HISTORY of SCIENCE in 20TH C. GREEK SCIENCE TEXTBOOKS of PRIMARY EDUCATION

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Abstract Studying 20th century Greek science textbooks of primary school is part of a wider research project of studying the History of Science Education in Greece. Science textbooks usually include elements of History of Science (HOS) in various forms, either as introductory chapters or simple inset information. Goals of our research are; a) to identify and classify elements of HOS in 20th century Greek primary school science textbooks according to the extent and the manner they appear in the textbooks, b) to examine the historical precision or the possible didactical transformation of the historical content and c) to reveal the possible reasons (didactical or other) for which textbook authors choose to integrate HOS elements by studying, analyzing and integrating them into an explanatory context which is defined by pedagogical/instructional, scientific and cultural axes.Evidences for the understanding and interpretation of relative issues derive from the science textbooks themselves, the accompanying curriculum and last but not least the annotated bibliography on History of Greek Education 1831- 2004, History of Greek Curriculum on Science Education (1890-2000), History of Compulsory Education Textbooks, Textbooks' analysis, History of Science & Science Education.
Keywords; science textbook, history of science

INTRODUCTION

Over decades, a great number of researchers' findings in the field of science education argue that history of science plays a pivotal role in the achievement of science literacy. Science education research on learning science should and does include history of science when a better understanding of it is required. Its been identified by international scientific literature that History of Science (HOS) strongly influences teaching and learning science (Matthews 1994) as it helps to enhance the meaningfulness and comprehension of science content in the context of the nature of science (Wandersee & Roach 1998). Lynch (1985) indicates that trends in science education can be examined by examining science textbook content. He suggests that a historical overview is important and pertinent to contemporary thinking and contemporary problems in science education. Research interest is focused on questions like "What history" and "whose history" to select and for "what purposes" (Duschl 2000, p.1), which answers ultimately define the models of curriculum, instruction and assessment employed by every single educational policy. It is the textbook that in thousands of classrooms determines the content of instruction and guides the teaching procedures, as it has been known for decades as a dominant instructional tool in science education. Fifty percent (50%) of the weekly teaching time is based on the use of textbooks by science teachers as it's been showed by T.I.M.S.S. (Third International Mathematics and Science Study). Textbooks are mediators between general intentions and classroom instruction. Evidence for the understanding and interpretation of relative issues derives from the science textbooks themselves, the accompanying curriculum and last but not least the annotated bibliography.

It's been nearly fifty years after Conant's first project since internationally scientific/educational communities work on enhancing science literacy for all students. Basto describing problems which history of science programs appear to face refers that:

> '…. a) committing raw factual mistakes; b) neglecting the relationship between the process of scientific knowledge production and the social, political, economic and cultural context; c) suggesting that scientific knowledge made progress solely by means of fantastic or fabulous

> discoveries carried out by genius scientists; d) glorifying the present and its paradigms, neglecting the importance of the scientific branches which diverge from the recent ones, the richness of the debates that took place in the past, the discontinuity between the past and the present, etc. and e) encouraging the belief in current scientific knowledge as a universal truth'.

When Bizzo claims that 'these problems result of a science's amputation from the body of the history. Once ... divorced from the history, science generated and gave birth to a child called "scientific knowledge neutrality". In other words, knowledge was removed from its historical context, losing a big part of its sense (Bizzo In: Sao Paulo, Secretaria de Estado da Educagao. Coordenadoria de Estudos e Normas Pedagogicas, *Ensino de Biologia: dos fundamentos a pratica,* 1996) '.

(Carvalho W. et al. 2002, p.745)

Entering 20th c brings along not only great scientific developments, but also important changes to different aspects of Greek education and society. This study goes along with the educational research on teaching materials which is being conducted on the field (e.g Carvalho W. et al. 2002; Leite L. 2002; PISA; TIMMS; Wang H.A. 1999; 2001; Wandersee J.H. et al. 1998; Williams J. 2002). It intends to investigate both the extent and the manner in which HOS are included in 20thcentury Greek science textbooks of primary school. Moreover there is a correlation with science education curriculum, in accordance to which science textbooks were or should be written. Finally, the interpretational context was understood and formed mainly by relative Greek & international literature review not only on these topics (Boostrom R. 2001; Carvalho et al. 2000; Chang 1999; Drakopoulou et al. 2002; 2003; Kindi 2003; Koulouri 1994; Mikk, J.: 2000; 2002; Maniati 2003; Nicholls J.: 2003; Seroglou et al 1998; Skordoulis 2003; Wang H. A. 1999; 2001; 2002;), but also studying textbooks in a multilevel way.

What is the trigger which drives authors to include HOS elements when writing a science textbook? Textbooks are '… conceived, designed and authored by real people with real interests' and are '… published within the political and economic constraints of markets, resources and power' (Apple, 1993, p.46). Noustos (1986) argue that (Greek) school knowledge organization is a social fact … and curriculum represents knowledge which can be evaluated classified and distributed according to certain social criteria. In other words it is through curricula that every correlation of political and social forces is represented, as well as political culture and ideology.

> 'The school curriculum is essentially the knowledge system of a society incorporating its values and its dominant ideology. The curriculum is not 'our knowledge' born of a broad hegemonic consensus, rather it is a battleground in which cultural authority and the right to define what is labelled legitimate knowledge is fought over and where particular knowledge and selected organising principles receive the official stamp of approval. Much curricular content is the outcome of compromise and will, if we choose to look hard enough, reveal signs of conflict. A crucial context for such analyses is the politics of the social movements that create the need for compromises over school knowledge and an investigation of the larger crisis in the economy, in ideology, and in authority relations'.

(Keith Crawford 2003, p.7)

Similar is Zambeta's position on the matter; she proposes that textbooks bear the main goals of educational policy, while the essential relation between the educational content and political system is being proved by our (Greek) History of education (Zambeta 1994).

Crawford writings on the matter are quite alike;

> 'School textbooks are crucial organs in the process of constructing legitimated ideologies and beliefs and are a reflection of the history, knowledge and values considered important by powerful groups in society. In many nations debates over the content and format of school textbooks are sites of considerable educational and political conflict.'
>
> …'School textbooks are based upon the cultural, ideological and political power of dominant groups and they tend to enforce and reinforce cultural homogeneity through the promotion of shared attitudes and the construction of shared historical memories. The construction of textbook knowledge is an intensely political activity and debates, controversies and tensions over the construction of school textbooks involve a struggle over the manufacture and control of popular

> memory. School textbooks are one vehicle through which attempts can be made to disseminate and reinforce dominant cultural forms.
>
> (Crawford 2003, p.5)

The passage from 19th in the 20th century is signaled by explosive scientific developments, as well as by important changes in various levels of Greek education and society. Thus the main axes of analysis and interpretation are instructional aim, scientific tradition, cultural context and dominant ideology.

PURPOSE OF THE STUDY

Considering the theoretical positions on the neutral or not presentation of scientific achievements within primary school science textbooks and the way they are affected by external factors, the purposes of the study are;

a) to investigate differentiations among 20th century Greek primary school science textbooks, that is to identify and classify elements of HOS in 20th century Greek primary school science textbooks according to the extent and the manner they appear in the textbooks ,

b) to examine if HOS elements (or elements related to it) present scientists work adequately shaping a positive image of science towards students,

c) to reveal the possible reasons (didactical or other) for which textbook authors choose to integrate HOS elements

and d) to examine the historical precision or the possible didactical transformation of the historical content .

A further goal is to reveal through a different level of elaboration the possible reasons that textbook authors choose to integrate HOS elements in them.

METHODOLOGY

The sample of our study is consisted of almost hundred (N=100, including different versions of the same textbook) of 20th century Greek science textbooks of primary school. The sample was recorded and classified according to 20thc Greek educational reforms, curriculum changes and the policy of Greek Ministry of Education on textbooks production, so as it could be easily analysed. This is part of a wider research program of multilevel study on 20th c. Greek science textbooks.

At first, we found and studied Greek science education curriculum from 1890 to 2000 in order to find clues that imply directly or not HOS elements inclusion, which reveals either the "character" or the "philosophy"- scope of science textbooks and science education in Greece. It wasn't until 1831 that Greece became a free country. We should always bear in mind that the first ever constitution of HOS university position is placed in France in 1892 by Compte and that in Greece similar position was given to M.K. Stefanidis in 1924. Greek science education curriculum were found and studied at Pedagogical Institute, the official state independent consultant organisation on Greek educational issues.

Secondly, we collected in various forms (original, photocopies, digitalized) Greek primary school science textbooks from the end of 19th c. to the end of 20th c.

The textbook selection was based on the following criteria: should apply to students of 5th and 6th grade of primary school, that is 10 to 12 years old; Have physics as main or part of its content; Have all of its pages; Have no serious damage; Be available to the researcher.

The study is concentrated on physics pages only.

Retrieving our sample was most difficult as it was spread to various public and private libraries and antique bookshops all over Greece. Our collection varies from 1878 to 2002 (N=48 series of textbooks, see Chart 5). Our textbook sample was located in Pedagogical Institute Library, Benakio Library, Library of Dimitsana, Aigina, Ioannina, Moraiti School Library and researchers' private collection. Textbook collection is continued up today.

The analysis of textbooks' historical content is based on both quantitative and qualitative content analysis according to the Leite's validated checklist (2002) which has already been used on Portuguese science textbooks & educational material.
The checklist adapted on Greek science textbooks nature & structure, is the following:

Criteria of data classification and content elaboration.

A. Type and organisation of the historical information

1 *Scientists*

A1A ***scientists' life***

- *biographic data* (at least name, and date of birth and death)
- *personal characteristics* (feelings, character, mood, etc.)
- *episodes/anecdotes* (married to . . . , decapitated by . . .)

A1B ***scientists' characteristics***

- *famous/genius* (intelligent, bright, the most important . . .)
- *ordinary* (fail exams, need to work in order to survive)

2 *Evolution of science*

A2A ***type of evolution***

- *mention to a science discovery* (a discovery or historical idea is mentioned)
- *description of a science discovery* (the happening of a certain discovery is described)
- *mention to discreet periods* (two or more periods/discoveries are mentioned but not related)
- *linear and straightforward* (one period is related to the following, keeping the direction)
- *real evolution* (movement 'back and forth' between opinions, including controversies, etc.)

A2B ***responsible people***

- *individual scientists* (a scientist is shown as the only person working for the discovery)
- *group of scientists* (two or more known scientists worked together for the same purpose)
- *scientific community* (the scientists of the time are said to be responsible for the happening)

B. Materials used to present the historical information

B1 ***Scientists' pictures***

B2 ***Pictures from machines, laboratory equipment, etc.*** (once used or discovered by past scientists)

B3 *Original documents/texts* (produced/written by the scientists themselves; they may betranslated)

B4 ***Historical experiments*** (experiments once done by or attributed to past scientists)

B5 *Secondary sources* (texts, models, drawings of equipment not done by scientists/textbook authors)

B6 *Texts by the textbook author(s)* (essays on a topic/scientist; minimum biographic data are not a text)

B7 *Other* (e.g., stamps, poetry, paintings)

C. Contexts to which the historical information is related

C1 ***Scientific*** (historical information related to science and maths knowledge available and/or lacking)

C2 ***Technological*** (historical information related to the technology available and /or to its lack)

C3 ***Social*** (historical information related to the living conditions and acknowledged values of the time)

C4 ***Political*** (historical information related to the politics of the time)

C5 ***Religious*** (historical information related to the religious beliefs of the time

D. Status of the historical content

Role of the historical content in science teaching and learning

D1 ***fundamental*** (content matter to be studied)

D2 ***complementary*** (optional content, at least for some students)

such as postscripts, independent (complementary) text or "add-on"- the last bit of information in the paragraph

E. Bibliography on the history of science

– *History of science books*

– *Science books with historical information* (although not history of science books)

ST. Extended scientist's biography

Textbooks were analyzed accordingly these criteria. Data numbers (Chart 1) and graphs below (Charts 2-4)help us draw observations and conclusions on different levels or directions (time, criteria, methods, society, authors, etc).

	A1A	A1B	A2A	A2B	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	D1	D2	E	ST
1878	4	2	9	10		1		2			5	7				10	2		
1920	9		12	10		2		2			3	9	2			11	1		
1935 1	4	1	5	4		1					2	3				5			
1935 2	7		12	10		2		2			3	9	2			10	2		
1936	2	1	4	3		1						3	3			4			
1946	4	1	7	6							5	4	0		0	8	0		
1947	2	2	8	2				2			3	5				8			
1949	2	1	2	2							2					2			
1950 1			3	4				2			3					4			
1950 2	2	2	4	4							2	2				4			
1950 3	25	9	33	37							19	22	11		2	39	1		
1950 4	23	17	33	31	5		2	3			21	28	18	16		26	7		2
1950 5	35	18	43	41		1					37	19	17	1		29	15		15
1950 6	4		6	6		4					4	3				6			1
1950 7	2	2	4	4		1	0	1			4	1	1	0	0	3	2		
1955 1	38	5	20	20		6					14	10	3			24	23		
1955 2	7	3	14	14	2	3	1			1	10	3	3		1	10	6		
1955 3	18	1	7	7							4	3				7	15		
1955 4	2		3	3		1		1			2	1				3			
1955 5	4	2	5	5		1					2	3	1			6			
1955 6	13	8	22	22	2	5		1			13	12	3			26	1		
1955 7	4	1	6	6		3		1			4	2	2			7	1		
1955 8	4		4	4		2		1			3	1				4	3		
1955 9	7		9	9		1		2		1	6	3				9			
1955 10	7	5	10	10							6	5	1	1		12			
1955 11	18	1	16	16	5	4		1			9	8	3			17	15		
1955 12	24		15	15		4		1		1	8	9	4			19	14		
1955 13	16	5	7	7		2					9	1				4	15		
1955 14	10	1	14	14		3				1	4	10	1			15			
1955 15	5	1	19	17		2	2	2			10	11		1	2	13	8		
1955 16	16	2	20	18		8	1	3			10	11		1		17	4		
1955 17	14	6	25	32	4	3	3	3		3	11	18	13	6	1	31	4	1	4
1955 18	12	4	17	15		2	1	1			8	10	4	1	2	13	4		4
1955 19	15	3	16	16		4		1			10	10	5	2		13	4		
1955 20	5		9	8				2			6	3				8	1		
1955 21	17	8	22	22		9		3			11	18	13	1		26	2		
1969	8	4	13	13	2	3					6	8	1	1		13	2		
1971	13	6	19	21	1	6	1	2		1	12	13	6	2	1	12	7		
1972	13	3	16	16		4		1			13	5	1	1		20			
1975	12	2	23	23	3	5	1	2			20	12	4	1	2	25	7	1	
1982	11	4	15	15		4					9	7	1			15	1		
1983	6	2	12	12		1				3	7	7			1	13	1		
1993 1-2	5	2	6	6	6					2	7					7	1		
1993 3-4	12	2	15	15	8	1		1		1	12	1	1			16			
2002 1-2	3	3	5	4	1	3	1			5	3	3	5		3	8	5		
2002 3-4	11	2	29	29	5	3	5			6	17	10	17			20	22		
2002 α	7	1	7	6	2	2		2		9	3	4	7		4	2	15		
2002 β	14	2	15	14	9	14	1	1		6	2	16	5	1	3	6	18		

Chart 1. Textbooks' analysis.

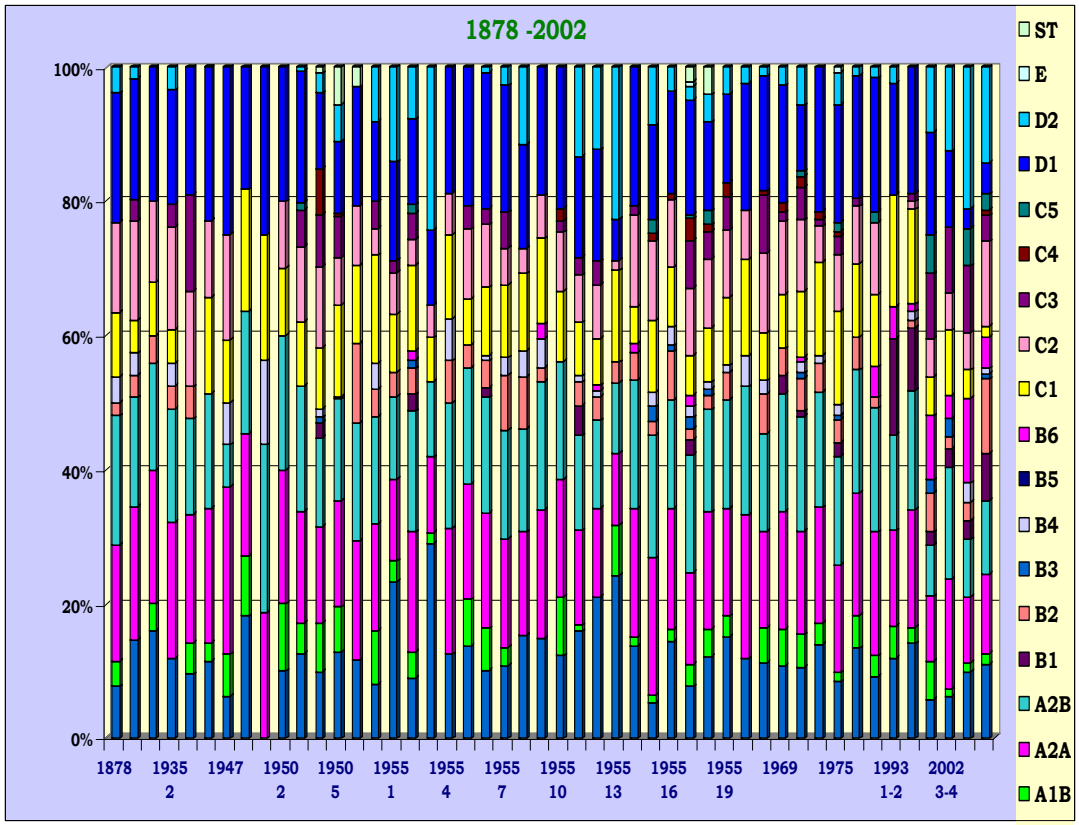

Chart 3. Criteria depending on textbook year edition.

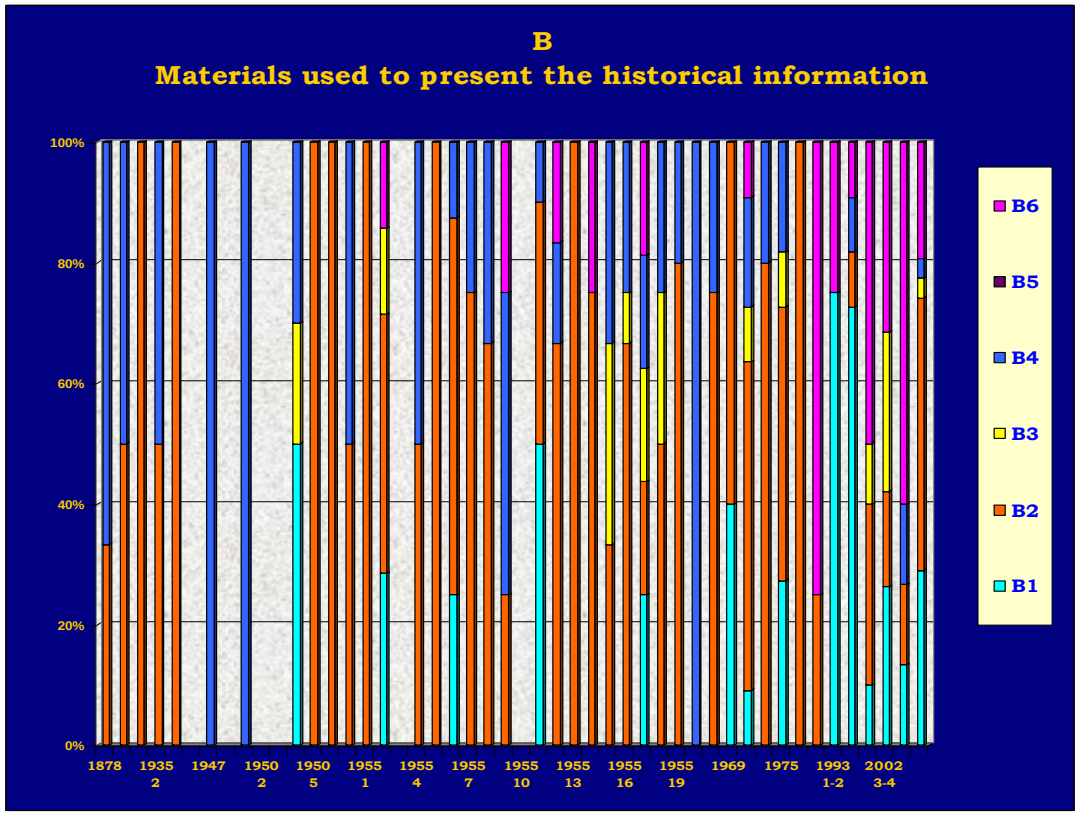

Chart 3. Textbook year edition depending on criterion B.

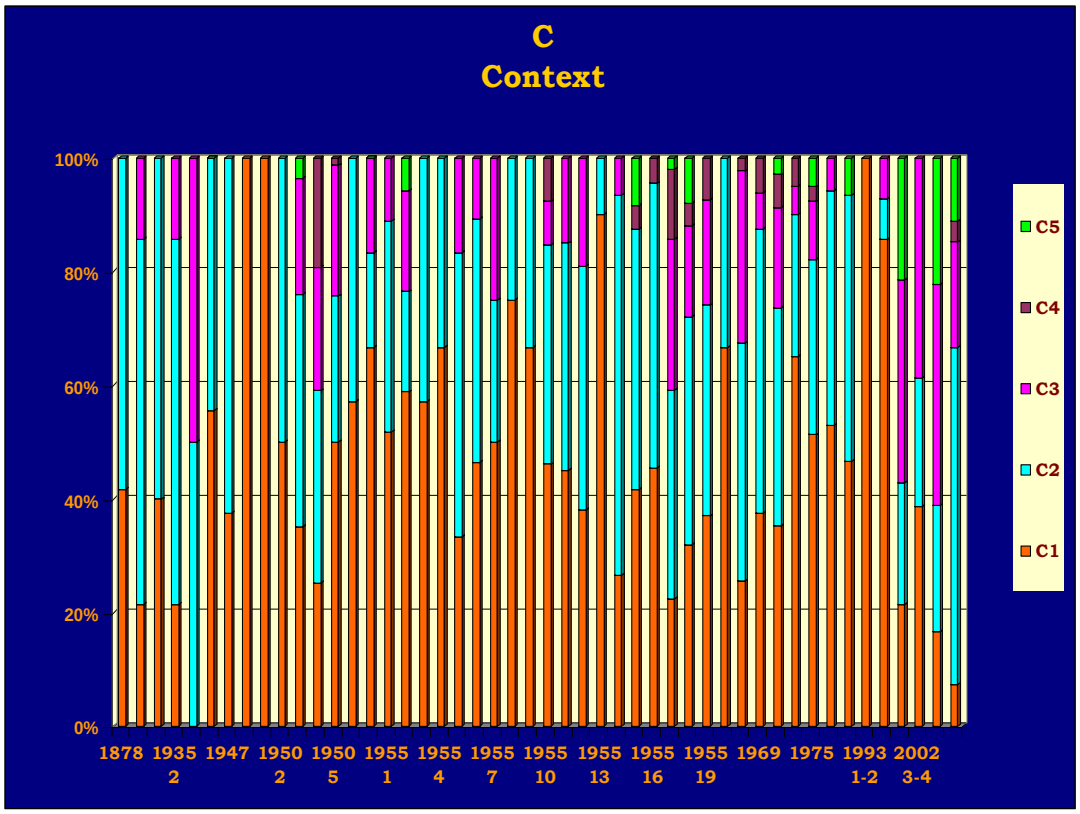

Chart 4. Textbook year edition depending on criterion C.

RESULTS

Charts show the recording & distribution of HOS elements in greek primary school science textbooks from 1878 to 2002. Data show that:

- None of the textbook has been written in the pure context of HOS perspective. Eg. Data show that HOS elements in absolute number in 1950 are 42, when only one of the modern series of textbook (2002) has almost the same number of references. It seems that the latter one took into account the latest progress of research in science education.
- The HOS content is merely another "add-on" in the textbook.
- Most of HOS content found in the textbooks lacks in – depth elaboration.
- Authors seem to integrate HOS elements in order to enrich the presentation of the science concepts, and not to focus on the nature of scientific knowledge.

Focus on each croup of criteria reveals that:

A - Type and organisation of the historical information high density in simple pieces of information on people

A1A (scientists), mainly the *name* and *nationality*

&

A2B (responsible people), "*he was the first that*…".Scientific progress seems to the result of individual's work and not team's work.

- **B - Materials used** to present the historical information are usually *scientific illustrations* of *apparatus* and *instruments*.

Only along the last 15 years there are other types of information representation which describe completely the context within which HOS elements are included.

(e.g. paintings, stamps, etc.)

- **C - Contexts** to which the historical information is related are mainly the *scientific* and the *technological* one, political and religious are rather rare.
- **D - Status** of the historical content. It is most of the times to be learned by heart.
- **E - Bibliography** on the history of science (barely exists)
- **ST- Extended scientist's biography** (barely exists)

The amount of HOS elements varies between different socio-political periods of 20th c. E.g The earliest we search, the more references we found relatively on our Greek ancestors (see below Discussion).

Science textbooks' scientific illustrations are mainly of scientific instruments in a scientific or technological context, or historical experiments. Men appearance in science textbooks illustrations is usually restricted to a part of the human body (eg. Hand, eye, ear). Female presence is usually seldom, though it seems to change towards the end of 20th c..

Science textbooks' scientific illustrations are rather plain, de-contextualised. It is the last 20 years since they seem to reflect any aspect (see also Drakopoulou M. et al. 2003) of the wider cultural context they belong to.

DISCUSSION

The results of the analysis show that the applied converted checklist is able to reveal differences among textbooks and that the historical content included in the textbooks is hardly able to give students an adequate image of science and scientists' work.

Why do science textbook authors choose to include HOS elements?

It seems that they facilitate students' introduction to scientific concepts and procedures, try to create a positive attitude towards science lessons, promote students motives for learning science and generally they support teaching difficult scientific concepts. In this way one can succeed students' familiarization with scientific topics; a preferential network of access in Modern Age Science is created, which compensates any difficulty in knowledge approach with the wish and the ambition that students understand the realizations of pioneers of knowledge (Kindi 2003). It was only in 1938 that M. K. Stefanidis supported the constructive learning in science education (physics especially) through Historical Elements inclusion.

Greek science curriculum is not very explicit about the teaching of science. It sounds surprising to find out that primary's school curriculum was the same from 1913 to 1969 (Andreou 2002). Not to mention that even the newly published Greek science curriculum (1999, 2003) include no kind of bone with HOS either as part of it or as instructional aspect. The only clue found is that it should be easy to perceive by the student.

Therefore, textbook authors may not feel compelled to give enough importance to the history of science in their textbooks and consequently little history of science will pervade the science lessons. They try, though, to enrich them with some HOS elements to help understanding of scientific concepts. Examples of HOS support the status of "great inventions", sketching out the distinguished physiognomies, which related themselves with big moments of scientific development. It is authors themselves who want to feel better through them; and students who are brought into a long-lasting scientific revolution of modern era.

All the previous conquests were the first steps for scientific development. Former theories can be presented as special cases or incomplete of the modern theories; they preserve their scientific truth promoting an image of continuity of science which leads to the truth.

So, Historical references aim to prove that modern science cannot cancel the former one, as perspective by which HOS elements are chosen and presented goes along harmonically with the image of a firm evolution that leads to the utmost truth (Kuhn 1962).

Greek authors are often influenced by their traditional cultural context (antiquity) and dominant ideology, choose inventions of antiquity era to legislate and justify modern science. Authors some time consider explicitly or implicitly the Sciences revival to their birthplace (Nicolaidis 2003). Something like this serves the social incorporation of science in the

dominant ideological models. In this way HO Ancient Science references facilitate teaching science and integrate it into the educational system which functions as a shaper of national identity. Therefore, references in antiquity and stress on historical elements of scientific reason function as reservoir of probative material of gloried intellectual origin. This finding is most intense in the study of secondary school Greek science textbooks from 1900 to 1950. On the other hand, authors try to show the differentiation of concepts in antiquity and modern science (Maniati H. 2003).

Science is a language we (humans) use to understand nature. When we keep science out of this context or out of other aspects of human life, we do not facilitate the enhancement of science literacy. Throwing in, though, one or two paragraphs with historical elements does not really facilitate student's understanding of science.

> '…Bizzo (1992), who points out that the attempts to evoke the history to enlighten the science teaching have generally been failing mainly because: a) our look to the past usually selects the elements that can explain the present, instead of trying to bring back the history of science, and b) the scientific theories proposed in the past are considered simple and ingenuous whereas the present ones are seen as complex and ingenious'
>
> (Carvalho W. et al. 2002, p. 745)

Textbook authors should embrace that science must be understood as a collective human endeavour which pursues a logical and evidence based method to understand nature; otherwise " "*problem solving and "story-telling" will continue to be treated as two separate issues instead of one integral whole*" (Wang H. A.1999).

Chart 5. **Research field – Series of Greek science textbooks (N=48)**

1.	**1878**	ΔΗΜ ΣΧΟΛΕΙΟ, ΜΑΞΙΜΟΥ Δ. ΔΑΣΚΑΛΑΚΗ (ΕΚ ΤΟΥ ΓΑΛΛΙΚΟΥ), ΜΙΚΡΑ ΦΥΣΙΚΗ ΔΗΜΗΤΣΑΝΑ
2.	**1920**	1920, ΑΝΩΤ ΔΗΜ, ΗΛ. Χ. ΓΟΝΤΖΕ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΤΕΥΧ Α΄
3.	**1935 1**	1935, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, ΑΝΤ. Δ. ΜΟΝΟΚΡΟΥΣΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ
4.	**1935 2**	1935, ΑΝΩΤ. ΤΑΞ. ΔΗΜ, ΗΛ. Χ. ΓΟΝΤΖΕ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ
5.	**1936**	1936 -ΣΤ΄ Β΄ ΕΤΟΣ - ΛΕΩ. ΣΠ ΛΙΩΚΗ - Δ ΠΑΠΑΙΩΑΝΝΟΥ, ΦΥΣΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
6.	**1946**	1946, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, Α ΑΛΟΙΖΟΣ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ
7.	**1947**	1947, Ε΄ ΔΗΜΟΤΙΚΟΥ Α' ΕΤΟΣ, Δ ΔΟΥΚΑ- Ε. ΚΑΡΑΓΙΑΝΝΟΠΟΥΛΟΥ- Σ. ΜΑΛΛΗ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
8.	**1949**	1949, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ Β΄ ΕΤΟΣ, ΛΕΩΝ ΣΠ ΛΙΩΚΗ - ΔΗΜ ΚΑΡΝΑΒΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ
9.	**1950 1**	1950, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, ΛΕΩΝ ΣΠ ΛΙΩΚΗ -ΚΛ Δ ΚΑΡΝΑΒΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
10.	**1950 2**	1950, Ε΄ ΔΗΜΟΤΙΚΟΥ, Α Ε ΜΑΖΗ -Ι Γ ΔΡΙΒΑ, ΦΥΣΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
11.	**1950 3**	1950, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ Β΄ ΕΤΟΣ, ΑΝ ΧΑΡΑΛΑΜΠΟΠΟΥΛΟΥ – ΣΤΕΛ. ΣΠΕΡΑΝΤΖΑ- ΑΓΛΑΙΑΣ ΜΕΤΑΛΛΙΝΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
12.	**1950 4**	1950, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΧΡ. ΑΛΕΞΟΠΟΥΛΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ
13.	**1950 5**	1950, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, ΧΡ. ΑΛΕΞΟΠΟΥΛΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
14.	**1950 6**	1950, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, ΓΑΒΡΕΣΕΑ -ΠΑΠΑΔΟΠ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
15.	**1950 7**	1950, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΔΙΟΝ ΛΕΟΝΤΑΡΙΤΟΥ, ΦΥΣΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
16.	**1955 1**	1955, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, 2ο ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑΛΙΑΣ, Α.Χ. ΠΑΤΣΗ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
17.	**1955 2**	1955, Ε΄- ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, 1ο ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑΛΙΑΣ, ΠΑΠΑΔΑΚΗ - ΜΠΑΜΠΑΛΗ, ΦΥΣΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
18.	**1955 3**	1955, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΑΓΓ. ΠΑΤΣΗ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
19.	**1955 4**	1955, Ε' ΔΗΜΟΤΙΚΟΥ, ΓΕΩΡΓΟΠΟΥΛΟΥ- ΓΑΒΡΕΣΕΑ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ.
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22.	**1955 7**	1955, Ε΄ ΔΗΜΟΤΙΚΟΥ, Ν. ΚΟΝΙΔΑ – Ν. ΔΙΑΜΑΝΤΟΠΟΥΛΟΥ, ΦΥΣΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
23.	**1955 8**	1955, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΣΤΥΛ. Ε. ΚΑΤΑΚΗ – ΓΕΩΡ. Ο. ΑΝΔΡΕΑΔΗ
24.	**1955 9**	1955, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, ΚΩΣΤΑΝΤΑ- ΠΑΠΑΔΟΠΟΥΛΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
25.	**1955 10**	1955, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΠΑΠΑΙΩΑΝΝΟΥ- ΠΑΠΑΚΗ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
26.	**1955 11**	1955, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΧΡ. ΑΛΕΞΟΠΟΥΛΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
27.	**1955 12**	1955, Ε΄- ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, Β΄ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑΛΙΑΣ, ΒΛΕΣΣΑ - ΔΟΥΚΑ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
28.	**1955 13**	1955, Ε΄- ΣΤ΄ΔΗΜΟΤΙΚΟΥ, Α΄ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑΛΙΑΣ, ΒΛΕΣΣΑ - ΔΟΥΚΑ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
29.	**1955 14**	1955, Ε΄- ΣΤ΄ΔΗΜΟΤΙΚΟΥ, Α΄ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑΛΙΑΣ, Α. ΠΑΤΣΗ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
30.	**1955 15**	1955, Ε΄ ΔΗΜΟΤΙΚΟΥ, Δ ΔΟΥΚΑ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
31.	**1955 16**	1955, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΑΡΚΟΥΔΕΑ Δ- ΚΑΤΣΙΚΑ Ν, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ
32.	**1955 17**	1955, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΜΙΧΑΗΛ ΠΑΠΑΔΑΚΗ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ
33.	**1955 18**	1955 (επανέκδοση 1965) , Ε΄ΔΗΜΟΤΙΚΟΥ, ΚΑΤΣΑΔΗΜΑ- ΑΛΕΞΙΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
34.	**1955 19**	1955, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, Γ Δ ΚΑΦΕΝΤΖΗ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ
35.	**1955 20**	1955, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΜΑΖΗ - ΔΡΙΒΑ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ
36.	**1955 21**	1955, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, 2ο ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑΛΙΑΣ, Α.Χ. ΠΑΤΣΗ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
37.	**1969**	1969, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΘΕΟΦ. ΠΑΠΑΓΕΩΡΓΟΠΟΥΛΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
38.	**1971**	1971, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, ΖΕΝΑΚΟΥ ΑΝΑΡΓΥΡΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
39.	**1972**	1972, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, ΑΝΑΡΓ. ΖΕΝΑΚΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
40.	**1975**	1975, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΟΕΔΒ, ΦΥΣΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
41.	**1982**	1982, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΑΛΕΞ. ΘΕΟΔΟΣΙΑΔΗ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
42.	**1983**	1983, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, ΖΑΧ. ΝΙΚΟΛΑΟΥ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑΤΙΚΗ ΚΑΙ ΧΗΜΕΙΑ
43.	**1993 1-2**	1993, Ε΄ ΔΗΜΟΤΙΚΟΥ, ΕΡΕΥΝΩ ΤΟ ΦΥΣΙΚΟ ΜΟΥ ΚΟΣΜΟ
44.	**1993 3-4**	1993,ΣΤ΄ΔΗΜΟΤΙΚΟΥ, ΕΡΕΥΝΩ ΤΟ ΦΥΣΙΚΟ ΜΟΥ ΚΟΣΜΟ
45.	**2002 1-2**	2002, Ε΄ ΔΗΜΟΤΙΚΟΥ, Επ. Υπ. Π. ΚΟΚΚΟΤΑΣ, ΦΥΣΙΚΕΣ ΕΠΙΣΤΗΜΕΣ
46.	**2002 3-4**	2002, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, Επ. Υπ. Π. ΚΟΚΚΟΤΑΣ, ΦΥΣΙΚΕΣ ΕΠΙΣΤΗΜΕΣ
47.	**2002 α**	2002 Ε΄ ΔΗΜΟΤΙΚΟΥ, Επ. Υπ. Γ.Θ.ΚΑΛΚΑΝΗΣ ΕΡΕΥΝΩ ΚΑΙ ΑΝΑΚΑΛΥΠΤΩ
48.	**2002 β**	2002 ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, Επ. Υπ. Γ.Θ.ΚΑΛΚΑΝΗΣ ΕΡΕΥΝΩ ΚΑΙ ΑΝΑΚΑΛΥΠΤΩ

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