

The Investigative Approach in Primary School: Analysis of the Place Given to This Approach in Science Teaching Textbooks

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Abstract: The investigative approach is increasingly demonstrating its potential in teaching. Indeed, it allows students to develop the skills, attitudes and interests necessary to live in a society increasingly dependent on the applications of science. This study is part of the research work questioning the application of the investigative approach in the teaching of science at the primary level. We carried out an analytical study of primary school science textbooks in order to identify the investigative tools that can help teachers to manage the teaching and learning process using an analysis grid. Based on this tool, comparisons were made and an analysis was carried out.

Keywords: Investigative approach, Analytical study, Textbooks, Scientific awakening, Primary school.

Introduction

Everyone is aware that science education is not producing the desired results. It is more a question of training only scientists, but also of allowing a scientific acculturation of citizens living in a world where science and technology have a primordial place. This is why, from an institutional point of view, the renewal of this education has become indispensable in recent years. The results of the International Assessment conducted in 1995 by the International Association for the Evaluation of Educational Achievement (I.E.A.), showed a deficiency in student achievement in science around the world. In the United States, the national research committee, as early as 1996, recommended that science education should be based on the development of classroom situations in which students conduct their own investigations (Coquidé et al., 2009). In Europe, the Rocard report calls for the need to renew science teaching based on students conducting their own investigations. This approach is part of a socioconstructivist perspective, favouring exchanges between students in order to build their own knowledge, as recommended in official instructions (Rocard et al. 2007).

In Morocco, the authorities have made considerable efforts to improve the quality of education and ensure its universalization. Major reform projects have been launched since 2000, particularly the National Charter for Education and Training, which aimed essentially at generalizing education, improving its quality, including that of pedagogical content, and restructuring education cycles. The launch of the emergency plan in 2009 gave new impetus to educational reform which, despite significant progress, has not been able to achieve the major objectives, especially those related to improving the quality of education and the supply of teaching materials,

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and reducing disparities between the environment and gender (Special Commission on Education and Training, 1999). However, research in science didactics has shown that learning difficulties are partly responsible for the observed academic failures. Research has shown that these difficulties are not only related to the knowledge itself and to the representations that students and teachers make of science but also to teachers' pedagogical practices (Robert & Rogalski, 2002; Mathé & al 2008). In Morocco, a very limited amount of research work has been carried out on the analysis of the meaning of the investigative approach and the elements that need to be taken into account in order for students to be able to engage in scientific investigation work autonomously. In this work, we carried out an analytical study of primary school science awareness textbooks with the aim of identifying investigative tools that can help teachers manage the teaching-learning process.

Method

The study focused on the analysis of three 4th grade primary school textbooks of scientific awakening. Table 1 collects representative data on these textbooks. The choice of these three textbooks is linked to their availability in libraries in the Marrakech region. For the collection of information related to the problem under study, we used an analysis grid as an investigative tool.

Table 1. List of textbooks included in this research

Authors	Title	Year	Editor
Mohamed RACHIH Idriss DABLI Az-Eddine ETTALHAOUI Hassan MAHBOUBI Mohamed BAHOU Mohamed ELHILALI Abdelilah ABOUTAHER	ALMOUNIR FI NACHAT AL ILMI (TEXTBOOK A)	2019	SOUMAKRAM
Mohamed BELKBIR Khadija ESSAMADI Soumya ELKSSAR Bouazza SYASSI Mohamed BERCHA	FADAA ANACHAT ALILMI (TEXTBOOK B)	2019	EL MAARIF AL JADIDA
Mohamed MALLOUK Abdelkrim ELHYANI Abdelghani SLIMANI Abdelmjid ELBOUNSARI Yahia LKOTB Yahia ESSAYM	ALMORCHID FI NACHAT AL ILMI (TEXTBOOK C)	2019	GARBAOUI

Results and Discussion

These three textbooks cover four areas: life sciences, physical sciences, earth and space sciences and technologies. Thus, each field is divided into three categories. The textbooks consist of six units, and each unit consists of 8 sessions. They begin with a session of pre-requisite assessment and knowledge support, while the last session is devoted to a topic of technology, acquisition control and unit support. These 6 units are divided between two semesters, and each semester contains 3 units with end-of-semester evaluation and support. As shown in Table 2, for the ALMONIR FI NACHAT ALILMI 4th grade primary school textbook: 20.26% of the charts covered the characteristics of living beings, their biological functions and interactions with the environment, followed by 19.74% for Forms and types of energy transfer, forces and motion, 16.32% for The natural properties of the earth and its resources, 15.53% for Life cycles, reproduction and heredity in living beings, 14.74% for Human health and interaction with the environment and 13.42% for the classification of matter and its properties. For the ALMORCHID FI NACHAT ALILMI textbook of 4th grade of primary school: 24.33% of the graphs were devoted to the characteristics of living beings, their biological functions and interactions with the environment, followed by 20.25% for the natural properties of the earth and its resources, 18.20% for Life cycles, reproduction and heredity in living beings, 14.52% for Forms and types of energy transfer, forces and motion, 12.06% for the classification of matter and its properties and 10.36% for human health and interaction with the environment. While for the textbook FADAA NACHAT ALILMI of 4th grade of primary school: 21.89% of the charts covered the characteristics of living beings, their biological functions and interactions with the environment, followed by 19.73% for the natural properties of the earth and its resources,

16.49% for Human health and interaction with the environment, 15.95% for Forms and types of energy transfer, forces and motion, 14.32% for Life cycles, reproduction and heredity in living beings and 11.62% for the classification of matter and its properties. Finally, the total of frequencies for the three textbooks of the scientific awakening of the 4th grade of primary school : 22.36% of the charts covered the characteristics of living beings, their biological functions and interactions with the environment, followed by 18.88% for the natural properties of the earth and its resources, 16.55% for the Forms and types of transfer of energy, forces and motion, 16.22% for life cycles, reproduction and heredity in living beings, 13.64% for human health and interaction with the environment and 12.35% for the classification of matter and its properties.

Table 2. Frequencies of graphs in the different thematic areas for the three manuals

TEXT BOOK	Thematic area											
	Human health and interaction with the environment.		The classification of matter and its properties		Characteristics of living beings, their biological functions and interactions with the environment		Life cycles, reproduction and heredity in living beings		Forms and types of energy transfer, forces and motion		The natural properties of the land and its resources	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
T.BOOK-.A	56	14,7	51	13,4	77	20,2	59	15,5	75	19,7	62	16,3
T.BOOK-C	52	10,6	59	12,0	119	24,3	89	18,2	71	14,5	99	20,2
T.BOOK-B	61	16,4	43	11,6	81	21,8	53	14,3	59	15,9	73	19,7
Total	169	13,6	153	12,3	277	22,3	201	16,2	205	16,5	234	18,8

Table 3. Teaching materials in the three textbooks

Form	Textbook names						Total	
	TEXTBOOK-A		TEXTBOOK-C		TEXTBOOK-B		Freq	%
	Freq	%	Freq	%	Freq	%		
Pictures and Drawings	349	87,6	446	85,7	333	84,9	1128	86,1
Scientific texts	6	1,5	18	3,4	8	2,0	32	2,4
Graphic representations	0	0	0	0	0	0	0	0
Tables	22	5,5	39	7,5	35	8,9	96	7,3
Experiments and Manipulations	21	5,2	17	3,2	16	4,0	54	4,1
Total	398	100	520	100	392	100	1310	100

The study of these three textbooks is composed of numerous activities, each of which includes a variety of scientific documents to be used by the learners. An analysis of these learning activities reveals that photos and drawings dominate the curriculum. On the other hand, scientific texts, experiments and tables represent a minority, and finally, graphic representations are neglected.

Table 4. Distribution of the forms of graphic representations in the three scientific awakening textbooks

Form	Name of textbooks						Total	
	TEXTBOOK-A		TEXTBOOK-C		TEXTBOOK-B		Freq	%
	Freq	%	Freq	%	Freq	%		
Photography	239	62,8	310	63,3	251	67,8	800	46,6
Drawing	108	28,4	136	27,8	82	22,1	800	46,6
Table	22	5,8	39	7,9	35	9,4	96	5,6
Organizational chart	5	1,3	1	0,2	1	0,2	7	0,4
Map	6	1,5	5	1,0	1	0,2	12	0,7
Graphic	0	0	0	0	0	0	0	0
Total	380	100	489	100	370	100	1715	100

The results showed that: in the ALMORCHID FI NACHAT ALILMI textbook, photographs were the most common form of graphs at 63.39%, while drawings came second at 27.81%, tables at 7.98%, maps at 1.02%, flow charts at 0.2% and graphs at 0%. In the ALMONIR FI NACHAT ALILMI textbook, photographs were the most common form of graphs at 62.89%, while drawings came second at 28.42%, tables at 5.80%, maps at 1.57%, flow charts at 1.32% and graphs at 0%. In the FADAA NACHAT ALILMI textbook, photographs were the most common form of graphs at 67.84%, while drawings came second at 22.16%, tables at 9.46%, maps at

0.27%, flow charts at 0.27% and graphs at 0%. Finally, the total frequencies for the three textbooks for scientific awakening in the 4th year of primary school: photographs and drawings were the most common form of graph with 46.65%, tables with 5.60%, maps with 0.70%, flow charts with 0.41% and graphs with 0%. Table 5 shows the dominance of static versus dynamic graphs in the three textbooks studied. Table 6 shows that the majority of charts were presentational in nature, followed by organizational charts followed by organizational charts in all of the textbooks in our study. Table 7 presents the data concerning the link between graphics and written text (indexing, subtitling) in the textbooks for scientific awakening in the 4th year of primary school. We can see that none of the graphs are indexed, 38.74% are subtitled and 61.26% of the graphs are not subtitled. According to Table 8, the following are present: chapter headings, summary at the end of the chapter, documents, activities at the beginning of the chapters, learning exercises, acquisition control and a conclusion.

Table 5. Distribution of quality of graphic representations in the three manuals

Quality	Name of textbooks						Total	
	TEXTBOOK-A		TEXTBOOK-B		TEXTBOOK-C		Freq	%
	Freq	%	Freq	%	Freq	%		
Static	258	74,3	227	79,3	330	73,9	815	75,5
Dynamic	89	25,6	59	20,6	116	26,0	264	24,4
Total	347	100	286	100	446	100	1079	100

Table 6. Distribution of the functions of the graphical representations in the three manuals

Function	Name of textbooks						Total	
	TEXTBOOK-A		TEXTBOOK-B		TEXTBOOK-C		Freq	%
	Freq	%	Freq	%	Freq	%		
Decorative	18	4,0	25	8,7	17	7,1	60	6,1
Representative	351	78,7	245	85,6	174	72,8	770	79,3
Organizational	77	17,2	16	5,6	48	20,0	141	14,5
Total	446	100	286	100	239	100	971	100

Table 7. Distribution of indexing and captioning of graphs in textbooks

Indexing and subtitling	Name of textbooks						Total	
	TEXTBOOK-B		TEXTBOOK-A		TEXTBOOK-C		Freq	%
	Freq	%	Freq	%	Freq	%		
Indexed	-----	-----	-----	-----	-----	-----	-----	-----
Not indexed	370	100	380	100	489	100	1239	100
Subtitled	104	28,11	225	59,21	151	30,88	480	38,74
Not subtitled	266	71,89	155	40,79	338	69,12	759	61,26

Table 8. Content stringency analysis ALMORCHID FI NACHAT AL ILMI

	Criteria	Yes	No
Chapter Titles	Clair	X	
Abstract	Presence	X	
	Clair	X	
	Précis	X	
Document	Is at the beginning of the chapter		X
	Is at the middle of the chapter		X
	Is at the end of the chapter	X	
Activity	Presence	X	
	Presence	X	
	Is at the beginning of the chapter	X	
Learning exercise	Is at the middle of the chapter		X
	Is at the end of the chapter		X
	Presence in each chapter	X	
Control d'acquisition	Presence in each chapter	X	
	Claire	X	
Conclusion	Argumented	X	
	Objective	X	
	Response to the stated objective	X	

Table 9. Content rigor analysis ALMONIR FI NACHAT AL ILMI

	Criteria	Yes	No
Chapter Titles	Clair	X	
	Abstract		
Activity	Presence	X	
	Clair	X	-----
	Precis	X	-----
	Is at the beginning of the chapter		X
	Is at the middle of the chapitre		X
	Is at the end of the chapter	X	
	Presence	X	
Learning exercise	Is at the beginning of the chapter	X	
	Se situe au milieu du chapitre	X	
	Is at the end of the chapter	X	
Control of acquisition	Presence in each chapter	X	
	Presence in each chapter	X	
Conclusion	Claire		X
	Argumented		X
	Objective	X	
	Response to the stated objective	X	

According to Table 9, the following are present: chapter headings, summary at the end of the chapter, documents, activities at the beginning, middle and end of the chapters, learning exercises, acquisition control and a conclusion. Table 10 shows the presence of: chapter headings, summary at the end of the chapter, documents, activities at the end of the chapters, learning exercises, acquisition control and a conclusion.

Table 10. Content rigour analysis FADAA NACHAT AL ILMI

	Criteria	Yes	No
Chapter Titles	Clair	X	
	Abstract		
Activity	Presence	X	
	Clair	X	
	Precis	X	
	Is at the beginning of the chapter		X
	Is at the middle of the chapter		X
	Is at the end of the chapter	X	
	Presence	X	
Learning exercise	Is at the beginning of the chapter	X	
	Is at the middle of the chapter	X	
	Is at the end of the chapter	X	
Control of acquisition	Control of acquisition	X	
	Présence dans chaque chapitre	X	
Conclusion	Claire		X
	Argumented	X	
	Objective	X	
	Response to the stated objective	X	

Table 11 shows the presence of all the different stages of the process in the three manuals.

Table 11. Presence or not of the different stages of the investigation process in the three textbooks

	TEXTBOOK-C		TEXTBOOK-A		TEXTBOOK-B	
	Yes	No	Yes	No	Yes	No
Presence						
Initial data	X		X		X	
Problématisation	X		X		X	
Hypothesis	X		X		X	
Tests	X		X		X	
Results	X		X		X	
Interpretation	X		X		X	
Conclusion	X		X		X	

Conclusion

According to the analysis that we carried out for the 4th grade primary school textbooks for scientific awakening using a grid, we found that the different stages of the ID were respected, the rigor of the textbook contents is in line with the program requirements, and the distribution of photographs and drawings occupies a very important place in the textbooks. To conclude, therefore, the investigation approach adopted in the textbooks for the scientific awakening of the 4th year of primary school is investigation by observation.

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