History of Science (HOS) integration in 20th century Greek primary school science textbooks.

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Abstract

Science textbooks usually include elements of history of science in various forms, either as introductory chapters or simple inset information.

This study belongs to a greater research project which is being conveyed on Greek primary science textbooks all along 20th century where we intend to a) trace and classify this kind of historical findings in them and b) study, analyze and integrate 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.

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Suggested key terms : Primary school, science textbook, History of science, 5th - 6th grade, science education, Greek science education curriculum, 20th century

INTRODUCTION

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) and that science textbooks have been known for decades as a dominant instructional tool in science education. It is the textbook that in thousands of classrooms determines the content of instruction and guides the teaching procedures. 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). It's been nearly fifty years since Conant's first project since internationally scientific/educational communities work on enhancing science literacy for all students. Science can be taught in a holistic way.

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 (eg Wang H.A. 1999, Leite L. 2002, Carrvalho W. et al. 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 this topics (Seroglou 1998, Chang 1999, Carvalcho et al. 2000, Wang 2002, Skordoulis 2003, Kindi 2003, Maniati 2003), but also studing textbooks in a multilevel way (Wang 1999, Drakopoulou 2003, Koulouri 1994).

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 according to the extend of HOS inclusion and b) to examine if HOS elements (or elements related to it) present scientists work adequately shaping a positive image of science towards students.

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

The main axes of analysis and interpretation are instructional aim, scientific tradition, cultural context and dominant ideology.

METHODOLOGY

This presentation is part of a wider research program of multilevel study on 20th C Greek primary school science textbooks (almost a hundred is found so far, including different versions of the same textbook).

Here we will cope with the completed part of our research sources sample, which is the primary school science textbook from 1950 to 2002 (N=40 series of textbooks).

Retrieving the books was most difficult as they were spread not only to various public libraries all over Greece but to private collections as well. Not to mention that a lot of them were found and purchased from antique bookshops.

Firstly, we found and studied Greek science education curriculum from 1900 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. 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 in 1924 the position was given to M.K. Stefanidis!

Greek science education curriculums were found and studied in Pedagogical Institute* Library valuable collections (*state independent consultant organisation on greek education issues)

Secondly, we collected in various forms (original, photocopies, digitalized) greek primary school science textbooks from 1950 to 2002.

The textbook selection was based on the following criteria.

The textbooks should:

- Belong to 20th century
- Apply to students of 5th and 6th grade of primary school, that is 10 to 12 years old.
- Have physics (not any other science) as content
- Have all of its pages
- Have no serious damage.
- Be available to the researcher.

The study is concentrated on physics pages only.

Our textbook sample was located in Pedagogical Institute* Library, Benakio Library, Moraitis Private school Library and Ms Drakopoulou private collection from antique bookshops.

The analysis of textbooks' historical content is based on both quantitative and qualitative content analysis (depending on the purpose) according to a validated checklist (Leite L. 2002) which has already been used on Portuguese science textbooks.

The checklist for analysing the historical content of science textbooks (Leite 2002,), adapted on Greek science textbooks nature & structure, is the following:

Dimensions and sub-dimensions

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 (I) 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 postscirts, 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

RESULTS

The following charts show the recording & distribution of HOS elements in greek primary school science textbooks from 1950 to 2002.

None of the textbook has been written in the pure context of HOS perspective.

- **Most of HOS content found in the textbooks lacks in – depth elaboration.**
- **The HOS content is merely another "add-on" in the textbook.**
- **Authors seem to integrate HOS elements rather to enrich the presentation of the science concepts, not to focus on the nature of scientific knowledge.**

		A1A	A1B	A2A	A2B	B1	B2	B3	B4	B5	B6	Γ1	Γ2	Γ3	Γ4	Γ5	Δ1	Δ2	E	ST
1950, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, ΛΕΩ ΛΙΩΚΗ -ΚΛ Δ ΚΑΡΝΑ	1950 1			3	4				2			3					4			
1950, Ε΄ ΔΗΜΟΤΙΚΟΥ, Α Ε ΜΑΖΗ -Ι Γ ΔΡΙΒΑ, ΦΥΣΙ	1950 2	2	2	4	4							2	2				4			
1950, ΣΤ ΔΗΜΟΤΙΚΟΥΒ ΕΤΟΣ, ΑΝ ΧΑΡΑΛΑΜΠΟΠΟ	1950 3	25	9	33	37							19	22	11		2	39	1		
1950, Ε ΔΗΜΟΤΙΚΟΥ, ΧΡ. ΑΛΕΞΟΠΟΥΛΟΥ, ΦΥΣΙΚ	1950 4	23	17	33	31	5		2	3			21	28	18	16		26	7		2
1950, ΣΤ ΔΗΜΟΤΙΚΟΥ, ΧΡ. ΑΛΕΞΟΠΟΥΛΟΥ, ΦΥΣΙ	1950 5	35	18	43	41		1					37	19	17	1		29	15		15
1950, ΣΤ΄ΔΗΜΟΤΙΚΟΥ, ΓΑΒΡΕΣΕΑ -ΠΑΠΑΔΟΠ, ΦΥ	1950 6	4		6	6		4					4	3				6			1
1950, Ε΄ΔΗΜΟΤΙΚΟΥ, ΔΙΟΝ ΛΕΟΝΤΑΡΙΤΟΥ, ΦΥΣΙΚ	1950 7	2	2	4	4		1	0	1			4	1	1	0	0	3	2		
1955, ΣΤ΄ΔΗΜΟΤΙΚΟΥ, 2ο ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑΛΙΑΣ	1955 1	38	5	20	20		6					14	10	3			24	23		
1955, Ε΄-ΣΤ΄ΔΗΜΟΤΙΚΟΥ, 1ο ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑΛ	1955 2	7	3	14	14	2	3	1			1	10	3	3		1	10	6		
1955, Ε΄ΔΗΜΟΤΙΚΟΥ, ΑΓΓ. ΠΑΤΣΗ, ΦΥΣΙΚΗ ΠΕΙΡΑ	1955 3	18	1	7	7							4	3				7	15		
1955, Ε' ΔΗΜΟΤΙΚΟΥ, ΓΕΩΡΓΟΠΟΥΛΟΥ- ΓΑΒΡΕΣ	1955 4	2		3	3		1		1			2	1				3			
1955, ΣΤ΄ΔΗΜΟΤΙΚΟΥ, Δ.ΔΟΥΚΑ - Μ. ΠΑΠΑΪΩΑΝΝ	1955 5	4	2	5	5		1					2	3	1			6			
1955, Ε΄- ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, 2ο ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑ	1955 6	13	8	22	22	2	5		1			13	12	3			26	1		
1955, Ε΄ΔΗΜΟΤΙΚΟΥ, ΚΟΝΙΔΑ - ΔΙΑΜΑΝΤΟΠΟΥΛΟ	1955 7	4	1	6	6		3		1			4	2	2			7	1		
ΚΑΤΑΚ ΑΝΔΡΕΑΔ	1955 8	4		4	4		2		1			3	1				4	3		
1955, ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, ΚΩΣΤΑΝΤΑ- ΠΑΠΑΔΟΠΟΥ	1955 9	7		9	9		1		2		1	6	3				9			
1955, Ε΄ΔΗΜΟΤΙΚΟΥ, ΠΑΠΑΙΩΑΝΝΟΥ- ΠΑΠΑΚΗ, Φ	1955 10	7	5	10	10							6	5	1	1		12			
1955, Ε΄ΔΗΜΟΤΙΚΟΥ, ΧΡ. ΑΛΕΞΟΠΟΥΛΟΥ, ΦΥΣΙΚ	1955 11	18	1	16	16	5	4		1			9	8	3			17	15		
1955, Ε΄-ΣΤ΄ ΔΗΜΟΤΙΚΟΥ, Β΄ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑΛ	1955 12	24		15	15		4		1		1	8	9	4			19	14		
1955, Ε΄-ΣΤ΄ΔΗΜΟΤΙΚΟΥ, Α΄ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑΛΙ	1955 13	16	5	7	7		2					9	1				4	15		
1955, Ε΄-ΣΤ΄ΔΗΜΟΤΙΚΟΥ, Α΄ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑΛΙ	1955 14	10	1	14	14		3				1	4	10	1			15			
1955, Ε΄ΔΗΜΟΤΙΚΟΥ, Δ ΔΟΥΚΑ, ΦΥΣΙΚΗ ΠΕΙΡΑΜΑ	1955 15	5	1	19	17		2	2	2			10	11		1	2	13	8		
1955, Ε΄ΔΗΜΟΤΙΚΟΥ, ΑΡΚΟΥΔΕΑ Δ- ΚΑΤΣΙΚΑ Ν, Φ	1955 16	16	2	20	18		8	1	3			10	11		1		17	4		
1955, Ε΄ΔΗΜΟΤΙΚΟΥ, ΜΙΧΑΗΛ ΠΑΠΑΔΑΚΗ, ΦΥΣΙΚ	1955 17	14	6	25	32	4	3	3	3		3	11	18	13	6	1	31	4	1	4
1955-1965 , Ε΄ΔΗΜΟΤΙΚΟΥ, ΚΑΤΣΑΔΗΜΑ- ΑΛΕΞΙΟ	1955 18	12	4	17	15		2	1	1			8	10	4	1	2	13	4		4
1955, ΣΤ΄ΔΗΜΟΤΙΚΟΥ, Γ Δ ΚΑΦΕΝΤΖΗ, ΦΥΣΙΚΗ Π	1955 19	15	3	16	16		4		1			10	10	5	2		13	4		
1955, Ε΄ΔΗΜΟΤΙΚΟΥ, μαζη δριβα, ΦΥΣΙΚΗ ΠΕΙΡΑΜ	1955 20	5		9	8				2			6	3				8	1		
1955, ΣΤ΄ΔΗΜΟΤΙΚΟΥ, 2ο ΕΤΟΣ ΣΥΝΔΙΔΑΣΚΑΛΙΑΣ	1955 21	17	8	22	22		9		3			11	18	13	1		26	2		
1969, Ε΄ΔΗΜΟΤΙΚΟΥ, ΘΕΟΦ. ΠΑΠΑΓΕΩΡΓΟΠΟΥΛ	1969	8	4	13	13	2	3					6	8	1	1		13	2		
1971, ΣΤ΄ΔΗΜΟΤΙΚΟΥ, ΖΕΝΑΚΟΥ ΑΝΑΡΓΥΡΟΥ, Φ	1971	13	6	19	21	1	6	1	2		1	12	13	6	2	1	12	7		
1972, ΣΤ΄ΔΗΜΟΤΙΚΟΥ, ΑΝΑΡΓ. ΖΕΝΑΚΟΥ, ΦΥΣΙΚΗ	1972	13	3	16	16		4		1			13	5	1	1		20			
1975, Ε΄ΔΗΜΟΤΙΚΟΥ, ΟΕΔΒ, ΦΥΣΙΚΗ ΚΑΙ ΧΗΜΕΙΑ	1975	12	2	23	23	3	5	1	2			20	12	4	1	2	25	7	1	
1982, Ε΄ΔΗΜΟΤΙΚΟΥ, ΑΛΕΞ. ΘΕΟΔΟΣΙΑΔΗ, ΦΥΣΙΚ	1982	11	4	15	15		4					9	7	1			15	1		
1983, ΣΤ΄ΔΗΜΟΤΙΚΟΥ, ΖΑΧ. ΝΙΚΟΛΑΟΥ, ΦΥΣΙΚΗ Π	1983	6	2	12	12		1				3	7	7			1	13	1		
1993, Ε ΔΗΜΟΤΙΚΟΥ	1993 1-2	5	2	6	6	6					2	7					7	1		
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2002, Ε ΔΗΜΟΤΙΚΟΥ,Ά ΜΕΡΟΣ, Π. ΚΟΚΚΟΤΑΣ, Φ	2002 1-2	3	3	5	4	1	3	1			5	3	3	5		3	8	5		
2002, ΣΤ ΔΗΜΟΤΙΚΟΥ,Ά ΜΕΡΟΣ, Π. ΚΟΚΚΟΤΑΣ, Φ	2002 3-4	11	2	29	29	5	3	5			6	17	10	17			20	22		
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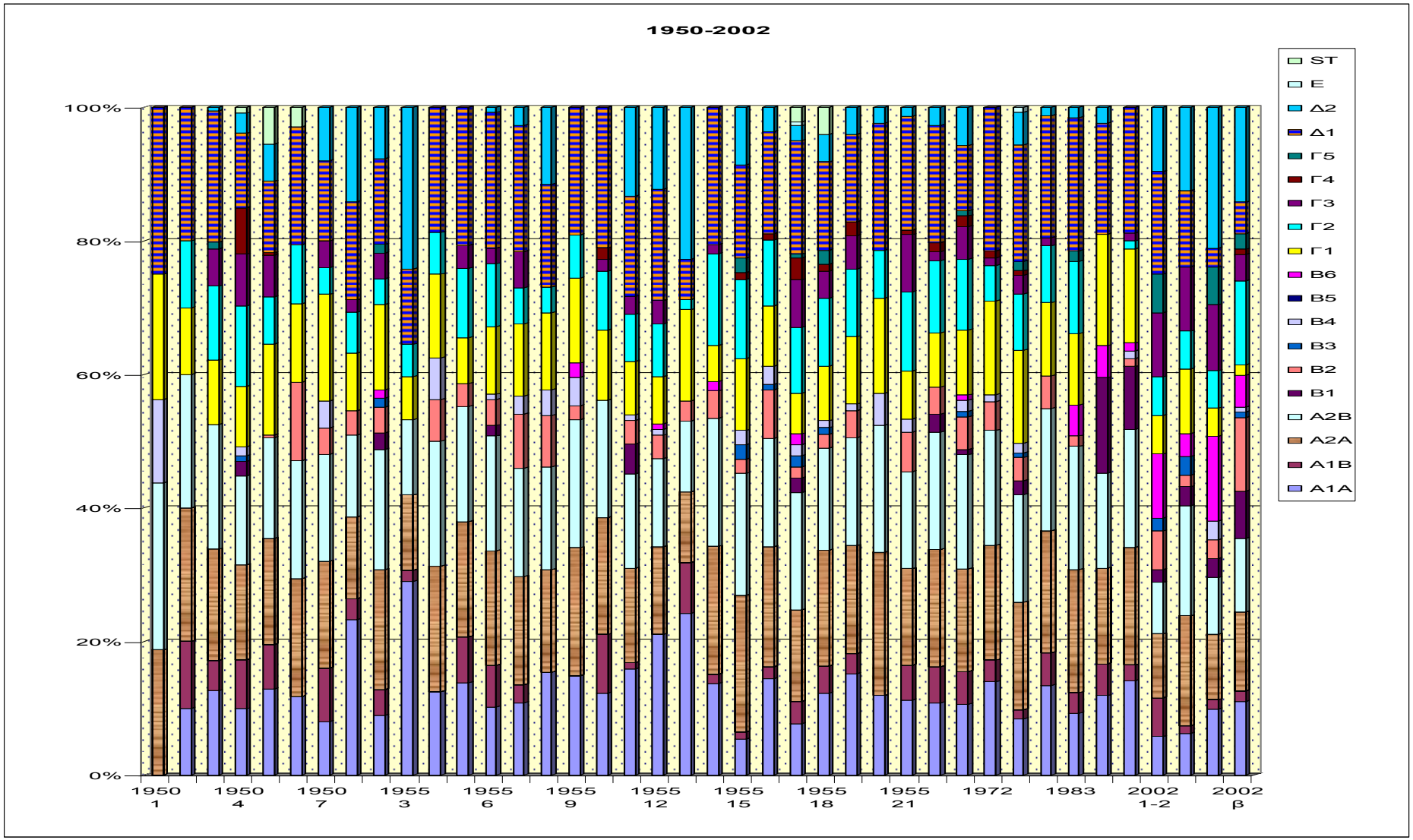
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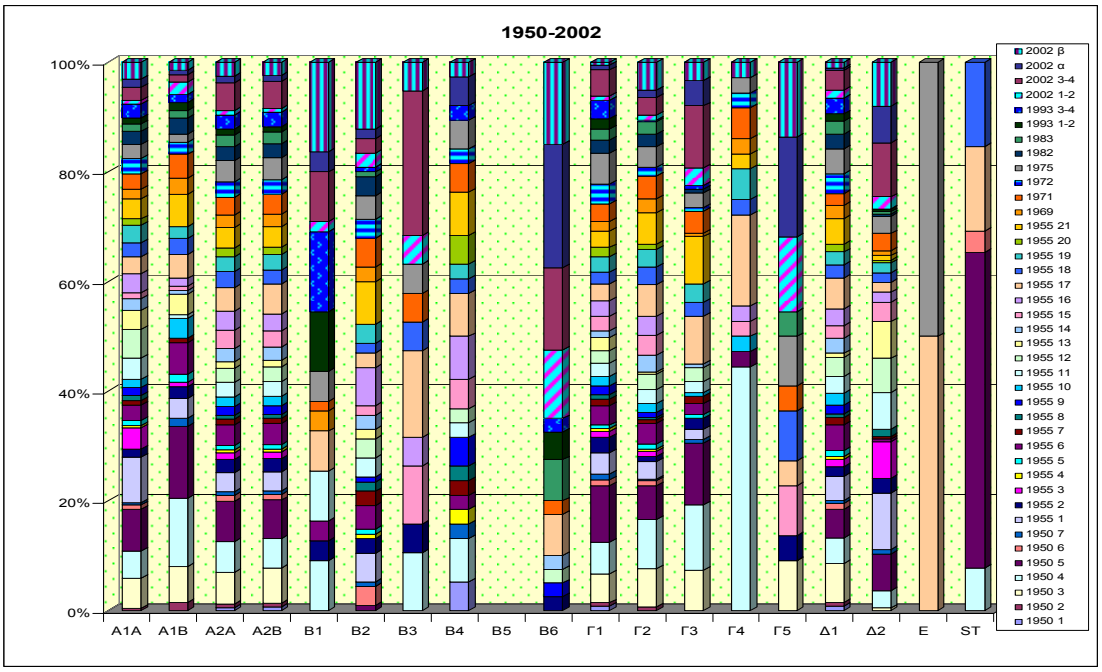
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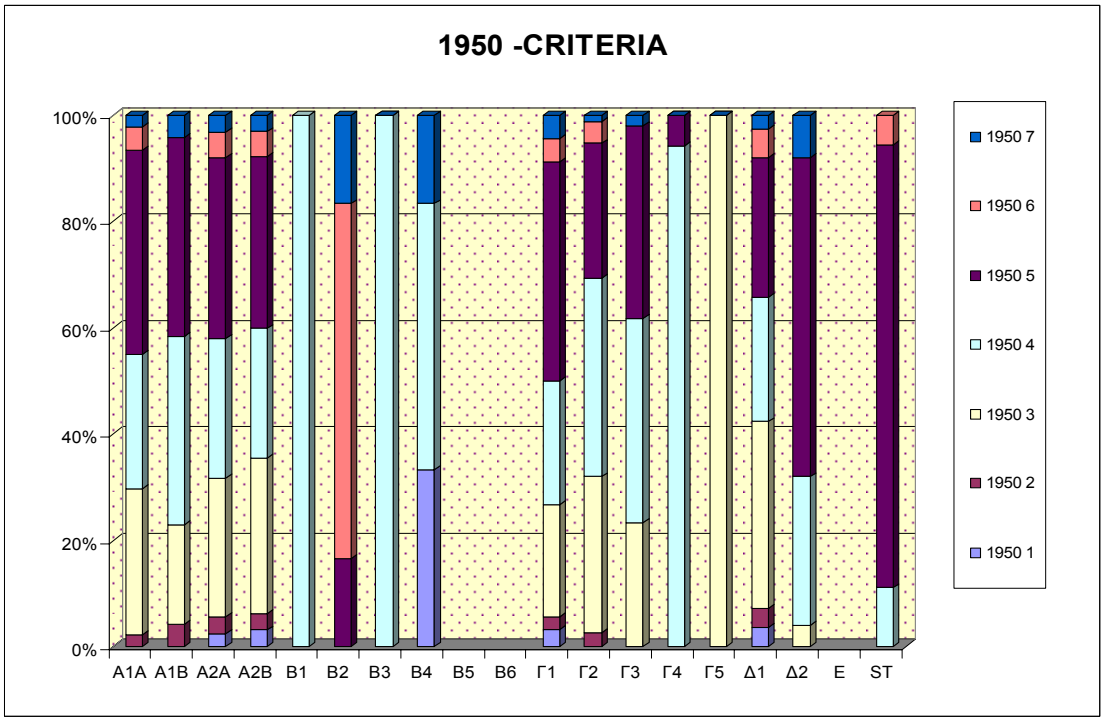
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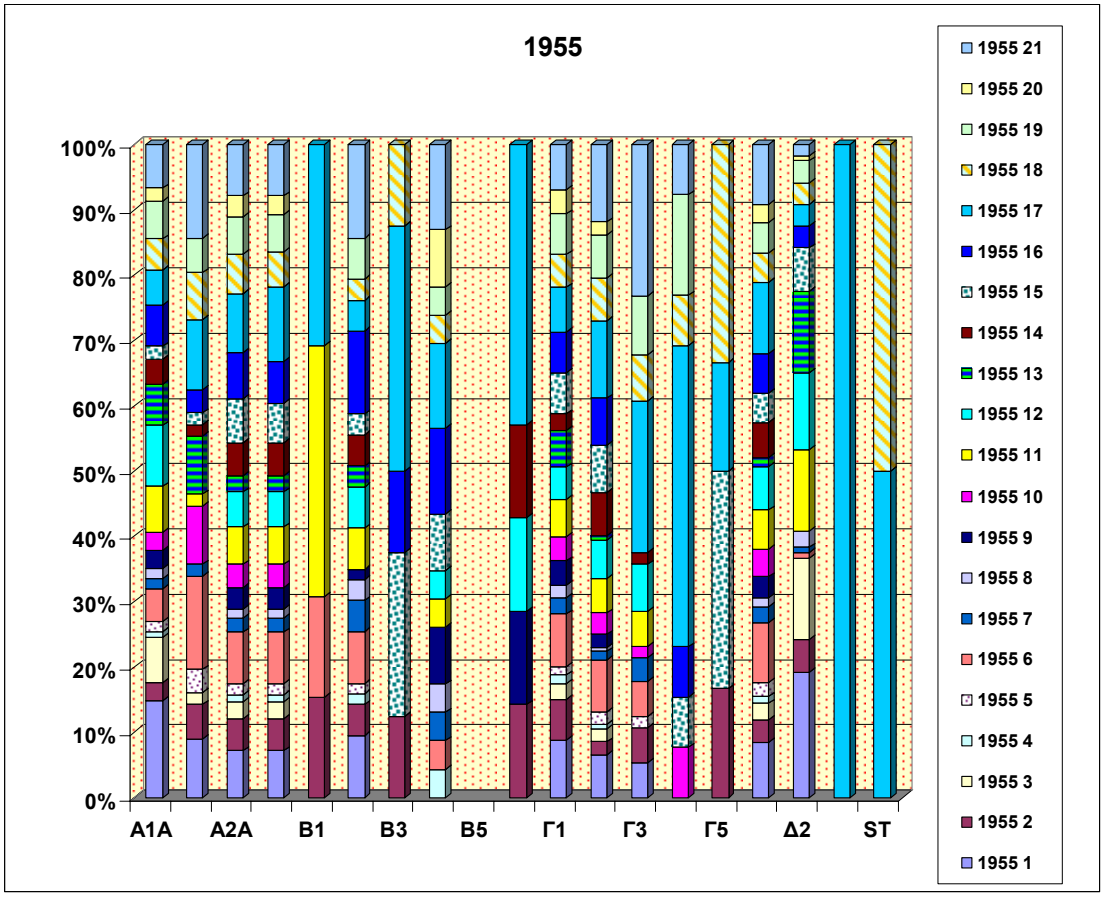
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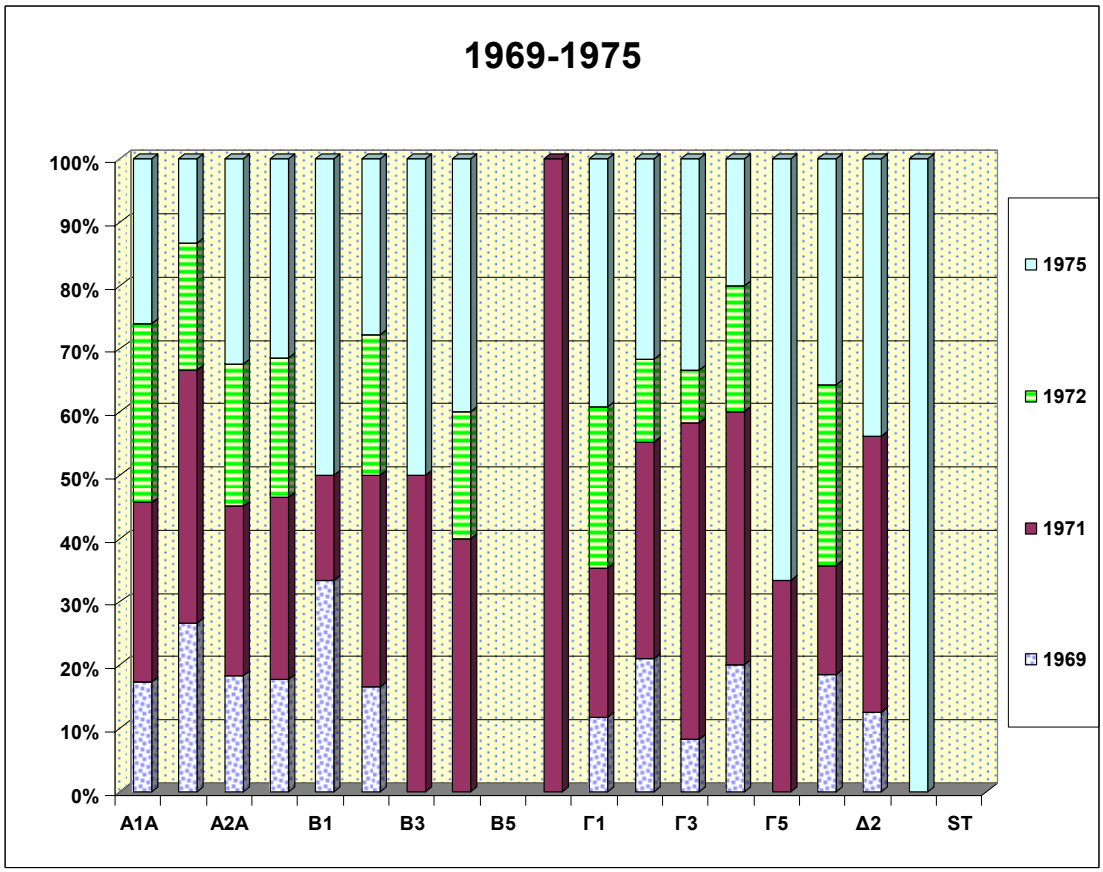
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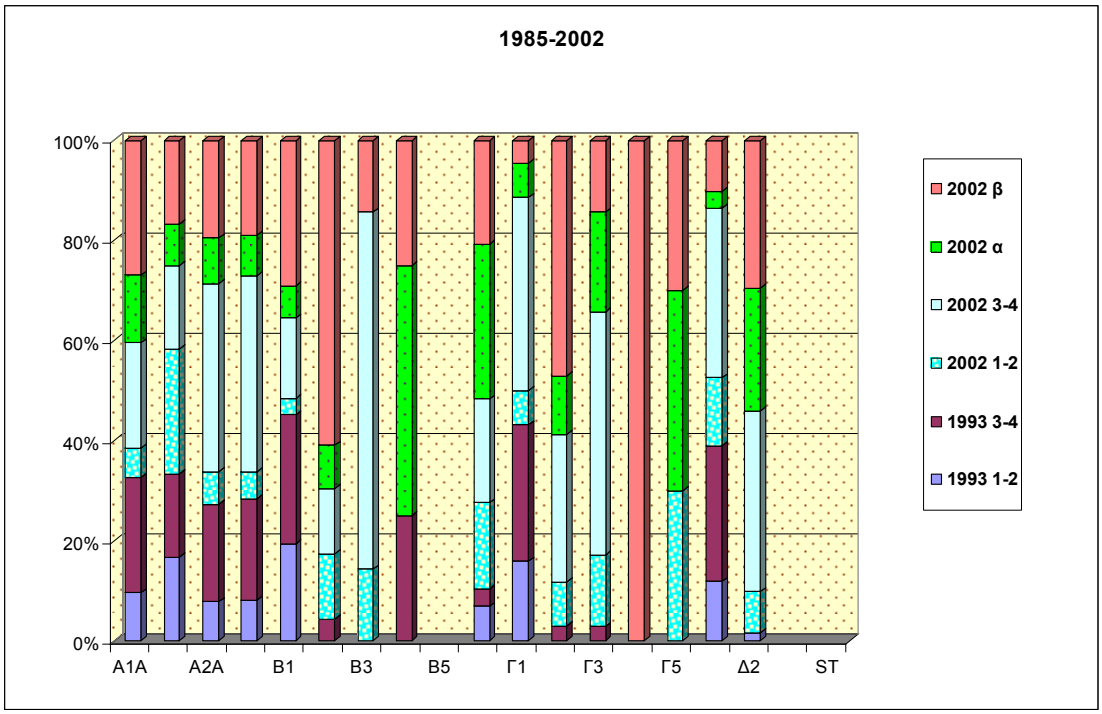
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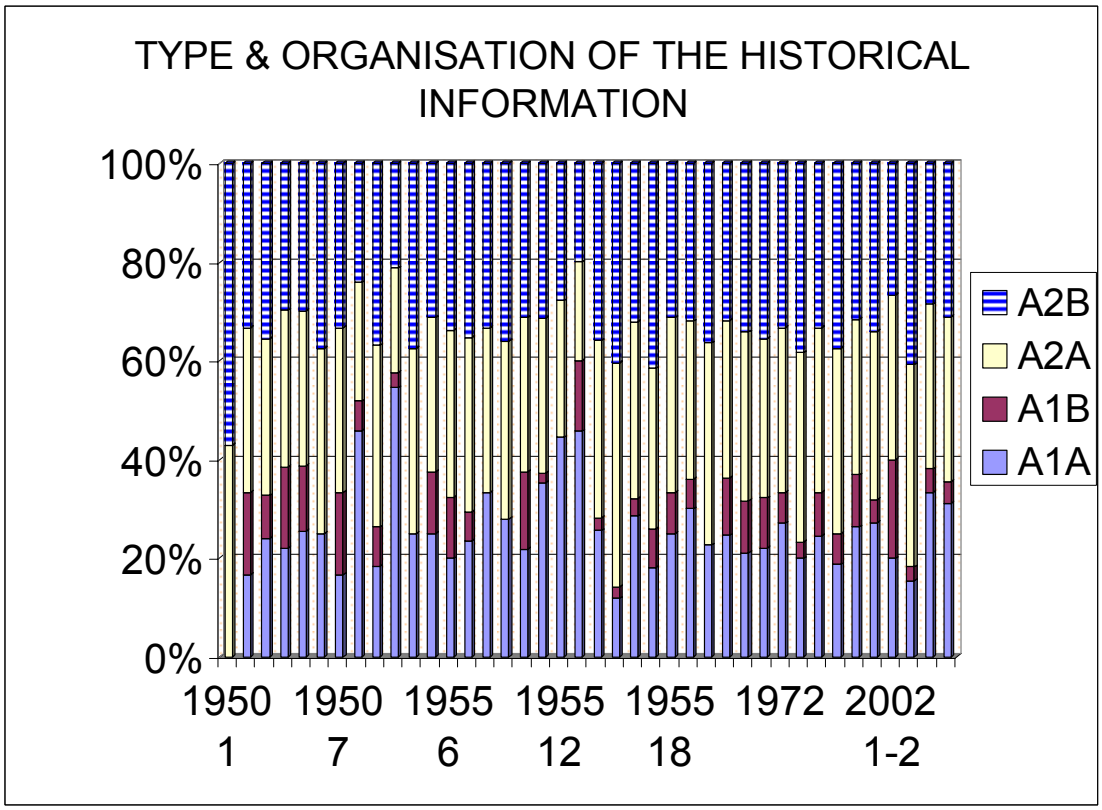
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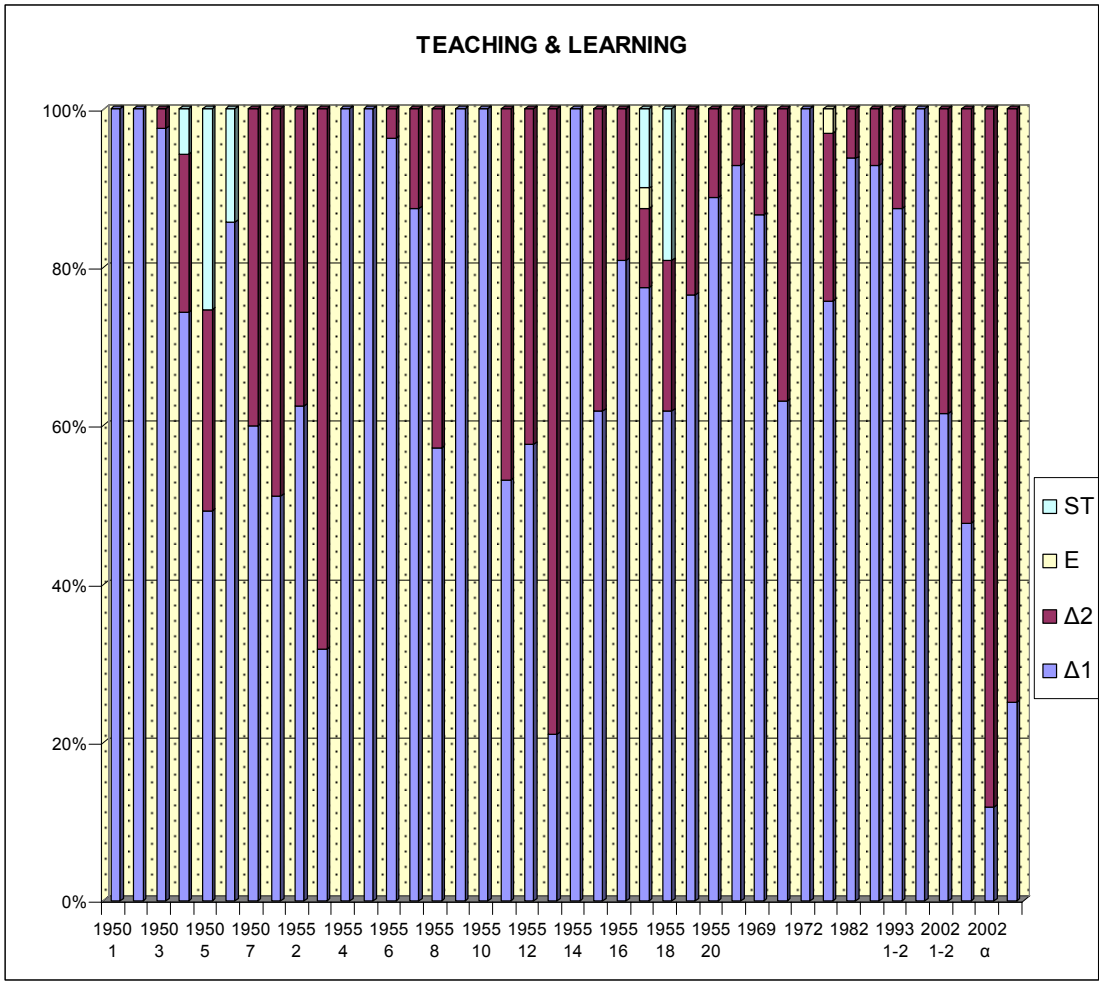
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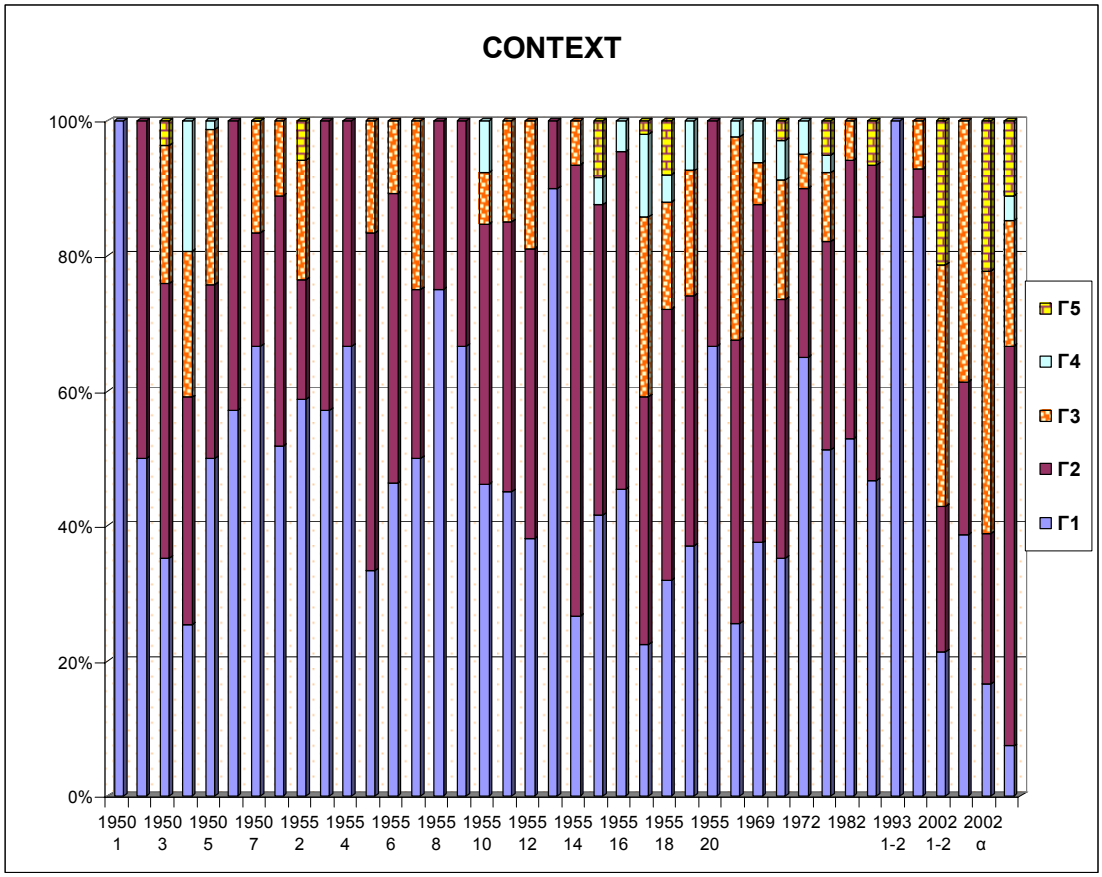
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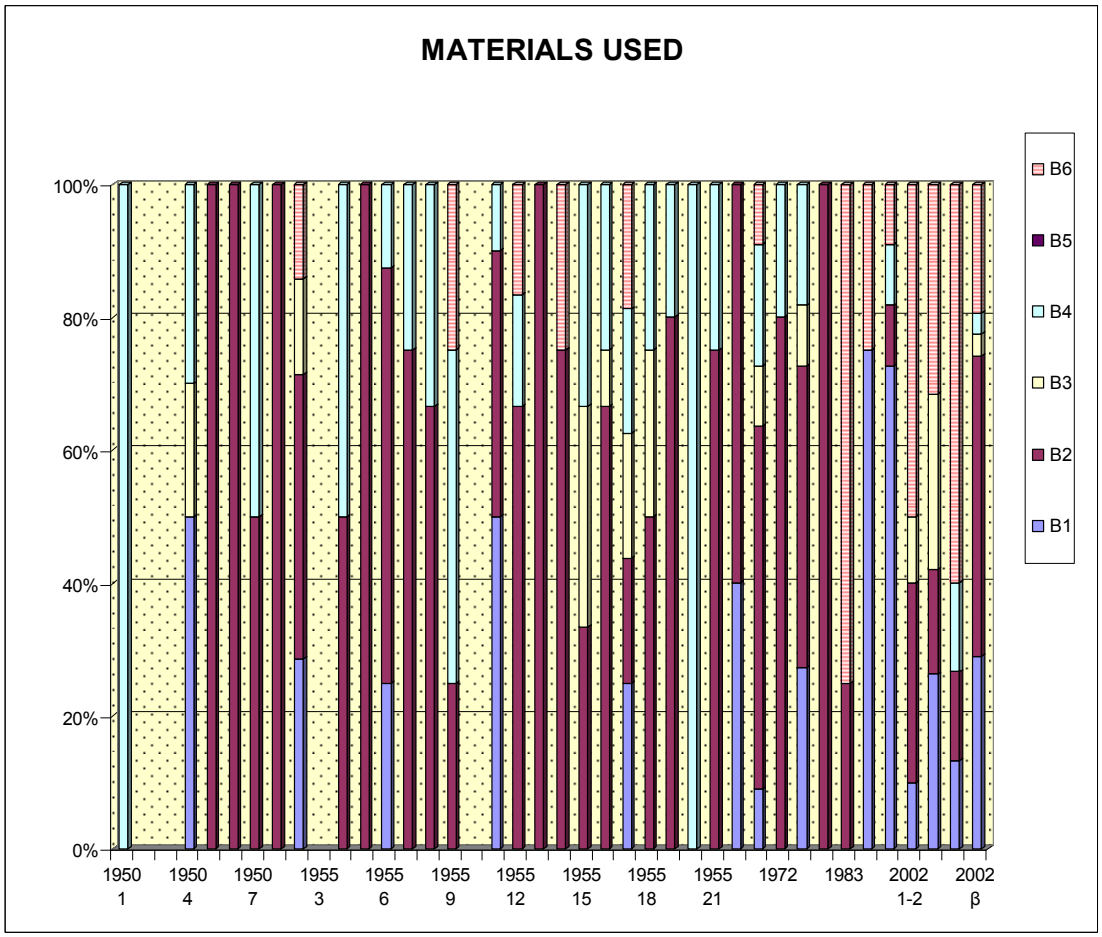
1955 8
1955 10
1955 12
1955 14
1955 16
1955 18
1955 20
1969
1972
1982
1993 1-2
2002 1-2
2002 α


MATERIALS USED
100%
80%
60%
40%
20%
0%
B6
B5
B4
B3
B2
B1
1950 1
1950 4
1950 7
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1972
1983
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2002 β

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 the 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 1838 that M K Stefanidis supported the constructive learning in science education (physics especially) through Historical Elements (Stefanidis 1938).

Greek science curriculum is not very explicit about the teaching of the 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 science curriculums (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 writers 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.

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. Textbook writers 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 1999).

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