystem vitality	72.4 (7,1)	68.1 (4.4)	74.1 (1.9)	58.7 (9.7)
Religion	**92% Catholics** 3% Atheists	**56% Catholics** 21% Orthodox 10% Atheists	**39% Atheists** **37% Catholics** 12% Protestants	**72% Sunnite** 9.6% Shiite 8.7% Catholic
Belief in God	4.4 (1.0)	4.1 (1.3)	2.7 (1.7)	4.9 (0.5)
Practice religion	3.8 (1.4)	3.3 (1.6)	2.1 (1.5)	4.5 (1.1)

Preservation was highly correlated to the pollution measure sub-score Ecosystem vitality[1] (ρ = -.63), whereas affluence was not significantly correlated with it. Clusters with weaker ecosystem vitality (4, 2) had higher Preservation scores than those with better ones (3, 1). On the other hand, Utilisation was higher in countries with lower per capita Gross National Income (c4, c1) and in countries with poor environmental performance. The negative relationship of Utilisation with Environmental Health may be attributed to its correlation with affluence. According to the 2-MEV model a high Utilisation score is not automatically related to a low Preservation score. Moreover, the highest Preservation scores were found in the

cluster scoring highest on Utilisation. Furthermore, the role of the latter for active environmental protection is not clear: Milfont and Duckitt (2006) reported Utilisation to be highly positively related to economic liberalism, but only Preservation was positively related to environmental behaviour. We cannot decide here, if higher Utilisation scores imply lower awareness of the negative impact human-beings have on nature and environment or if it just implicates another, maybe more optimistic way of coping with evolving problems. The latter might be explained by cultural factors like religion. The clusters with high U-scores (table 5) have also high portions of religious people (Catholics or Muslims) and high mean scores for belief in God. Religion may explain the grouping of Estonia together with the two countries with highest per capita GNI: together with France, the Estonian sample includes the most Agnostics or Atheists (being related to low U-scores). Within the same culture, religion does not make a remarkable difference. Thus, to combat environmental degradation, a change in social norms in general may be more effective than discussing a potential positive or negative impact of religion on environmentalism.

Main references:

Bogner, F. X., & Wiseman, M. (1999). Towards measuring adolescent environmental perception. *European Psychologist, 4*, 139-151.

Bogner, F. X., & Wiseman, M. (2004). Outdoor Ecology Education and Pupils' Environmental Perception in Preservation and Utilisation. *Science Education International, 15*(1), 27-48.

Oerke, B., & Bogner, F. X. (2007). Social desirability, environmental attitudes and general ecological behavior. *Submitted for publication*.

Wiseman, M., & Bogner, F. X. (2003). A higher-order model of ecological values and its relationship to personality. *Personality and Individual Differences, 34*, 783-794.

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IV. Human Evolution:

Objectives, methodologies, main achievements and implication

1. Evolution approaches in school textbooks of 19 countries

1.1. Introduction

Today, nothing in biology can be thought without an evolutionary perspective. "Biological evolution is the central organizing principle of modern biology"[2]. Nevertheless, the growing offensive of fundamentalist religious groups is trying to disturb science teaching, proposing to introduce creationist ideas in the curricula or, at least, to avoid to teach evolutionism in schools. To counter-attack, the scientists mainly present the facts of the Evolution to help media and teachers.

We urgently need to know better the present impact of creationist ideas on the systems of education around the world, particularly on teachers, including the biology teachers. That is a necessary step to then improve the teachers' training related to this fundamental topic.

In fact, the links between science and religion could be peaceful. The historians of science analysed that the modern science born in a religious context where the laws of the nature, considered as created by God, were possible to analyse and describe, and had to be respected. After some conflicts as the Galileo affair, the three main monotheist religions (Jewish, Christian and Muslim) have accepted the autonomy and respect of science. The pope Jean-Paul 2 clearly recognized in 1996[3] that the theory of evolution is no more to be considered as a hypothesis after the amount of new knowledge in this field. Today, it is quite possible to believe in God (being Jewish, Christian or Muslim) and at the same time to be evolutionist. Nevertheless, inside these three monotheist religions, some fundamentalist groups, as the "*born-again Christians*"[4] are claiming that evolutionism is not compatible with religion and that the educational systems would have to respect their creationism, at least through its new look: the intelligent design.

What is the impact of this renewed creationism movement on the educational system, and mainly on teachers' conceptions? We tried to answer to this question by carrying out two large enquiries in 19 contrasted countries (table 1) where until now no enquiry has been applied to teachers' conceptions on evolution. One enquiry to analyse the syllabuses and school textbooks in these countries, and a second one to analyse the teachers' conceptions on evolution.

1.2. Syllabuses

The main point is that Evolution is not taught at all in several countries and taught at only one school level in some others (generally the last year of Secondary School).

The figure 1 is a possible synthesis of the today curriculum related to Biology.

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[2] National Academy of Science, 2008, "*Science, Evolution, and Creationism*": http://www.nap.edu/catalog/11876.html (consulted the 14th February 2008)

[3] http://www.hominides.com/html/theories/jean_paul_evolution.html

[4] George S., 2007 - *La pensée enchaînée.* Paris : Fayard (translation from English: *Culture in chains. How the Secular and Religious Right Captured America*).

This synthesis must be nuanced: some History syllabuses involve human evolution (as in Cyprus, Italy …), and the question of Evolution is only discussed in Philosophy in Algeria (last year of secondary school). In Lebanon, the syllabus was mentioning Evolution at two levels (we have analysed the corresponding textbooks), but this topic is no more taught today. In Burkina Faso, the French textbooks (with Evolution) are generally used but Evolution is not included in the syllabus. Moreover, in several countries, the matter "Religion" can speak about Evolution, promoting sometimes only a creationist approach.

Other point: the 2007-8 syllabuses (figure 1) sometimes differ from the 2004-5 ones (studied in the Biohead-Citizen project); and, in some country, the school level is corresponding to several years and no only one.

Nevertheless, the synthesis of the figure 1 is informative, showing great differences among countries. In 3 countries (Finland, France and Lithuania), Evolution is today taught at least at 6 school levels. In the 6 non European countries, but also in Poland and Romania, Evolution is not taught or only at one school level. In the other European countries, it is taught at 3 or 4 school levels (figure 1).

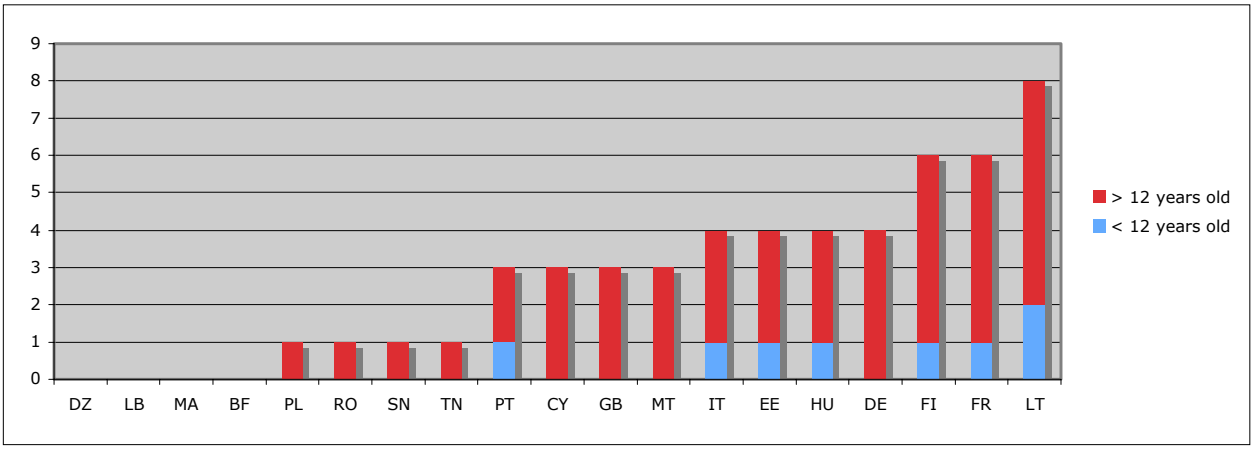

Figure 1- *Number of school levels where Evolution is taught (biology syllabuses) in the 19 countries (see the table 1 for the full names of the countries).*

1.3 - Textbooks

During the first year of the Biohead-Citizen project (2004-2005), a grid has been elaborated collectively and tested on samples of textbooks in several countries for verification and improvement of its accuracy. For each textbook, the total grid (7 full pages of tables) has been filled. Only some of these data are analysed today (see the list of publications and communications). One example of results is shortly illustrated below: the Images of *Homo sapiens* in evolution trees or lines.

62 images were gathered containing illustrations of *Homo sapiens* in lines or trees of evolution. These schemas were collected from 28 science textbooks of twelve countries (Cyprus, Estonia, France, Germany, Italy, Lebanon, Lithuania, Mozambique, Portugal, Romania, Senegal, Tunisia,).

The majority of textbooks illustrate human biological evolution as linear and finalised, projecting an image of light-skinned, male *Homo sapiens*.

Figure 2 illustrates the most frequent type of drawing of this human linear evolution. Here, *Homo sapiens* appears to be a white-skinned man, naked, resembling the prototypical image of Adam.

Another frequent representation of *Homo sapiens* is a male human, with characteristics of the occidental society (white-skinned, occidental clothing and/or tools and accessories): for instance a white man with suit in a Senegalese book, a man wearing a modern blue dress in an Italian book and a boy in a German book.

Finally, we found only 3 images with a couple (man + woman, e.g. in figure 3: never a woman alone) and one unique image, showing ethnical diversity of humankind with a sketch of three persons from three different ethnical origins, one of them being a woman (figure 4).

These results clearly show that, behind the apparent objectivity of the familiar scientific images on human evolution, there are some implicit choices: in most of the analysed textbooks, from 12 different and contrasted countries, only adult occidental men are represented in the trees or lines of human evolution. Why has this disequilibrium not been eliminated until now, even after the feminist and antiracist movements?

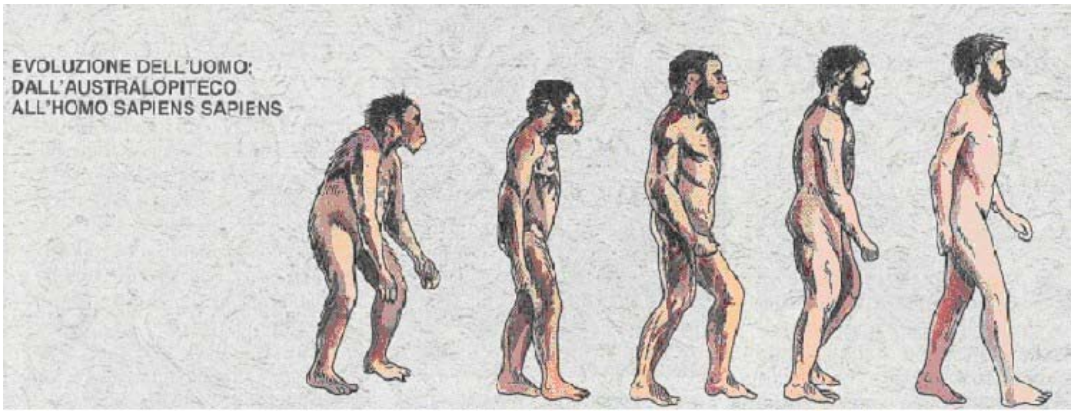

Figure 2. *The most frequent image: the linear conception of human evolution, ending with a white-skinned and bearded man. (Italia, Il Capitello, senior high school, 2001, p.277)*

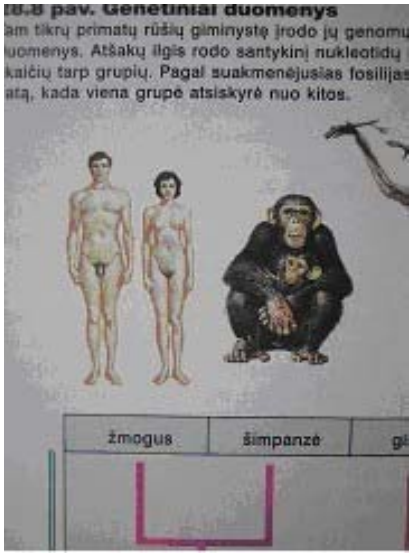

Figure 3. *One of the 3 images showing a couple (in Biologija, S.S.Mader, Vilnius, Lithuania, 1999, p.134)*

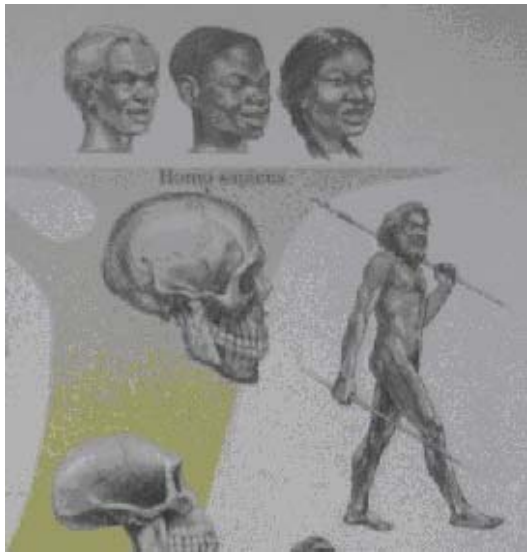

Figure 4. *The unique image found showing a diversity of Homo sapiens (Germany, illustration by Koehler, 2005, from Ikarus, Natur und Technik, p.185.*

One possible explanation may be a strategy on the part of the textbooks publishers to choose illustrations representing the most numerous type of human being in their country. Images of occidental human beings could be considered as normal in occidental countries. Nevertheless,

in this case, why mainly men and not women? Furthermore why have occidental men appeared up until now in the evolutionary trees in the textbooks of African countries as Senegal? One answer is that some African countries still use or reproduce European textbooks (e.g. Tunisia and Senegal use French textbooks). However, there is a different explanation, too, that can be revealed by an epistemological approach.

The historical study of the construction of scientific knowledge on human evolution shows that the main epistemological obstacles are ideological. At the end of the 19th century and during the first part of the 20th century, the belief in the superiority of occidental man was the dominant conception in the European scientific community. In the mind of the researchers of this period, the biological evolution was linear and finalised: the goal of evolution would be an occidental man in accordance with their ethnocentrism and sexism (figure 2). Two complementary hypotheses can be proposed: (1) The dominance of white male in the textbooks results from the inertia of the diffusion of scientific knowledge i.e. we still go on using the same unrepresentative images of human beings for reasons of not questioned tradition. (2) The occidental ethnocentrism is always in action. Until now it has been difficult to think of images of human evolution that don't lead to a white male. There is also a link between scientific knowledge about human evolution and the myths like Adam and Eve in the Garden of Eden. The "nude white men" illustrations are probably rooted in deep occidental myths for the humankind's origin.

1.4 - Discussion and recommendations related to syllabuses and school textbooks

In conclusion, this work concerning the topic human origin in the textbooks shows that the scientific data are often mixed with implicit values. It is important to identify these values, to acquire a better citizenship whilst teaching this topic. The use of the KVP model helped us to identify the implicit values (sexism, occidentalism, reductionism) hidden behind these images.

Other results can emerge from our data on evolution in textbooks: lack of historical and epistemological approaches, dogmatic pedagogical style, …

Therefore, we recommend an introduction of epistemological reflection into teachers' training and a historical approach to science in curricula, including particular reference to this topic (human origins). This would undoubtedly favour the ability of students to develop a critical outlook at new discoveries on this subject linked to the never ending debates.

An other recommendation is to propose the creation of structures developing a critical analysis of school textbooks, to identify this kind of implicit values, and to propose more scientific ways to teach Evolution and particularly Humankind origins.
* At an international level to dare to identify implicit values eventually linked to scientific knowledge as we have done for the image of Homo sapiens;

* At a national one (or regional if the syllabuses and textbooks are defined at a regional level) to publish critics of the local textbooks with the goal to help teachers and schools in their choice of textbooks.

Nevertheless, the main conclusion of our enquiry on syllabuses and textbooks is related to the absence or little place of biological evolution in several countries of our sample: mainly the six non European countries, but also in Poland and in Romania (figure 1).

A main recommendation, even more important than the precedent ones, is to open a reflection on how to incite all the governments to introduce more education on evolution in their respective educative systems.

The progressive implementation of the Environmental Education could be an example: what equivalent of the Tbilissi international Conference on EE (1977) can be imagined?

What kind of activities (Associations, Museums, Science Centres, medias, books and journals for children, literature, games, …) can be developed to more familiarise people with the knowledge related to biological evolution?

The question is complex, principally because the roots of the decrease of teaching of Evolution in some countries are strongly correlated to the renewal and increase of the creationist conceptions in these countries.

To know how to counter attack the creationist ideas, we have in a first time to know how they are extended in each country, and possibly correlated with political, economical, religious or other social parameters. That is the main goal of our second enquiry on the teachers' conceptions on evolutionism and creationism presented below.

2. Conceptions of teachers and future teachers about Human Evolution

2.1. Samples

The samples are presented in the table 1. In each country, approximately half of the sample is composed by in-service teachers (1/3 inP = Primary schools, 1/3 inB = Secondary Biology, 1/3 inL = Secondary Language/Letters), the other half by pre-service teachers (with the same three 1/3).

We have collected several personal information from each (future) teacher: gender, age, level of training, religion, political, social, economical convictions, etc. All this information will be used to interpret and discuss our results. Some of them are used in the co-inertia analysis presented below. In this first presentation, the table 1 present only the main parameters which are important to interpret the teachers' conceptions on evolution: the amount of biologists, and the different religions.

The countries have been chosen to be contrasted: 6 out of Europe, the others from North of South of Europe, and from West to East, with different religions. Nevertheless, a bias can be introduced related to the Muslims: quasi all of them are located outside Europe. In consequence, we will take a particular attention on the conceptions of Christian teachers in the 6 countries outside Europe, to analyse if the Muslims' conceptions are or not rather conceptions of teachers outside Europe: they can be more linked to the economical socio-political context than to the precise religion. That is the reason of the choice of Burkina Faso as a complementary country initially not involved in the Biohead-Citizen project (2/3 of our sample of teachers in Burkina Faso are Christian). There is also an important minority of Christians in Lebanon (30%) and a little less in Senegal (8%).

Our samples are not representative of the total population of each country:

- In some case, only one Region is concerned: Bavaria in Germany, Minho in Portugal, Rhône Alpes and Languedoc-Roussillon in France (that explain the number of French teachers: 732, nevertheless, they are grouped because we did not find any significant differences between the two Regions), etc.

- In all case, only (future) teachers are interviewed. Their social characteristics are not representative of all the national population, even if not always very different[5].

Nevertheless, our samples are significant of the precise category in each country (or Region): 6 samples of at least 50 persons in each country (inP, preP, inB, preB, inL, preL), about 300 persons by country in total. In three cases, the sample is more important to test some complementary precise hypotheses (in France, Lebanon and Tunisia). In some other cases, the sample is less important: in small countries as Malta and Estonia, but also in Great Britain (because they left the project just after the first year) and in Algeria (which did not receive the Biohead-Citizen money until now).

Table 1 - Presentation of the samples for the 19 countries

	Country	Total	including biologists	% Agnost.	% Catho.	% Prot.	% Ortho	% Muslim	% Other
BF	**Burkina Faso**	**296**	**92**	*2,4*	***45,6***	*18,6*	*0,0*	*24,7*	*8,8*
CY	**Cyprus**	**322**	**63**	*4,0*	*9,0*	*1,2*	***77,3***	*0,0*	*8,4*
DE	**Germany**	**365**	**109**	*13,4*	***44,7***	***31,8***	*0,0*	*0,3*	*9,9*
DZ	**Algeria**	**217**	**57**	*1,4*	*0,0*	*0,0*	*0,0*	***92,2***	*6,5*
EE	**Estonia**	**182**	**60**	***43,4***	*7,7*	*14,8*	*2,2*	*0,5*	***31,3***
FI	**Finland**	**306**	**121**	*15,0*	*1,0*	***66,3***	*2,9*	*0,0*	*14,7*
FR	**France**	**732**	**249**	***50,5***	***38,1***	*1,9*	*0,3*	*1,5*	*7,7*
GB	**Great Britain**	**154**	**106**	***33,1***	*11,0*	***33,8***	*0,6*	*0,0*	*21,4*
HU	**Hungary**	**334**	**108**	*15,3*	***46,4***	*16,2*	*0,0*	*0,0*	*22,2*
IT	**Italy**	**559**	**119**	*12,3*	***78,7***	*0,5*	*0,0*	*0,0*	*8,4*
LB	**Lebanon**	**722**	**212**	*0,4*	*21,1*	*0,4*	*8,3*	***65,0***	*4,8*
LT	**Lithuania**	**316**	**98**	*4,1*	***89,9***	*0,6*	*0,3*	*0,0*	*5,1*
MA	**Morocco**	**330**	**128**	*0,6*	*0,0*	*0,0*	*0,0*	***97,3***	*2,1*
MT	**Malta**	**198**	**41**	*0,5*	***96,5***	*1,0*	*0,0*	*0,0*	*2,0*
PL	**Poland**	**311**	**100**	*1,9*	***94,2***	*0,6*	*0,0*	*0,0*	*3,2*
PT	**Portugal**	**350**	**102**	*9,4*	***76,3***	*7,4*	*0,0*	*0,0*	*6,9*
RO	**Romania**	**273**	**93**	*7,3*	*8,1*	*7,0*	***71,1***	*0,0*	*6,6*
SN	**Senegal**	**324**	**114**	*0,9*	*8,3*	*0,0*	*0,0*	***89,2***	*1,5*
TN	**Tunisia**	**753**	**318**	*1,9*	*0,0*	*0,0*	*0,0*	***96,0***	*2,1*
Total		**7 044**	**2 290**	11,8	35,1	8,3	7,4	29,6	7,8

(in blue are the non European countries); Agnost= Agnostic / Atheist; Catho = Catholic; Prot = Protestant; Ortho= Orthodox; Muslim = Muslim; Other= mainly no answer + all the other religions.

The long work to build the questionnaire, and to validate it, is described previously (see also Clément & Carvalho 2007). All the questionnaires were filled in the strictly same way in each country, in presence of the researcher but with a total guaranty of anonymity. Only the questionnaires with more than 95% of filled questions have been used to analyse the data.
The 15 questions related to Evolution are reproduced in the Annex 1[6]. Four of them were included in the questionnaire A filled in the 19 countries. The other 11 questions were included in the questionnaire B filled in only 14 countries. The personal questions will be mentioned below only when it will be useful.

Below are just illustrated some examples of our results. For more details, see Clément et al 2008 and in preparation. The examples are chosen to illustrate the most important conclusions.

[5] We have for instance the percentage of the different religions in all the population of each country in "*L'Atlas des Religions*", Paris: La Vie, Le Monde hors série, 2007.
[6] Most of these 15 questions came from previous research of P.Clément or of M.P.Quessada, but some of them were new and just validated by the Biohead-Citizen pilot test.

2.2. Results

- An unexpected high amount of creationists, and low (but sometimes significant) differences between biology and other teachers.

Question A64. **Which of the following four statements do you agree with the most ?** (tick only **ONE** answer)

1 ☐ It is certain that the origin of life resulted from natural phenomena.
2 ☐ The origin of life may be explained by natural phenomena without considering the hypothesis that God created life
3 ☐ The origin of life may be explained by natural phenomena that are governed by God.
4 ☐ It is certain that God created life

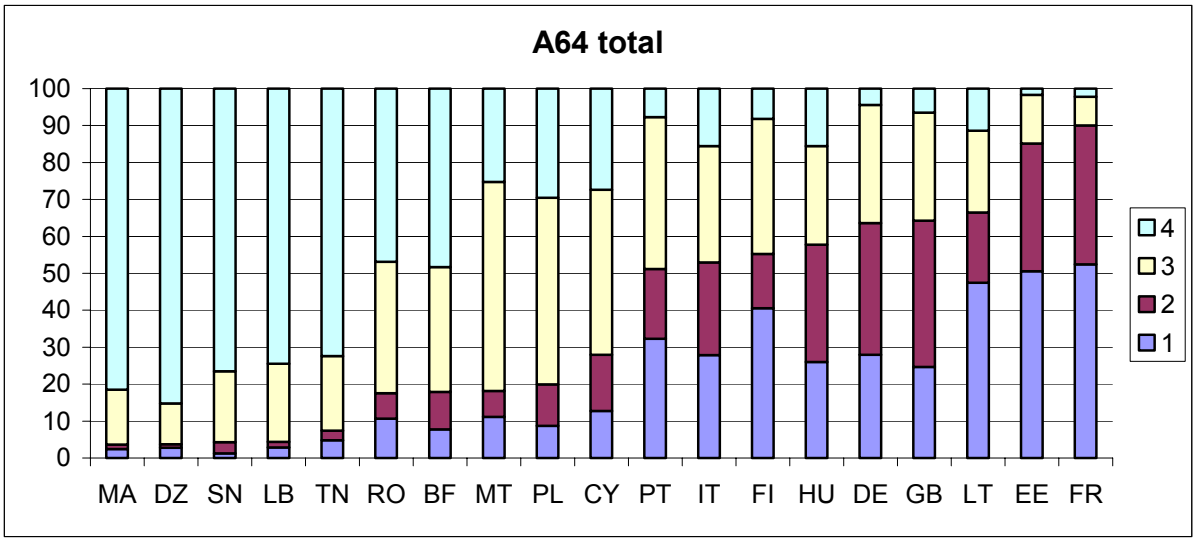

Figure 5a - Answers of the 7044 teachers to the question A64 (for the full name of each country, see the table 1)

The figure 5a shows strong differences among countries. The creationist (and not evolutionist) conceptions (item 4) are very frequent in the 6 non European countries (50 to 85%) but also in Romania (nearly 50 %), and stay very high (about 30% in Poland and Malta). It is very low in France and Estonia (2%) and also in Germany (4%) and between 7 and 12% in Great Britain, Portugal, Finland and Lithuania. These amounts are globally well correlated with the importance of Evolution in the school syllabuses of each country (figure 1), but we are going to analyse more precisely other important correlations.

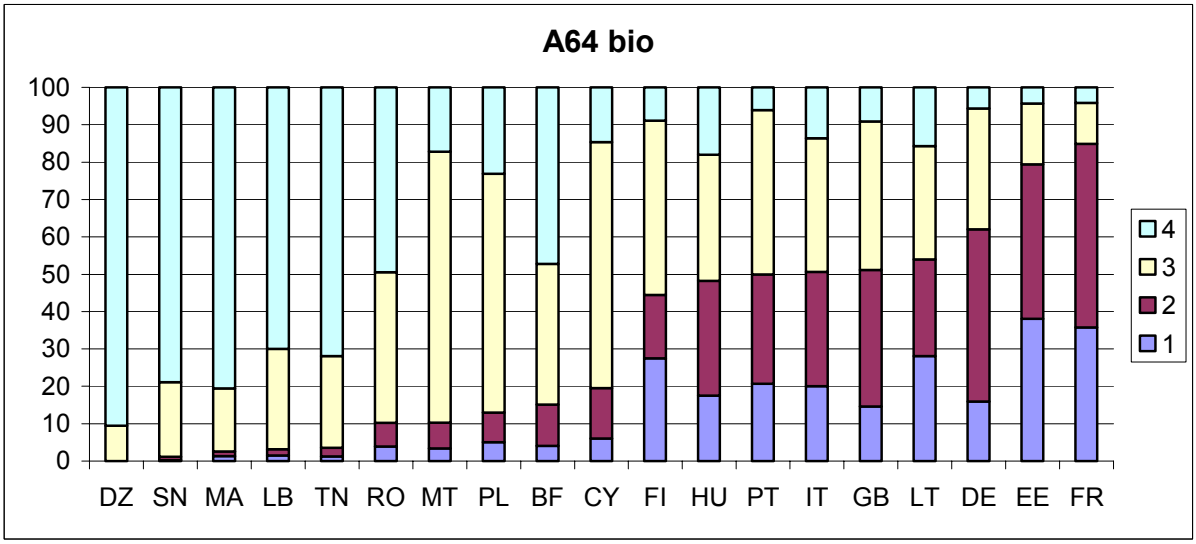

Figure 5b - Answers of the 2290 biology teachers to the question A64
(for the full name of each country see the table 1)

The figure 5b shows the conceptions of only the biology teachers when answering to this A64 question. The same great difference between countries can be observed. In 8 countries (Algeria, Senegal, Romania, Malta, Great Britain, Lithuania, Estonia and France), there is no significant differences between biology and other teachers. In the other countries, the significant differences show that the biologists are more evolutionists than the other teachers, mainly by the increase of the amount of "evolutionist creationists" (item 3).
This result is important, showing the compatibility between believing in God and being evolutionist, and showing that more biology training in University increases the amount of evolutionist conceptions.

Question A62 - In the list below, tick the <u>THREE</u> expressions that you think are the most strongly associated with the origins of humankind.

☐ Adam and Eve ☐ Australopithecus ☐ Creation ☐ Evolution ☐ God ☐ Natural selection

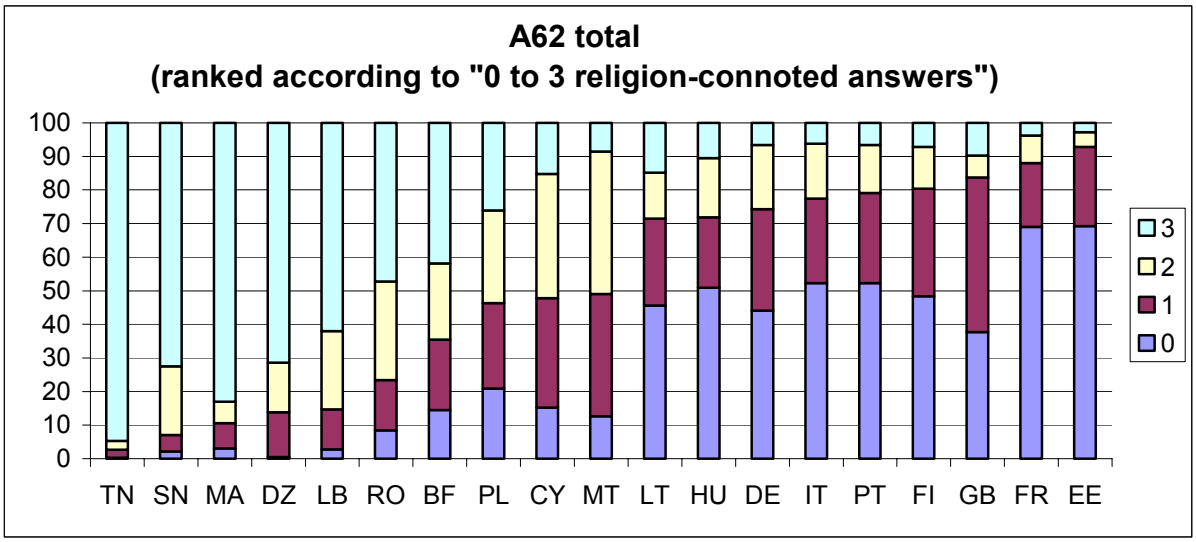

Figure 6 - Answers of the 7044 teachers to the question A62 (for the full name of each country see the table 1)

The question A62 (figure 6) is an other way to measure the impact of creationist or evolutionist notions on teachers. The answers measure more the cultural context than the precise creationist (or evolutionist) convictions. Three of the six proposed words are in the semantic field of religion, the three other being in the semantic field of evolution. We have quoted the number of religion-connoted ticked words. The detailed analysis of the answers would be informative, and we have just started to identify the different possible associations. Nevertheless, in a first time, we can observe the same great differences among countries as in the figures 5a & 5b: 72 to 96% of religious words in Algeria, Senegal, Morocco and Tunisia, and, at the other pole, 68% of words related to Evolution in France and Estonia.

- The weight of religion: mainly the degree of believing in God and practising religion (for any religion).

Using the 15 questions related to Evolution, inserted in the questionnaires A and B (and in consequence limiting this work to the 14 countries where these two questionnaires have been filled by 5249 in-service or pre-service teachers), we did a PCA (Principal Components Analysis) to see the correlations between the answers to these 15 questions. For instance, the figures 5 and 6 suggest a strong correlation between the individual answers to the questions A64 and A62 that is verified in the PCA. All the answers to the questions related to the opposition between creationism vs. evolutionist conceptions are strongly correlated, defining the main principal component (axis 1 of this analysis). The weight of the second component

(linked to some precise knowledge on the evolutionary process) is much lower, as well as the third component (linked to finalism when not correlated with the first component).

We did also, independently, an other PCA from the 17 questions related to each teacher's personal opinions: related to believing in God or practising religion (P12a & P12b), to separation between science and religion (A51) or politics and religion (A37), to political positions (A42, A48), social or socio-political positions (A15, A52, A20, A50), economical positions (A34, P9, P10, P11) and also degree of engagement for environmental protection (P6, P7, P8).

Then, using these two PCA, we did a co-inertia analysis to look for the best correspondence between each teacher's personal opinions and his / her conceptions on Evolution. The results are shown and explained on the figure 7: they are very interesting. The correspondence is highly significant, showing a very strong correlation between creationist conceptions and the degree of believing in God and the degree of practising religion.

Linked to the religious / creationist pole are some political conceptions (figure 7) as the opposition to a separation between science and religion, or between politics and religion, for a strong central national power, and for some private structures.

The evolutionist pole is characterized by the opposite positions.

All the other political, social, economical opinions, or degree of engagement for environmental protection, are not correlated to this strong opposition.

These results are putting in evidence that I call "systems of conceptions", where creationist conceptions are strongly correlated to the degree of religious practise, associated to some religious and / or political positions.

We are now going to analyse the eventual link between the different religions and the creationist or evolutionist positions (figure 8 & 9).

The figures 8 and 9 must be interpreted together.

In black are the not evolutionist creationist answers (item 4 of the question A64). Just above are the evolutionist creationist answers (item 3) and in grey the item 1 and 2 (evolutionist not creationist answers). The amount of the 4 items differs strongly from a religion to another (figure 8) but also from one country to another for the Christian teachers (figure 9).

In the figure 8, the differences are significant from one religion to another, except between Catholics and Protestants. Without surprise, almost all (96%) of the agnostic / atheist are evolutionist and not creationist. For Catholics and Protestants, 20% are not evolutionist creationists, 40% evolutionist creationists and 40% not creationist evolutionists. Orthodox teachers are more creationist (40% not evolutionist creationist and 40% evolutionist creationists, for only 20% not creationist evolutionists), and the Muslim teachers much more creationist (75% not evolutionist creationists, 20% evolutionist creationists for only 5% not creationist evolutionist).
Nevertheless, we have insisted in the beginning of this chapter on the fact that nearly all the Muslim teachers are in non European countries (table 1). That is not the case for Christians and if we look at the national differences inside the 2508 Christian teachers (figure 9), we observe a great diversity: from 2% of not evolutionist creationist Christian teachers in France to 64% in Lebanon. The amount of not evolutionist creationist positions in high (43% to 64%) in the 3 non European countries (Senegal, Burkina Faso and Lebanon) as well as in Romania. It is low (2 to 11%) for the Christian teachers of France, Germany, Estonia, Portugal, Great Britain and Lithuania.

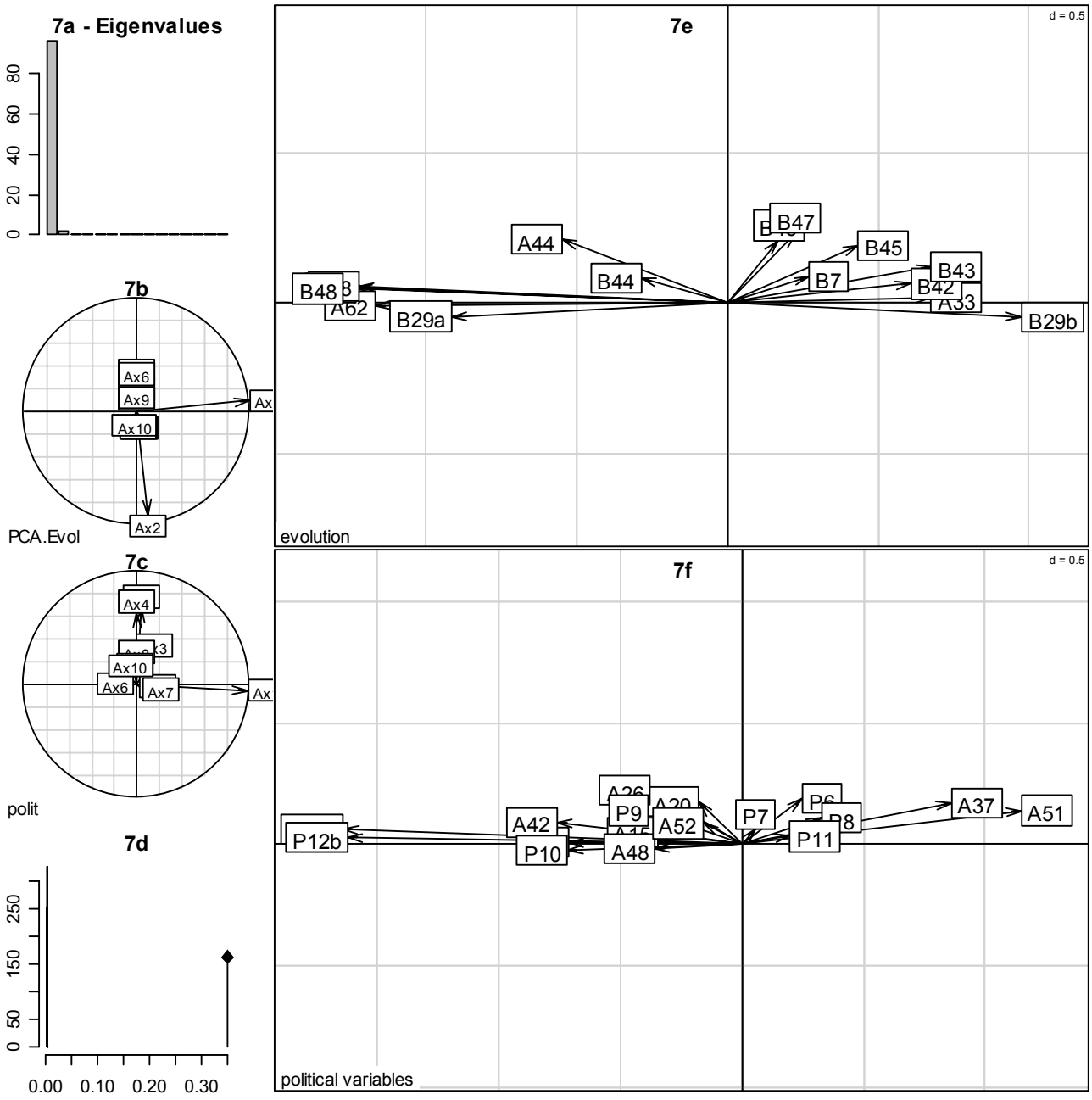

Figure 7 - Co-inertia analysis between the 15 questions on Evolution (upper part of the figure), and the 17 questions related to political, religious, economical, social, environmental ideas and declared practices (lower part of the figure). **7a -** Only the first component (axis 1, horizontal, in 7b, 7c, 7e & 7f) is important for the co-inertia analysis.
7b and 7c - This axis 1 is mainly the same in the initial separated PCA and in the co-inertia analysis.
7d - The randomisation test (Monte Carlo) shows a very high significance of the co-inertia results: the observed result is very far from the histogram (at left) resulting from 1000 essays by randomisation.
7e - Concerning the variables Evolution, this first axis is clearly explained by the opposition between the creationist conceptions (at left: questions B28, A64, A62, B28, B29a with also a correlation with finalism: A44) and the evolutionist conceptions (at right: question B29b, but also one anti-finalist position with question A33 and two knowledge questions related to the importance of chance and natural selection in evolution: B42 & B43)
7f - Concerning the "political, religious, social variables", the first axis is clearly explained by the religious positions: at left great level of believing in God (P12a) and practising religion (P12b), at right defending the separation between science and religion (A51) and the separation between politic and religion (A37). The religious pole (at left) is also correlated to the preference of private health structures (P10) and by agreeing with the proposition "Only a strong central power can put some order in my country" (A42).

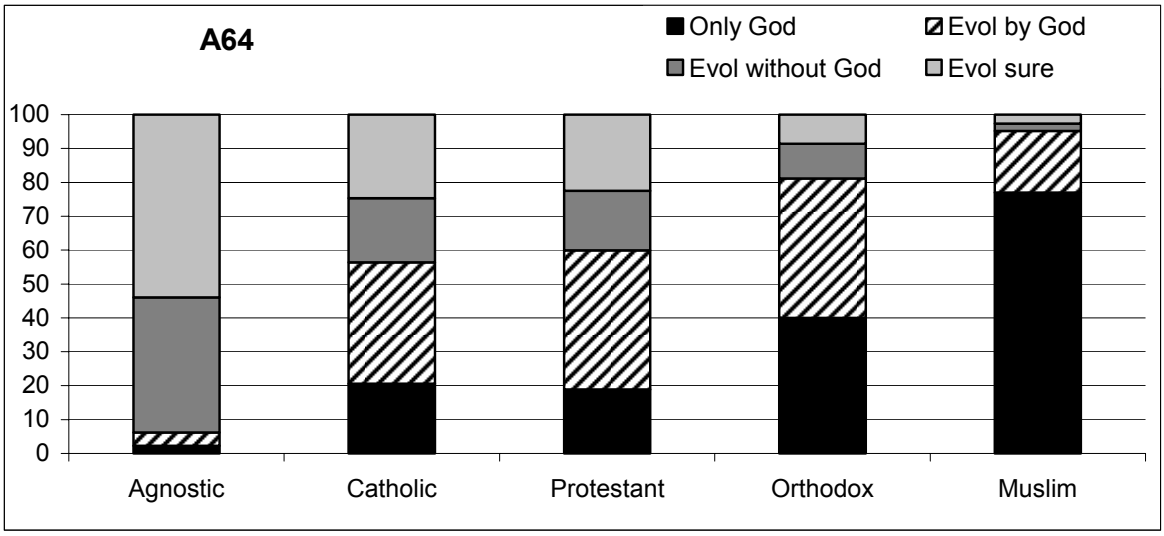

Figure 8 - Answers to the question A64 by the teachers from the 19 countries (see figure 5 for differences between countries), here grouped by main religions.

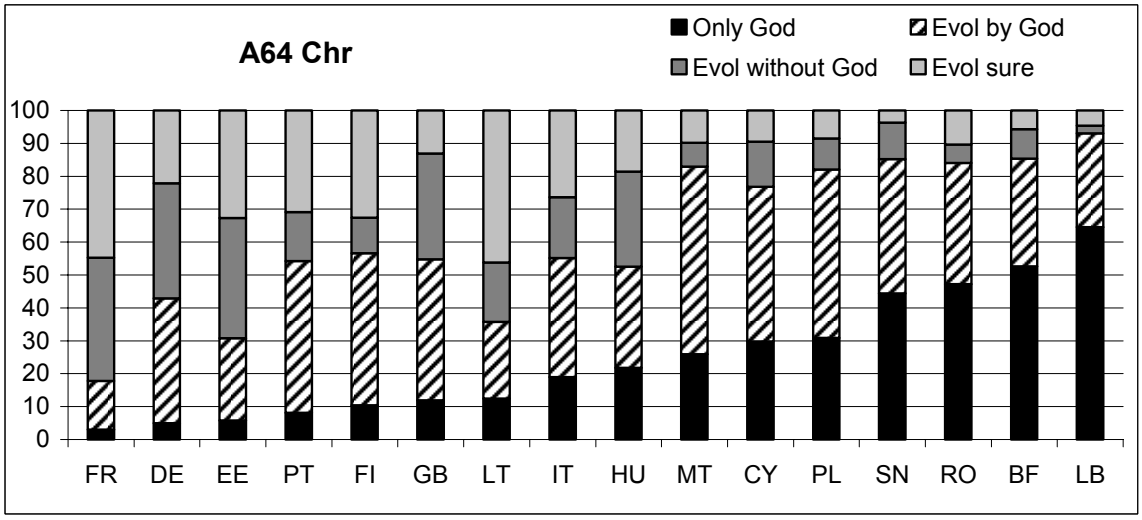

Figure 9 - Answers to the question A64 by the only 2508 Christian teachers from the 19 countries (3 countries are missing because there were only 1 to 3 Christian teachers).

Figure 10 is showing, country by country, the degree of practising religion: the correlation is excellent with the questions related to evolutionism / creationism (as the questions A64 and A62: figures 5 and 6). This correlation is very apparent also in the co-inertia analysis (figure 7).

In conclusion, there is a strong interaction between several parameters, and we must be aware to not reduce our interpretation to only one of them: the number of creationist teachers rejecting evolutionism is increasing in the less developed countries and when the practising of religion is very high. And also, in the same countries, the Evolution is not taught at school or only a little (figure 1) and the religious education is very strong (often at school).

The figure 8 has not to induce a war (or concurrence) between religions! With our sampling of countries, nearly all the Muslims are in non European countries and are highly practising their religion. For the Orthodox teachers, only two countries are represented (Romania and Cyprus + a minority in Lebanon: table 1): impossible here also to separate the level of development from the degree of practising religion (high in these 3 countries) and the national cultural context, all these parameters being linked to the high amount of not evolutionist creationist conceptions.

In consequence, the differentiation of Christian teachers' conceptions from one country to another (figure 9) is a very important result. That is inside each religion (and not by opposing one religion against one other) that the struggle against the renewal of fundamentalism (and its anti-evolutionist convictions) must be developed: probably by increasing the level of development, but also by increasing the level of education. We saw that in 11 of the 19 countries, biologists are less anti-evolutionist than the other teachers. We are now going to present other results related to the influence of the level of teachers' training.

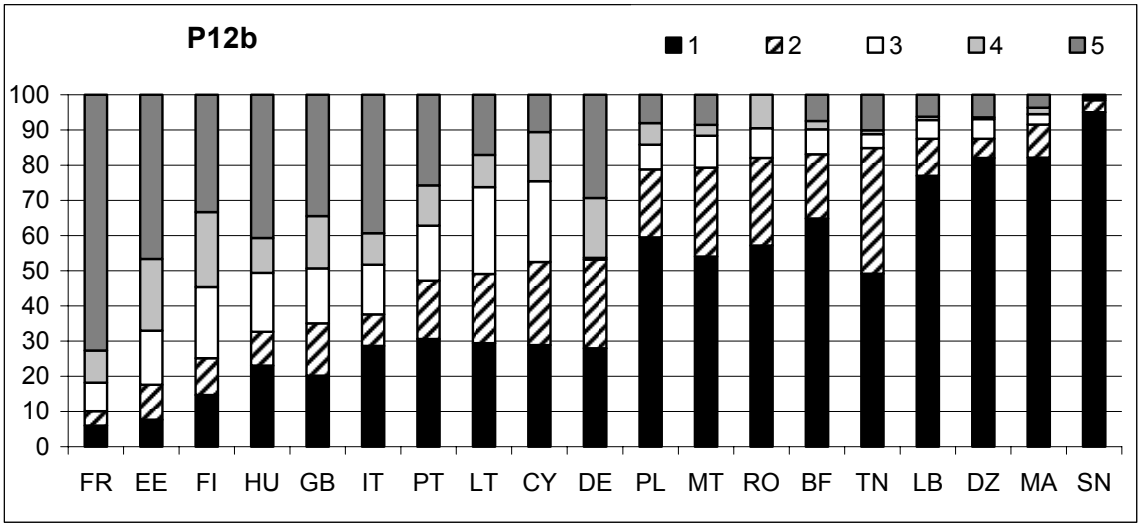

Figure 10 - Answers of the 7044 teachers (from the 19 countries) to the question P12b (For the complete name of the countries, see Table 1).

P12b	I practise religion	**1**	**2**	**3**	**4**	**5**	I do not practise religion

- Higher is the degree of his / her training in University, more a teacher is evolutionist.

The question P5 of the questionnaire was: What is your highest level of education?

1 Secondary education **2** University 1-2 years **3** 3-4 years **4** 5-6 years
5 longer (specify) _____

You had very few answer corresponding to the items 1 and 5. In consequence, we have grouped the results in 3 categories: 1_2: 2 years in University or less; 3: 3 or 4 years at University; 4-5: more

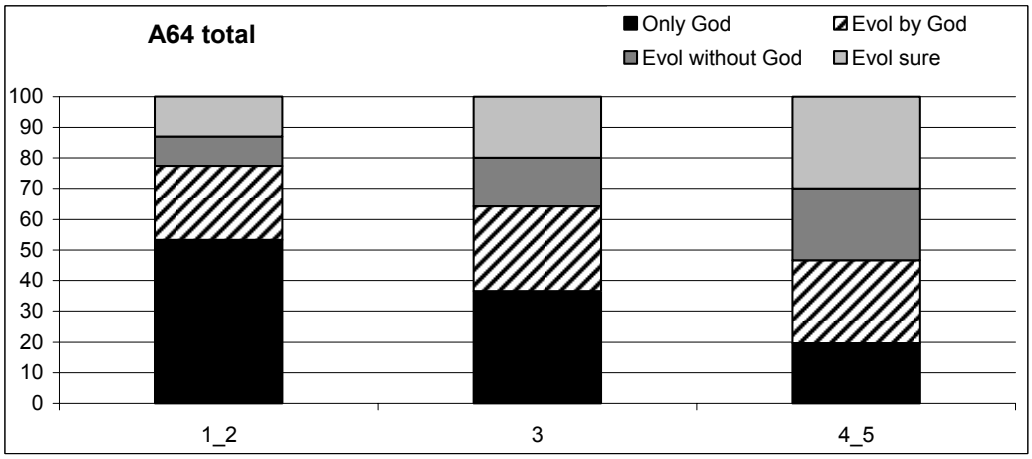

Figure 11 - Answers of the 7044 teachers (from 19 countries) to the question A64, grouped by levels of teachers training in University. (see the question with figure 5 and in Annex 1)

In the figure 11, the differences are very significant from one degree of teachers' training to the other: higher is this degree, more evolutionist is the teacher.

When differentiating biologists from other teachers, the difference of answers is significant for the lowest and for the highest levels: biologists are more evolutionist than other teachers.

This kind of difference can be observed for the other questions related to evolutionism vs. creationism. After a PCA from the 15 questions Evolution, we can see a clear separation when grouping teachers' conceptions by these 3 levels of training.

A between analysis has been done to differentiate these 3 groups: the consecutive test of randomization shows that the difference is highly significant ($p < 0.001$).

Nevertheless, this effect can be a consequence of the unequal repartition of these levels of teachers' training among the 19 countries: this level is higher in the developed European countries than in the non European ones.

In consequence, we did a specific multivariate analysis to test if this possible bias: a PCAViO suppressing the effect of countries and the effect of religions, with a new between analysis which still differentiates the groups of teachers' conceptions (the 3 groups by level of training). A test of randomization shows that this difference is still very significant.

We also did the same by suppressing also the effect of age[7], still observing a very significant difference between the 3 groups of levels of training.

In conclusion, we can now be affirmative: there is an effect of the level of teachers' training independent of the effects of countries, of religions and of age: for the all the tested countries, **more a teacher has been educated in University, more he or she is evolutionist.**

This effect is not to be confused with the differences between biology and other teachers that we have shown above. The Primary teachers, as well as the Language teachers in Secondary Schools, generally did not studied biology in University (and when they did before being Primary teachers, we have included these exceptional cases in the category "biologists").

The effect of the level of training is very general, independent of the learned or taught matter. This result shows that, in any country, it is important to increase the general level of teachers' training in the University.

2.3. Conclusions and recommendations related to the teachers' evolutionism/creationism

Our results are the first large international enquiry on the teachers' conceptions on Evolution. Several important results were unexpected: the high amount of anti-evolutionist teachers' conceptions as well as the correlation of these conceptions with the level of training.

Several recommendations can be proposed:

- A continuation of analyses of the obtained results: only some results were exposed here. For instance we also observed other significant effects: e.g. of age, and of gender. The detailed analyses country by country started, but must be published, as well as by groups of countries. Several publications will be written in the next months.

- An extension of this kind of enquiry to know the teachers' conceptions on Evolution in other countries and, in each country, to compare different religious practices. The goal will be to better analyse the links between the creationist conceptions, the religious practices and the

[7] Other analyses, that I have not the place to insert here, show a significant effect of age: youngest are the teachers, less they are evolutionist. In consequence, the effect of the level of training could also be only linked to this effect of age. We can answer no only after a new PCAViO suppressing also the effect of age.

socio-cultural-economical background of each context (local, regional, national, etc.). These questions are complex and sensitive but this research would be useful for possible actions inside and outside the educational system.

- This kind of international enquiry could also be extended to analyse the students' conceptions on Evolution, at several school levels. The international enquiries as PISA or TIMMS are only focused on knowledge and competencies, forgetting the citizenship values that are also an essential goal of Education.

- To reject the scientific knowledge on Evolution is a value that the educational systems cannot accept. Our results show the compatibility of evolutionist conceptions and believing in God: these evolutionist creationist convictions are more present in biologist teachers than in other teachers. Every teacher's training, in any country, could include a reflection on this possible articulation.

- The importance of a higher level of teachers' training is one of the most important results of our research. Higher is this level (in any matter), more evolutionist are the teachers. An international recommendation could be formulated, and actions developed to help each country to increase the level of their teachers' training.

- A fundamental point is the absence of Evolution in the school syllabuses or in the effective scholar teaching in several countries, or its very little importance (and generally just at the end of secondary schools, when an important amount of students have already stopped their secondary studies). That is a consequence of the socio-cultural-religious national context, but that is also a cause of the increase of fundamentalism in these countries.

At the same time, the religious education is often well developed, even inside the public schools and curricula in several countries.

Education at school is a crucial point to increase (or not) scientific ideas in a society, and to explain their possible articulation with religious convictions (when they are not too fundamentalist!).

- The last point is to improve the quality of the scientific education related to Evolution. We have analysed some implicit values (dogmatism, sexism, Occidentalism) in most of the European textbooks, which often are models in non European countries. In consequence, the present report is proposing several precise recommendations: see above page 5.

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V. Human Genetics and Human Brain:

Objectives, methodologies, main achievements and implication

There was two different topics in the Biohead-Citizen project: "Human Genetics" and "Human Brain". Both remained distinct for the analysis of syllabuses and textbooks.
Nevertheless, for the analysis of teachers' conceptions, they fused in the same topic to evaluate conceptions on the determinism of human features, mostly cultural and social features with debated biological supports, as the gender differences, the heredity of intelligence or of performances in music, etc.

The roots of this topic is the old debate between "innate OR acquired", slowly transformed, during the 20th Century, in "innate AND acquired". We know today that this debate is gone past, because there is a necessary INTERACTION between innate and acquired: all our human genes are essential, but they always are in interaction with their environment for the emergence of our human features: our morphological phenotype as well as our intelligence and socio-cultural features.

Biology research, as well as biology teaching, are living a kind of cultural revolution with the new paradigm of "epigenesis". Atlan wrote a book in 1999: "La fin du tout-génétique" (The end of "everything is genetic").
In genetics, since the human DNA sequencing (2001), the new ways of research are structured by a new approach called "epigenetics" (Morange 2005).
In neurobiology, we know since a longer time that the human newborn' brains are not mature. Each human being build his / her neuronal connections by learning, and these connections are the support of our memory and of our cerebral performances. This cerebral epigenesis has been popularized by Changeux (1983) in France and, at the same time, by Edelman and others in USA and all around the world. Nevertheless, this cerebral epigenesis is not yet taught at school (or is just starting to be taught in some countries). The constructivism (Piaget et al) is now well known by teachers, and generally learned during the teachers' training, but not yet the cerebral basis of the constructivism.

In consequence, most of people associates biology to strict genetic determinisms, while this image is strongly changing in the world of the research in biology.
Biology has been used, historically, to justify Sexism, Racism, even anti-Semitism in the period of Hitler. Biology is still today to much thought as reductionist, reducing a living feature to single biological cause, while biologists know well the complexity of any living structure, and develop more and more systemic approaches.

For these reasons, the Biohead-Citizen project decided to work on the double topic of "Human Genetic" and "Human Brain", to evaluate how it is taught today in several countries, and to analyse if the teachers' conceptions are starting or not to change in relation to some "questions vives" as sexism, racism and the old overcome debate innate / acquired.

The report on this topic in structured in 3 parts:

1 - An analysis of teachers' conceptions related to KV (knowledge - values) interactions in this topic "Human genetics and brain": gender issues, hereditarianism, racism, twins, clones.
This analysis is new, not yet published, and limited to some of our results, as general analyses and a gender effect in the 19 countries (7044 teachers).

2 - First results related to Human Genetics in syllabuses and textbooks of 16 countries. This part is submitted to publication in Science Education International.

3 - First results related to Human Brain in syllabuses and textbooks of 15 countries. This part is also submitted to publication in Science Education International.

The theoretical background summarized above is more detailed in the introductions of the parts 2 and 3.

All the references are gathered after the part 3.

The last short part VI is exposing some recommendations.

1. Conceptions of teachers and future teachers about Human Genetics and Brain

1.1 - Methodology

The samples are presented in the table 1. In each country, approximately half of the sample is composed by in-service teachers (1/3 inP = Primary schools, 1/3 inB = Secondary Biology, 1/3 inL = Secondary Language/Letters), the other half by pre-service teachers (with the same three 1/3). We have collected several personal information from each (future) teacher: gender, age, level of training, religion, political, social, economical convictions, etc. All this information will be used to interpret and discuss our results. Some of them are used in the co-inertia analysis presented below. In this short presentation of our results on this topic, the table 1 presents only the main parameters which will be discussed below as an example: the gender (% of women in each sample).

The countries have been chosen to be contrasted: 6 out of Europe, the others from North of South of Europe, and from West to East,
Our samples are not representative of the total population of each country:
- In some case, only one Region is concerned: Bavaria in Germany, Minho in Portugal, Rhône Alpes and Languedoc-Roussillon in France (that explain the number of French teachers: 732, nevertheless, they are grouped because we did not find any significant differences between the two Regions), etc.
- In all case, only (future) teachers were interviewed. Their social characteristics are not representative of all the national population, evidently for the sex-ratio.

Nevertheless, our samples are significant of the precise category in each country (or Region): 6 samples each with at least 50 persons (inP, preP, inB, preB, inL, preL), about 300 persons by country in total. In three cases, the sample is more important to test some complementary precise hypotheses (in France, Lebanon and Tunisia). In some other cases, the sample is less important: in small countries as Malta and Estonia, but also in Great Britain (because they left the project just after the first year) and in Algeria (which did not receive the Biohead-Citizen money until now).

Table 1 - *Presentation of the samples for the 19 countries. In blue are the six countries outside Europe (in 4 of them the % of women is lower than in the European countries)*

	Country	Total	% women in PreP.	% women in InP	% women in PreB	% women in InB	% women in PreL	% women in InL	% women Total
BF	Burkina Faso	296	49,0	30,0	32,1	23,1	39,2	25,9	**33,4**
CY	Cyprus	322	85,3	74,1	72,0	57,9	85,0	78,4	**78,0**
DE	Germany	365	96,9	90,0	64,8	36,4	84,3	46,2	**69,0**
DZ	Algeria	217	69,8	67,4	75,8	87,5	79,4	56,8	**71,4**
EE	Estonia	182	90,0	77,4	72,4	80,6	93,3	90,3	**84,1**
FI	Finland	306	83,9	65,6	78,2	75,8	97,1	100,0	**83,7**
FR	France	732	82,3	81,6	64,4	72,0	89,1	69,1	**76,1**
GB	Great Britain	154	76,3	60,0	73,7	80,0	-	-	**74,7**
HU	Hungary	334	89,8	96,2	76,8	76,9	68,4	80,9	**81,1**
IT	Italy	559	94,5	95,9	74,2	75,5	87,0	89,7	**88,9**
LB	Lebanon	722	100,0	87,8	69,5	74,5	83,9	70,3	**82,1**
LT	Lithuania	316	92,5	100,0	82,0	89,6	91,7	100,0	**93,0**
MA	Morocco	330	78,7	67,3	54,8	45,5	44,0	57,1	**57,9**
MT	Malta	198	92,3	86,8	71,4	66,7	85,2	84,3	**82,8**
PL	Poland	311	98,1	98,1	88,0	98,0	85,4	91,2	**93,2**
PT	Portugal	350	93,2	82,1	83,0	73,5	83,6	73,8	**81,7**
RO	Romania	273	93,6	78,3	79,6	93,2	97,8	78,6	**86,8**
SN	Senegal	324	43,1	31,5	22,6	11,5	31,4	27,8	**27,8**
TN	Tunisia	753	35,9	45,3	77,2	55,2	58,2	63,8	**58,6**
	TOTAL	7044	81,7	77,4	68,9	66,2	76,2	70,8	**73,7**

The long work to build the questionnaire, and to validate it, is described previously in this report (see also Clément & Carvalho 2007). All the questionnaires were filled in the strictly same way in each country, in presence of the researcher but with a total guaranty of anonymity. Only the questionnaires with more than 95% of filled questions have been used to analyse the data.

31 questions are related to the topic "Human Genetics and Epigenetics". 18 were included in the questionnaire A filled in the 19 countries. The other 13 questions were included in the questionnaire B filled in only 14 countries. The personal questions will be mentioned below only when it will be useful.

QUESTIONNAIRE BIOHEAD-CITIZEN (questions related to the topic "Human Genetics and Epigenetics")

Indicate to what point you agree with the following statements by ticking only one box between "I agree" and "I don't agree" for <u>EACH</u> of the following statements:

A2.	In a modern society, men and women should have equal rights.	I agree					I don't agree
A3.	If clones of Einstein could be obtained, they all would be very intelligent.	I agree					I don't agree
A6.	Due to identical genes, identical twins have identical immune responses to transplants from one other person.	I agree					I don't agree
A9.	Women are less intelligent than men are because their brains are smaller than men's brains are.	I agree					I don't agree
A14.	Thanks to their physical features, men perform better in athletics than women do.	I agree					I don't agree

A19.	Due to identical genes, identical twins have identical brains and, therefore, identical behaviour and ways of thinking.	I agree					I don't agree
A21.	Biologically, women can be as intelligent as men.	I agree					I don't agree
A24.	If clones of Mozart could be obtained, they all would be excellent musicians.	I agree					I don't agree
A25.	It is for biological reasons that women cannot hold positions of as high responsibility as men can.	I agree					I don't agre e
A27.	The human genome contains more genes than the genome of any other living being.	I agree					I don't agree
A30.	It is important that there are as many women as men in parliaments.	I agree					I don't agree
A31.	When a couple has already had two girls, the chances that their third child be a boy are higher.	I agree					I don't agree
A35.	Ethnic groups are genetically different and that is why some are superior to others.	I agree					I don't agree
A36.	Men might be more able to think logically than women, because men might have different brain bilateral symmetry.	I agree					I don't agree
A38.	It is for biological reasons that women more often than men take care of housekeeping.	I agree					I don't agree
A43.	In identical twins, one can be right-handed and the other one left-handed.	I agree					I don't agree
A46.	Biologically, men cannot be as sensitive and emotional as women.	I agree					I don't agree
A53.	Due to identical genes, identical twins have identical immune responses to micro organisms.	I agree					I don't agree

B4.	Human social behaviour is partly directed by genes.	I agree					I don't agree
B8.	There are genetic factors in parents that predispose their children to become alcoholics.	I agree					I don't agree
B10.	There are genetic factors in parents that predispose their children to be good in school.	I agree					I don't agree
B11.	There are genetic factors in parents that predispose their children to become homosexual.	I agree					I don't agree
B14.	There are genetic factors in parents that predispose their children to be aggressive.	I agree					I don't agree
B20.	There are genetic factors in parents that predispose their children to become very good violinists.	I agree					I don't agree

Admitting that you don't have any children and that you wish to have only one child, would you do the following?

B30.	Let chance determine the sex (as usual)	I agree					I don't agree
B31.	Try to choose the sex of your child by a specific diet	I agree					I don't agree
B32.	Try to choose your child's sex by spermatozoa selection (or by other medically assisted techniques)	I agree					I don't agree

Please tick only one box per statement

B33.	I can explain what a synapse is	***Yes***					**No**
B34.	I can explain what a neural network is	**Yes**					**No**
B35.	I can explain what cerebral plasticity is	**Yes**					**No**
B36.	I can explain what cerebral epigenesis is	**Yes**					**No**

These questions are testing several hypotheses:

- Sexist or feminist values, sometimes in interaction with knowledge. Some questions on differences between men and women are only value-oriented (A2, A30), other are evaluating KV interaction where K (knowledge) is genetic or more general biological determinism (A14, A21, A25, A38, A46), or related to cerebral epigenesis (A9, A36).
- Other genetic and biological determinism (general): variables assumed to feature an interaction between Knowledge and Values (hereditarianism, innate ideas), dealing with genetic determinism by parents (B8, B10, B11, B14, B20), clones (A3, A24), racism (A35), sociobiology (social human behaviour: B4), identical twins (A43, A19 and, with more Knowledge: A6 and A53), number of human genes (A27)
- Knowledge-oriented questions: A31 (general), (A27, A6, A53: see above) and B33 to B36 (human brain and its epigenesis).
- Choosing the sex of the children (genetic knowledge interacting with V = bioethics): B30 to B32.

1.2 - Results by country for some questions

- Sexism or feminism

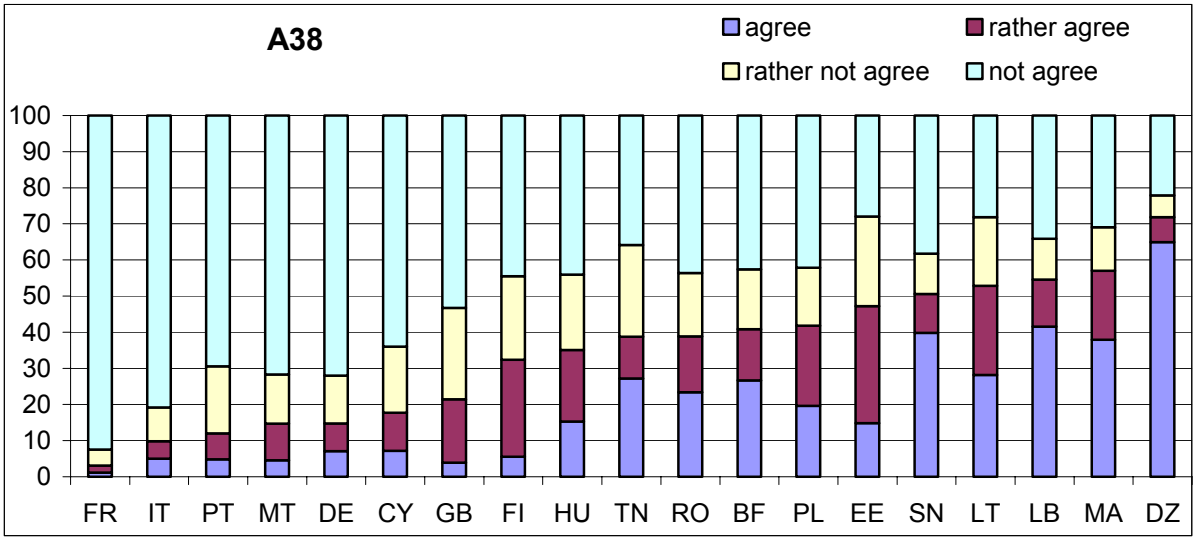

Figure 1 - Answers to the question A38 - "It is for biological reasons that women more often than men take care of housekeeping" in the 19 countries (7044 teachers) (for the full names of the countries, see the table 1)

The teachers' conceptions are very contrasted from one country to an other. If in France, 94% of teachers totally disagree with the proposition "It is for biological reasons that women more often than men take care of housekeeping", they are only 23% in Algeria. The teachers' sexism is more important in the 6 countries outside Europe but also in the Northern and Eastern Europe: about 40% of teachers agree or rather agree in Estonia, Poland, Romania, and more than 30% in Hungary and Finland.

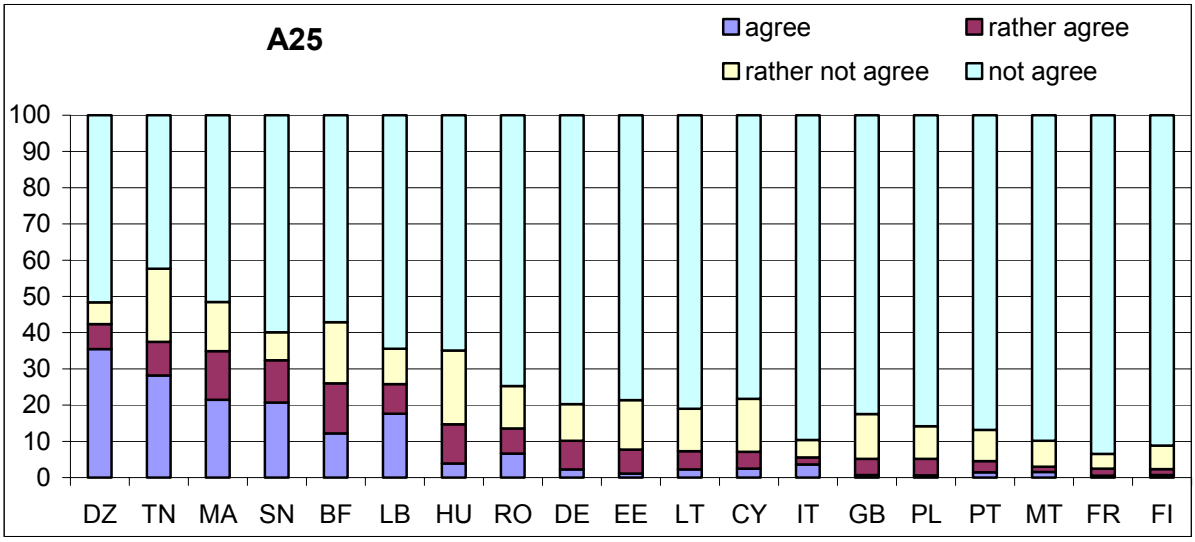

Figure 2 - Answers to the question A25 - "It is for biological reasons that women cannot hold positions of as high responsibility as men can" in the 19 countries (7044 teachers) (for the full names of the countries, see the table 1)

This justification of a sexist position by biological reasons is just defended by about 1/3 of teachers (from 25 to 42%) in the 6 non European countries. In Europe, only in Hungary, Romania and Germany 10% of teachers (or a little more) totally or rather agree. This amount is less than 10% in the other countries.

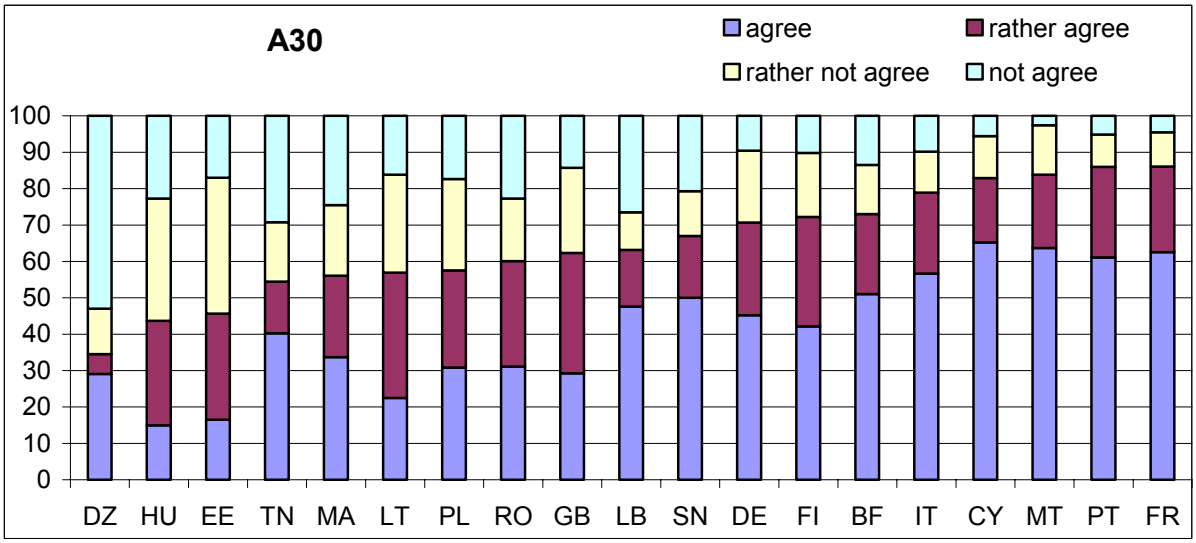

Figure 3 - Answers to the question A30 - " It is important that there are as many women as men in parliaments" in the 19 countries (7044 teachers) (for the full names of the countries, see the table 1)

There are great differences from one country to an other: only 33% Algerian teachers agree (totally or rather) against 85% of French teachers. In 3 non European countries (Burkina Faso, Senegal and Lebanon), this amount is between 63 to 72%, higher than in the 3 Maghreb countries. The lowest amounts of "totally agree" is found in Hungary, Estonia and Lithuania. Complementary comments would be useful to discus possible different ways to understand this question (wishing quota ?), but the great differences between countries stays meaningful and will be discussed in subsequent publications. This question is only dealing with feminist values linked to political positions.

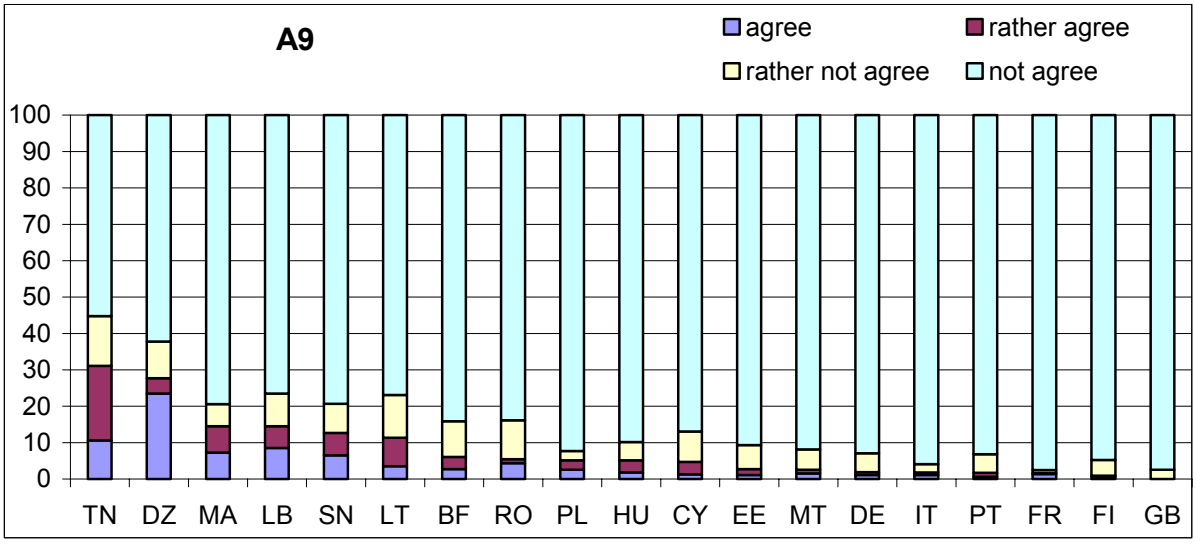

Figure 4 - Answers to the question A9 "Women are less intelligent than men are because their brains are smaller than men's brains are" in the 19 countries (7044 teachers) (for the full names of the countries, see the table 1)

St.J.Gould (1983) have well demonstrated that the assumption of craniologists about the relationship between intelligence and weight of the brain was wrong. Gould analysed again the original data of Broca (end of 19th Century) on the women and men brains showing a correlation between their weight and the individual size, and other parameters but nont the gender. Our results show that most of the teachers know today that this assumption is wrong, except in some countries (about 30% of teachers totally or rather agree in Tunisia and Algeria, as it was already shown by Clément et al 2001). They are also more than 10% in Morocco, Lebanon, Senegal and Tunisia. This classical old biological justification of sexism did not totally disappear, but is no more used by teachers in most of the European countries.

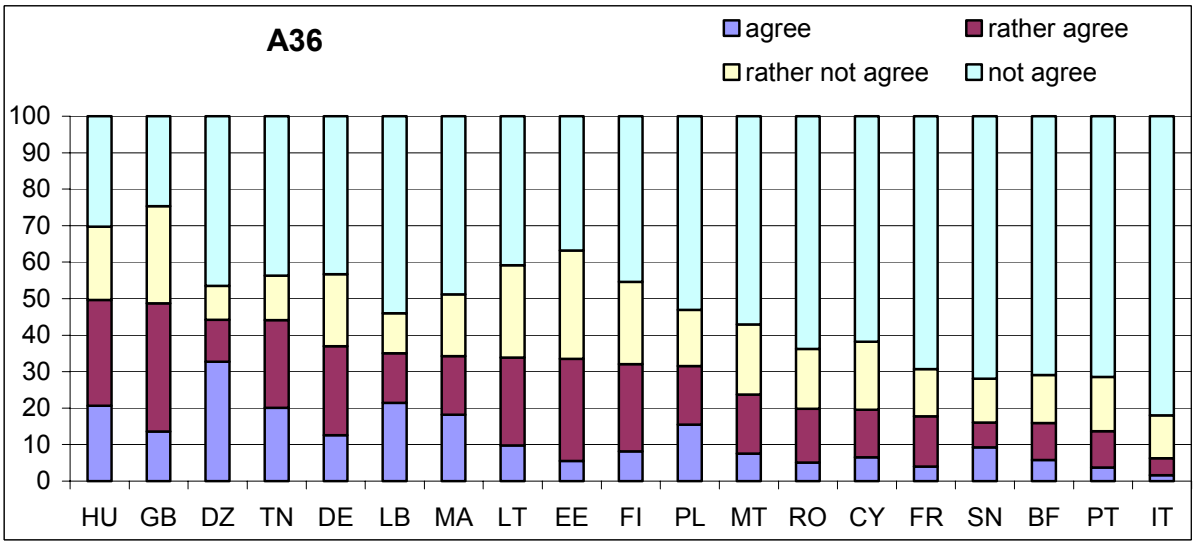

Figure 5 - Answers to the question A36 " Men might be more able to think logically than women, because men might have different brain bilateral symmetry" in the 19 countries (7044 teachers) (for the full names of the countries, see the table 1)

The answers to this question are most contrasted than for the precedent one, even is the same sexist ideology is present in this kind of assumption. Clément (1997, 2001, 2004) as well as Vidal (2000) analysed the ideology of this assumption, after a critical analysis of a paper published in Nature (Shaywitz 1995). The scientific appearance of the proposed item, as well as the popularization of this kind of thesis, can explain the relaticvely high amount of teachers answering I totally or rather agree: 50% in Hungary and Great Britain, more than 30% in

Germany, Lithuania, Estonia, Finland and Poland. This high amount in Algeria and Tunisia (45% is probably to explain by the frequent sexist opinions of teachers in these countries: why not the same explanation in the just above listed European countries?

- Racism

Answering to the A35 question, 62% of Lebanese teachers, and 55% of Algerian teachers agree (totally or rather) with the proposition "Ethnic groups are genetically different and that is why some are superior to others" (figure 6). Possibly because their country is living in a violent context. Nevertheless, this amount is also high in other countries: Morocco (47%), Tunisia(37%), Poland (33%), Lithuania (21%), … : figure 6.
In fact, there are two propositions in this item:
- the genetic difference between ethnic groups: biologists proved that is not possible to say that (see for instance Langaney: "All parents, all different");
- and the superiority of some groups, that is a typical racist assumption.
This is an example of interaction between values (racism) and knowledge (the pseudo justification of racism by biological argument) that is frequent in extreme right groups as it was with the Nazism.
Our results show that many teachers, at least in some countries, are still thinking in this way.

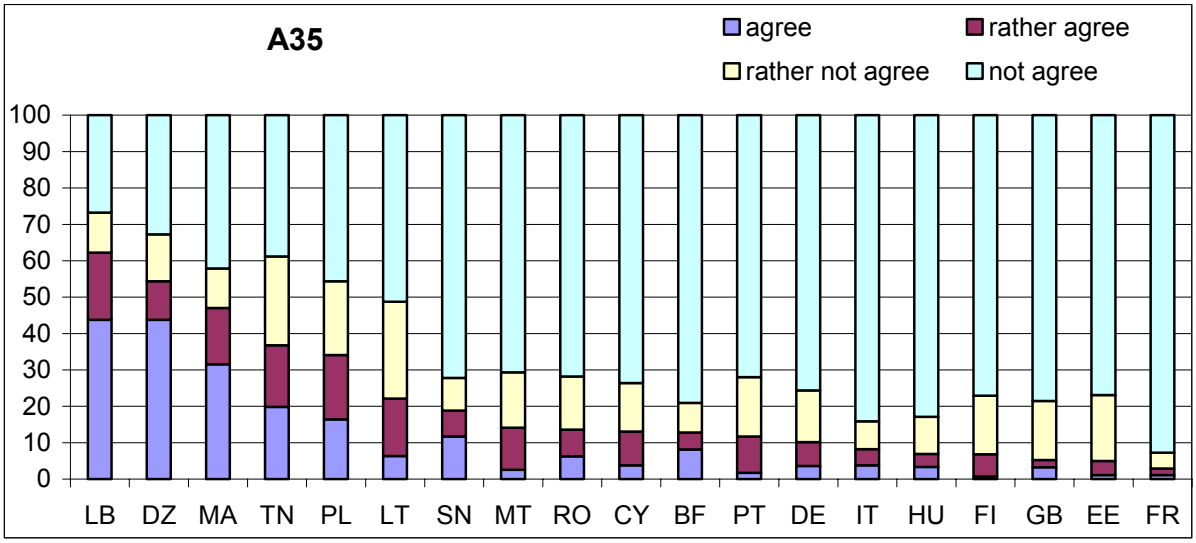

Figure 6 - Answers to the question A35 "Ethnic groups are genetically different and that is why some are superior to others" in the 19 countries (7044 teachers) (for the full names of the countries, see the table 1)

- Hereditarianism

Biologists and psychologist researchers know that each human person is building his / her own intelligence depending his/ her own surrounding and activities. A newborn having the same genes as Einstein would speak the language of his family, and have first their culture. His intelligence will be developed depending his surrounding and his individual and social activities. Agreeing with the proposed item means to ignore these processes and to still think that the intelligence is controlled by some genes. This idea seems to be still present in the 32% teachers in Finland and Lithuania, 30% in Malta, Senegal and even Germany.
The low amount of agreement in Morocco, Tunisia (and possibly the in other countries at right in the figure 7) can be due to an ethical position against any human cloning.

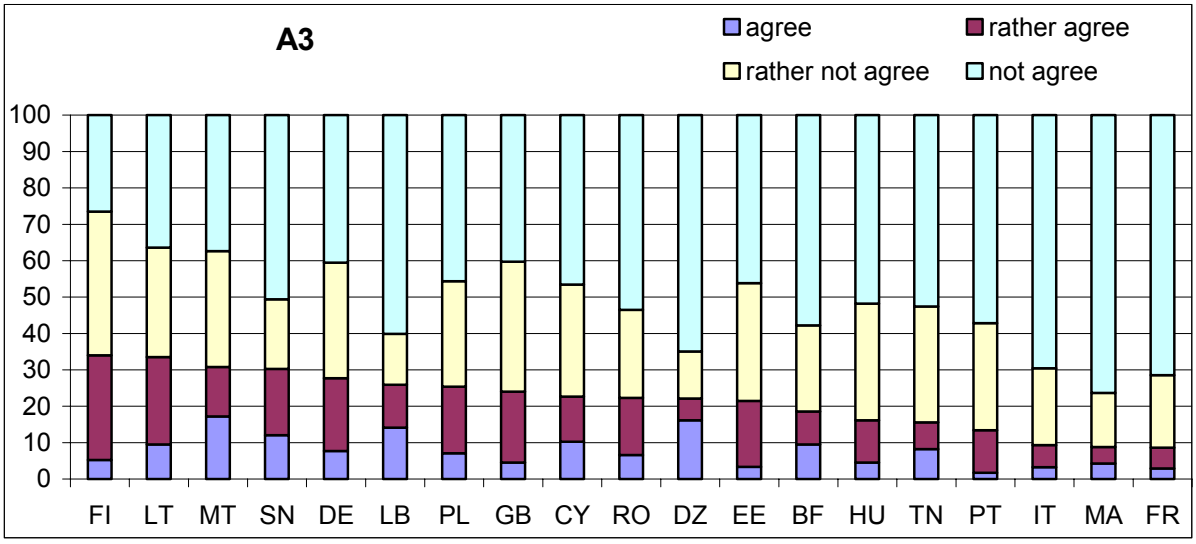

Figure 7 - Answers to the question A3 " If clones of Einstein could be obtained, they all would be very intelligent " in the 19 countries (7044 teachers) (for the full names of the countries, see the table 1)

This question is related to the "genes of intelligence". As for the precedent question, the most hereditarianist teachers' conceptions are in Finland (78%) and the less in France (17%). This situation in Finland is interesting, because the same teachers are feminist (see figure 2) and anti-racist (figure 6). Their conceptions seem to express two different trends: the politically correct against sexism and racism, but also a strong hereditarianism, probably coming from the way of teaching Genetics in Finland (see the part II of the present report). A contrario, the contestation of genetic determinisms is strong in the French culture, and seems to be also linked to the feminist and antiracist positions.

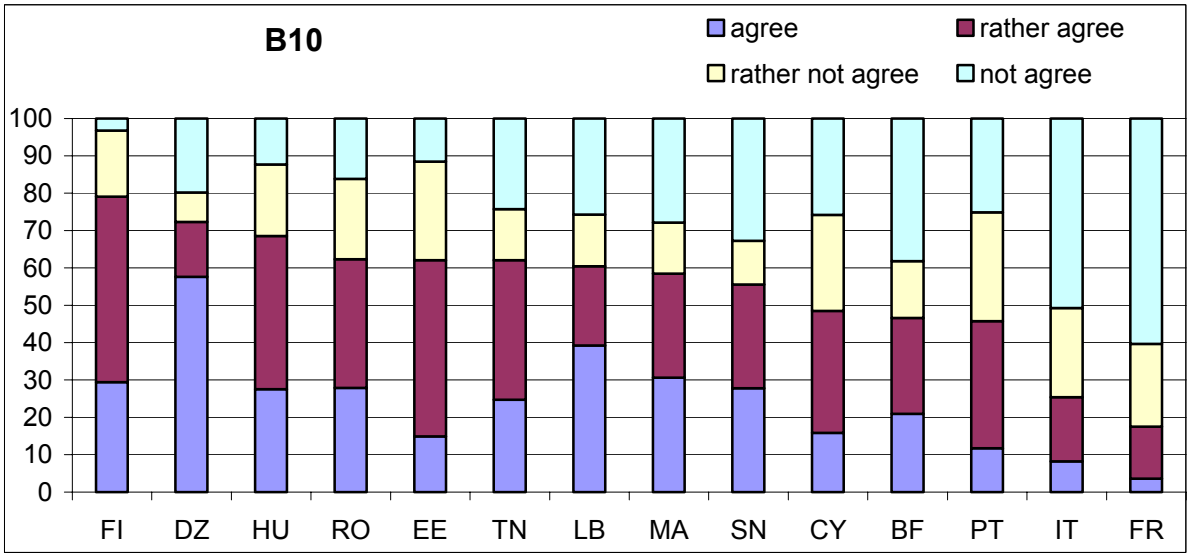

Figure 8 - Answers to the question B10 "There are genetic factors in parents that predispose their children to be good in school " in the 19 countries (7044 teachers) (for the full names of the countries, see the table 1)

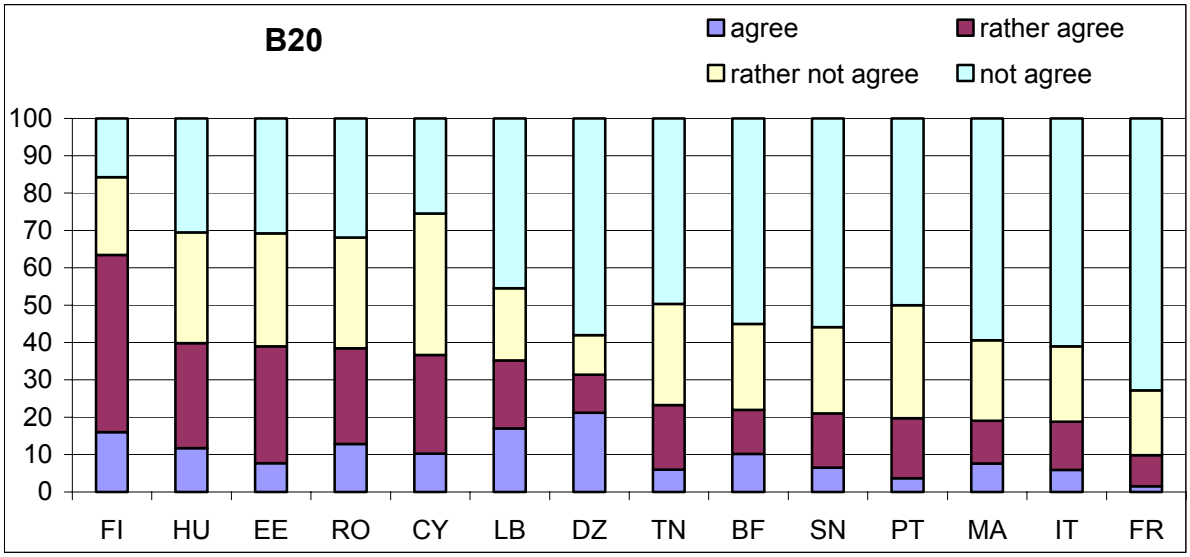

Figure 9 - Answers to the question B20 "There are genetic factors in parents that predispose their children to become very good violinists" in the 19 countries (7044 teachers) (for the full names of the countries, see the table 1)

The results to question B20 are well correlated with those to the precedent question (B10): the same teachers are thinking that some genes control intelligence and some other the musical performances.
The other answers to the questions related to other genetic predispositions of children are also correlated to the answers to the questions B10 and B20 (figures 8 & 9).
To better explore these correlations, their convergences as well as their diversity, we use multivariate analyses (part I.3 and 1.4 below).

1.3. Multivariate analysis of teachers' conceptions from the 31 questions on the topic "Human genetics and brain" (in 14 countries).

- Strong differences between countries

Figure 10 shows two kinds of differences between countries, depending to the respective teachers' conceptions in each country.

* A line (nearly vertical) can rely the European countries (at right of the graph 10e: from FR = France to FI = Finland), corresponding to the vectors related to genetic predispositions (hereditarianism) (fig 10b), as shown in the figures 8 & 9. The projection of each European country on the horizontal axis of the graph shows an other diversity among the European countries, due to their differences in the sexist / feminist positions (as shown in fig. 1 to 5).

* The non European countries are at left of the graphs 10c and 10e, due to the meaning of the horizontal axis linked to the sexist/ feminist conceptions: they are more sexist than the European countries. The projection of each non European country on the line of the European countries show their respective positions related to questions on genetic predispositions.

- Are there differences between religions?
A between analysis done to differentiate groups of religions has been done. The related test of randomization shows significant differences, mostly differentiating Muslims from the other religions. Nevertheless, this difference can be only a consequence of the differences between countries, because nearly all the Muslims are in countries outside Europe.
Consequently, we suppress the "effect country", and the effect of religions disappears.

A contrario, when we are suppressing the "effect religion", the "effect countries" is still highly significant.
In consequence, the "effect religions" is not due to religions, but is a single consequence of the differences between countries.

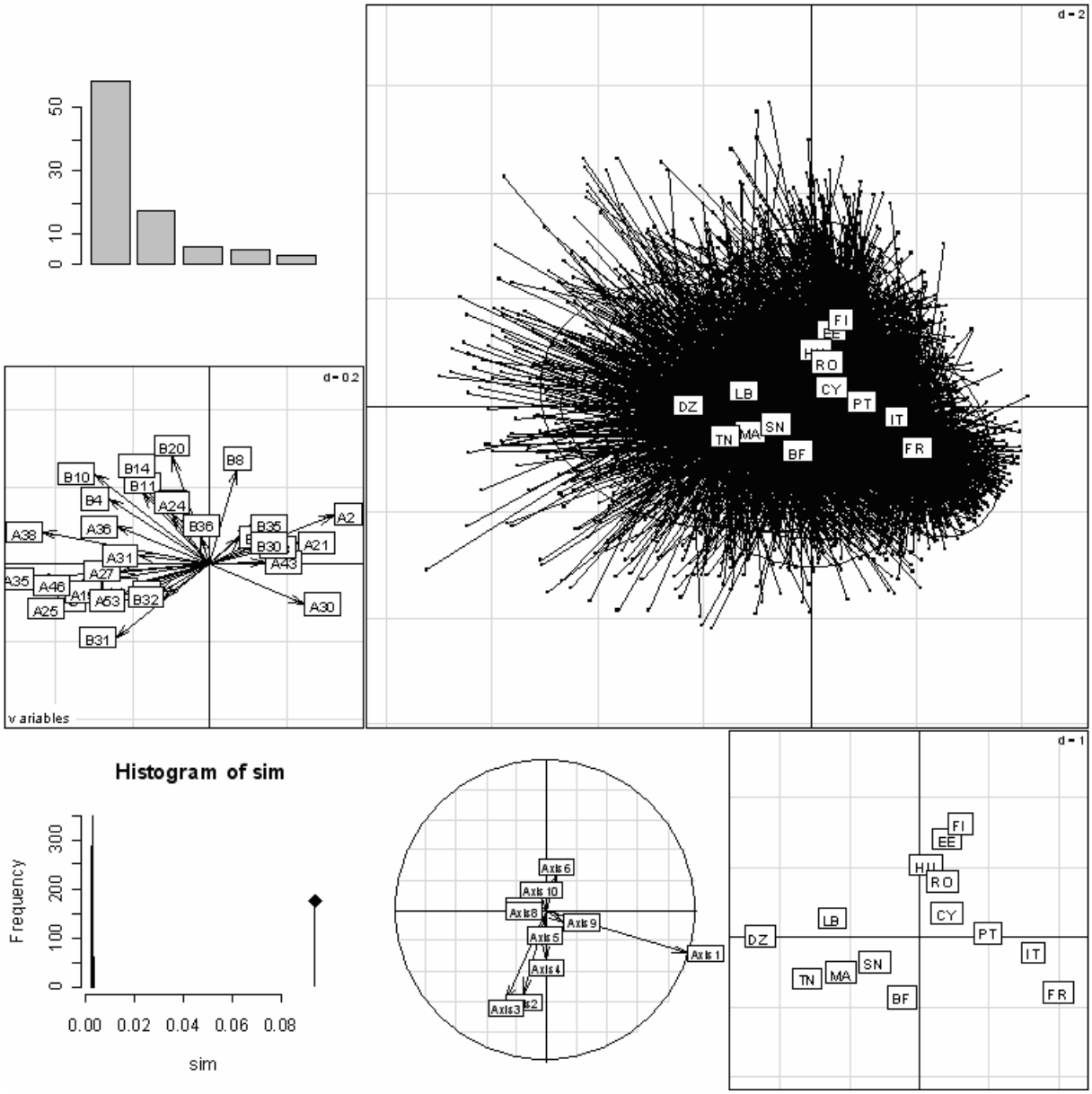

Figure 10 - Between analysis showing the differences between the 14 countries. **10a** - The eigenvalues show that the first component (horizontal axis of the other graphs) is the most important, but the second component (vertical axis in the other graphs) is also explaining a part of the variance between countries. The analyse differentiating 14 countries, there are 13 components, but only the 5 first ones are drawn here. **10b -** Explanation of the meaning of these two axes, by the weight of each question on them (each vector expresses the weight of each question on the 2 axes). The first axis is mostly explained by the questions related to sexism / feminism. The axis 2 is mainly explained by the questions related to the genetic predispositions (hereditarianism).
10c - Repartition of the 5249 teachers' conception on the plane resulting from the axes 1 and 2. Each point is corresponding to one teacher, and is linked to the name of his/ her country.
10d - The randomisation test (Monte Carlo) shows a very high significance of this between analysis: the observed result is very far from the histogram (at left) resulting from 1000 essays by randomisation.
10e - A repartition easier to read of the 14 countries (as in 10c): see text for comments.

- Effect of groups of samples (Biology knowledge).
A between analysis done to differentiate the six samples presented in the table 1 (prP, inP, preB, inB, preL, inL) shows very significant differences, due to the questions of knowledge (mainly B33 and B34, a little less B35 and B36), that is not surprising. This effect of biology knowledge is still present after suppression of the precedent significant effects.
It is not illustrated here by graphs, because it is not a surprise, nor an interaction between knowledge and values.

- Effect of the general level of qualification.
We observe with this new between analysis the same effect as we just described for biologists. It is also linked to the questions of knowledge B33 and B34: more is the teachers' training in the University, more they can define a synapse and a neuronal network
Here also it is not illustrated by graphs, because it is not a surprise, nor an interaction between knowledge and values.

- A clear gender effect
The figure 11 is illustrating the between analysis differentiating women from men. The difference is highly significant, and is mainly related to the following questions:
A2 - In a modern society, men and women should have equal rights: women more agree.
A30 - It is important that there are as many women as men in parliaments: women more agree.
A14 - Thanks to their physical features, men perform better in athletics than women do: women more disagree.
A9 - Women are less intelligent than men are because their brains are smaller than men's brains are.: women more disagree
A25 - It is for biological reasons that women cannot hold positions of as high responsibility as men can: women more disagree.
A21 - Biologically, women can be as intelligent as men: women more disagree.

	Comp1
A2	**-0,21**
A30	**-0,18**
A21	-0,10
(…)	(…)
A25	**0,17**
A9	**0,17**
A14	**0,19**

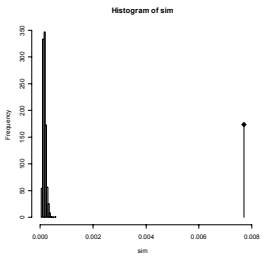

Figure 11 - Gender effect after a between analysis differentiating women from men. There is her only two groups and, in consequence, only one component (one axis). The meaning of this axis is read from the repartition of the questions along it: only the questions related to sexism have an important weight.
The randomisation test (Monte Carlo) shows a very high significance of this between analysis: the observed result is very far from the histogram resulting from 1000 essays by randomisation.

To be sure that this gender effect is not a bias, due to an other significant effect, we have suppressed all the other significant effect: countries, religions, samples, levels of training and age. The gender effect is still very significant (figure 12).

	Comp1
A30	**-0,16**
A2	-0,09
A21	-0,07
(…)	(…)
A25	0,07
A36	0,08
A9	**0,12**
A14	**0,12**

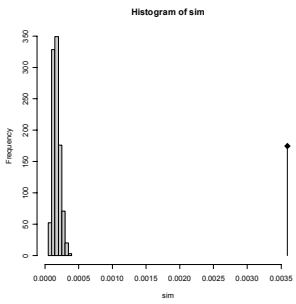

Figure 12 - Gender effect after a between analysis differentiating women from men, after suppression of the other significant effects= countries, religions, samples, level of training and age.
The randomisation test (Monte Carlo) still shows a very high significance of this between analysis: the observed result is very far from the histogram resulting from 1000 essays by randomisation.
The meaning of the difference is explained by the questions listed in the left column.

As all the questions related to this gender effect are inside the questionnaire A (figures 11 & 12), we can do again a between analysis to differentiate women from men btu in the 19 countries, using only the questionnaire A.The results are exactly the same as shown in the figure 12 (with just very little different values along the axis 1)

An other way to visualize the gender differences is to compare the amount of men and women question by question, as done in the figure 13 for two questions, showing that women are more feminist.

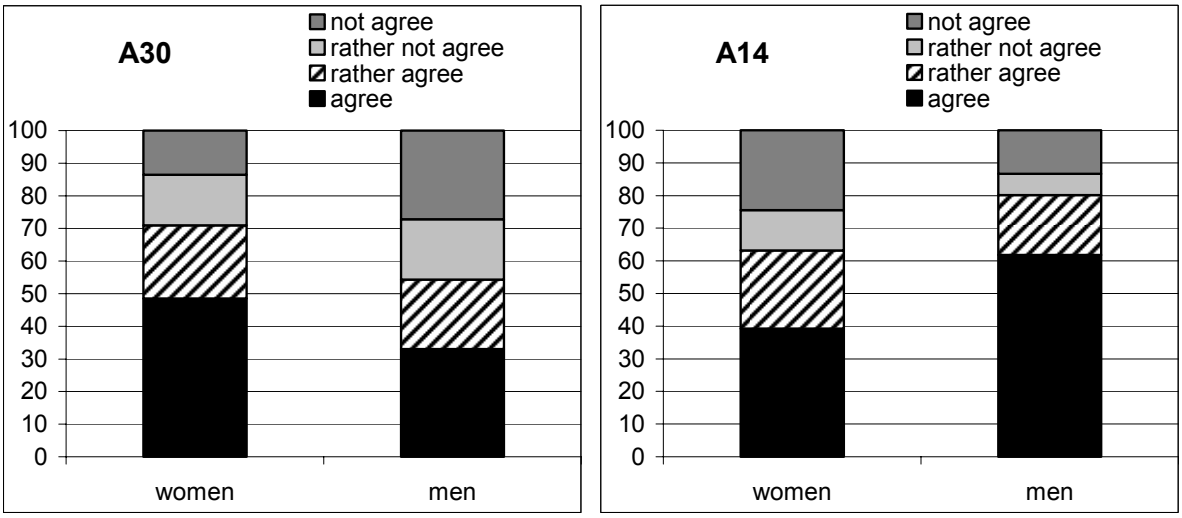

Figure 13 - Separation of women and men' s answers to the 4 items of the questions A30 and A14.

We can also show the gender effect for each country, question by question.
In the figure 14, the women's answers are regularly more feminist than the men's answers.
The difference is significant for each country, except for Romania, Great Britain and Poland.

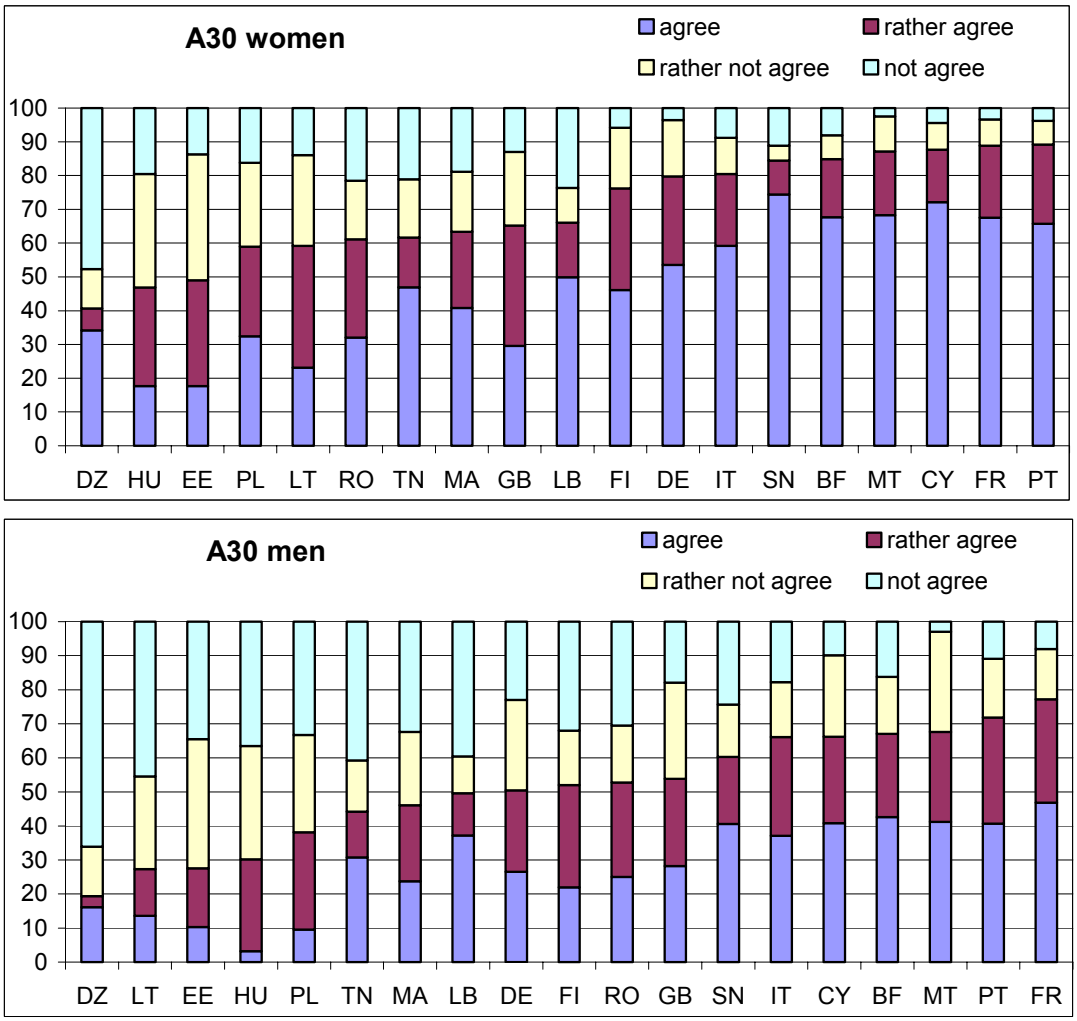

Figure 14 - Answers of the 7044 teachers to the 4 items of the question A30, country by country. The upper graphs show the women's answers, and the lower one the men's answers.

1.4. Conclusions

These results are just the first ones on this topic from our questionnaire Biohead-Citizen. They have to be analysed in more details, country by country, and also with only the European countries, or only the non European countries to avoid misinterpretations and to test some hypotheses.

Nevertheless, our analyses from the 19 countries show several unexpected results: a great diversity of teachers' conceptions from one country to an other, with some trends.

The first trend is the difference between the European countries and the non European countries, due to more sexist and sometimes racist conceptions in the non European countries, but not for all the questions (e.g. the teachers of Burkina Faso and Senegal being more feminist or anti-racist for some questions).

The second trend is the diversity inside these two groups of countries. Concerning the European countries, this diversity is clearly linked to the degree of hereditarianism, with the believing in genetic predispositions and genetic determinism of intelligence or cultural features, competencies in music, etc. Several indicators are converging to this result (questions on genetic predispositions, questions on twins, others on cloning, ….).

This hereditarianism directly corresponds to the content of school teaching (and teachers' training).

The interaction of hereditarianism with other values as sexism or racism is more complex than expected. For instance in Finland, the teachers are politically correct concerning these values, and at the same time seem to be influenced by hereditarianism for other questions. Our figures have shown that the answers to some questions are very near in France and Finland, while for other questions they are totally opposite.

The critical analysis of the chapters Genetics in the school biology textbooks, in the same countries (chapter II just below), will help us to better understand the teachers' conceptions in these countries.

These first conclusions are nevertheless useful to propose some recommendation (see below point -VI-)

2. Human Genetics approaches in syllabuses and school textbooks of 16 countries

2.1. Abstract

Genetic concepts have evolved significantly over the last ten years, and are now less connected to innate ideas and reductionism. Unique reference to genetic determinism has been replaced by the interaction between the genes and their environment (epigenetics). Our research analyses how current school biology textbooks present this new paradigm in 16 different countries (12 in Europe + Tunisia, Morocco, Senegal and Lebanon). We used two precise criteria to analyse and compare the chapters dealing with the topic Human Genetics.

The first indicator is the occurrence of the expression "genetic program" (which is typical of innate values). It is present in some countries but totally missing in some others. The occurring differences derive the following hypothesis: (i) in Eastern European countries, the absence is long-standing, possibly linked to a previous influence of Lyssenko, (ii) in some other countries, the absence could be linked to various reactions during the Nazi period, (iii) in other cases, the observed diminution might be due to a modernisation of the scientific content , (iv) finally in several countries, the notion of "genetic program" is still present, without modernisation.

In contrast, there are no differences between countries with relation to the second indicator: the twins' pictures present in the textbooks. The monozygotic twins are always dressed identically and have the same hairstyle and body posture as if these features could be genetically determined, thus providing evidence of a persistent implicit determinist ideology.

All these results are discussed as interactions between implicit values and taught scientific knowledge.

2.2. Introduction: from innate ideas to epigenesis

During the first half of the 20th century, research in genetics occurred within the scientific societies of "genetics and eugenics". The idea of genetic determinism was explicitly linked with the eugenics ideology aimed at improving human "races". The Nazi ideological doctrine and the horrors of the Second World War illustrated the possible consequences of this link (Séralini 2003). More generally, the reduction of complex features solely to a genetic determinism can be called "innate ideas" or "hereditarianism", an ideology promoting the hereditary inheritance of human features, including behaviour, beliefs and other intellectual competences. According to Canguilhem (1977) such an approach represents a specific type of ideology called a "scientific ideology", where complex scientific phenomena are reduced to simplified definitions marked by an historical and epistemological approach. For example, life sciences become a scientific ideology when they are only referred to the molecular level, using a reductionist approach which ignores the complexity of life. In human genetics, reductionism and hereditarianism are convergent whilst trying to explain the complexity of human phenotypes only by genetic determinism. They are also convergent with fatalism and social conservatism, justifying the social inequalities by a natural order. In their book "No God, neither genes" Kupiec and Sonigo (2000), denounced the scientific ideology of the dictatorship of genes. Nevertheless, since the end of the 20th century, and mainly since decoding the human DNA sequencing, biologists are becoming progressively more open to the theories of complexity, including epigenetic processes.

Several researches on genetics using identical or fraternal twins, during the second half of the 20th century, ware sources of debates between innate and acquired of human features (Lewontin et al. 1984, Schiff et al. 1982). The latest proved that adopted children had an IQ corresponding to that of their foster parents. The psychologist Zazzo (1984) published a synthesis of his research, describing "the paradox of twins": identical twins, physically similar, tend to differ more by their respective behaviour and psychological characters than fraternal twins or brothers or sisters that are not twins.

Nevertheless, by the end of the 20th century, while the media were still continuing to publicly suggest, often by sensational means, the existence of genes for shyness, violence, obesity or intelligence, biologists were claiming that the debate between innate and acquired was scientifically obsolete, because there is an inevitable interaction between the influences of both genotype and environment, both being necessary (Stewart 1993, Jacquard & Kahn 2001). In 1999 Atlan claimed "the end of all genetics" ("la fin du tout - génétique"; see also Kupiec & Sonigo 2000). The first results for the sequencing of human DNA (Venter et al 2001; International human genome sequencing consortium 2001) compromised the thesis of a simple genetic determinism of human intellectual performance. 99.99 % of the genes of a given human being are identical to those of any other human being. From this collective human genetic patrimony, specific intellectual performances are built progressively by the singular configuration of neuronal networks along each individual's history (cerebral epigenesis: Changeux 1983, Edelman 1990). The notion of epigenesis is related to the morphogenesis of an organism, for instance, the development of the neuronal pathways.

More recently, the notion of epigenetics has been used for the study of heritable changes in the genome function, affecting a cell, an organ or an individual without affecting its DNA: as DNA methylation or histones acetylation.

These processes, which are controlled by environmental parameters, have a significant role in every phase of DNA activity, from self-repair (Friedberg 2003) to protein synthesis (Morange 2005a; 2005b). For instance, results of Fraga et al. (2005) illustrate that in 35% of the monozygotic twins studied, there were differences in the methylation of their DNA and histones acetylation; these epigenetic differences are more important in the oldest twins and in twins with different lifestyle or medical history.

In consequence, it appears that any phenotype is determined by an interaction between three parameters: genetical, epigenetical and environmental.

Until recently, the notion of a "genetic program" was very important for the education of genetic at school in some countries such as France. Research has shown this hereditarianism in French textbooks (Abrougui & Clément 1997b; Clément & Forissier 2001; Forissier & Clément 2003). It appeared as questionable, suggesting an implicit ideology. In 1999, Atlan suggested its replacement with a less ideological expression which is more scientifically correct: "genetic information". Taking into account the results of all this research, curricula have recently changed in several countries. Some effects of these changes have been analysed in France (Castéra et al 2007). Nevertheless, with the exception of recent studies in Sweden (Gericke & Hagberg 2006) and in Brazil (Pitombo et al 2007), very little research has been done from this perspective in other countries. The present work is the first essay from a large-scale comparison among 16 countries.

2.3. Theoretical background in Didactics of Biology. Our research question

The didactic background of our study is based on the concepts of didactic transposition and conceptions. Giordan & de Vecchi (1987) defined conceptions as "*a set of explanatory, coordinated ideas and coherent images used by learners when confronted with a problematic situation".* Until now, most of the studies in Didactics of Biology related to genetics were focused on the learners' conceptions and difficulties, often suggesting new ways to teach genetics and to improve students' conceptions (Rumelhard 1986, Banet & Ayuso 2000; Lewis et al 2000; Marbach-Ad & Stavy 2000; Wood-Robinson et Lewis 2000; Marbach-Ad 2001; Lewis 2004; Dass & Bradley 2006). More recently, conceptions have been increasingly analyzed at the teacher's level as well. So, while the first international review of conceptions relative to scientific subjects concerned only learners (Pfundt & Duit on 1994), R. Duit's current site (IPN, Kiel), which contains an up-to-date list of these works, concerns both the conceptions of learners and teachers. After certain genetic researchers realised the difficulty in defining the concept of "gene" (Griffihts& Neumann-Held 1999; Falk, R. 2000; Chevassus-Au-Louis 2001), and after the concept of epigenetics (see above) had been defined, a critical analysis of school biology textbooks in France and Tunisia (Abrougui & Clément 1997a, 2005, Castéra et al 2007) as well as in Spain (Martinez-Gracia et al 2006) and in Brazil (El Hani et al 2007; Pitombo et al 2007) was begun. Our research project, called BIOHEAD-CITIZEN, addresses teachers' conceptions on the one hand and recognizable conceptions in textbooks on the other hand. The present work concerns only textbooks. Conceptions can be considered as the results of interactions among three poles: scientific knowledge (K), social practices (P) and values (V) (Clément 2006). This model has been presented by G.Carvalho in the introduction of this report

Our research is focused on a precise step in didactic transposition: school textbooks. We also take into consideration other steps which influence school textbooks: scientific literature, its popularization and finally curricula and syllabuses, focusing mainly on their propositions to teach Human Genetics. So our precise research question is: are the new trends in Human Genetics research (epigenetics, genetic information) present in school textbooks? Or, on the contrary, are there still some signs of the precedent concepts (such as the "genetic program") and of implicit innate ideas or hereditarianism?

Our hypothesis is that this renewal of syllabuses and textbooks is not an automatic consequence of the renewal of the scientific concepts by researchers, but is also strongly influenced by the socio-cultural context: the KVP interaction (see above). To test this hypothesis, we decided to compare several countries which contrast one another with respect to various parameters: level of development, culture, religion, recent and past political situation, etc.

2.4. Methodology

The grid to analyse the textbooks

We collectively constructed and improved a specific grid to analyse the chapters dealing with Human Genetics in the textbooks of the 19 countries involved in the Biohead-Citizen European research project (http://www.biohead-citizen.net/). The precise work on the topic Human Genetics was conducted under the responsibility of J.Castéra and P.Clément, and took into account all the collective discussions developed in the Biohead-Citizen meetings, leading to the decision to write the present paper collectively with the data gathered from 16 countries. We decided to focus the present work on the results drawn from only two points in the grid, which are two main points related to our research question:

- *Occurrences of the expressions "genetic program" and "genetic information" (and other expressions with the same implicit value):* These terms are indeed significant, showing whether or not the textbooks break from the "all genetics" values according to which we would be largely programmed by our genes (corresponding with a fatalist ideology in society and a reductionist ideology in the life sciences). We focused on the occurrences of the words "program" and "information" when associated (explicitly or implicitly) with the term "genetic": "genetic program" and "genetic information". This method ("pivot-terms", defined by Harris 1952) has previously been used by Jacobi (1987), Abrougui (1997) and others to analyse biology-specific contents of school textbooks. The difficulty here was the language. The initial collective grid was written in English, but 14 different languages were used in the textbooks analysed. We worked together to be sure to fully understand the two notions, "genetic program" and "genetic information", and to identify their translation in each language as well as a list of possible synonyms.

- *Photos of human twins in textbooks:* these photos are considered as scientific images because they convey a scientific message (Clément 1996). In this specific case the message is the morphological similitude of identical twins, which corresponds to the identity of their genotype. In contrast, some images intend to show morphological differences between fraternal twins. Nevertheless, the images of monozygotic twins can also have an implicit ideological message when they strongly suggest that features other than morphological ones can be genetically determined: the same clothes, the same hairstyle, the same behaviour, etc. Consequently, for each image of twins, we examined whether the twins were presented as having the same clothes, tastes and behaviour or, on the contrary, if they showed differences illustrating the paradox of the twins who tend to differ by characteristics such as clothing and socio-cultural appearances (Zazzo 1984).

The sample of textbooks

The same grid, using these two indicators, was used in the 16 different countries involved in the BIOHEAD-CITIZEN research project. Comparisons took into account the school level (corresponding to similar students' ages) at which Human Genetics is taught in each country.

We analysed 50 textbooks, which are listed below after the references: France (11 textbooks), Italy (7), Portugal (4), Lebanon (4), Germany (3), Hungary (3), Lithuania (2), Tunisia (3), Cyprus (2), Estonia (2), Finland (2), Malta (2), Morocco (2), Poland (1), Romania (1), Senegal (1). There are two reasons for the differences in the numbers of textbooks studied in each country: (i) in some countries, Human Genetics is taught at only one school level, while in other countries it is taught at two or more school levels: (table 1); (ii) in some countries, there is only one official national publisher for school textbooks, while in others there are several private publishers. In this case, each team chose the most significant publishers.

Each team filled out the grid corresponding to the textbooks of its country. All of the data were then centralised in Lyon (France), and their interpretation was performed collectively.

2.5. Results and discussion

At what level is human genetics taught?

The analysis of the syllabuses in the 16 countries concerned shows (table 1) that the number of levels where Human Genetics is taught varies among countries. The teaching of human genetics is distributed over six levels in Finland (but with just two textbooks; it can be taught at two school levels or more) and is found at only one level (for older students) in Romania, Poland and Senegal. Generally, human genetics is first taught to students who are between the ages of 13 and 15 years old. In Malta, this teaching begins earlier, with the students who are between 11 and 12 years old (table 1).

Table 1

Students' ages at which human genetics is taught in 16 countries

Age of students (in years) / Country	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19
Cyprus					■		■	
Estonia				■		■		
Finland			■	■	■	■	■	■
France				■	■	■	■	
Germany				■			■	
Hungary						■	■	
Italy		■	■	■				
Lebanon			■		■	■		
Lithuania					■		■	
Malta	■				■			
Morocco			■				■	
Poland							■	
Portugal				■		■	■	
Romania							■	
Senegal								■
Tunisia				■			■	■

Differences among the countries concerning "genetic program" vs. "genetic information"

Table 2

Total occurrences of genetic program + expressions with the same implicit value

Textbooks devoted to students of / Country	11-12 years old	12-13 years old	13-14 years old	14-15 years old	15-16 years old	16-17 years old	17-18 years old	18-19 years old
Cyprus					0		0	
Estonia				0		0		
Finland			17			53		
France				66-7 *	18-49*	1-2 *	0-0 *	
Germany				0			0-0	
Hungary						1	0-0*	
Italy	0-0-0*			0-2-0-0*				
Lebanon			27		3-0**	1		
Lithuania					0		1	
Malta	No textbook				10-1*			
Morocco			23				28	
Poland							0	
Portugal				2		2	0-1***	
Romania							5	
Senegal								1
Tunisia				0			0	0

* Occurrences in textbooks from one publisher - another publisher.

** Occurrences in textbooks from the same publisher but: from science section - from humanity section.

*** Occurrence in biology textbook - in psychology textbook.

Table 3

Total occurrences of genetic information or expressions with the same implicit value

Textbooks devoted to students of / Country	11-12 years old	12-13 years old	13-14 years old	14-15 years old	15-16 years old	16-17 years old	17-18 years old	18-19 years old
Cyprus					8		17	
Estonia				5		9		
Finland			0			5		
France				9-73*	81-59*	27-28*	15-1*	
Germany				0			9-15*	
Hungary						6	2-53*	
Italy	Oftentimes found			Oftentimes found				
Lebanon			55		39-5**	2		
Lithuania					3		3	
Malta	No textbook				0-0*			
Morocco			0				10	
Poland							8	
Portugal				9		8	1-0***	
Romania							19	
Senegal								2
Tunisia				7			30	3

* Occurrences in textbooks from one publisher - another publisher.
** Occurrences in textbooks from the same publisher but: from science section - from humanity section.
*** Occurrence in biology textbook - in psychology textbook.

An implicit hereditarianism value with the notion of "genetic program" (table 2)

In Maltese textbooks, "genetic information" as well as "genetic program" are never present. Nevertheless, at both levels where human genetics is taught (table 1) the same expression is used: "the DNA molecule forms a code which instructs the cell" (ten occurrences and one occurrence, depending on the publisher, for 15-16 year-old students, see (table 2). The message is that the cells could simply follow these instructions to produce the phenotype, just like a program. This implicit way to suggest a genetic program has already been noticed by Clément (2007) when analysing the cell concept in a Maltese textbook. Both textbooks still used today in Malta are in fact British textbooks published in 1986. The hypothesis to explain the presence of this hereditarianist expression is probably thus: old textbooks emphasised hereditarianism with the notion of a "genetic program" (or similar expression). It would be interesting to analyse the most recent English textbooks from this perspective to identify an eventual modification of this topic presentation. The French textbooks from the same period, and even those published in 1995, showed a clear presence of implicit hereditarianism (Abrougui 1997, Clément & Forissier 2001), nevertheless with significant differences from one publisher to another (Forissier & Clément 2003).

In Finnish textbooks, we found a strong presence of the notion "genetic program": 70 occurrences (vs. only five occurrences for "genetic information") in recently published textbooks (2004 and 2006). So even though the scientific community no longer uses the expression "genetic program", the Finnish textbooks still do.

In France, we compared textbooks from three different publishers. In the textbooks published by Nathan, the occurrences of "genetic program" decrease from the youngest students to the oldest ones. In the textbooks published by Hatier, the first level is dominated by the notion of "genetic information", the second level by "genetic program", and then again by "genetic information". We also analysed the textbooks published by Bordas for the non- scientific curricula (students aged 15-16 years old, data not included in tables 2 & 3): we found ten occurrences for "genetic information" and one occurrence for "genetic program" in each textbook. Compared to syllabuses and French textbooks published in the 1990's, today the occurrence of the notion "genetic program" is very infrequent, being increasingly replaced by the notion "genetic information". Nevertheless, the disappearance of "genetic program" is not total, suggesting the influence of other parameters. (i) The first such parameter is a pedagogical project, starting with "genetic program" for the youngest students, and progressively using "genetic information" more often. This initial simplification (to start with the message

genotype → phenotype), is dangerous because Clément et al (2003) showed that the first concepts taught are those most memorised by students, which hinders their replacement by more scientific concepts later. (ii) The strategy of the publisher Nathan conforms more closely with the syllabus, because this textbook is one of the most used in France. In contrast, the publisher Hatier is striving for originality in order to increase the audience. The image of identical twins with different clothes (see below) is another illustration of this strategy. (iii) Finally, it is possible that the difficulty in totally suppressing the notion "genetic program" springs from the fact that it was extremely central to the precedent syllabuses: this notion, and possibly its implicit ideology, is still present in the textbook authors' and publishers' conceptions.

In Moroccan, Lebanese and Senegalese textbooks, we found the same kind of results as in France, possibly indicating a French influence, but sometimes with delay. *In Morocco*, Human Genetics is taught at only two levels, and the notion of a "genetic program" dominates the curriculum even if "genetic information" is introduced in the last level of teaching (tables 2 & 3). *In Lebanon*, the three textbooks analysed were published in 1999 and in 2000. The occurrences of "genetic program" show the delay with respect to the French texts, as well as a pedagogical project to start with this "simple" notion for the youngest students. A complementary explanation comes from the analysis of Lebanese students' and teachers' conceptions about genetic determinism, showing a strong influence from hereditarianism (Abou Tayeh 2003). The same explanation can be offered for Morocco, where the occurrence of "genetic program" is frequent. *In Senegal*, the chapter devoted to Human Genetics is very short, and includes only one occurrence of "genetic program" and two of "genetic information". These three countries (Morocco, Lebanon and Senegal) seem to be evolving in the same way as France, diminishing the amounts of "genetic program" and implicit hereditarianism, even though this trend is marked by a longer delay in Morocco, and a reduced importance of Human Genetics in Senegal. We are going to see that, in Tunisia, the change is faster and more radical than in France.

Before proceeding, however, we can note that in *Portuguese textbooks*, throughout the different levels, there is both a persistence of the notion of a "genetic program" with at least one occurrence by level, and an absence of a truly clear evolution between the various levels. The hypothesis in this case is that a difficulty exists in changing the scientific and ideological content of the chapter Human Genetics.

On the contrary some countries don't use, or else very rarely use the expression "genetic program" in textbooks.

Tunisian textbooks use only the concept of "genetic information" throughout the three levels where Human Genetics is taught. Nevertheless, the absence of the notion "genetic program" does not yet mean a total disappearance of innate ideas from the Tunisian textbooks (Clément et al 2006 for the human brain) nor from the Tunisian teachers' conceptions (Kochkar 2007). It means that, for the chapters dealing with Human Genetics, the textbooks adopted the new scientific contents very quickly: is this a consequence of the growing influence of Tunisian researchers in Didactics of Biology?

In Germany, the students are first presented with human genetics between the ages of 14 and 15: at this school level, there is no use of "genetic program" nor "genetic information" but only "genetic constitution" and "hereditary disposition". The concept of "genetic information" is introduced at the highest level where Human Genetics is taught. "Genetic program" is never used. Hereditarianism was the foundation for the majority of genetic research performed in the beginning of the 20th century in Germany. As in other Western European countries and the USA, German genetic research developed in eugenics institutes with the goal of building genealogical trees and tracking patterns of occurrence of diseases and disabilities, having considered that characters such as poverty and criminality were hereditary (Wolf 2002). More recently, O'Mahony et Schäfer (2005), in their study dedicated to comparing German and Irish media discourse on Human Genome Research, consider that Germany can be assumed to offer favourable conditions for extensive communication about this subject. *"Moreover, it is a large country highly influenced by the enlightenment, but no less by enlightenment scepticism, contained within its religious, philosophical and social heritage, and by left-wing critique of capitalism."* According to these authors, the collective memory of the Nazis' eugenics program is an important background, increasing the communication in Human Genetics. Furthermore, co-dominance of both the Catholic and Protestant religions *"prevented the dominance of one confessional worldview and morality, a dominance that can inhibit communication about genetic issues"*.

In the Italian textbooks, the precise expression, "genetic program", occurs only twice and just in one textbook (Boschetti 2004), but in this textbook terms like "hereditary patrimony" and "genetic patrimony" are very often used. They are also present in other textbooks (Leopardi 2004, Miller 2000, Colombi 2006, Piseri 2001). These expressions are more neutral than "genetic program", with less implicit value. This could show the same desire as in Germany to use caution in dealing with hereditarianist ideology. The common past of Germany and Italy during the Second World War certainly had an influence on the way human genetics is taught, albeit sometimes awkwardly. For example, in the Miller textbook (2000) the metaphor of the books of life is used: *"The information that is necessary for the expression of an individual's characteristics is contained in the genes, which are like books; the genes are ordered on chromosomes, which are like bookshelves"*. According to the

metaphor of *"the book of life",* it would be enough to know the alphabet and the genetic syntax to reach the essence of the human being. It could be interesting to try to analyse whether this metaphor is further developed in a Catholic culture. Today, such a conception is scientifically unacceptable and ethically dangerous. In the Piseri textbook (2001), an allusion to epigenetic processes is nevertheless found: *"each organism is often the result of a complex interaction among genes, environment and causal events".* But the same textbook uses another expression, reminiscent of the metaphor of *"the book of life": "...each cell is able to auto-construct itself and to function because it contains a very precise project (DNA) and the structures that can interpret and drive it"*. The expression *"precise project"* suggests that everything is written, forgetting that cellular differentiation is ALSO the result of the interactions between cells in an organism. So even if the precise expression, "genetic program", is almost absent from the Italian textbooks, other expressions show some implicit inneism.

In the Lithuanian textbooks, there is just one occurrence that could be considered as a notion similar to "genetic program": *"the reproduction of cells is programmed in genes"*, but there is never the precise expression: "genetic program". In Lithuania, the explanation for this absence seems to be deeply rooted in the past: the notion was traditionally absent in the precedent syllabuses and textbooks. We have verified this for textbooks published since 1979.

Three other Eastern Europe countries included in our sample show the same characteristics for the current textbooks analysed: *Estonia, Poland and Hungary*. *In Poland*, Human Genetics is taught at only one school level, but with 40 pages, without any mention of "genetic program". In the *Hungarian textbooks*, we found only "genetic information" in the three textbooks analysed: two occurrences in one textbook for 17-18 year-old students, 53 occurrences in the other textbook for the same-age students and six occurrences in the textbook for 16-17 year olds. Only one exception was found in the last textbook: "programmed by a gene" (exactly the same expression found in the Lithuanian textbook). *In Estonian textbooks* there is no trace of the notion of "genetic program".

Our hypothesis is that in East European countries, which were either included in or associated with the USSR, there was one official line to teach biology based on the work of Lyssenko and Mitchourine, with a negation of the idea of a "genetic program", even if at the end of the 1960s, the ideas of Lyssenko and Mitchourine were thrown out. The role of DNA in hereditary information was acceptable and presented in all textbooks. However, the differences between human individuals were also always explained by environmental or social conditions. As a rule, there was a chapter in these textbooks that criticized "bourgeois" ideological considerations, explaining that not all people are equal due to the differences in their genes. This situation was the same in most socialist countries, because textbooks were under Moscow's control for ideological and political reasons. Changes appeared at the end of the 1980s, when several socialist countries and some republics of the USSR (including the Baltic countries) started to write their own original textbooks, but they still show these influences even today.

In Romania, the topic Human Genetics is not really developed: five occurrences of "genetic program" and 19 occurrences of "genetic information" were found in the unique Romanian textbook, among the 13 pages devoted to Human Genetics.

In Cyprus, the textbooks use exclusively "genetic information": eight occurrences in the textbooks for 15-16 year-old students and 17 occurrences in the textbooks for 17-18 year-old students. A possible explanation is that the absence of the notion of "genetic program" could show a desire to avoid using the metaphor of a computer program.

An implicit hereditarianism from the photos of twins

Among the 19 representative images of twins found in the 50 textbooks, 13 represented monozygotic twins who have exactly the same hairstyle and the same clothes. Figure 2a illustrates one of these images. Among the six images showing differences, five are fraternal twins' photos and only one represents monozygotic twins (Hatier, France, 14-15 year-old students). This image is reproduced in figure 2b, showing that there are only minor differences between the identical twins (hairstyle, clothing and the way to cross the arms). All the monozygotic twins' images (with this single exception) illustrate a simple and direct relation between genotype and phenotype, and suggest that genes could determine much more than just physical resemblance to include choices of hairstyle or clothes, attitudes and behaviour. This illustrates both the parents' conceptions when these twins are young, and apparently dressed by their parents, as well as more general social representations of identical twins. Consequently, innate ideas are conveyed by these images as an implicit ideology. This appears in all the countries where textbooks contain illustrations of twins.

(a)

(b)

Figure 2. Monozygotic twins.

(a) Monozygotic twins who have exactly the same hairstyle, the same clothes (Moroccan textbook: Afriquia Achark for 17-18 year-old students, page 6). (b) The sole image found with some differences between two monozygotic twins (French textbook: Hatier publisher for 14-15 year olds, page 23).

We found twins' photos in the textbooks from nine countries (among the 16 countries involved in this research). In the other seven countries, time devoted to human genetics education is sometimes very short (only one school level in Poland, Romania and Senegal: (table 1), and/or there are no photos with colours in the textbooks (as in Tunisia or Cyprus). Finland and Lithuania are the only exceptions, but it is difficult to be sure whether the absence of images of identical twins is a real choice.

Therefore, a clear message is an internationally persistent, implicit hereditarianism expressed by these monozygotic twins' photos in all the countries where these images are presented in textbooks. This result illustrates the KVP model presented in the introduction of this work. The knowledge (K) is the scientific message of these images: the morphological identity of twins. Nevertheless, another message is transmitted through these images, more ideological than scientific: the identity of hairstyle, clothes, body postures and smile suggests that these features are programmed by their identical genotype. The value (V) in this case is the implicit innate idea, hereditarianism, suggesting that human cultural and social features (such as hairstyle and dress) could be genetically determined. The social practice (P) is the textbook authors' and publishers' way to work. A more detailed enquiry could be performed in each country; nevertheless, it seems that the photos of twins included in the textbooks come from image banks where twins of every age and nationality are as identical as possible. This identity is very present in the media, which covers, for example, the international meetings of identical twins. In this way, media are still reinforcing the dominant ideology of hereditarianism. Only a very few magazines for the popularisation of science have just recently started to present scientific knowledge on epigenesis using the example of differences between identical twins: for instance, in France a special issue of Sciences & Avenir did so in December 2006, explaining that they tried to find images of monozygotic twins showing differences in their hairstyles, clothes, etc, but with no success.

2.6. Conclusions

Is hereditarianism disappearing in the chapters dealing with Human Genetics in school biology textbooks? Not totally. We just used two categories of indicators to analyse 50 textbooks from 16 different countries. The results related to the indicator based on the occurrences of "genetic program" and "genetic information" vary among the 16 countries, showing in at least several cases, if not yet all the countries, a coherence with the new

scientific trends in human genetics. However, the results obtained using the indicator "photos of twins" show no differences among the countries, attesting to the persistence of an implicit hereditarianism.

Our work primarily illustrates clear interactions between taught scientific knowledge (K) and certain values (V) such as implicit hereditarianism (the idea that all human features are programmed in genes) and reductionism (the reduction of socio-cultural features to genetic determinism), as well as some social practices (P). These social practices are namely those of the publishers when they choose images for their textbooks and those of the teachers when they wish to start with simpler (reductionist) notions, such as the "genetic program", to introduce the influence of genotype on the phenotype. But there is also an influence from social practices and values which are dominant in each country and which don't easily change (in the major media forms for instance), even if scientists are proposing new knowledge linked to other values. We hope that this work will play a role in raising the awareness of the various actors involved in didactic transposition to the fact that their conceptions are sometimes marred by ideologies (most times involuntarily). Our results illustrate interesting differences among the 16 countries analysed. We proposed some initial hypotheses to interpret these differences. Nevertheless, most of these hypotheses need to be tested, mainly by an historical approach in each country.

Moreover, the current research being conducted through the Biohead-Citizen European project, on the conceptions of pre-service and in-service teachers in these 16 countries will provide important information for the further interpretation of our data from the textbook analysis. The undertaken research is still in progress, currently at the stage of analysing answers of a questionnaire which includes precise questions on the topic of Human Genetics. The renewal in teaching this topic, on introducing interactions between genetic, epigenetic and environmental influences for the interpretation of the phenotypes, represents an important step, responding to the challenge of improving citizenship at school level.

Such teaching can be a tool to promote social integration in a knowledge-based society.

3. Human Brain approaches in syllabuses and school textbooks of 15 countries

3.1. Abstract

In the human brain, the neuronal pathways are networks which support our learning, memory and thought and which work with permanent regulations (feedbacks).

However, only 19 % of illustrations of these neuronal pathways, in the 55 analysed school textbooks coming from 15 countries, are showing feedbacks. The neuronal pathways related to movements are generally introduced by linear spinal cord reflexes, and sometimes mostly reduced to reflexes. In consequence, in most countries, the scientific knowledge taught with these images of neuronal pathways is linked with an implicit ideology: a clear behaviourism associated with reductionism, and even sometimes with innatism or spiritualism.

Two thirds of the few images with feedbacks are related to vegetative functions: the neuro-hormonal control of female and male reproduction, and of heart and breathing rhythms. Nevertheless, even for these vegetative controls there is not any feedback in several of the 55 analysed textbooks. Only in three countries the double innervation (gamma and alpha) of striated muscles, with the regulatory function of the neuro-muscular spindle, is illustrated, with only one image in each of the three corresponding textbooks. Few images illustrate neuronal pathways in the brain, and only exceptionally as the neuronal networks (with feedbacks) which are the supports of our memory and of our thought.

The persistence of the same kind of images in school textbooks of these contrasted countries suggest that the conceptions on human brain are less linked to national socio-cultural contexts rather than to international dominant ideologies.

3.2. Introduction: theoretical background and question of research.

The scientific content of Neurosciences is evolving very fast, especially during these last 20 years with the emergence of cognitive sciences and of the cerebral imagery. The concepts of cerebral plasticity and epigenesis are now central in the research field (Changeux 1983, 2002, Edelman 2000), as well as the connexionnism and the concepts of emergence, enaction and umwelt (Varela 1989, Stengers 1997, Stewart et al 1997, Buisseret 1999). We know that our leaning and our memory are configured in our neuronal networks (Changeux & Ricoeur 1998). We know also that any process in our central nervous system is controlled by several regulations, with neuronal feed-back.

In France, a recent president of the National Committee of Programmes for the Life and Earth Sciences, was claiming that *"the cybernetic approach can be an extraordinary pedagogical tool, offering us a language and a formalism very easy to use"* (Calvino, in an interview by the SNES[8]), and proposed to introduce in the syllabuses the concepts of homeostasis and of servomechanims. In 1984, Carpenter developed in his book on Neurophysiology a simple formalism of cybernetics, particularly to illustrate the control of any movement by the double innervations (gamma and alpha) of every striated muscle. He insisted on the importance of this control, indicating that, for instance, the solear muscle of the cat is innervated by 150 motoneurones α and 100 motoneurones γ (Matthews 1972).

How these perspectives are introduced in the biology syllabuses?

A first survey has been done recently by Clément, Mouelhi & Abrougui (2006) to analyse the French and Tunisian syllabuses and textbooks, showing a strong influence of behaviourism and hereditarianism, nevertheless with a recent evolution in France (introduction of the concepts of cerebral plasticity).

We enlarge here this survey to 15 countries, with the analysis of the current syllabuses and textbooks.

We use some concepts of Didactics of Biology. The didactical transposition, defined by Chevallard (1985) in didactics of mathematics, has been already adapted to biology education (Clément 1998, 2004, 2006). The main change is to enlarge the scientific knowledge at each level of the transposition, considering interactions KVP between scientific knowledge (K), values (V) and social practices (P).

Textbooks are an important step in the didactic transposition (Bruillard 2005, Bernard et al 2006). We will analyse here the content of the textbook as the expression of the interactions between the three poles KVP (Clément 2004, 2006): K – for the scientific knowledge related to the nervous system and more precisely to the human brain; P – for the social practices of the authors and publishers of the textbooks and also of the teachers and of the social context; V – for the values as ideologies or philosophies or ethics which are generally implicit behind the precedent points.

For instance, the reduction of neuronal pathway to linear transmission, without any regulation from stimuli to responses, illustrates the influence of behaviourism (Clément et al 2006) as well as of the reductionnist ideology (Canguilhem 1981). The reduction to reflexes is probably also a sign of the influence of hereditarianism (innatism). And the separation between brain and body, the former controlling the latter, could be a new way to express the Cartesian dualism with the separation soul/body.

We compared the textbooks coming from 15 countries to analyse if some of the above KVP interactions are present or not in these countries and if their possible differences can be related to some socio-cultural features of these countries.

[8] SNES = Syndicat National de l'Enseignement Secondaire

3.3. Methodology

This work is a part of the European project of research BIOHEAD-CITIZEN (Biology, Heath and Environmental Education for better Citizenship), coordinated by Carvalho, Clément & Bogner (2005). A great part of this project is dealing with the critical analysis of syllabuses and textbooks for six topics, being "Human Brain" one of them.

We have analysed 55 school textbooks currently used in 15 countries (see Table 2 below – left columns). The analysis of these chapters were done by the team of each country (see Acknowledgements and the list of co-authors of the present work).

Eleven countries are located in different parts of Europe: North and South, West and East. All these countries are contrasted by their own history and their economical, social, cultural and religious features. The other four countries are outside Europe and are included in the "French Speaking Communities" (even if Arabic is the official language in Morocco, Tunisia and Lebanon).

In all 15 countries, we have used the same grid, elaborated collectively under the responsibility of P.Clément, within the Biohead-Citizen project. We analyse here the answers of the part of the grid, concerning the question reproduced in the table 1. For this first work on our results related to the topic "Human Brain" in the textbooks, we chose this question because it is highly significant of the possible reductionism in the biology teaching and of possible presence of implicit ideologies.

Table 1 *- Part of the grid used to analyse the chapters dealing with Human Brain*

C-2. Grid - Analysis of the images with (neuronal) pathway for Human Brain

See the annex for more information on the definition of the ten categories used below.
CNS = Central Nervous System, including spinal cord and / or brain. One image by box : just indicate the page number (e.g. p.23). In the column at right, indicate the total number of images of each category.

Image on pages						Total
Categ 1 : only Stimulus → CNS (Central Nervous System)						
Categ. 2 : only CNS → Response						
Categ. 3 : Stimulus → Spinal Cord → Response						
Categ 4 : Stimulus → Brain → Response						
Categ. 5 : Several stimuli, and / or several Responses						
Categ. 6 : with feedback(s) Brain → Response → Brain						
Categ. 7 : muscle double innervation gamma + alpha						
Categ.8 : other voluntary movements or sensori-motor coordination with feedbacks						
Categ. 9 : Neuro-hormonal regulation						
Categ.10 : other examples of regulation						

3.4. Results and discussion

- General results

Most of the 55 textbooks were Biology textbooks, but some were dealing with Psychology at the end of secondary school (Portugal), or more generally with Science in the Primary School. The chapters related to Nervous System and Human Brain are generally developed at the end of the secondary School, the last year and/or the year before, depending of the country. The situation is very diverse for the earlier years, with or without teaching the human brain. In most of the countries, this topic is totally absent in the Primary School. Due to this diversity, we grouped in the same column of the Table 2 the results obtained from the two last school years together, and in an other column all the other school levels.

In Estonia (two books, one with 8 pages and the other one with 5 pages on Human Brain), there are no images with a neuronal pathway, and in Lithuania there is only one image (Stimulus → Brain → Response) in 40 pages on Brain (Table 2).

In the other countries, there are important variations (Table 2) but in all cases the linear pathways with no feed-back at all are the majority of images (80% for the total), showing a strong reductionism as well as the influence of behaviourism. In two countries (Italy and Cyprus), there is not any image with feedbacks. In contrast, some

countries present images with feedbacks in a proportion just below 20% (France, Lebanon, Tunisia), in other ones about 20-25% (Malta, Portugal, Romania, Finland, Germany) and others present about 30 to 40% (Hungary, Morocco, Senegal).

Table 2 - *Occurrences of images showing neuronal pathways, only linear ("linear") or with feedbacks ("feedback") in the analysed textbooks, for each country.*

Participant Country	**Number of textbooks**	under 16 years		17-19 years		**TOTAL**	
		linear	feedback	linear	feedback	**linear**	**feedback**
Estonia	**2**	0	0	0	0	**0**	**0 (0%)**
Lithuania	**1**	1	0	-	-	**1**	**0 (0%)**
Italy	**8**	11	0	1	0	**12**	**0 (0%)**
Cyprus	**1**	15	0	-	-	**15**	**0 (0%)**
France	**16**	23	1	72	19	**95**	**20 (17%)**
Lebanon	**4**	26	2	10	6	**36**	**8 (18%)**
Tunisia	**4**	5	0	17	5	**22**	**5 (19%)**
Malta	**2**	7	2	-	-	**7**	**2 (22%)**
Portugal	**3**	7	3	3	0	**10**	**3 (23%)**
Romania	**1**	-	-	32	10	**32**	**10 (24%)**
Finland	**2**	5	1	4	2	**9**	**3 (25%)**
Germany	**3**	5	2	4	1	**9**	**3 (25%)**
Hungary	**4**	0	0	7	3	**7**	**3 (30%)**
Morocco	**2**	9	0	2	5	**11**	**5 (31%)**
Senegal	**2**	5	0	4	6	**9**	**6 (40%)**
TOTAL	**55**	119 (92 %)	10 (08 %)	158 (74 %)	55 (26 %)	**277 (80 %)**	**68 (20 %)**

Thus, when pathways are drawn, the linear pathways (without any feedback) for nervous tracks are dominant in all countries.

- The control of movements: a massive dominance of linear patterns without any feedback

In textbooks presenting images, the example of the reflex is always present, with a pedagogical goal but also carrying behaviourist and sometimes hereditarianism implicit messages, when the only explained movements are conditioned reflexes or innate reflexes.

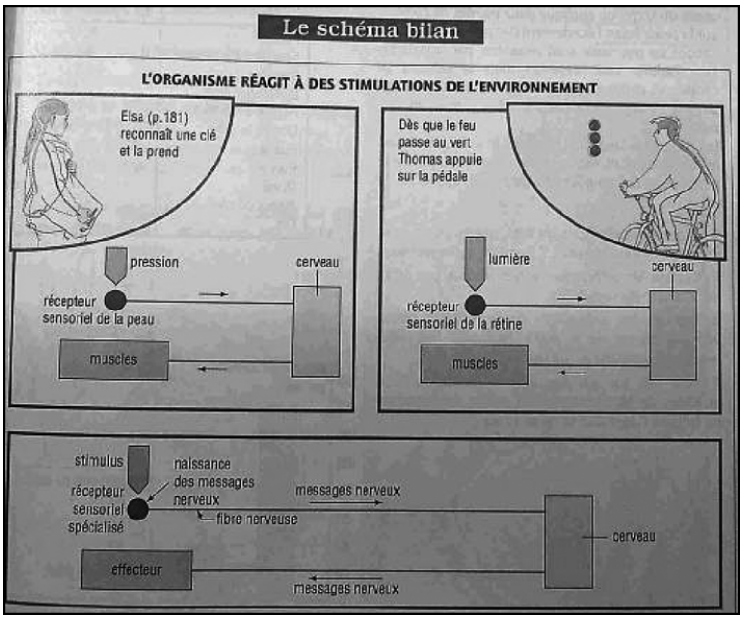

Figure 1: Typical behaviourist linear pathway: stimulus → Brain → muscles
(French textbook Biology 3e = 14-15 years old students, Bordas 1999, p. 187)

Figure 1 is commonly used for the youngest students in several countries, showing a typical behaviourist schema: Stimulus and receptor → Brain as a black box → Muscular response. That is an important message, because most of our movements are controlled by this kind of reflexes (when we are walking, standing on, etc). Nevertheless, it suggests that there are no feedback in our movements, presented as only controlled by our sensory perception.

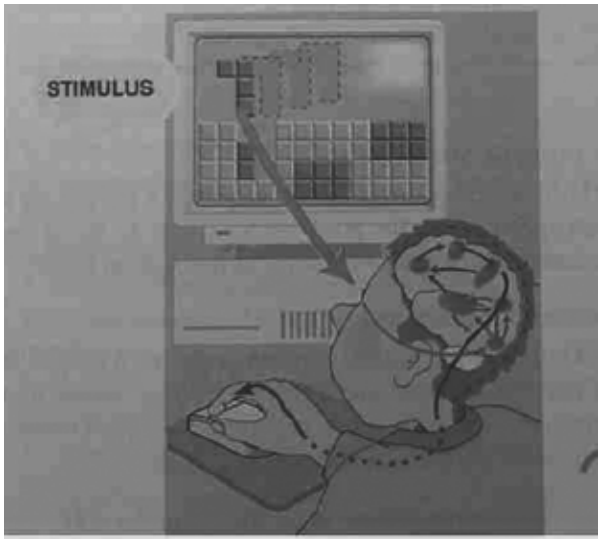

Figure 2: The same pathway: Stimulus → Brain → muscles,
nevertheless with feedbacks between several cerebral areas: the brain is not totally a black box.
(French textbook Biology 3e = 14-15 years old, Nathan publisher, 1999, p. 197)

Figure 2 illustrates the same behaviourist pathway, with a network of interactions inside the brain, which is no more only a black box: category 10 of our grid: the only image with feedbacks in the French textbooks for students before 16 years old (Table 2) and a special category in our general diagram (Figure 6). This image is just inserted in a larger image which is nearly the same as in figure 1 above: a typical behaviourist linear pathway (category 4 of our grid).

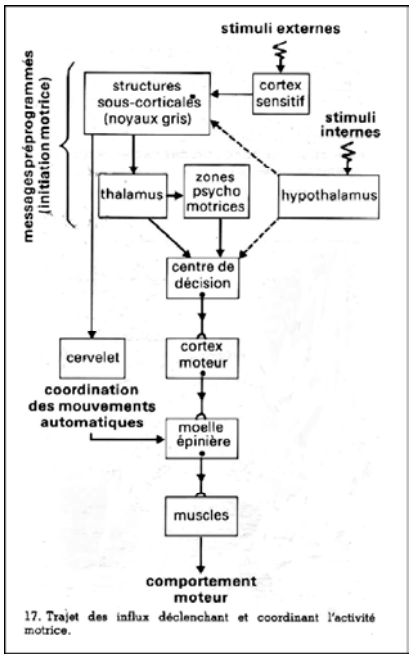

Figure 3: A more complex linear pathway (textbook from Senegal, 18-19 years old students,
Dion M. & Escalier J., Nathan publisher, 1983, p. 273)

For older students (as in Figure 3 for 18 years old students) the interactions inside the brain can specify the intervention of several cerebral areas. Nevertheless, this Figure 3 is typical of a still totally linear pathway inside the brain, with no one feedback.

All the precedent examples are concerning controls of movements that imply the brain. Nevertheless one of the main problems related to the topic "Nervous System and Human Brain" is the great importance of nervous pathways illustrating only reflexes where the central nervous system is limited to the spinal cord (e.g. in Figures 4 and 5).

The linear pathway (without any feedback), is sometimes more complex with the command of several antagonist muscles implied in the same movement (category 5 of our grid, Figure 4). The most used example, in all the countries, especially in France and in Tunisia (Clément et al 2006) is the myotatic reflex. The central nervous system is only the spinal cord (Figure 4), and the origin of the reflex is a sensory receptor that is generally not known by the students: the neuromuscular spindles (Figures 4 and 5). This receptor has also an important role in the control of any muscular contraction, as a comparator between the wished contraction (transmitted to it by the gamma innervation) and the obtained contraction (coming from the alpha innervation which sets in motion from the brain informed by the sensorial nerves coming from the neuromuscular spindle, playing here its sensorial function).

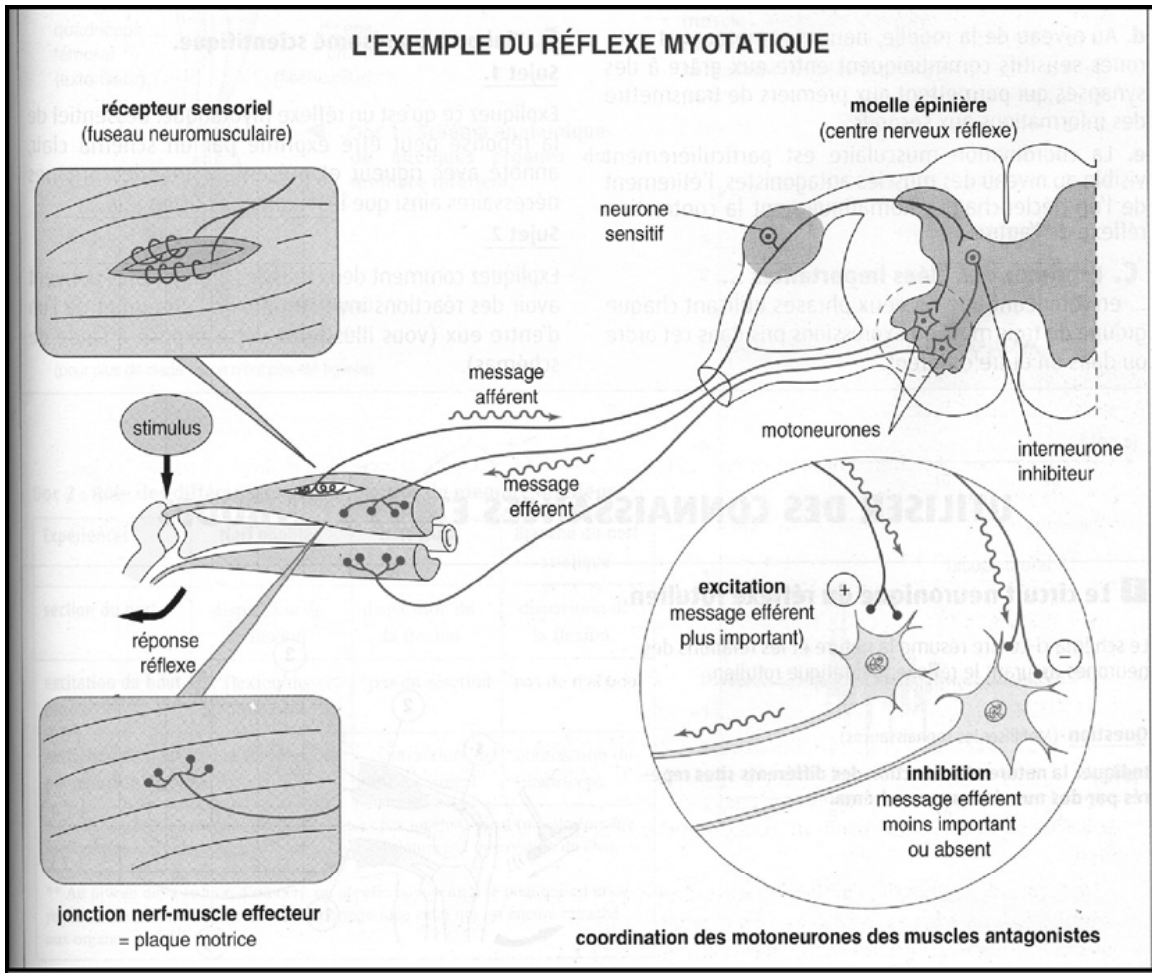

Figure 4 - The classical linear pathway (Stimulus → Spinal chord → Muscle. The myotatic reflex (French textbook 1ère S = Sciences for 16-17 years old students, Bordas publisher, 2001, p. 191)

When textbooks are introducing images of neuromuscular spindles and presenting their sensorial function, it would not be so complex to introduce also the gamma innervation and the mechanisms of regulation of muscular contractions for the human body movements. This is done and illustrated by one image only in Lebanon, in Romania and in Tunisia, although limited to the example of myotatic reflex (Figure 5), including only the spinal cord and not the different areas of cerebrum and cerebellum which are implied in any voluntary or even automatic movements, as are the areas drawn in Figure 3 (see Clément et al 2006 for more information on these points).

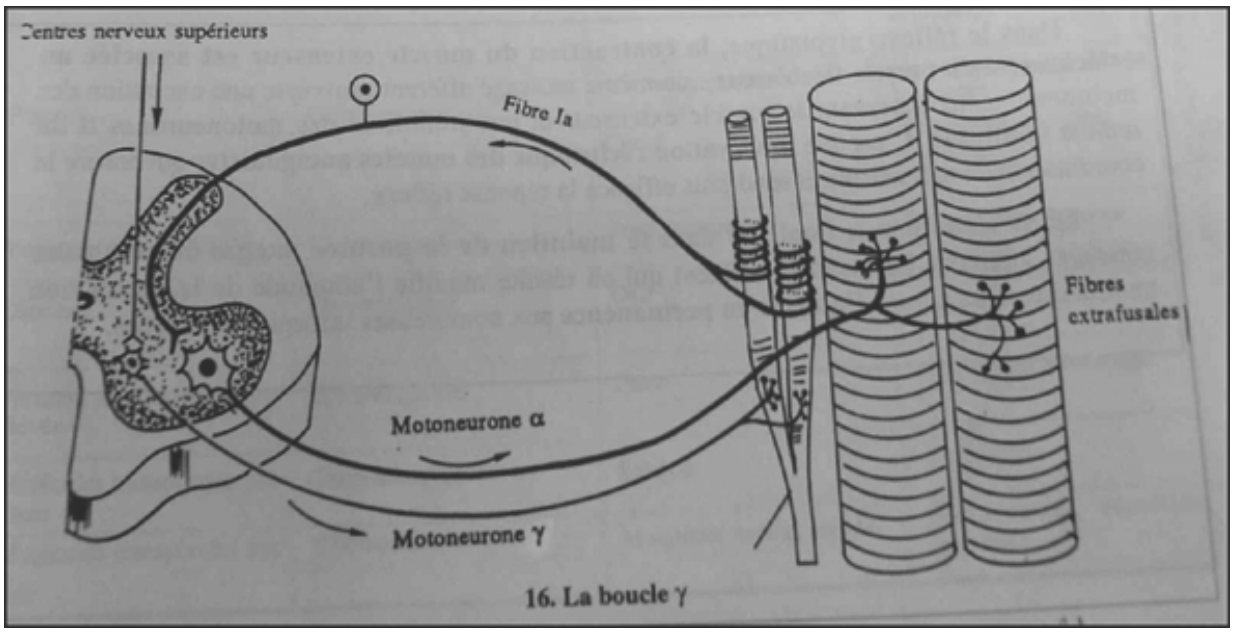

Figure 5: An exceptional feedback with the gamma / alpha innervation of muscular fibres, but only for the myotatic reflex.(Tunisian textbook for 18 years old students = last year of secondary school, Sciences "Sciences Naturelles", 4ème Sc.Exp., 2004, Tunis: CNP, p.231)

- The neuro-hormonal controls: with or without feedbacks?

As referred before (Table 2) there are few images with feedbacks related to the human brain or nervous system in the 55 analysed textbooks: only 65 (19%) images with feedbacks on a total of 342 images illustrating nervous pathways. More than 2/3 of these 65 are dedicated to the neuro-hormonal controls (Figure 6) of the human reproduction, sometimes of heart beats (tension) and/or respiration.

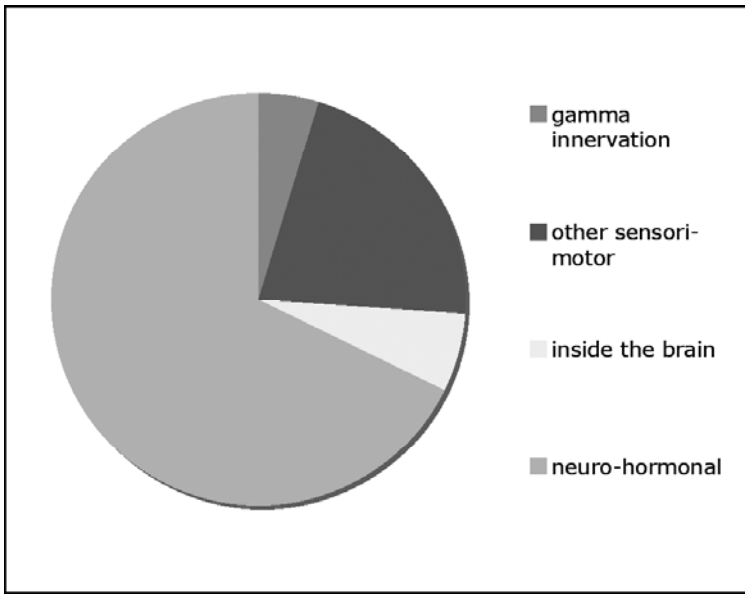

Figure 6 - Repartition by topics of the 65 images presenting feedback, in all analysed textbooks (see also the right column of Table 1 for their occurrence by country).

The most frequent illustrations of neuro-hormonal regulations with feedbacks are found for the control of the sexual women cycle and also the control of men sexual activity. Figures 7 and 8 are illustrations of this kind of feedback, generally occurring at the level of the hypothalamus. It is more an interaction between hormones and central nervous system controlling neurohormones secretion, rather than feedbacks inside the brain itself.

Nevertheless, even here, we can find in some countries (as in Portugal, or in Cyprus: Figure 9) a still linear control coming from the brain (the hypothalamus) without any retro-control mentioned.

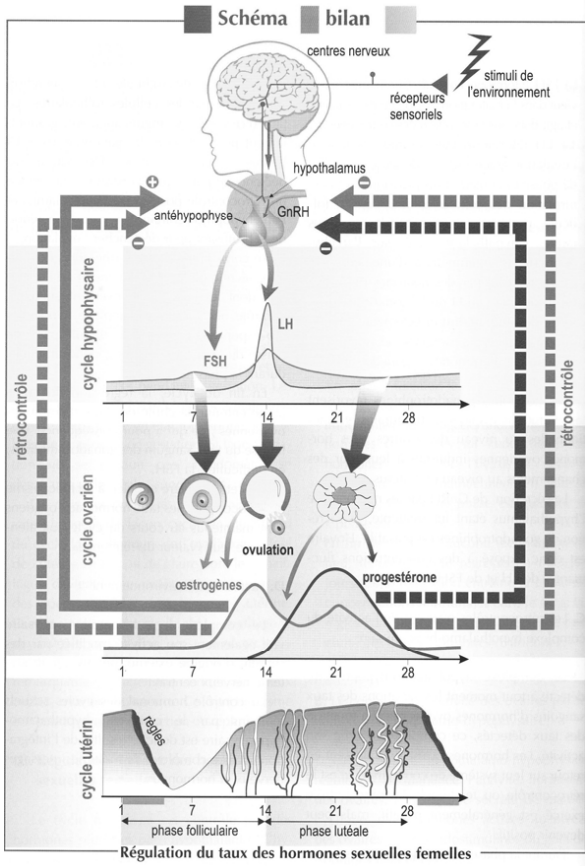

Figure 7 - An example of a neuro-hormonal pathway with positive and negative feedbacks at the level of the hypothalamus which controls the female hormones (LH and FSH).
Modified from a Lebanese textbook: Sciences de la Vie, 3rd year (16-17 years old students), Chalhoub E. et al., Beyrouth: CRDP, 2002, p.306. The initial image is coloured

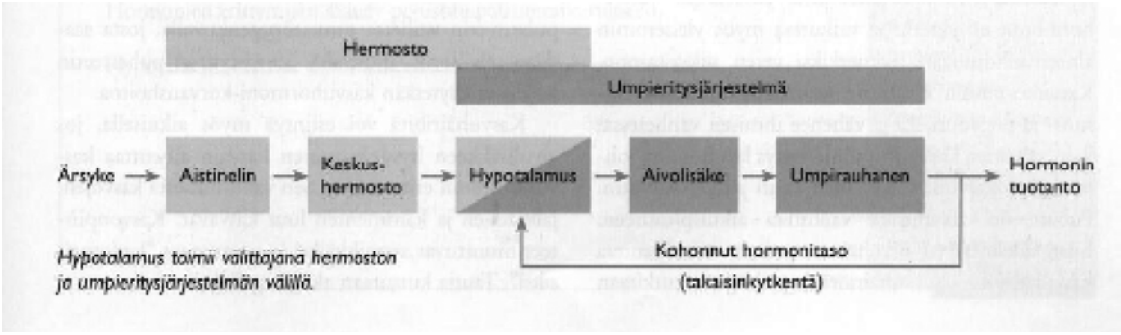

Figure 8 - An other example of a neuro-hormonal pathway with a feedback. The light grey boxes are the nervous system: from left to right: stimulus →sense organ → central nervous system→ hypothalamus. The dark grey boxes are endocrine parts (hypothalamus → pituitary → endocrine gland. The feedback is coming from the "hormone production" to the hypothalamus. (Modified from a Finnish textbook: Bios 4: Human Biology, 16-18 years old students, Happonen et al., Virpi Aalto Wsoy publisher, 2005, p.53. The initial image is coloured)

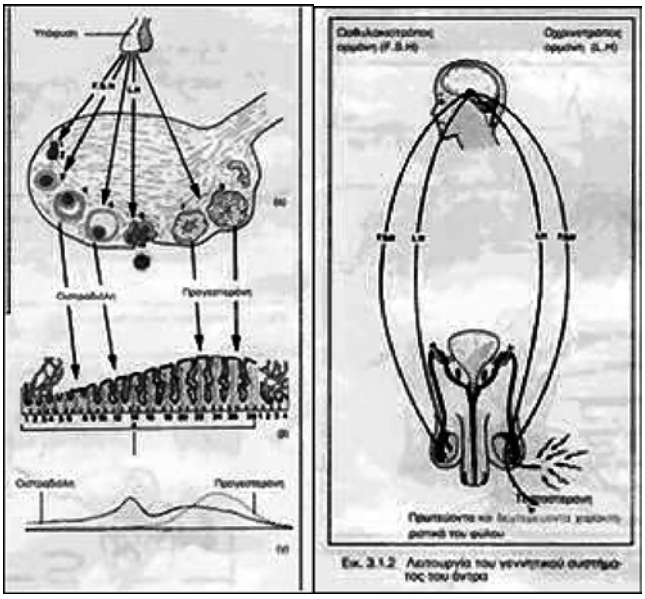

Figure 9: No feedback in the control (by the brain) of the sexual activity for women (at left) and men (at right): Modified from a Cyprus textbook: Human Biology - Health Eduction, Kousparov A.C. et al, 2nd grade of High School (13-14 years old students), Cyprus: Ministery of Education, 2001, p.23 and p.18.

There is here a strong link not only between these taught knowledge and the values of reductionism and behaviourism, but also with important social practices: how to understand the use of feminine contraceptive pills without any knowledge on the neuro-hormonal regulation they are interfering with?

The regulation of the cardiac rhythm is an other example of a possible illustration of a neuro-hormonal retro-control to illustrate feedbacks. Nevertheless, in several countries (as in Tunisia), they only illustrate this reflex activity with a linear pathway "Receptors → Central Nervous System → Responses". And even when the feedbacks are drawn in the nervous pathways, the explanation can still be behaviourist.

All these examples illustrate the reticence of most of the biology textbooks to include the processes of regulation, with cycles or even some clear feedbacks. As if it was too complex for the students (and/or for their teachers…).

Nevertheless, the taught knowledge is often rich in new concepts as indicated here in Figures 3 and 4. In contrast, schemas with feedbacks can be very simple and clear, as in Figure 10 reproduced here from a Hungarian textbook to illustrate somatic and vegetative reflexes related to the spinal cord.

In consequence, it is less a question of simplicity vs complexity than a crucial choice to teach or not the processes of regulations and the concept of feedback, a choice to teach or not that every biological process is regulated, and never a single cause – effect process.

QuickTime™ et un
décompresseur TIFF (LZW)
sont requis pour visionner cette image.

Figure 10: Clear feedbacks showing the somatic and vegetative reflexes related to the spinal cord (Hungarian textbook for 18 years old students, Biologia IV, Mihaly E. et al, Toth Géza publisher, 2003, p. 725)

3.3 - Are there illustrations of cerebral neuronal networks in textbooks?

Very few countries are illustrating neuronal networks in the brain. In the textbooks for the youngest students, there are sometimes areas drawn inside the brain, with linear connections between them, or in few cases, with a network of areas including feedbacks (e.g. Figure 2 above). This dominance of anatomy in biology was identified by Canguilhem (1981) as an ideology, and is still prevalent in most of the biology textbooks in the 15 chosen countries.

For older students, some neurons can be drawn inside the brain or inside the spinal cord: with only one of two neurons (Figure 4, 5 and 10), or more as in Figure 11, but still in a linear continuity, without any feedback.

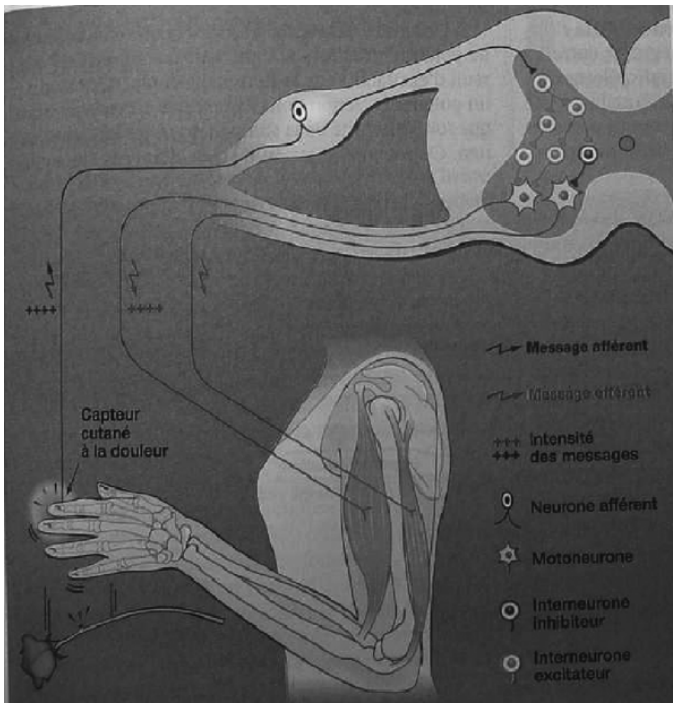

Figure 11: Linear pathways involving several neurones in the spinal chord (reflex) - (Modified from a French textbook 1ère S, 16-17 years old students, Hatier publisher, p. 163: the original is coloured)

These examples (figures 4, 5, 10, 11) also illustrate that there are generally more images of spinal chord with neuronal pathways rather than brain. The brain is possibly considered too complex by teachers and by publishers of textbooks, too complex for themselves and in consequence for their students, as Clément (1996, 1997) showed in France from teachers' interviews. A possible explanation of this complexity can also be the persistence of a spiritualist, or at lest dualist, interpretation of the thought (Clément 1994).

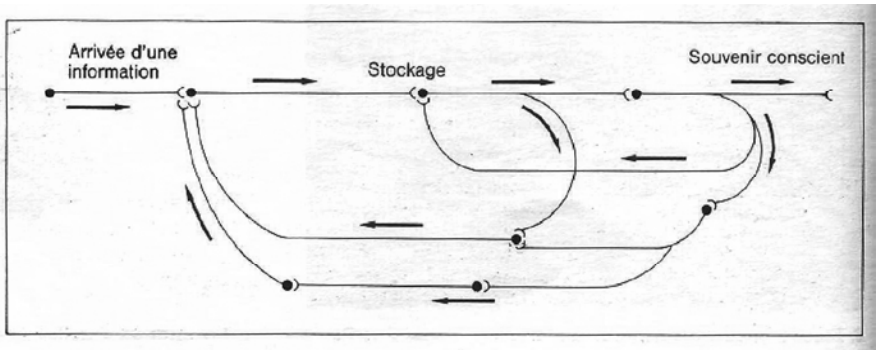

Figure 12 - An exceptional image of cerebral neuronal network with feedbacks, showing how they can be the support of memory (modified from the Senegal textbook for 18 years old students, 18-19 years old students, Dion M. & Escalier J., Nathan publ., 1983, p.266: the original is coloured)

In the 55 analysed textbooks, we found only one illustration of cerebral neuronal networks with feedbacks, in a Senegalese textbook (Figure 12) to illustrate the storage of information in our memory. This image is typical of the knowledge coming from research in neurobiology and cognitive sciences. It is an exception in the analysed biology textbooks, the memory is not a total mystery. The brain is not a black box where the students (and their teachers) often put the soul or the spirit (Clément 1994, 2004), but it is full of neurones and neuronal networks that are the biological support of our thought and memory.

3.5. Conclusions

In conclusion, most of the images of neuronal pathways of the 55 analysed textbooks coming from 15 countries show to be still under the influence of:

(1) reductionism, without any feedbacks or cycles or regulations, with very few exceptions which are mainly dealing with neuro-hormonal control (and this not in all the15 countries);

(2) behaviourism, with a large prevalence of the schema "Stimulus → Central nervous system (brain or spinal cord) → Response": in 14 of the 15 countries (the 15th is Estonia: there is no image of neuronal pathways in the Estonian textbooks).

(3) innatism (or hereditarianism), only in some countries as Tunisia where the place devoted to innate reflexes is very important;

(4) spiritualism, which is more implicit when the brain is at the origin of the responses, or even when the brain is like an anatomical black box with a strong resistance to explain that our memory and thoughts are located in neuronal networks.

Very few images are related to the constructivism or the cognitive approaches.

These results are so strong in all the 15 chosen countries that the few differences observed from one country to another are not relevant, suggesting that the conceptions (interactions KVP, between scientific knowledge, values and social practices) on human brain are less linked to local or national socio-cultural contexts rather than to international dominant ideologies, which have difficulties to change and to integrate the new scientific findings of research on the human brain: epigenesis and plasticity of the neuronal networks which are in our brain the biological support of our thought, learning and memory, and which are organised with a lot of feedbacks.

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VI. Some general recommendations

The general challenge of this research is summarised in the beginning of this report, and presented with more details in the introductions of each topic. How can we improve, in these countries and more largely, the biology education related to questions directly related to citizenship, as is the gender question (including sexism or feminism), racism, reduction of learning processes and of intellectual performance to genetic determinism, etc ?

Our analyses are using an exceptional corpus by its importance: syllabuses and textbooks from 19 countries, 7044 teachers' answers to our long Biohead-Citizen questionnaire. This large amount of data is just starting to be analysed and interpreted, and we need more time to continue these analyses and to publish our interpretations.

Nevertheless, some recommendations can immediately be suggested.

At international level.
(1) The international enquiries PISA and TIMMS are mainly evaluating the degree of knowledge and competencies of students. ROSE is trying to measure the degree of motivation. All these international projects forget the citizen goals of any education. Citizenship is rooted in values, and the originality of the Biohead-Citizen project is to work on interactions between scientific knowledge and values. The degree of sexism, of racism, of hereditarianism of students could also be evaluated. The recommendation is to enlarge the PISA and TIMMS enquiries by including items on these citizen values, as we have done in our Biohead-Citizen questionnaire.
A possible extension could be, at shorter term, to enlarge a continuation of the use of the Biohead-Citizen questionnaire to other countries, involving teachers and students.

(2) As it has been done for the international Conference of Tbilissi (1977) for the Environmental Education, and after that for other international Conferences on this topic and Sustainable Development, an international Conference on Education to Citizen values could be organised to promote these values through several matters, including Biology, Health and Environmental Education.

(3) An international Committee could be created to develop critical analyses of syllabuses and textbooks of different countries, with several possibilities from a formal UNESCO Commission to an informal Journal as the movies can be today criticized.

At a local and national level.
(1) Use the Biohead-Citizen results to improve the teachers' training in each country. For that, publish these results in national journals as well as local documents.

(2) Use the Biohead-Citizen results to improve the effective teaching of Biology, with when possible an evaluation of the effects of these innovations, and an articulation of these evaluations with projects of research (local, national or / and international).

(3) Work with Associations of Biology teachers, and with groups of Biology Education (Didactics of Biology) to enlarge the diffusion of the Biohead-Citizen results and perpectives.

(4) Work also locally and nationally in an interdisciplinary way to enlarge the citizen perspective of Education, particularly on the gender questions, and all the points where biology is used to develop not citizen attitudes (racism, elitism, etc).

(5) A national (or regional in some countries) Committee could be created to develop critical analyses of syllabuses and textbooks of different countries, articulated with the possible proposed structures at the international level.

(6) Organizing national Conference(s) in each country, with the Minister of National Education and the main policy makers of this Ministry, to discuss these points and try to develop national citizen initiatives.

At an European level
Trying to impulse and help the two precedent levels.
Trying to take into account the seriousness of our results, particularly when related to "questions vives" as creationism, sexism, racism, innatism, … by developing European networks on these topics to help continuation of research and also actions in schools and in the national school systems.
… (to discuss !)

Annex

Post-graduation; Publications; Communications

Total Post-graduation: 45

Post-graduation	Number	Total
PhD thesis		
2008	1	**15**
2007	4	
Submitted	1	
Running	9	
Master dissertations		
2007	19	**30**
2006	6	
2005	6	
Submitted	1	
Running	4	
TOTAL		**45**

Total Publications: 129

Publications	Number	Total
Papers in Proceedings		
2008	3	**88**
2007	57	
2006	13	
2005	15	
2004	1	
Papers in journals		
Already published	9	**32**
Papers accepted	10	
Papers submitted	13	
Books & Chapters in books		
Chapters published	6	**9**
Chapters submitted	2	
Books	1	
TOTAL		**129**

Total Communications: 128

Communications	Number
2008	10
2007	78
2006	22
2005	14
2004	4
TOTAL	**128**

POST-GRADUATION :45

PhD degree – total (15)

PhD – 2008 (1)

Amâncio António de Sousa Carvalho, "Promoção da Saúde: Concepções, valores e práticas de estudantes de enfermagem e de outros cursos de ensino superior"", DCILM-IEC, Universidade do Minho, Portugal, 8.01.2008.

PhD – 2007 (4)

Britta Oerke, "Environmental consciousness: dimensionality and validity of attitude and behaviour measurement", (Germany) 10.2007.

Lassaad Mouelhi, "L'enseignement de la neurobiologie dans les collèges t lycées en Tunisie et en France : analyse didactique des contenues des programmes, des documents d'accompagnement et des manuels scolaires", ISEFC, Université de Tunis (Tunisie) en co-tutelle avec l'Universidade Claude Bernard-Lyon 1 (France), 16/02/2007.

Mohamed Kochkar "Les déterminismes biologiques. Analyse des conceptions et des changements conceptuels consécutifs à un enseignement sur l'épigenèse cérébrale chez des enseignants et des apprenants tunisiens", Université de Tunis (Tunisie) en co-tutelle avec l'Universidade Claude Bernard-Lyon 1 (France), 16/02/2007.

Zélia Ferreira Caçador Anastácio, "Educação Sexual no 1º Ciclo do Ensino Básico: Concepções, obstáculos e argumentos dos professores para a sua (não) cinsecução", DCILM-IEC, Universidade do Minho (Portugal), em co-tutela com Universidade Claude Bernard Lyon-1 (França) 17.12.2007.

PhD – 2006 (0)

PhD – 2005 (0)

PhD – Submitted (1)

Artur Gonçalves, "Álcool, tabaco e outras drogas: Concepções de professores e alunos do ensino básico e secundário e análise dos programas e manuais escolares", para efeitos de doutoramento em *Estudos da Criança*, Área do Conhecimento *Saúde Infantil,* pelo DCILM-IEC, Universidade do Minho, Portugal.

PhD – Running (9)

Alaya Alaya "Les conceptions d'enseignants et élèves tunisiens sur la nature et l'Environnement, et analyse dês changerments conceptuels d'élèves après un enseignement." Thèse en cotutelle Université de Tunis et Université Lyon 1.

Assaad Yammine, soutenance en 2011, «L'éducation à la sexualité dans les établissements scolaires libanais : Analyse des conceptions d'enseignants et futurs enseignants, et des responsables religieux ». thèse en cotutelle : Université Libanaise et Université Lyon 1.

Christine Geier: "Health education at school – student-centred smoking prevention for 5th-graders". Germany.

Delfim Paulo Fernandes de Carvalho, sobre "Genética Humana na Educação para a Saúde", DCILM-IEC, Universidade do Minho, Portugal.

Jérémy Castéra "Analyse contrastive, dans 19 pays, des conceptions d'enseignants sur des questions vives liées à la Génétique humaine. analyse des programmes et manuels scolaires sur ce thème dans les mêmes pays". Université Lyon 1, France.

Marie Pierre Quessada, soutenance en 2008 - "Les origines de l'homme dans l'enseignement français aux 19ème et 20ème siècles et aujourd'hui dans les programmes et manuels scolaires de 19 pays et dans les conceptions d'enseignants des mêmes pays." Université Montpellier 2.

Odile Saab "Analyse de l éducation à la santé dans les manuels officiels libanais du primaire et du secondaire » Université Saint Joseph, Liban.

Rosa Branca Tracana, "Concepções dos professores em Educação Ambiental: conhecimento, valores e práticas", para efeitos de doutoramento em Estudos da Criança, Área do Conhecimento Estudo do Meio Físico, pelo DCILM-IEC, Universidade do Minho, Portugal.

Sandie Bernard, "L'enseignement de la reproduction et de la sexualité humaines dans le secondaire de 1950 à nos jours en France, et dans A9 pays aujourd'hui. Analyse des programmes et manuels scolaires, et des conceptions des enseignants ",

Université Claude Bernard Lyon-1, co-tutelle avec DCILM-IEC, Universidade do Minho, Portugal.

Master degree – total (30)

Master – 2008 (0)

Master – 2007 (19)

Alexandra Carina Gonçalves Novais, "Concepções, interesses e questões das crianças em idade pré-escolar, no âmbito da sexualidade". DCILM-IEC, Universidade do Minho, Portugal, 24.07.2007.

Alexandra Saracut, "Environmental education and the relationship with the curriculum", Babes-Bolyai University, Romania, 04/07/2007.

Catrinel Popescu, "Radioactive Pollution: Study case: Cernobyl Accident", Babes-Bolyai University, 04/07/2007.

Cristina Corpodean, "Sustainable development education reflected in chemistry curriculum" Babes-Bolyai University, Romania,04/07/2007.

Doina Scripet, "Didactical research in secondary school: The role of nutrition, Babes-Bolyai University, Romania,04/07/2007.

Emília da Conceição de Jesus Gonçalves, "Conteúdos de saúde nos programas de Educação Física do ensino básico e secundário e perspectiva de professores". DCILM-IEC, Universidade do Minho, Portugal, 1.02.2007.

Flaviu Bolobos, "Sustainable development in the European context", Babes-Bolyai University, Romania,04/07/2007.

Hynninen. T., "Home economics teachers' and home economics teacher students' conceptions of health education", University of Joensuu, The Savonlinna Department of Teacher Education, Finland, 2007.

Ivette Béré-Yoda "*Analyse des conceptions d'enseignants et futurs enseignants du Burkina Faso, de France et du Sénégal sur des questions vives relatives à l'éducation a la sexualité et à l'enseignement de l'évolution*." Master HPDS, LEPS-LIRDHIST, Université Lyon 1, France.

Josephine Hendel "The workbook as a form of ensuring results from a student-centred smoking intervention: Learning at workstations: analysis and evaluation of pupils' answers" Germany, 2007.

Kyllönen T., "Finnish teachers' and teacher students'conceptions about human, nature and environmental education", University of Joensuu, The Savonlinna Department of Teacher Education. Finland, 2007.

Mihaela Boghian, “The role of human in the nature”, Babes-Bolyai University, Romania, 04/07/2007.

Mielonen S., “Health Education in Textbooks of Science Education in Comprehensive School and Sixth Form”, University of Joensuu, The Savonlinna Department of Teacher Education, Finland, 2007.

Mourad Hadj Hameur, “Pollution et Education a l’environnement dans l’enseignement primaire tunisien : Analyse des programmes et des manuels scolaires”. ISEFC, Université de Tunis (Tunisie) en co-tutelle avec l’Universidade Claude Bernard-Lyon 1 (France), 16.02.2007.

Ruokamo M., “Ecology and Environmental Education in Biology Textbooks of Upper Secondary Education”, University of Joensuu, The Savonlinna Department of Teacher Education, Finland, month/2007.

Simona Catuna, “Environmental education – heuristical strategies in teaching learning process”, Babes-Bolyai University, Romania, 04/07/2007.

Simona Vasilciu, “Cooperative learning in environmental education”, Babes-Bolyai University, 04/07/2007

Tunde Kiss, “An enquiry of environmental education in secondary school”, Babes-Bolyai University, 04/07/2007.

Vőcsei K., A körynezeti nevelés a magyar közoktatásban egy vizsgálat tükrében ELTE University, Hungary, 05/06/2007.

Master – 2006 (6)

Albertina Maria Gomes Sousa, "Aparelho reprodutor: Concepções e obstáculos de aprendizagem em crianças do 1º CEB – Um estudo de caso". DCILM-IEC, Universidade do Minho, Portugal, 31.10.2006.

Catarina Rebolho Dantas, "Concepções sobre a digestão/excreção em alunos, professores e futuros professores do Ensino Básico". DCILM-IEC, Universidade do Minho, Portugal, 19.07.2006.

Magali Peyre, Recherche d'indicateurs permettant d'identifier les valeurs attachées aux "principe de précaution, solidarité et responsabilité", dans l'éducation à l'environnement durable. Analyse des manuels scolaire de 6ème. Université de Montpellier 2, France, septembre 2006.

Marie Saudadier, Elaboration d'une grille permettant d'identifier les valeurs explicites et implicites utilisées pour l'éducation à la santé, dans les manuels scolaires du 2nd cycle. Université de Montpellier 2, France, septembre 2006.

Marie-Thérèse Nicolas, Approche comparative de l'enseignement de la physiologie dans les médecines tibétaine et occidentale. Université de Montpellier 2, France, septembre 2006.

Sylvie Jourdan, Quelles stratégies les auteurs de manuels scolaires mettent-ils en place afin que les élèves adoptent des comportements citoyens? Analyse des chapitres concernant le changement climatique au lycée. Université de Montpellier 2, France, septembre 2006.

Master – 2005 (6)

Gilda Cristiana Alves, "Manuais escolares: Contributos para a história da educação para a sexualidade em meio escolar". DCILM-IEC, Universidade do Minho, Portugal, 2005.10.21.

Isabel Maria Ribeiro Pereira, "Concepções e obstáculos de aprendizagem no estudo da reprodução humana em crianças do 1.º C.E.B. do meio rural". DCILM-IEC, Universidade do Minho, Portugal, 2005.04.18.

Jérémy Castéra, *" La génétique humaine dans les programmes et manuels scolaires du secondaire."* Master HPDS, LIRDHIST, Université Lyon 1, France.

Mabrouk Aloui , "Analyse didactique des programmes et des manuels scolaires tunisiens à propos de la nutrition humaine et de son lien avec l'éducation à la santé". ISEFC, Université de Tunis (Tunisie) en co-tutelle avec l'Universidade Claude Bernard-Lyon 1 (France), 20.12.2005.

Rui Manuel Correia da Silva, "Digestão/Excreção no 1CEB: Concepções das crianças, obstáculos de aprendizagem e estratégias para os ultrapassar, e análise de manuais dos Séculos XX e XXI". DCILM-IEC, Universidade do Minho, Portugal, 2005.03.18.

Sami Abdelli "Le concept de la reproduction humaine et de l'éducation à la sexualité dans les programmes et les manuels scolaires de l'enseignement secondaire tunisiens" ISEFC, Université de Tunis (Tunisie) en co-tutelle avec l'Universidade Claude Bernard-Lyon 1 (France), 20.12.2005.

Master – Submitted (1)

Cláudia Cristina Soares Ferreira, "Análise da Poluição e do Uso de Recursos em manuais escolares do ensino formal: Comparação entre 17 Países". DCILM-IEC, Universidade do Minho, Portugal.

Master – running (4)

Lina Abdul Ghani « Quelle place de l'éducation à l'environnement dans les manuels scolaires libanais du primaire ? »Université Libanaise, Faculté de Pédagogie, Liban.

Nadine Mokkadem « traitement des problèmes environnementaux dans les manuels scolaires de chimie dans le secondaire »Université Libanaise, Faculté de Pédagogie, Liban.

Nisrine Hijazi « analyse des manuels scolaires officiels de chimie à propos de la pollution » Université Libanaise, Faculté de Pédagogie, Liban.

Yolla Jaber «l'éducation à le sexualité dans les manuels scolaires libanais » Université Libanaise, Faculté de Pédagogie, Liban.

PUBLICATIONS : 129

Papers in Proceedings (88)

2008 (3)

Anastácio, Z., Carvalho, G.S. & Clément, P. (2008) "Concepções dos professores de 1º CEB sobre o contributo da educação sexual das crianças para a promoção da sua saúde futura". *In*: Actas do I Coloquio LusoBrasileiro em Saúde, Educação e Representações sociais, Évora.

Carvalho, G.S., Berger, D. & Clément, P. (2008) "Concepções de professores sobre saúde e educação para a saúde: Análise a partir de 16 países europeus, africanos e do próximo oriente". *In*: Actas do I Coloquio LusoBrasileiro em Saúde, Educação e Representações sociais, Évora.

Carvalho, G.S., Gonçalves, A., Rodrigues, V. & Albuquerque, C. (2008) "O modelo biomédico e a abordagem da promoção da saúde na prevenção de comportamentos de risco". *In*: 7º Congresso Nacional de Psicologia da Saúde – Intervenção em Psicologia e Saúde (Eds I. Leal, J.L.P. Ribeiro, I. Silva & S. Marques), Universidade do Porto, pp. 247- 250. (ISBN: 972840082-9).

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Abrougui, M., Berthou, G., Khalil, I., Youssef, R., Alaya, A., Hadj Ameur., M, Mouelhi, M., Abdelli, S., Agorram, B., Selmaoui, S., Khzami, S. et Elabboudi,T. (2007) « Écologie et éducation à l'environnement : les styles pédagogiques dans les manuels scolaires de 4 pays francophones » In proceedings of IOSTE international meeting on Critical Analysis of School Science Textboos,, Hammamet (Tunisia), 7 - 10 February 2007.

Agorram, B.,Selmaoui S.,Khzami SE.,Elaboudi T.,Clément P.& Abroughui M. "L'Homme et l'Environnement, analyse historique des manuels des svt de l'enseignement secondaire marocain ". IOSTE, International meeting on Critical Analysis of School Science Textbooks, Hammamet (Tunisia), 7 - 10 February 2007.

Agorram, B.,Selmaoui S.,Khzami SE.,Elaboudi T.,Castera J. & Clement P. " Etude des conceptions de futurs-enseignanats à propos de la génétique" ; Symposium International :Formation, Apprentissage et Evaluation en Sciences et Techniques à l'Université ; Fès ;Morocco , Les 23 et 24 novembre 2006.

Alaya. A., Abrougui. M & Clément. P., (2007) « L'homme et l'environnement dans les manuels tunisiens des Sciences de la Vie et de la Terre en 2ème année secondaire ». in Critical analysis of school science textbook, Hammamet 7-10 Fevrier 2007, Tunisie.

Alves, G. & Carvalho, G.S. (2007) "A reprodução humana nos manuais escolares do 1º ciclo do ensino básico" In: Contributos para a qualidade educativa no ensino das ciências – do Pré-Escolar ao Superior (Eds J. Bernardino Lopes & José Paulo Cravino), Universidade de Trás-os-Montes e Alto Douro, pp. 203-212 (CD – ISBN: 978-972-669-837-1).

Alves, G. & Carvalho, G.S. (2007) "Reproduction and Sex Eduction in Portuguese Primary School Textbooks: a poor contribution to scientific learning". In proceedings of IOSTE international meeting on *Critical Analysis of School Science Textbooks*, Hammamet (Tunisia), 7 - 10 February 2007.

Alves, G. & Carvalho, G.S. (2007) "Reprodução humana e sexualidade nos manuais escolares portugueses e moçambicanos". In B.Pereira, G.S.Carvalho & V.Pereira (Eds) *3º Seminário International de Educação Física, Lazer e Saúde: Novas Realidades, Novas Práticas*, IEC, Universidade do Minho, Braga, 16-19.05.2007.

Anastácio, Z. & Carvalho, G.S. (2007) "Educação sexual na escola de 1º Ciclo em debate: Estudo da argumentação dos professores". *In*: Barca, A., Peralbo, M., Porto, A., Duarte da Silva, B. e Almeida, L. (Eds). *Libro de Actas do IX Congreso Internacional Galego-Portugués de Psicopedagoxía*, pp. 2629-2640. A Coruña: Universidade da Coruña e Universidade do Minho (ISSN: 1138-1663).

Anastácio, Z., Carvalho, G.S. & Clément, P. (2007) "Educação sexual no 1º CEB: Percepções dos professores sobre as suas dificuldades em áreas e tópicos específicos" *In*: Contributos para a qualidade educativa no ensino das ciências – do Pré-Escolar ao Superior (Eds J. Bernardino Lopes & José Paulo Cravino), Universidade de Trás-os-Montes e Alto Douro, pp. 150-155 (CD – ISBN: 978-972-669-837-1).

Ayoubi, Z. & Khalil, I. (2007) « Do science textbooks in Lebanon incorporate the local/global conception of Environmental Education ? ». In proceedings of IOSTE international meeting on Critical Analysis of School Science Textboos,, Hammamet (Tunisia), 7 - 10 February 2007.

Berger, D., Bernard, S., Carvalho, G.S., Munoz, F. & Clément, P. (2007) "Sex education: analysis of teachers' and future teachers' conceptions from 12 countires of Europe, Africa and Middle East" *In*: WCCES XIII World Congress – Comparative Education Societies, Sarajevo, Bosnia-Herzegovina, 3-7.09.2007. (CD).

Bernard, S., Clément, P. & Carvalho, G.S. (2007) "Méthodologie pour une analyse didactique dês manuels scolaires, et sa mise en oeuvre sur un example" *In:* Le Manuel scolaire d'ici et d'ailleurs, d'hier à demain (Coord : M. Lebrun) Presses de l'Université du Québec (CD). (ISBN : 978-2-7605-1481-2).

Bernard, S. Clément, P. & Carvalho, G.S. (2007) "Prevention of sexual transmitted diseases in biology textbooks from different countries" *In* Symposium: "Biology, health and environmental education in 18 countries: An overview of textbook analysis" ESERA (European Science Education Research Association) Conference 2007, Malmö, Suécia, 21 – 25.08.2007 (CD).

Bernard, S., Clément, P., Carvalho, G.S, Alves, G., Thiaw, M.S., Selmaoui, S., Khzami, S., Skujiene, G., Berger, D. (2007) Sexual Transmitted Diseases and Control of Reproduction in Biology Textbook. A comparative analysis in 15 countries. In proceedings of IOSTE international meeting on Critical Analysis of School Science Textboos,, Hammamet (Tunisia), 7 - 10 February 2007.

Bernard, S., Munoz, F., Carvalho, G.S., Clément, P. & Berger, D. (2007) "L'éducation à la santé et à la sexualité : conceptions d'enseignants et futurs enseignants de douze pays" *In*: Actes du Congrès AREF 2007 - Actualité de la Recherche en Education et en Formation, Strasbourg, 28-31.08.2007. (CD).

Caravita, S., Margnelli, N., Valente, A., Luzi, D. (2007). *Intreccio tra conoscenza e valori in Educazione ambientale: una griglia per analizzare libri di testo*. In: Atti del V°

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Caravita, S:, Cerbara, L., Valente, A., Luzi, D. (2007) Conoscenza, valori e pratiche educative nell'educazione ambientale. In: Atti del V° Convegno Nazionale sulla Comunicazione della Scienza, Pitrelli N., Sturloni G. (eds.), Polimetrica, 2007.

Caravita S. ,Valente A., Luzi D., Pace P., Khalil I., Ayoubi Z., Valanides N. Nisiforou O., Berthou G., Kozan-Naumescu A., Clément P., Sarapu T. (2007) Construction and Validation of Textbook Analysis Grids for Ecology and Environmental Education. Invited paper. In proceedings of IOSTE international meeting on Critical Analysis of School Science Textboos,, Hammamet (Tunisia), 7 - 10 February 2007.

Carvalho, G.S., Berger, D., Bernard, S., Munoz, F. & Clément, P. (2007) "Health education: Analysis of teachers' and future teachers' conceptions from 16 countries (Europe, Africa and Middle East)" *In*: WCCES XIII World Congress – Comparative Education Societies, Sarajevo, Bosnia-Herzegovina, 3-7.09.2007. (CD).

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Ferreira, C., Tracana, R.B, Ferreira, M.E. & Carvalho, G.S. (2007) "Análise comparativa do tema 'Uso de recursos' nos manuais do ensino básico em Portugal e em Moçambique" *In*: Contributos para a qualidade educativa no ensino das ciências – do Pré-Escolar ao Superior (Eds J. Bernardino Lopes & José Paulo Cravino), Universidade de Trás-os-Montes e Alto Douro, pp. 197-202 (CD – ISBN: 978-972-669-837-1).

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