



# *Introduction to the Special Issue of SEI Relating to Critical Analysis of School Science Textbooks*

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The use of school textbooks strongly differs from one country to another. In some cases, the textbook is used like the bible, and students should prepare the lesson, for example, of biology by reading one chapter, and the lesson is mainly an explanation of the chapter paragraph by paragraph. Students try to understand, summarize, and finally know the content by heart. In other countries, the textbook is only a tool besides many other tools. Teachers and learners can use the textbook depending on the lesson or the context and, in some cases, the textbook is not used at all. Nevertheless, in all cases, the school textbooks are aligned to the syllabus and represent the way of teaching in the respective country. Critical analysis of textbooks is thus interesting, even without having any information of the way they are used, and reflects, to a certain extent, aspects of the real classroom situation in any country.

The number of the available school textbooks is also different from country to country. Some countries in Africa and Malta use old British or French school textbooks, and just started to develop their own textbooks. In some other countries, such as, Tunisia, Morocco, or Mozambique, there is only one official textbook for each subject matter and for each grade level. In contrast, there are several private publishers for each kind of textbook in most of the developed countries. Publishing textbooks seems to be a good business, while the selection of textbooks depends on the individual teachers or, in some countries such as Brazil, this depends on a national commission that usually should give authorization for the use of any textbook. In some cases, such as in Lebanon, there coexist an official publisher and other private ones. Thus, the quality of textbooks is often a consequence of the political or economical situation in each country. The best but also the worst are possible, and a critical analysis of the textbooks is a necessity for improving the quality of textbooks. Many attempts to define precise indicators for evaluating the quality of the textbooks, their scientific content, their pedagogical style, their presentation, and other attributes relating to citizenship, have been undertaken.

The content of the textbooks is usually determined at a national level, sometimes at a regional level (as in each German State) and sometimes at multi-national level. For example, the first Franco-German history textbook is used since 2006, while a German-Polish one is in preparation. The content of history books is always problematic, because history is linked to a national identity, and sometimes to a more local one. History textbooks are also considered as tools for constructing or, in some cases, for undermining national (or local) identity. European history textbooks may exist in the future, but such a possibility appears as a utopia, or a future political project, because the teaching of history is everywhere obligatory, and is considered as a political and cultural challenge, similar to literature and national language.

On the contrary, teaching science could a priori be more consensual. The scientific

contents are defined as universal, and each country is wishing to enhance a more science-based society. Nevertheless, for mathematics, physics, chemistry or biology, even if the scientific knowledge is generally stabilized, it has to be adapted not only to the level of students, but also to the local context and to the educational priorities in each country. The necessity of a contextualization at a national or more local level is particularly evident for topics as ecology, environment, or health. Some papers gathered in this special issue of SEI are dealing with these multidisciplinary topics, but other papers are also showing a great diversity of taught contents even in more classical scientific fields, depending on the country or depending on the publishers of the textbooks. The differences between the scientific contents that are usually taught indicate political or ideological choices of the governments, or more diffuse influences of the socio-cultural context.

In February 2007, we have organized in Hammamet (Tunisia) an international Meeting of IOSTE (International Organisation for Science and Technology Education) on “*Critical Analysis of School Science Textbook*,” The goals of this international Meeting were:

- To confront different methodologies, rooted in different theoretical backgrounds and perspectives.
- To present empirical results dealing with the analyse of syllabuses and science textbooks.
- To compare different countries, identifying the transversal contents and those that are specific of precise socio-cultural contexts.
- To also take into account the implicit messages related to the presence or absence of precise scientific information, showing a link between this scientific knowledge (K) and values (V) or social practices (P): the KVP model.

Researchers from 34 countries were present: 77 communications (including 11 in plenary sessions) and 41 posters were finally selected for presentation from those that were submitted that were more than double of the selected. This special issue of SEI presents an improved version of only nine of these presentations, selected by the organizers after a double evaluation by the reviewers of the IOSTE Meeting. Thus, six papers relating to the project of research BIOHEAD-Citizen (one of the main organizer of this Meeting) and three other papers that relate to their thematic and geographic diversity were selected for publication in the present special issue of SEI. The six first papers relate to the collective work that was completed within European research BIOHEAD-Citizen since 2004 (*n° CIT2-CT2004-506015, FP6, Priority 7: “Biology, Health and Environmental Education for Better Citizenship”*). Half of the research of this project concerned the comparative analysis of syllabi and textbooks from 19 countries, in relation to six different topics. One paper from each topic has been selected for the present special issue of SEI. The six topics had been selected as significant in terms of interaction between science and society. The analyses of textbooks were rooted in the KVP model, considering the interaction between scientific knowledge (K), values (V) and social practices (P). The 19 countries that participated in the project were European countries and six of them non-European.

The grids for textbook analysis had been constructed, pilot-tested and then validated collectively during the two first years of the project. Then each team applied the grids to their national textbooks. At the moment of the IOSTE Meeting (February 2007), some national analyses were partly missing (namely from UK, Mozambique and Algeria). In consequence, the papers presented here are generally dealing with 16 countries, that are in alphabetical order as follows: Cyprus, Estonia, Finland, France, Germany, Hungary, Italy, Lebanon, Lithuania, Malta, Morocco, Poland, Portugal, Romania, Senegal, and Tunisia. The six papers from the BIOHEAD –Citizen project are typical of research in Didactics of Biology (Human genetics, Human Brain, Evolution) as well as in Environmental Education, Health Education, and Sex Education. Each of these papers focused on each of six topics and applied an epistemological approach as a basis for the didactical one.

The first paper (Caravita et al.) deals with the construction and validation of textbook analysis grids for *Ecology and Environmental Education* (EEE). It presents in detail how the grids for analyzing textbooks in terms of this topic were constructed, and exemplifies not

only the way the grids were constructed, but also the way these have been applied for textbook analysis in the 19 countries that were involved in project BIOHEAD-Citizen. This paper is particularly interesting, showing the richness of the theoretical background that was used for constructing the specific grids. Explicit reference was made to the different systems of values relating to EEE and an explanation of how these different systems of values were incorporated in constructing the grids that are specific to a critical analysis of textbooks for the topic EEE. Of special interest is the question of the local contextualisation of EEE. The general goal of these grids is a “*comparison among a wide variety of cultural contexts that facilitated the appraisal of the connections that exist among prevailing ideologies and knowledge transmission*”.

The second paper (Clement et al.) addresses the topic “*Human Brain*”. The authors present the occurrences and absences of feedback in the figures depicting the neuronal pathways in 55 school textbooks from 15 countries. In fact, feedback is the rule in all the nervous pathways, but such feedback was totally absent in 80% of the figures. Concerning the other 20% figures (images), 2/3 of them relate to neuro-hormonal feedback, mainly for the female and male reproductive cycles. Differences among countries were not identified indicating a strong international resistance to teach this fundamental notion of feedback. Most of these images relate to reflexes. In conclusion, the neuronal images are mostly aligned to behaviorism and innatism and minimal support to constructivism is present, indicating clearly that implicit values are usually linked to the presentation of scientific knowledge.

“*Health Education*” is the topic of the third paper (Garvalho et al.). The authors mainly analyzed and compared 71 textbooks from 16 countries using indicators associated to either the Biomedical model or the Health Promotion approach. The *Biomedical Model* was prevalent in some countries, such as France and Italy, and is limited to pathologic, curative, and preventive conceptions. The *Health Promotion approach* (as defined by WHO: healthy habits, empowerment, better environment) was dominant in Germany, Mozambique, and Finland, while the two models were juxtaposed in other countries. These strong differences seem to be deeply rooted in socio-cultural traditions. Health Promotion was also more prevalent in the textbooks of almost all the countries for the younger pupils than in those for the oldest ones.

The fourth paper (Quessada et al.) relates to the topic “*Human Evolution*”, as it was presented in the textbooks from 18 countries. Human Evolution did not appear in the textbooks of six countries, while in the other 12 countries, the images illustrating the genus *Homo* in the chapters “*Human Evolution*” presented mainly men. This implicit sexism was even clearer when analyzing the images of *Homo sapiens* in the trees or timelines of Evolution, where mainly white adult occidental men appeared, and only 4 images showed women (never alone, each with one man) and only one image showed several ethnic types (in a German textbook). There were few differences among countries, because some more images of women appeared in the Northern European countries. Images of human evolution are so familiar that nobody paid attention to their implicit sexism and Occidentalism until recently.

The fifth paper investigated the topic “*Human Genetics*”, and the authors (Castéra et al.) analyzed the occurrence of “genetic program” in 50 textbooks from the 16 countries. The results indicate extreme differences from one country to the other. The notion of “program” is no more used by the researchers in genetics, but it is still present in the textbooks of some countries, showing some persistence of a determinist ideology (hereditarianism), while other countries already use the words “genetic information” that it is presently accepted by the scientific community. In contrast, there was no difference among countries for the images of monozygotic twins. In all images monozygotic twins appeared to have similar morphology and also the same hairstyle and body posture as if these features could be genetically determined, thus providing evidence of a persistent implicit determinist ideology.

The last paper investigated the topic “*Sex Education*” and more specifically the sexually transmitted infections (STIs), as these were presented in 42 biology textbooks from 16 countries. The authors (Bernard et al.) also examined how the use of condoms was

presented in the same textbooks. Although AIDS was always present, there were also important differences among countries, and even among publishers from the same country. These differences occurred mainly in the examples of the STIs that were presented in the analyzed textbooks. In general, the examples were not linked to the prevalence of STIs in each country, with some exceptions as in Senegal. More than half of the analysed textbooks did not link the presentation of STIs with their prevention via the use of condoms, and only few textbooks illustrated an unrolled male condom on the penis. These results illustrate clear interaction between dominant values and biomedical knowledge included in biology textbooks.

The next paper (Pitombo et al.) is an interesting illustration of the interaction between an epistemological approach and a didactical approach. The focus was on a precise scientific content (the gene concept), as it was presented in 126 syllabi from 67 universities randomly selected from universities across the five continents. Some textbooks were used in most of the countries throughout the world. From a precise analysis of the content of the textbooks, the authors pointed out that there existed “a proliferation of meanings about genes that may make the concept look vague and confused, and even lead to ideas that are at odds with our current knowledge about genomes”. This conclusion could be an illustration of the concept of “didactic transposition delay” (DTD) defined by Quessada and Clément (2007).

The semi-final paper (Izquierdo, Marques, & Gouvea) applied a semio-linguistic approach to analyze the rhetorical structures in textbooks of chemistry from Spain and South America. Although the examples relate to chemistry, the same method can be used for any science textbook. The conclusion is that the 20 textbooks that were analyzed included rhetorical structures that were stories on a dogmatic science offering different meanings to knowledge production (everyday life as well as inside scientific research). The aim was to identify science stories as indicators for evaluating the possible use of these textbooks in class and to propose how to write more innovative textbooks.

The last paper (Green & Naidoo) is rooted in the political context of South Africa. It compares three popular textbooks of physical science for the same level, one prepared to support the previous curriculum, and the other two prepared for the new curriculum. The authors distinguished between an indigenous science view and an academic view (canonical science), and examined whether the latter was conveyed in a decontextualized, contextualized, or utilitarian fashion. They also distinguished between factual knowledge, conceptual knowledge, procedural knowledge and metacognitive knowledge. This original approach was the basis of an interesting comparison between the three textbooks, but only the third one was aligned to the new ideas about knowledge as well as social goals that were recently defined for the country.

In conclusion, the 9 papers gathered in this special issue of SEI present research related to the critical analysis of school science textbooks. The guidelines until now published by UNESCO to help the analysis of school textbooks were mainly focused on the scientific content (more or less conform to the results of the scientific research) and on the didactical or pedagogical dimensions (here also more or less conform to the most recent pedagogical research and innovation). The originality of the papers presented here is to introduce new parameters for the critical analysis of textbooks: rhetorical or epistemological approaches and mainly indicators linked to the project to improve Citizenship through teaching science, environment, and health. The clarification of the implicit values that are often linked to the taught scientific knowledge is a new but indispensable perspective to improve citizenship in more science-based societies.