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Didactic Analysis of Two Physics Textbooks in Lebanese Secondary Schools: A Specific Study of Elementary Electricity

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ABSTRACT: This study investigates the effectiveness and use of physics textbooks in Lebanese secondary schools, with a focus on teaching elementary electricity in the first year. A qualitative approach combined content analysis of two widely used textbooks—the CRDP national textbook (1998) and a private textbook (2011)—with a survey of 106 physics teachers. A didactic and epistemological grid assessed scientific, pedagogical, disciplinary, material, and socio-cultural dimensions, while the survey explored teachers' practices, perceptions, and the textbooks' role in promoting inquiry-based learning.

Results reveal that, although the textbooks provide generally accurate scientific content, significant pedagogical gaps exist. Activities rarely support scientific inquiry, differentiated instruction, or real-world application, and key concepts such as electric voltage, current, and current intensity are not presented in ways that promote analysis, synthesis, or deep conceptual understanding. Many teachers do not participate in textbook selection, and the teacher's guide is underutilized, leading educators to supplement resources with digital materials and self-designed exercises.

The findings underscore the need for updated, pedagogically robust textbooks and structured teacher support. By improving instructional design and guidance, textbooks can more effectively foster conceptual understanding, scientific reasoning, and inquiry-based learning in physics education.

KEY WORDS: physics education, textbooks, didactic analysis, elementary electricity, teacher practices, Lebanon

I. THE ROLE, FUNCTIONS, AND QUALITY OF SCHOOL TEXTBOOKS IN PHYSICS EDUCATION

School textbooks are central tools in the teaching–learning process, supporting both teachers and students. They have been defined as didactic resources presenting essential knowledge (Le Petit Robert, 2003), structured tools to enhance learning (Gérard & Roegiers, 2009), or printed works covering core curriculum elements (Robert, 2002). Beyond content delivery, textbook's structure disciplinary knowledge and complement other teaching resources, mediating curriculum requirements within institutional, social, and cultural frameworks (Cuq, 2003; Choppin, 1992; Lenoir, 2001; Bendjebbar, 2005).

Empirical research on textbook use remains limited. Few didactic studies have explored their impact on learning (Choppin, 2008), and surveys show that textbooks are often underutilized (Nyssen, 1998; Demeuse &Monseur, 2000). In science education, learners require reference models to guide reasoning, which textbooks frequently provide, particularly in physics (Kock, Taconis, Bolhuis, &Gravemeijer, 2015; Park & Jang, 2005). International initiatives—including the OECD seminar in Chile (2005), the Laboratory on Textbooks (2006), and IOSTE (2007)—have emphasized the central role of textbooks in teaching scientific concepts.

Textbooks serve multiple functions: implementing curricula, supporting instruction, fostering autonomy, organizing knowledge, providing assessments, and contextualizing learning (Zabo, 2013). Their roles extend to course management, teacher training, and access to scientific information (Gérard & Roegiers, 2009), while also promoting cultural awareness, societal values, equity, and pedagogical supervision (Quebec Commission on Educational Materials, 2002). Despite

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potential limitations—such as reduced collaborative engagement or restrictive influence on teaching methods (Van Boxtel, Van der Linden, &Kanselaar, 2000; Cook & Tulip, 1992)—textbooks remain indispensable structuring tools (Choppin, 1980).

High-quality textbooks combine scientific accuracy with pedagogical effectiveness. They must provide reliable, curriculum-aligned content, clear explanations, and exercises fostering autonomy, motivation, and knowledge construction (Jimmy Pierre Louis, 2018). Coherent learning sequences, syntheses, contextualized problems, multidisciplinary development, legal compliance, and cultural inclusivity are also essential. These criteria informed the development of the analysis grid and the teacher questionnaire used in this study.

II. RESEARCH METHODOLOGY

This research employs a qualitative design combining content analysis of two first-year secondary physics textbooks in Lebanon—the CRDP national textbook (1998) and a widely used private textbook (2011)—with a survey of 106 teachers. Analysis grids evaluated didactic, pedagogical, disciplinary, material, and socio-cultural dimensions, validated by four teachers and clarified through follow-up telephone interviews. The questionnaire collected teachers' perceptions of textbook functions, characteristics, and influence on teaching and learning practices.

III. TEXTBOOK ANALYSIS GRIDS[1]

To construct the textbook analysis grids, I collaborated with three experienced high school physics teachers. Each independently assigned scores to the different dimensions, based on the extent to which the element was present in the textbook or on their level of agreement with the proposed statement.The teachers' professional experience ranged from 6 to 40 years. All hold the C.A.P.E.S. diploma, two hold a master's degree, and one is pursuing a doctorate. Their established reputation among students and within the educational community adds credibility to their evaluations.

Scores were given on a scale from 0 to 3: 0 indicating the absence of the dimension or complete disagreement, and 3 reflecting full agreement.

A- General View		
	National School Textbook	Private School Textbook
Presence of a glossary/user guide to support easy navigation of concepts, laws, and results.	2	0
Availability of a teacher's guide or special teacher's edition.	2	1
The textbook is accompanied by a CD-ROM providing pre-designed activities, animations, simulations, and other instructional resources.	0	2
The textbook provides practical work (P.W.) sheets to guide experimental activities.	1	2
Sequences include concise, accurate summaries.	3	3
Key points to retain are clearly highlighted.	3	3
Summary of characteristics related to the textbook's overview. The maximum total score is 18 (6 × 3).	**11/18**	**11/18**
B- Formal Aspects		
	National School Textbook	Private School Textbook
Activities are temporally organized according to the curriculum schedule.	2	2
Illustrations and real-life diagrams are used to clarify concepts for learners.	2	2

[1] This grid originates from the collaborative work carried out with the participants of the seminars organized by the International Organization of La Francophonie (OIF) in Paris, Lyon, Montreal, and Yaoundé between 2006 and 2008.

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Instructions are precise and lead directly to expected tasks.	2	2
Pages clearly structured with pertinent titles and subtitles.	3	2
Includes authentic documentary studies.	2	1
Short section at the end of each chapter.	3	3
Formal aspects summary, maximum 18 points (6 × 3).	**14/18**	**12/18**
C- Preparatory Activities for the Introduction of Electricity Concepts		
	National School Textbook	Private School Textbook
Includes prerequisites and review of prior knowledge.	0	0
Problem situation introduced at the beginning to highlight the studied concept.	0	0
Textbook helps to concretize electricity concepts.	1	0
Summary of characteristics related to the textbook's preparatory activities. The maximum total score is 9 (3 × 3)	**1/9**	**0/9**
D- Teaching Activities		
	National School Textbook	Private School Textbook
Presence of biographical notes about inventions and their inventors.	0	2
Reference to the history of electricity (epistemological).	0	1
Well-developed objectives classified into knowledge and skills.	0	1
Well-structured and coherent electricity chapters.	3	3
Illustrations (circuits, diagrams, images) are relevant to activities.	2	2
Includes Science-Info related to the studied concept.	0	1
Presence of tables with fundamental physical constants.	2	0
Lesson is preceded by experimental activities.	0	0
Presence of real circuit photos alongside diagrams.	1	1
Summary of classroom activities – maximum score: 27 (9 × 3).	**8/27**	**11/27**
E- Content – Subject Matter		
	National School Textbook	Private School Textbook
Learning content aligns with curriculum requirements.	3	3
Content follows a logical progression of concept classification.	3	3
Content is free of disciplinary errors.	3	3
Respects the cognitive and psychological development of students.	2	3
Content includes transversal or longitudinal repetitions.	2	2
Respects previously acquired skills of learners.	2	2
Content includes local examples familiar to learners.	0	0
Proposed scenarios are connected to learners' lived experiences.	0	0
Vocabulary is accurate and suitable for learners' level.	3	3
'Electric voltage' and 'current intensity' are clearly defined.	1	1
Proposed experiments effectively illustrate electricity concepts.	1	2
Proposed applications are realistic and based on credible quantities.	2	3
Homogeneity verification through dimensional analysis is applied in the textbook.	0	0
Analogy is introduced as an instructional approach to treat basic concepts in electricity.	1	1
The textbook includes exercises on the schematization of electrical circuits and their reciprocal representation.	0	0
Summary of the characteristics related to the 'Contents' of the textbook. The maximum total score is 45 (15 × 3).	**23/45**	**26/45**

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F- Pedagogical Dimensions		
	National School Textbook	Private School Textbook
Pedagogical and didactic approaches support learning as prescribed in the curriculum.	1	1
Textbook teaching situations help learners understand electricity concepts.	1	1
Electricity situations are connected to the learner's sociocultural environment.	0	0
Electricity situations in the textbook are realistic and doable.	2	3
Electricity situations in the textbook make sense to the learner.	1	1
Situations include different cognitive levels: knowledge, application, analysis, and synthesis.	2	1
Electricity situations in the textbook are appropriate to the content being taught.	2	2
Prior knowledge of learners is considered in the situations.	0	0
Situations give learners instructions to handle difficult tasks (e.g., series or parallel circuits).	1	1
Textbook includes self-assessment sections.	0	0
Textbook suggests approaches like competency-based, problem-based, and objective-oriented learning.	1	1
Sequences are clear and well-organized.	2	2
Overview of pedagogical dimensions – maximum score: 36 (12 × 3).	**13/36**	**13/36**

IV-INTERPRETATION OF THE RESULTS OF THE TEXTBOOK ANALYSIS GRID

This study did not aim to compare the two analyzed textbooks or to emphasize their differences. Rather, it highlights the utility of a didactic and epistemological analysis grid based on clearly defined indicators. Such a framework provides teachers, coordinators, and school administrators with a tool for critically evaluating textbook selection and use.

The results showed substantial consistency in the evaluations provided by the four participating teachers. Most ratings were identical, with only two items producing notable discrepancies. These differences were resolved through discussion, resulting in consensus.

Overall, the analysis revealed considerable similarities between the two textbooks. The presentation of electricity concepts was generally satisfactory, and the scientific content was deemed acceptable. However, pedagogical aspects—such as the structuring of sequences and preparatory didactic activities for concept introduction—were less effective, leading to weaker outcomes in these areas.

V- RESULTS OF A QUESTIONNAIRE (REMOTE) ADMINISTERED TO LEBANESE SECONDARY SCHOOL TEACHERS ON PHYSICS TEXYBOOKS, WITH A FOCUS ON ELECTRICITY

The study combined a didactic and epistemological textbook analysis with a teacher survey to examine physics textbook use in Lebanese secondary schools. The grid analysis, conducted by four teachers, revealed substantial agreement: both textbooks presented electricity concepts satisfactorily, and the scientific content was generally acceptable, but pedagogical aspects—such as the structuring of sequences and preparatory activities—were less effective. The questionnaire, completed by 106 teachers, showed that 73% use the National Textbook developed by the Center for Educational Research and Development (CERD), with some private schools adopting it more recently due to the 2019 economic crisis. Moreover, 57% of teachers in private institutions did not participate in textbook selection, which was typically decided by school administrators or subject coordinators. These findings highlight the importance of structured evaluation frameworks and teacher involvement to optimize textbook use and improve learning outcomes.

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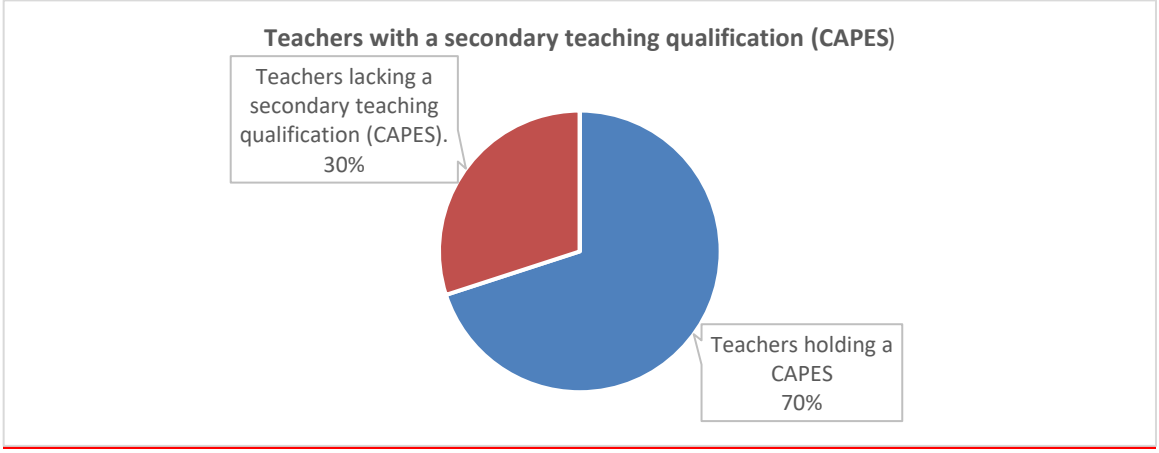
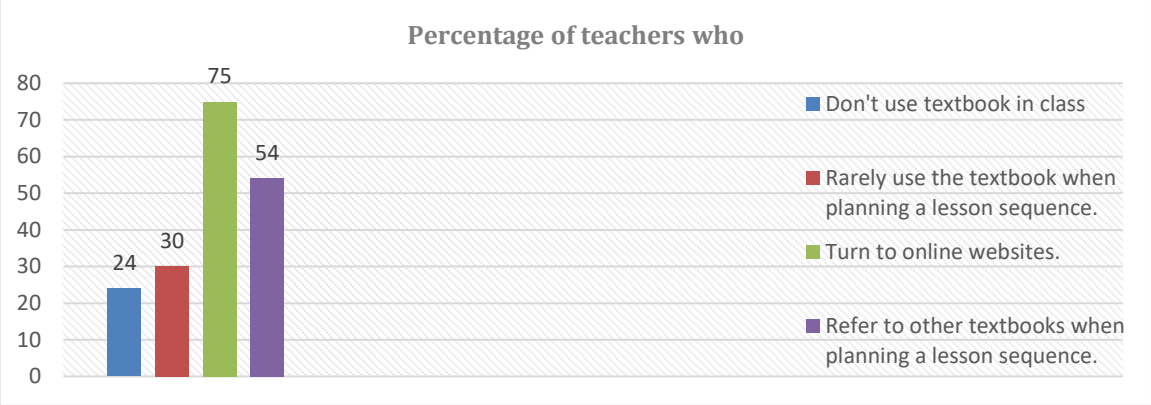


The survey also indicated that 70% of physics teachers have a professional teaching qualification for secondary education, and 86% have more than ten years of teaching experience.



Analysis of the questionnaire responses revealed that 24% of teachers do not use the textbook in class, while 30% consult it only occasionally when preparing teaching sequences. Instead, these teachers frequently rely on websites (75%) and, to a lesser extent, other textbooks (54%) to design sequences, laboratory worksheets, and exercise sets. These findings suggest that teachers actively seek to adapt and renew the instructional activities proposed in the adopted textbooks.The study also indicates that the teacher's guide is underutilized: 46% of respondents reported never consulting it when preparing physics sequences for the first year of secondary education. This limited use may reflect the fact that the curriculum, textbooks, and teacher guides have not been updated for several years.

Finally, 60% of physics teachers considered that the textbook alone does not provide an adequate reference for teaching the fundamental concepts of elementary electricity in the first year of secondary education. These results underscore the need for more effective pedagogical support and regular updates of teaching resources to enhance the instruction of key concepts.

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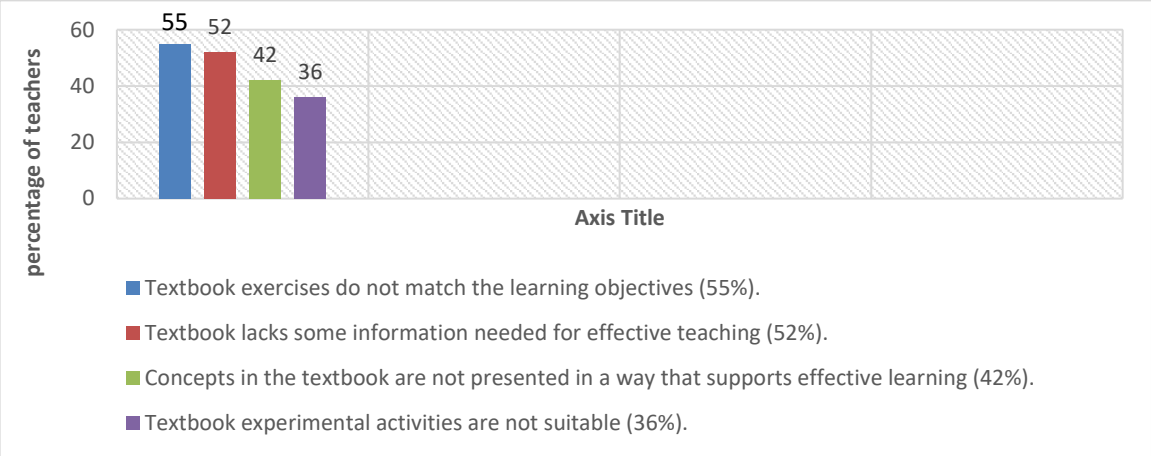
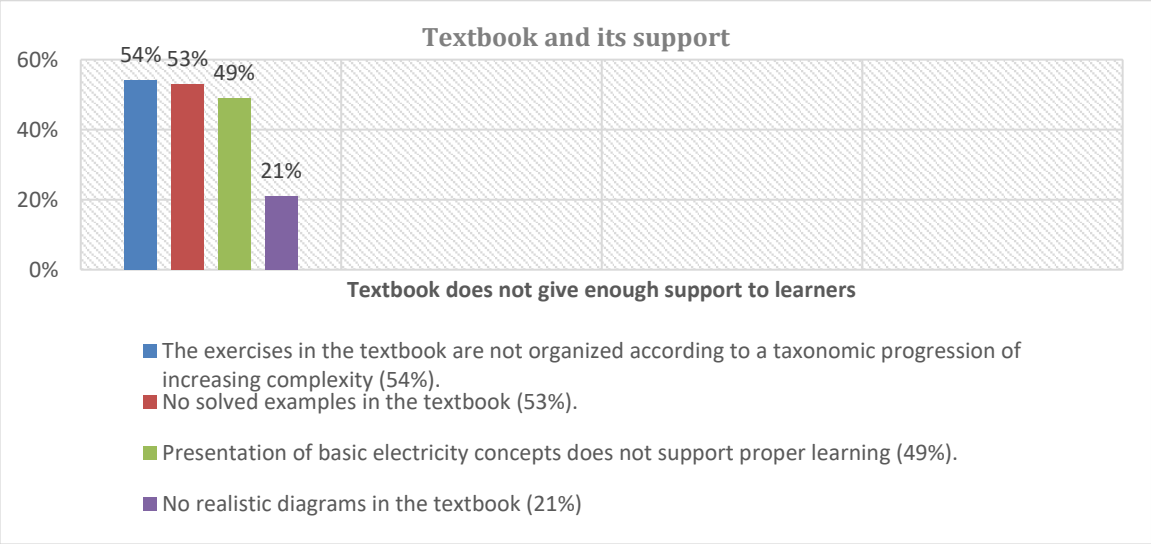


The findings highlight notable shortcomings in the physics textbooks used in Lebanese secondary schools. A considerable proportion of teachers reported that the exercises do not fully align with the intended learning objectives (55%), the content lacks essential information for effectively teaching elementary electricity (52%), and the presentation of concepts does not support long-term learning (42%). Experimental activities were also judged inadequate by 36% of respondents. Furthermore, more than half of the teachers noted the absence of innovative practices, such as digital laboratories or computer-assisted experiments (57%), and emphasized that the textbooks provide insufficient support for learners (53%).



According to the teachers who responded to the questionnaire, the physics textbook used in class does not provide sufficient support for learners for several reasons. First, the exercises are not organized according to a taxonomic progression of increasing complexity (54%) and the textbook does not include solved sample exercises (53%). Additionally, the presentation of fundamental concepts of elementary electricity does not promote appropriate learning (49%), and the textbook lacks realistic diagrams (21%).

Furthermore, regarding the content, most teachers (84%) believe that the textbook emphasizes activities focused on practical application rather than on analytical reasoning, thereby limiting the development of learners' analytical skills.

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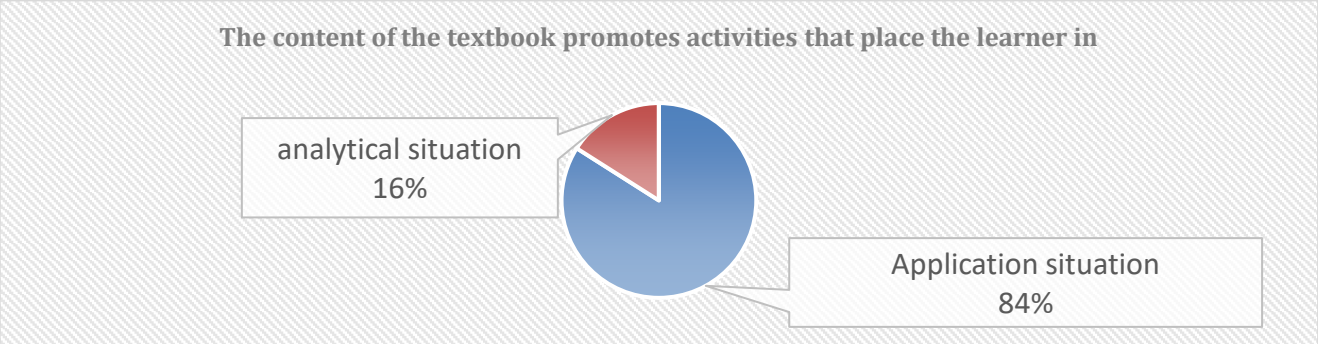


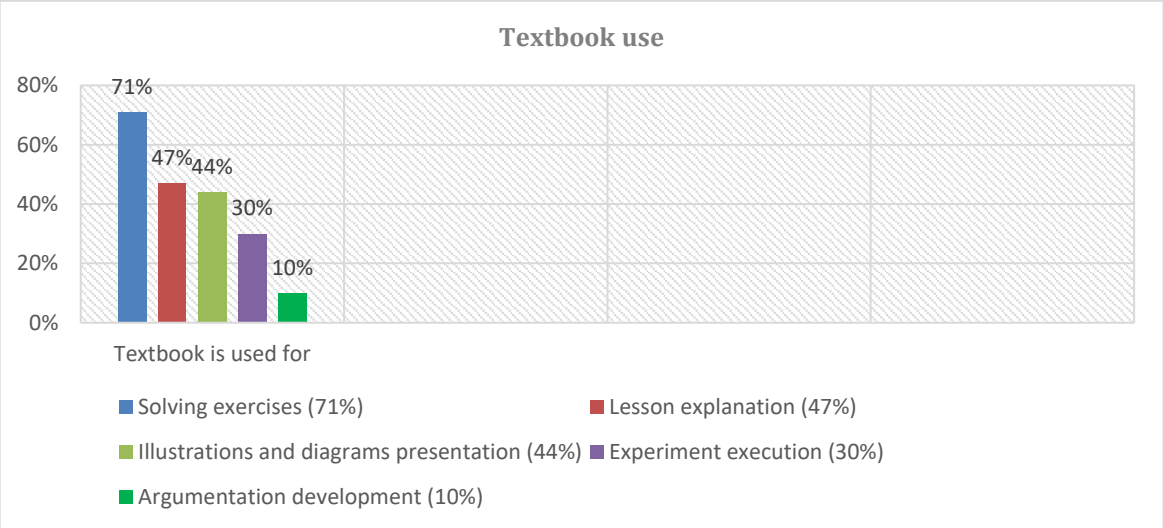
According to the questionnaire responses, 77% of teachers reported that the activities proposed in the textbook do not enable students to engage in genuine scientific inquiry. This finding underscores the need for teaching strategies that emphasize investigation, the scientific method, and the development of critical thinking and scientific curiosity.

Regarding the presentation of fundamental concepts in elementary electricity, two-thirds of teachers indicated that the textbook's approach is not optimally aligned with the intended learning outcomes. Specifically, 67% of teachers noted that the presentation of electric voltage is insufficient to support learning that allows students to analyze and synthesize related situations. Defining voltage merely as electric potential difference may hinder comprehension, as students may not have a sufficiently solid understanding of the concept of electric potential. Similarly, 60% of teachers reported that the presentation of electric current and current intensity is inadequate for promoting analytical and synthetic reasoning in both textbooks studied.

Given that physics aims to understand, model, and explain natural phenomena and to study the world around us, 60% of teachers indicated that textbook activities fail to clarify concepts or connect them with real-life contexts. Students frequently ask questions such as, "What is the use of this?" or "Where will we apply this knowledge?"

Furthermore, 78% of teachers noted that the textbook does not accommodate differentiated pedagogy. It lacks multiple approaches for assimilating information, and its activities are not sequenced according to a progression of increasing complexity. Slower learners or students encountering difficulties cannot progress at their own pace, and there are few solved exercises to support problem-solving skills. Conversely, advanced exercises or challenges for more capable learners are largely absent.

Finally, the study revealed that teachers primarily use the textbook for exercise resolution rather than for fostering deeper conceptual understanding or developing scientific reasoning skills.



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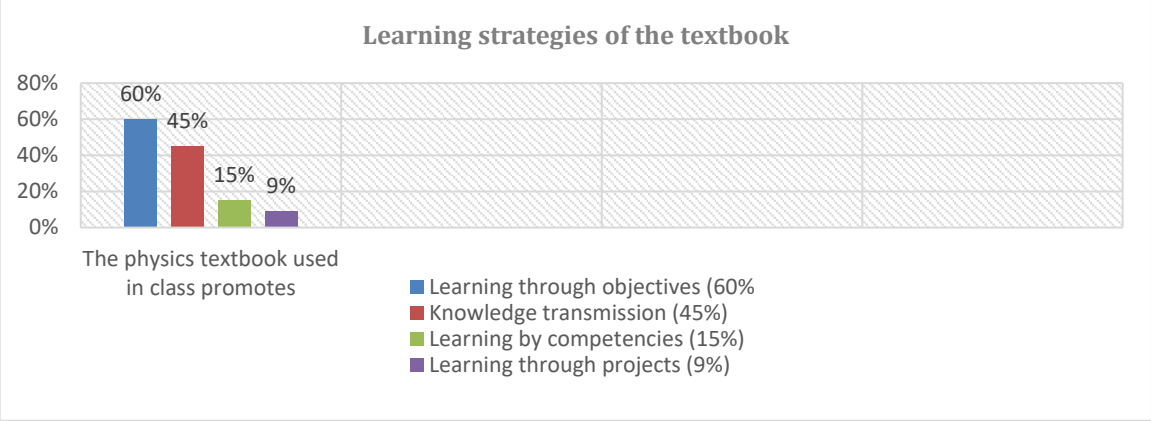
The questionnaire analysis shows that teachers primarily use the textbook for solving exercises (71%), lesson explanation (47%), presenting illustrations and diagrams (44%), conducting experiments (30%), and developing argumentation (10%).

Most teachers (78%) reported that the textbook does not support learner autonomy or self-directed learning, as its presentation of electricity concepts is unclear and it lacks resources for individualized learning. Although 81% refer to laboratory activities to teach elementary electricity, 68% noted that the textbook does not require lab use, and 59% considered the proposed activities unsuitable for hands-on practice.

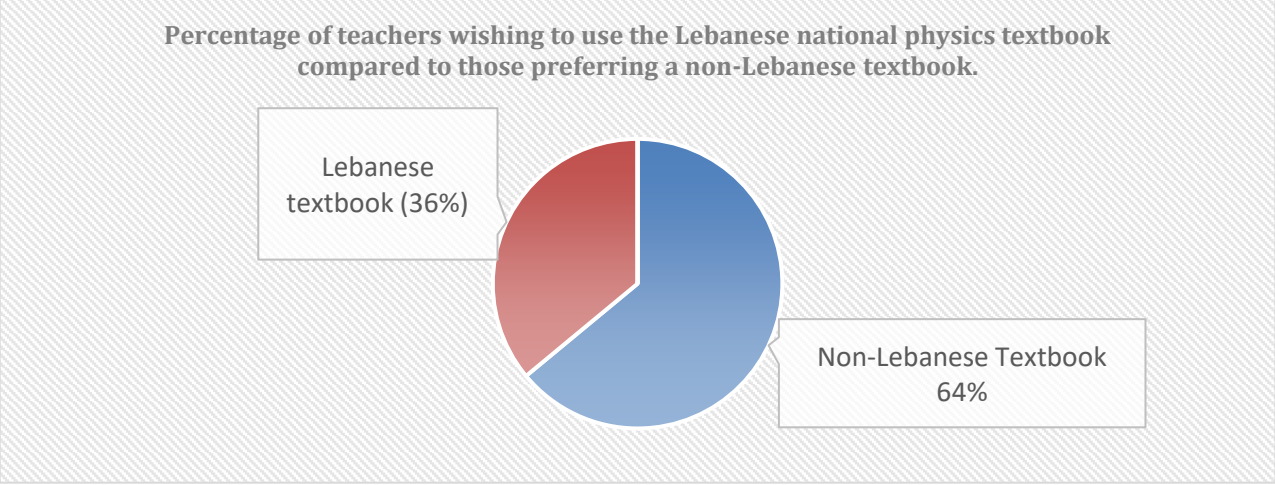
Nevertheless, 46% of teachers agreed that the teaching situations in the textbook can convey the knowledge prescribed in the curriculum.

Teachers also observed that the textbook primarily promotes a learning-by-objectives approach.



Sixty percent of teachers indicated that the textbook primarily promotes learning by objectives, while 45% reported that it favors knowledge transmission over other learning strategies. Only 15% of teachers observed that the adopted textbook supports competency-based learning, and 9% endorsed the project-based learning approach.

It is also noteworthy that 73% of the teachers who participated in the questionnaire expressed a preference for replacing the currently adopted textbook in their institution.



Sixty-four percent of Lebanese teachers who participated in the questionnaire opted for a non-Lebanese textbook. This suggests that teachers prefer changes in the curriculum, teaching strategies, and even the content.

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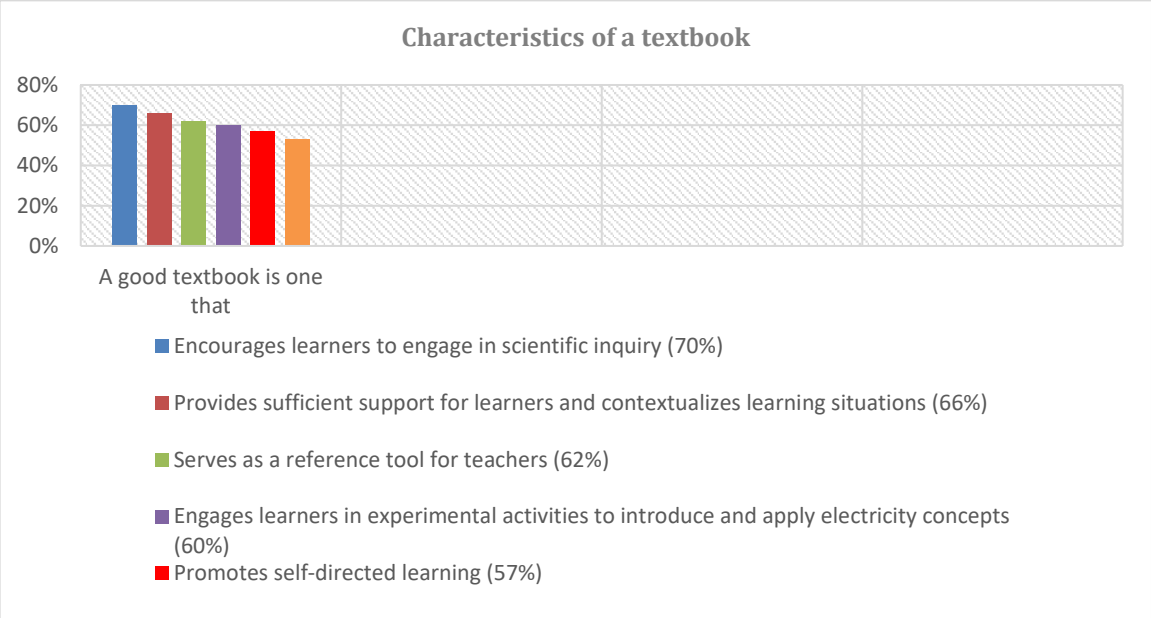
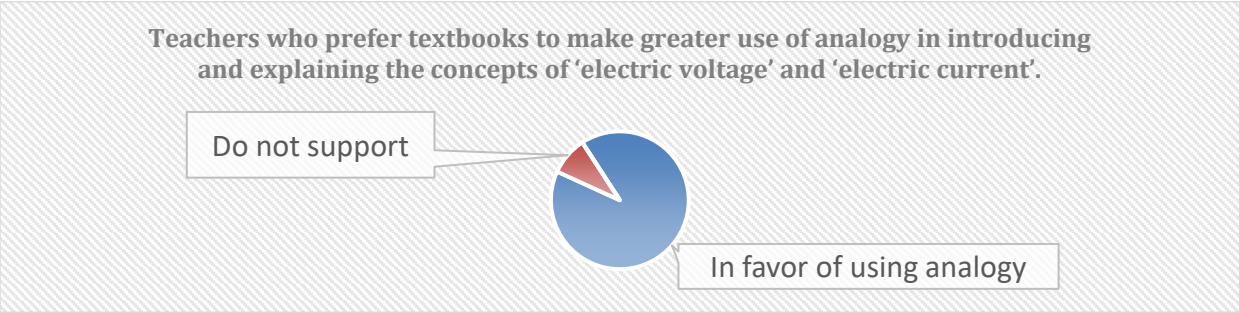


Considering the characteristics of a textbook, 70% of the teachers who participated in the survey consider that a good textbook is one that encourages learners to engage in scientific inquiry. Sixty-six percent favor a textbook that provides sufficient support for learners and contextualizes learning situations by relating them to everyday life. Sixty-four percent believe that a good textbook promotes the development of analytical skills more than application skills. In addition, 62% of teachers indicate that an effective textbook serves as a reference tool for teachers, while 60% prefer a textbook that includes experimental activities to introduce and apply electricity concepts. Fifty-seven percent support a textbook that promotes self-directed learning, and 53% value one that provides innovative activities. Finally, among all the characteristics examined, the use of analogy in teaching basic electricity concepts received the highest percentage of responses.



The analysis of the responses indicates that 91% of teachers prefer textbooks to make greater use of analogy when introducing and explaining basic electricity concepts, particularly to clearly differentiate between "electric voltage" and "electric current." This high percentage is likely due to the abstract and complex nature of these concepts.

Overall, most teachers report using the adopted textbook only rarely, considering it insufficient in terms of both the information provided and the exercises offered. The textbook does not introduce pedagogical innovations and places learners primarily in application-based situations rather than in analytical or investigative ones. Many teachers express dissatisfaction with the presentation of fundamental electricity concepts, such as "electric voltage," "electric current," and "current intensity."

From the teachers' perspective, the textbook is most often used for solving exercises. Its activities are not consistently linked to learners' everyday experiences and do not always follow a progressively increasing taxonomic order. Most teachers also believe that the textbook does not adequately support self-directed learning of basic electricity concepts.

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Finally, nearly all surveyed teachers express a desire to replace the currently adopted textbook, preferring a non-Lebanese textbook.

VI- CONCLUSION AND RECOMMENDATIONS

This study conducted a didactic and epistemological analysis of textbooks used for teaching physics at the Lebanese secondary level. The objective was not to resolve the pedagogical and didactic issues associated with these textbooks, but rather to identify their shortcomings and propose avenues for reflection and potential solutions.

The findings indicate that textbooks can act as barriers to learning certain basic electricity concepts due to the lack of explicit links between the content presented and the real physical world. The dominant pedagogical approach in the two analyzed textbooks is the objectives-based approach, which negatively affects the overall coherence of sequences as well as that of individual sequences.

The scarcity of research on textbooks limits the analysis of proposed activities and the identification of recommended pedagogical methods. This study offers a pathway to improve evaluation grids and promote a more harmonized approach within a research group. Such an approach could facilitate the comparison of decisions and judgments, thereby enriching textbook analysis.

Moreover, it appears that teachers expect textbooks to provide activities and teaching approaches that are easily usable, align with their views on teaching and learning, and reduce their preparation workload. As Martinand (1985) emphasizes, teaching strategies are not limited to questions about the main subjects and concepts, but also involve considerations of learners' behavior, the problems they will address, and changes in their attitudes toward the physical world.

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