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Research Article

Recontextualizing curriculum reform into teachable algebra in a Greek grade 10 textbook

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ABSTRACT

This article examines how curriculum reform in grade 10 algebra is transformed into student-facing textbook material in Greece. It analyses one newly approved textbook in relation to the new mathematics curriculum and its official teacher guide. The study uses qualitative document analysis in two phases. First, four approved textbooks were mapped to identify a focal case for close analysis. Second, four sequences from the selected textbook were analysed: identities and factorization, quadratic equations and inequalities, functions, and quadratic functions. The findings show that the textbook turns broad curriculum orientations into a tightly sequenced algebraic pathway. Algebra is organized mainly through symbolic transformation, equation-based reasoning, coordination of representations and guided problem-solving. The discriminant serves as a recurring organizer that connects quadratic equations, inequalities and functions, while graphical work extends symbolic activity towards functional interpretation. The textbook also provides strong pedagogic mediation through definitions, observations, worked examples, graded tasks and bounded opportunities for justification and modelling. The article contributes to curriculum and textbook research by showing how reform intentions are made teachable through the organization of content, tasks, representations and guidance. The study concerns textbook design rather than classroom enactment.

Keywords: curriculum reform, textbook analysis, algebra education, recontextualization, teachable knowledge, Greek mathematics education

INTRODUCTION

Curriculum reform in school mathematics is articulated in official curriculum documents and becomes student-facing through the resources that organize curriculum intentions into teachable material. Mathematics textbooks are especially important in this process because they select, sequence, explain and exemplify mathematical content before classroom enactment occurs (Fan et al., 2013; Rezat, 2006; Valverde et al., 2002). In periods of curriculum renewal, textbook analysis can therefore show how broad curricular aims are transformed into student-facing mathematical work.

The present study focuses on grade 10 algebra in Greece. The case is analytically significant because the new mathematics curriculum (Institute of Educational Policy, 2022) is accompanied by an official teacher guide (Zachariadis et al., 2022) and by a new corpus of approved algebra textbooks for upper secondary education (Gavrilis et al., 2026; Lambropoulos et al., 2026; Rekoumis et al., 2026; Vakalopoulos & Vrontakis, 2026). It is also situated within the Greek ‘multiple textbook’ policy, which places textbooks and related resources within the implementation of curriculum reform (Institute of Educational Policy, 2021). This setting makes the internal organization of a newly approved textbook a relevant site for examining how curriculum intentions acquire concrete pedagogic form.

Grade 10 algebra is a productive site for examining this process because it brings together symbolic transformation, equations, inequalities, functions, representations, reasoning and modelling (Bråting, 2023; Davis et al., 2014; Hemmi et al., 2021). Textbooks can organize these strands in different ways, foregrounding algebra as procedural fluency, structural reasoning, functional thinking, modelling, or coordinated representational work (Huntley et al., 2024; Sönnerhed, 2021; Wang & Lu, 2018). Analysing a grade 10 algebra textbook can therefore show which version of school algebra is made available to students within a reform context.

Against this background, the article analyses one newly approved Greek grade 10 algebra textbook as a curriculum artefact. It examines how the textbook transforms the new mathematics curriculum and the official teacher guide into student-facing algebra sequences, explanations, worked examples, representations and tasks. The analysis focuses on the designed pedagogic organization of the textbook rather than on classroom enactment.

Mathematics Textbooks as Curriculum Resources

Textbook research provides a methodological basis for examining textbooks as materialized curriculum rather than as neutral carriers of topics. In the TIMSS tradition, textbooks are treated as part of the potentially implemented curriculum because they organize curriculum expectations into content, examples, tasks and opportunities to learn (Valverde et al., 2002). Reviews of textbook research similarly show that mathematics textbooks can be analysed in terms of content organization, pedagogic design, cross-system comparison and textbook use (Fan et al., 2013).

This view directs attention to the internal organization of textbooks. Chapter structure, section order, explanatory voice, worked examples, task sequences, forms of justification and representational choices shape the mathematical work made available to students. Rezat's (2006) analysis shows that textbooks often contain recurrent microstructures, such as introductory tasks, exposition, worked examples and exercises, which can function as spatially fixed versions of idealized lessons. In this study, such structures are treated as analytic evidence of how algebra is organized for teaching before classroom enactment.

Curriculum-resource research adds an important boundary to this analysis. Teachers interpret and adapt curriculum materials in active ways, and textbook design cannot be equated with classroom enactment (Remillard, 2005). At the same time, curriculum resources have structures, representations and design features that can support or constrain pedagogic work (Rezat et al., 2021). The present study therefore examines the pedagogic possibilities and constraints inscribed in the student-facing textbook, without making claims about how teachers or students use the material in classrooms.

The official teacher guide is relevant because it provides a pedagogic reading of the new curriculum. Research on teacher guides shows that they can support lesson planning, mathematical interpretation, attention to student strategies and links between curriculum principles and classroom activity (Ahl et al., 2015; Jukić Matić & Glasnović Gracin, 2021). At the same time, teachers work with wider resource systems that may include curriculum documents, textbooks, digital materials, social resources and professional knowledge (Gustafsson et al., 2024). Accordingly, the teacher guide is treated as part of the curricular context against which the selected textbook's student-facing organization is analysed.

Algebra Textbooks, Recontextualization, and Pedagogic Mediation

Didactic transposition and recontextualization provide the theoretical frame for analysing how algebraic knowledge becomes textbook knowledge. Didactic transposition concerns the selection, adaptation and reorganization of mathematical knowledge for teaching. Kang and Kilpatrick (1992) are particularly relevant here because they treat textbooks as visible sites where school mathematics is declared, preserved and pedagogically reshaped. In this study, recontextualization refers to the movement from curriculum intentions and the pedagogic orientations of the teacher guide to the student-facing organization of algebraic content, examples, representations and tasks.

Algebra textbook analysis needs to consider topic inclusion together with the organization of algebraic activity. Comparative curriculum and textbook studies show that algebra may be framed through different emphases, including symbolic manipulation, functional thinking, verbal reasoning, everyday contexts, learning trajectories, representations, worked examples and task types (Bråting, 2023; Hemmi et al., 2021; Huntley et al., 2024; Sönnerhed, 2021; Wang & Lu, 2018). Textbooks may cover similar algebraic content while constructing different opportunities for students to work with that content. This study therefore examines how selected algebraic topics are transformed into a structured pedagogic pathway.

In the present study, teachability is examined through five textbook features: sequencing, worked examples, exercises, explanatory passages and representations. Sequencing shows how prior knowledge, formalization, application and explanation are ordered. Worked examples model legitimate techniques and forms of mathematical communication. Exercises define expected student activity. Explanatory passages and representations indicate how algebraic procedures are supported, justified and connected across symbolic, graphical, numerical, verbal and contextual forms.

Pedagogic mediation is used here to describe how the textbook guides students' access to algebraic knowledge through explanations, representations, worked examples and tasks. This guidance matters because student activity is shaped by the topics included and by the ways in which techniques, reasoning and justification are made available in the material. Research on reasoning-and-proving in algebra textbooks shows that opportunities for patterning, conjecturing, argumentation and justification may appear unevenly across exposition and tasks (Davis et al., 2014). The analysis therefore examines how the selected textbook connects rule use and technique execution with opportunities for reasoning and justification.

Praxeological textbook analysis also informs the operational analysis of tasks and justification. Studies drawing on the Anthropological Theory of the Didactic examine task types, techniques, technologies and theories, and show how textbook sequences may strengthen or weaken explanatory and justificatory connections (Strømskag & Chevallard, 2024; Yunianta et al., 2023). In this study, this literature is used as a sensitizing frame for analysing how tasks, techniques, explanations, representations and forms of justification organize algebraic knowledge in the selected textbook.

Research Gap

Existing research provides strong conceptual and methodological resources for studying mathematics textbooks. It shows that textbooks mediate curriculum, organize opportunities to learn, embody pedagogic models, and offer particular forms of mathematical activity to students. It also provides established approaches for analysing algebra content, textbook sequencing, task design, reasoning opportunities, teacher guides, and curriculum resources.

Current textbook research has not yet examined the newly approved Greek grade 10 algebra textbook corpus, or a selected case within it, as material through which the new mathematics curriculum and its official teacher guide are recontextualized into student-facing algebra. This gap is significant because the current Greek reform brings together a new curriculum, an accompanying teacher guide, newly approved textbooks and a policy movement towards multiple textbooks and digitally connected instructional resources. In this setting, the central issue is how a newly approved textbook transforms curricular intentions and pedagogic orientations into a structured version of teachable algebra.

The study makes three contributions to mathematics education research. Empirically, it provides a document-based case analysis of how a newly approved Greek grade 10 algebra textbook organizes curriculum reform into student-facing algebraic work. Methodologically, it shows how textbook recontextualization can be examined through a two-phase design that combines preliminary corpus mapping with close sequence-level analysis of sequencing, explanations, worked examples, representations, tasks and forms of justification. Theoretically, it connects didactic transposition, textbook research and pedagogic mediation to conceptualize the textbook as a site where curriculum intentions become a structured form of teachable algebra. These contributions are limited to textbook design and do not make claims about classroom enactment.

Table 1. Textbook corpus used in the preliminary comparative mapping

Label	Textbook included in the preliminary mapping
Textbook A	Vakalopoulos, K., & Vrontakis, E. (2026). *Álgevra. A´ lykeíou* [Algebra. Grade 10]. Computer Technology Institute and Press 'DIOPHANTUS'.
Textbook B	Gavrilis, K., Poulou, M. E., Baralos, G., Filippakis, M., Tasos, N., Malliaris, C., Nestoridis, V., & Motsakos, V. (2026). *Álgevra. A´ lykeíou* [Algebra. Grade 10]. Computer Technology Institute and Press 'DIOPHANTUS'.
Textbook C	Lambropoulos, T., Manias, D., Lampropoulou, D., & Lampropoulos, N. (2026). *Álgevra (genikí paideía). A´ lykeíou. Vivlío mathití/mathítrias* [Algebra (general education). Grade 10. Student book]. Computer Technology Institute and Press 'DIOPHANTUS'.
Textbook D	Rekoumis, K., Katsapas, L., Koumantos, N., & Rekoumis, E. (2026). *Álgevra. A´ lykeíou* [Algebra. Grade 10]. Computer Technology Institute and Press 'DIOPHANTUS'.

Research Questions

Main research question

How does the selected newly approved Greek grade 10 algebra textbook recontextualize the new mathematics curriculum and the official teacher guide into a pedagogically organized form of teachable algebra?

Sub-question 1

How are the aims, expected learning outcomes, and pedagogic principles of the new curriculum and the official teacher guide transformed into the textbook's sequencing, explanatory structure, examples, representations, and task design?

Sub-question 2

What forms of mathematical work and pedagogic mediation are privileged in this recontextualization, and what version of algebra learning is made available in the student-facing textbook material?

METHODS

Case Selection

The study followed a two-phase qualitative document-analysis design. The first phase consisted of a preliminary comparative mapping of the four newly approved grade 10 algebra textbooks developed for use in Greek upper secondary education. This mapping served the restricted methodological purpose of identifying a focal case for intensive analysis. Its function was analytic and selective, rather than evaluative. The scores reported below therefore document the grounds for case selection and should not be read as a general ranking of the approved materials (Fan et al., 2013; Zeynivandnezhad et al., 2024).

Table 1 identifies the four textbooks included in the preliminary mapping. The labels A-D are used only to make the comparative audit trail readable. The textbooks are nevertheless reported through their bibliographic references, because they constitute the empirical corpus of the study.

The preliminary mapping was conducted through a structured protocol derived from the new mathematics curriculum, the accompanying teacher guide, and research on mathematics textbooks and curriculum resources. The protocol treated textbooks as curriculum artefacts through which curricular intentions may become visible in material form (Fan et al., 2013; Rezat, 2006; Rezat et al., 2021; Valverde et al., 2002). It examined fifteen criteria, organized for reporting purposes into three analytic dimensions. The first dimension concerned curriculum alignment and textbook architecture. The second concerned the transformation of algebra into teachable mathematical work. The third concerned pedagogic mediation and instructional support (**Table 2**).

Because the first phase served case selection, the protocol was designed as a transparent qualitative mapping device rather than as a standardized measurement instrument. This approach is consistent with qualitative document analysis, where documentary evidence is examined through explicit analytic categories and interpreted in relation to the research purpose (Bowen, 2009; Zeynivandnezhad et al., 2024). The fifteen criteria were selected to correspond to the study's theoretical and empirical focus. D1 established whether

Table 2. Analytic dimensions and criteria used in the preliminary mapping protocol

Dimension	Focus of the dimension	Criteria included
D1	Curriculum alignment and textbook architecture	C1 Alignment with expected learning outcomes and central curricular ideas, C2 content selection, C3 internal learning sequence, C4 conceptual coherence, C8 praxeological completeness
D2	Mathematical recontextualization and teachable algebra	C5 mathematical practices, C7 task openness and variability, C9 reasoning and proof, C10 multiple representations and representational transitions, C11 explicit modelling
D3	Pedagogic mediation and instructional support	C6 socio-cultural visibility and mathematical literacy, C12 digital resources, C13 multiple entry points and graded difficulty, C14 formative assessment and feedback, C15 visibility of instructional management

Table 3. Operational scoring scale for the preliminary mapping protocol

Score	Operational meaning
0	The criterion is absent or only marginally visible
1	The criterion appears in isolated or weakly developed form
2	The criterion is clearly present, although not consistently integrated
3	The criterion is systematically integrated into the organization of the unit

each textbook provided sufficient alignment with the reform context and a coherent textbook architecture. D2 examined how algebraic content was transformed into teachable mathematical work. D3 examined the forms of pedagogic mediation and instructional support through which this work was made accessible to students. The scores therefore functioned as ordinal descriptors of visibility and integration within the textbook material, not as weighted indicators of general textbook quality.

Each criterion was scored on a four-point ordinal scale from 0 to 3 (**Table 3**). The scale was chosen because it distinguished four levels of documentary visibility: absence, isolated presence, clear presence and systematic integration. A score was assigned only when the relevant feature could be identified in the comparable textbook unit through textual indicators such as stated aims, explanatory passages, worked examples, task design, representations, prompts, digital or supplementary links, or connections with prior knowledge. Each score was accompanied by short textual evidence. The scores therefore summarized qualitative evidence in a structured form. They were not treated as interval data, were not subjected to statistical analysis and were used only to support a transparent audit trail for case selection.

To ensure comparability, the preliminary mapping was applied to a thematically comparable algebraic unit in each textbook, centred on algebraic expressions, identities and algebraic transformation. After the first application of the protocol, four criteria were re-examined with stricter operational definitions, namely task openness and variability, explicit modelling, multiple entry points and graded difficulty, and formative assessment and feedback mechanisms. These criteria were revisited because they were especially sensitive to over-inclusive coding. In the stricter scoring, task variety was not treated as openness unless the task allowed more than routine execution. An application was not treated as modelling unless it involved explicit mathematization and interpretation. Graded exercises were not treated as multiple entry points unless they offered substantively different ways into the mathematical activity. Additional practice was not treated as formative feedback unless it embedded self-check, feedback or reflection. This recalibration functioned as an internal consistency check on the qualitative coding and aligned the protocol more closely with the study's theoretical concern with recontextualization, curriculum coherence and pedagogic mediation. It ensured that higher scores reflected integrated textbook features rather than broad or over-inclusive interpretations of the criteria (Bosch & Gascón, 2006; Chevallard, 1989; Schmidt & Prawat, 2006).

Table 4 presents the criterion-level scores produced after this stricter recalibration of the preliminary mapping. The compact format is intentional, so that **Table 4** can be included in the manuscript without becoming visually unmanageable. The full criterion labels are provided in **Table 2**.

The zero score for C11 refers only to the thematically comparable unit used in the preliminary mapping, which was centred on algebraic expressions, identities and algebraic transformation (**Table 4**). It should not be read as a claim that modelling is absent from the whole textbook. Modelling is examined in the intensive phase, where the focal corpus includes the later sequence on quadratic functions, sign analysis, and modelling and problem solving with first- and second-degree functions.

Table 4. Criterion-level scores from the recalibrated preliminary mapping of the four grade 10 algebra textbooks

Criterion	Dimension	Textbook A	Textbook B	Textbook C	Textbook D
C1 Alignment with expected learning outcomes	D1	1	3	2	2
C2 Content selection	D1	2	3	3	2
C3 Internal learning sequence	D1	2	3	2	1
C4 Conceptual coherence	D1	2	3	3	2
C5 Mathematical practices	D2	1	2	2	1
C6 Socio-cultural visibility and mathematical literacy	D3	1	1	1	0
C7 Task openness and variability	D2	3	1	3	2
C8 Praxeological completeness	D1	2	3	3	2
C9 Reasoning and proof	D2	1	3	2	1
C10 Multiple representations and transitions	D2	2	2	2	1
C11 Explicit modelling	D2	0	0	0	0
C12 Digital resources	D3	0	1	2	0
C13 Multiple entry points and graded difficulty	D3	3	1	3	2
C14 Formative assessment and feedback	D3	2	0	2	1
C15 Visibility of instructional management	D3	1	2	2	1

Note. Scores range from 0 to 3 and were used as a qualitative mapping device for case selection, not as a psychometric measurement scale or as a general evaluation of textbook quality

Table 5. Dimension-level profile of the recalibrated preliminary mapping scores

Dimension	Textbook A	Textbook B	Textbook C	Textbook D
D1 Curriculum alignment and textbook architecture	9	15	13	9
D2 Mathematical recontextualization and teachable algebra	7	8	9	5
D3 Pedagogic mediation and instructional support	7	5	10	4

Note. D1 refers to curriculum alignment and textbook architecture, D2 to mathematical recontextualization and teachable algebra, and D3 to pedagogic mediation and instructional support

The dimension-level profile clarifies the basis of the case-selection decision (**Table 5**). Textbook B received the highest D1 score for curriculum alignment and textbook architecture. Textbook C (Lambropoulos et al., 2026) remained close in D1 and received the highest scores in the two dimensions most directly connected with the research question, namely the transformation of algebra into teachable mathematical work and the pedagogic mediation of that work.

The preliminary mapping therefore produced a documented comparative audit trail for case selection. Textbook C (Lambropoulos et al., 2026) offered the most analytically suitable case for the purposes of the present study. Its selection was grounded in the combination of sufficient curriculum alignment, clear evidence of algebraic recontextualization, and extensive forms of pedagogic mediation. These features made Textbook C suitable for examining the movement from official curriculum expectations to student-facing algebraic work within one coherent textbook case.

This selection should be read as an analytic judgement about suitability for the research question. It does not imply that Textbook C (Lambropoulos et al., 2026) is pedagogically superior in general terms. The textbook provided a concentrated site for examining how curriculum intentions are recontextualized through sequencing, explanation, worked examples, task design, representational activity and forms of pedagogic guidance.

The other three textbooks remained relevant as comparative background for the selection of the focal case, while the intensive phase treated Textbook C (Lambropoulos et al., 2026) as the single focal case. This decision preserved the depth required by the research question. A full parallel comparison of all four textbooks would have shifted the study towards broad textbook evaluation. The adopted design combines preliminary comparative mapping with intensive single-case analysis, allowing the focal textbook to be situated within the wider reform context while enabling close analysis of the mechanisms through which curriculum becomes pedagogically organized school algebra.

Focal Corpus

The intensive phase focused on four purposefully selected textbook sequences from Textbook C. Their selection was guided by the research question and by the need to examine how different forms of algebraic activity are pedagogically organized within the textbook. The aim was to construct a coherent analytic corpus capable of capturing symbolic transformation, equation-based reasoning, representational organization, functional thinking, and modelling (Bråting, 2023; Davis et al., 2014; Hemmi et al., 2021; Huntley et al., 2024; Sönnerhed, 2021; Wang & Lu, 2018).

The first focal sequence comprised Sections 2.2.1 and 2.2.2, on identities and factorization-transformation of algebraic expressions. This sequence allowed close analysis of how symbolic transformation is constructed as teachable mathematical activity, moving from recognition of algebraic forms to the purposeful rewriting of expressions. The second focal sequence comprised Sections 2.3.5 to 2.3.9, on quadratic equations, reduction to quadratic equations, applications of quadratic equations, quadratic inequalities, and applications of quadratic inequalities. This sequence allowed the analysis to examine how formal solution techniques are connected with problem transformation, strategic choice, and interpretation of solutions.

The third focal sequence comprised Sections 2.4.1 to 2.4.5, on the concept of function, criteria for identifying functions, representations of functions, graphical representation, and the linear function. This sequence allowed the analysis to move from symbolic manipulation to functional thinking and representational coordination. The fourth focal sequence comprised Sections 2.4.7 to 2.4.9, on the quadratic function, the sign of the quadratic function, and modelling and problem solving with first- and second-degree functions. This sequence allowed the analysis to bring together algebraic form, graphical behaviour, sign analysis, and modelling.

These four focal sequences provided a focused and sufficiently varied corpus for analysing the recontextualization of the new curriculum into teachable algebra. They cover key movements within the textbook, from expression transformation to equation solving, from symbolic activity to representation, and from functional analysis to modelling. Other parts of the textbook, including the introductory chapter on numbers, the section on sets, the earlier material on first-degree equations and inequalities, and the trigonometric sections, were excluded from the intensive corpus because they would have broadened the analysis beyond the article's central concern with the pedagogic construction of algebra through transformation, equations, functions, and modelling.

Analytic Framework

The analytic framework connected the study's theoretical concern with curriculum recontextualization to the close analysis of textbook material. It drew on three bodies of literature. Work on didactic transposition and recontextualization supported the treatment of the textbook as a site where official curriculum is transformed into teachable school mathematics (Bosch & Gascón, 2006; Chevallard, 1989; Kang & Kilpatrick, 1992). Research on mathematics textbooks and curriculum resources supported attention to the textbook as a curricular artefact that orders mathematical content through explanations, examples, representations, tasks and forms of guidance (Remillard, 2005; Rezat, 2006; Rezat et al., 2021; Valverde et al., 2002). Research on algebra in textbooks supported attention to the algebraic work made available to students, including symbolic transformation, equation-based reasoning, functional thinking, modelling, justification, proof-related activity and coordination of symbolic, graphical, numerical and verbal representations (Bråting, 2023; Davis et al., 2014; Hemmi et al., 2021; Huntley et al., 2024; Sönnerhed, 2021).

These literatures were translated into three analytical dimensions for close coding. The first dimension, curricular recontextualization in textbook architecture, examined how official curricular and pedagogic intentions were materialized through sequence order, links with prior knowledge, explanatory development, worked examples, task groupings and representational progression. The second dimension, construction of teachable algebra, examined which forms of algebraic activity became visible and recurrent across the selected sequences. The third dimension, pedagogic mediation, examined how access to algebraic knowledge was guided through definitions, observations, worked examples, procedural steps, scaffolding, task openness, graded difficulty, questions and prompts, supplementary or digital supports where present, and implied roles for teacher and student.

The three dimensions were applied together to trace how the focal textbook organized knowledge, activity and guidance. This made it possible to examine curriculum reform in the concrete sequencing, examples, representations, tasks and forms of support through which algebra was made teachable in student-facing material.

Coding Procedure

The intensive analysis was conducted through close reading and iterative coding of the four selected textbook sequences (Fan et al., 2013; Yunianta et al., 2023; Zeynivandnezhad et al., 2024). Coding was organized around the three analytical dimensions described above, rather than applied as a general evaluative checklist (Zeynivandnezhad et al., 2024). For each sequence, the analysis focused on the textbook's micro-structure, including explanatory passages, definitions, stated mathematical propositions, worked examples, task sequences, representations, modelling prompts, references to prior knowledge, digital or supplementary links, and forms of pedagogic signalling.

Each sequence was first read as a complete pedagogic unit in order to identify its internal progression and its relation to the surrounding textbook structure. It was then examined at a finer textual level, with attention to how mathematical content was introduced, legitimized, exemplified, practised, extended, and connected to other forms of mathematical activity (Kang & Kilpatrick, 1992; Rezat, 2006; Yunianta et al., 2023). Evidence was recorded through page-referenced analytic notes, selected short excerpts where necessary, and memos linking textual features to the relevant analytical categories. Page references in the Results follow the textbook's internal pagination.

The procedure was deliberately evidence-based. Interpretive claims were not made from an overall impression of a unit, but from identifiable textual indicators such as the ordering of concepts, the framing of examples, the wording of tasks, the presence or absence of justification, the use of representations, and the type of guidance offered to students. Where analytic judgements were uncertain, the relevant passage or task sequence was re-read in relation to the full unit before the analytic note was finalized.

The preliminary mapping also informed the intensive coding. Criteria that had proved sensitive to over-inclusive coding, especially task openness, modelling, multiple entry points and formative feedback, were treated conservatively in the close analysis (Zeynivandnezhad et al., 2024). Task variety was not coded as openness unless it allowed more than routine execution, and an application was not coded as modelling unless it involved movement between a situation, a mathematical representation and interpretation of the result.

The purpose of this procedure was to produce a theoretically informed account of textbook mediation rather than a numerical evaluation of textbook quality. The coding therefore supported systematic analysis across the four selected sequences within Textbook C, while keeping the focus on how the textbook recontextualizes curriculum aims into teachable algebra through its organization of knowledge, tasks, representations, and pedagogic guidance. The Results report the features that generated recurrent evidence across the four focal sequences, while categories that appeared only marginally were retained in the coding record without being foregrounded as findings.

RESULTS

The findings follow the three analytical dimensions of the study. The first subsection examines how curriculum intentions are transformed into the textbook's instructional architecture. The second identifies the forms of algebraic activity privileged in the focal corpus. The third examines the pedagogic mediation embedded in the textbook and the forms of learner participation it constructs.

Recontextualizing Curriculum Intentions Into Textbook Sequence

The textbook transforms curriculum expectations into section-level learning aims. Across the four focal passages, the opening statements closely correspond to the curriculum expectations for algebraic expressions, quadratic equations and inequalities, functions, and quadratic functions. The expectation that students prove and use identities is developed through consecutive material on notable identities and factorization. The expectations concerning quadratic equations, reduction to quadratic equations, applications, inequalities and applications of inequalities are unfolded across five consecutive textbook units. A similar pattern appears in the treatment of functions, where recognition of functions, representations, graphs and the linear function are presented as successive instructional units. In the final passage, the quadratic function, its sign and the use of first- and second-degree functions in problem solving extend the same curricular trajectory. The expected learning outcomes are therefore translated into a visible microstructure of aims, explanations, worked examples and exercises (Lambropoulos et al., 2026, sections 2.2.1-2.2.2, pp. 57-65; sections 2.3.5-2.3.9, pp. 82-97; sections 2.4.1-2.4.5, pp. 100-123; sections 2.4.7-2.4.9, pp. 126-138).

This microstructure creates a cumulative progression from algebraic forms to equations, inequalities and functions. The treatment of identities and factorization establishes algebraic transformation as a basic mathematical activity. The quadratic-equation material uses standard form, roots, the discriminant and reduction strategies to develop equation-based reasoning. The inequality material extends the same resources through sign analysis, while the treatment of functions reorganizes earlier algebraic tools through graphical and representational activity. This progression is especially visible when the textbook returns to the sign of the quadratic trinomial in the quadratic-function material and interprets it through the position of the parabola. Earlier algebraic techniques reappear as resources for later parts of the corpus, giving the selected material a cumulative internal structure (Lambropoulos et al., 2026, sections 2.2.1-2.2.2, pp. 57-65; sections 2.3.5 and 2.3.8, pp. 82-85, 89-95; section 2.4.4, pp. 114-117; sections 2.4.7-2.4.8, pp. 126-136).

New algebraic knowledge is introduced through explicit links with already established mathematical objects and techniques. The treatment of identities builds on prior knowledge from lower secondary mathematics and extends it towards factorization. The quadratic-equation material uses the discriminant and root formulae as a formalization of equation solving, while later work reuses roots and sign patterns in the study of inequalities. The treatment of functions begins from correspondence and the machine metaphor before moving towards formal notation, domain, range and graph. The quadratic-function material begins from the known graph of $y = x^2$ and uses it to introduce the general form ($f(x) = ax^2 + bx + c$). The textbook presents new content as a staged reorganization of earlier knowledge. This textual construction presents algebra through a progressive pedagogical architecture across the focal corpus (Lambropoulos et al., 2026, sections 2.2.1-2.2.2, pp. 57-65; sections 2.3.5 and 2.3.8, pp. 82-85, 89-95; sections 2.4.1-2.4.2, pp. 100-109; section 2.4.7, pp. 126-132).

Constructing Teachable Algebra as Symbolic and Representational Transformation

Across the selected passages, algebra is constructed primarily as activity involving structure, form and equivalent transformation. In the treatment of identities and factorization, the textbook presents identities as universally valid equalities and then uses them as tools for recognizing algebraic form, producing equivalent expressions and deciding when an expression has been fully factorized. The movement from identities to factorization gives students a language for seeing algebraic structure. Expressions appear as objects that can be transformed into more useful equivalent forms. The same orientation continues in the quadratic-equation material, where the general form of the equation, the relations between coefficients and roots, and the use of substitutions position algebraic activity as the transformation of one form of a problem into another. In the quadratic-function material, completing the square extends this logic, since symbolic transformation becomes the means through which the graph, vertex and axis of symmetry of the parabola are made available for study (Lambropoulos et al., 2026, sections 2.2.1-2.2.2, pp. 57-65; sections 2.3.5-2.3.6, pp. 82-86; section 2.4.7, pp. 126-132).

A recurring organizer in this construction of teachable algebra is the discriminant. In the treatment of quadratic equations, the discriminant is introduced as a classificatory device for deciding whether the equation has two distinct real roots, a double real root or no real roots. It then reappears in the treatment of inequalities, where the number and position of the roots support sign analysis for the quadratic trinomial. In the quadratic-function material, the same quantity is given a graphical role. It appears in the coordinates of the vertex and helps determine the position of the parabola in relation to the horizontal axis. The discriminant links several forms of algebraic activity that could otherwise remain separate, namely solving equations, classifying roots, analysing signs and interpreting the graph of a quadratic function. Its significance lies in its repeated use across symbolic and graphical contexts, producing continuity between equation solving, inequality solving and functional interpretation (Lambropoulos et al., 2026, sections 2.3.5 and 2.3.8, pp. 82-85, 89-95; sections 2.4.7-2.4.8, pp. 126-136).

The treatment of functions extends this algebraic structure by shifting the emphasis from symbolic transformation to coordination across representations. The textbook first presents the function through correspondence, domain, range, ordered pairs, verbal descriptions and diagrams. It then defines the graph of a function as the set of points that satisfy ($y = f(x)$), thereby connecting symbolic and graphical forms through a condition of verification. In the treatment of the linear function, the expression ($f(x) = ax + b$) is connected with the straight line, its intercepts and the role of the parameters. The activity includes movement between rule, ordered pairs, diagram and graph, together with interpretation of the information made visible by each representation. This representational activity remains strongly structured by the textbook. The function is treated mainly as a formally defined object that can be represented in several coordinated ways (Lambropoulos et al., 2026, sections 2.4.1-2.4.5, pp. 100-123).

The quadratic-function material is a concentrated point of integration between earlier symbolic activity and later graphical interpretation. Roots become intersection points with the horizontal axis, sign becomes position above or below the axis, and quadratic inequalities become comparisons between graphs. The textbook explicitly returns to the earlier algebraic treatment of the sign of the trinomial and adds a graphical interpretation through the parabola. This produces a bridge between the equation ($ax^2 + bx + c = 0$), the sign of ($ax^2 + bx + c$), and the graph of ($f(x) = ax^2 + bx + c$). The quadratic function is constructed as a graphical algebraic object. It is simultaneously a formula, a curve, a carrier of roots and signs, and a tool for comparing algebraic relationships. Extended modelling of external situations has a more limited role in this part of the material (Lambropoulos et al., 2026, sections 2.4.7-2.4.9, pp. 126-138).

Pedagogic Mediation and the Limits of Openness

The textbook embeds a strong pedagogic script through definitions, observations, worked examples and stepwise procedures. Across the focal corpus, mathematical activity is accompanied by explicit guidance. Factorization by grouping is introduced through conditions for applying the technique and through criteria for completing the transformation. The treatment of quadratic equations structures solution methods through cases, diagnostic observations and restrictions on admissible solutions when substitutions are used. In the function material, the machine metaphor, the formal distinction between domain and range, and the classification of correspondences as functions or non-functions provide students with staged entry points into the concept. In the quadratic-function material, graph construction is decomposed into identifiable steps, including the vertex, axis of symmetry, intercepts and symmetric points. The textbook mediates algebra learning by making procedures, criteria and forms of verification highly visible (Lambropoulos et al., 2026, section 2.2.2, pp. 61-65; sections 2.3.5-2.3.6, pp. 82-86; sections 2.4.1-2.4.2, pp. 100-109; sections 2.4.7-2.4.8, pp. 126-136).

The implied student is positioned as an active and closely guided algebraic worker. The selected tasks require students to classify relations, choose solution strategies, transform symbolic expressions, read graphical information, compare representations and verify conclusions. Some tasks ask students to decide whether visual or diagrammatic arguments are mathematically acceptable, while others require the recovery of algebraic information from a graph or the graphical solution of inequalities. The field of action is carefully delimited by the textbook. Students are usually asked to operate within an already established representation, method or sequence of steps. The textbook's implied algebra learner is therefore active in carrying out transformations, classifications and local justifications, with the openness of the mathematical situation remaining bounded (Lambropoulos et al., 2026, sections 2.2.1-2.2.2, pp. 57-65; sections 2.3.5 and 2.3.8, pp. 82-85, 89-95; section 2.4.2, pp. 103-109; sections 2.4.7-2.4.9, pp. 126-138).

Argumentation appears in localized and meaningful ways within material that is mainly technical and representational. The textbook's early treatment of identities relies on the idea of universal validity, and several exercises require proof, justification or evaluation of mathematical reasoning. In the quadratic-equation and inequality material, students are asked to reason about roots, coefficients, signs and parameters. In the quadratic-function material, graphical conclusions are sometimes followed by algebraic confirmation, giving students a way to validate one representation through another. These instances show that proof and argument have a visible place in the focal corpus. Their role is bounded. They appear as local demands embedded within material structured primarily around symbolic transformation, representational coordination and procedural guidance (Lambropoulos et al., 2026, sections 2.2.1-2.2.2, pp. 57-65; sections 2.3.5 and 2.3.8, pp. 82-85, 89-95; sections 2.4.7-2.4.9, pp. 126-138).

Modelling is explicitly present, and it is usually framed as a structured extension of algebraic technique. The textbook names modelling in the units on applications of quadratic equations, applications of quadratic inequalities, and problem solving with first- and second-degree functions. In these parts, modelling most often takes the form of translating a mathematical, geometric or verbal condition into an equation, an inequality or a comparison between graphs. This is visible in tasks where a condition is expressed through a quadratic equation, where an inequality represents a property of numbers, or where graphical comparison is used to solve an inequality involving functions. The modelling activity extends algebra beyond routine manipulation, while remaining strongly shaped by the techniques developed in the preceding parts of the chapter. The textbook incorporates modelling as part of algebraic problem solving. Extended modelling of external situations is less prominent in the selected corpus (Lambropoulos et al., 2026, sections 2.3.7 and 2.3.9, pp. 87-88, 96-97; section 2.4.9, pp. 137-138).

DISCUSSION

The analysis of Textbook C shows how the new Greek mathematics reform is given a student-facing textbook form. The curriculum and the teacher guide articulate broad aims for mathematical activity, reasoning, representation, modelling, communication, problem solving and the use of tasks that may allow different methods, explanations and assumptions (Institute of Educational Policy, 2022; Zachariadis et al., 2022). Textbook C gives these orientations a determinate algebraic form through aims, reminders of prior knowledge, definitions, propositions, proofs, worked examples, exercises, applications and local opportunities for explanation. The four analytical claims address the research questions in two groups. The first two examine how curricular aims are reorganized through textbook architecture and selected algebraic connections (sub-question 1), while the latter two examine how pedagogic mediation shapes mathematical work, learner responsibility and the openness of reform practices (sub-question 2). Together, they address the main research question of how reform is transformed into a pedagogically organized form of teachable algebra.

The Textbook as a Response to a Reform Design Problem

The first implication concerns the role of the textbook in curriculum reform. Official curriculum documents can sustain an open pedagogic language. They can call for investigation, modelling, reasoning, communication and multiple forms of participation without specifying the exact route through which students will encounter these practices. A student textbook operates under different design conditions. It must decide order, emphasis, notation, examples, techniques, tasks and expected forms of response. Textbook C can therefore be understood as a material response to a reform design problem: it gives concrete and manageable form to broad curricular aspirations.

This design response reduces uncertainty about what students are expected to notice, practise, justify and apply, while delimiting the range of mathematical activity made available to them. Recontextualization therefore involves decisions about which forms of mathematical activity will be made available, how open they will remain and how much strategic responsibility will be left to the learner.

This interpretation locates the textbook between official reform discourse and classroom enactment. The textbook functions as an intermediate design layer where reform is materially organized before classroom use, supporting continuity and accessibility while defining the forms of student action that count as appropriate within the textbook.

Coherence as a Selective Construction

A second implication concerns how the textbook constructs coherence through selected algebraic priorities. The recurring use of the discriminant across equations, inequalities and quadratic functions is particularly significant because it provides a common organizing resource across topics that might otherwise remain separate.

This organization can be interpreted through Duval's (2006) distinction between treatment and conversion. Mathematical activity depends on transformations of semiotic representations, and conversion between representation registers is a major source of difficulty in mathematical learning. In Textbook C, the discriminant helps regulate movement between symbolic classification and graphical interpretation. It provides a stable point through which students can connect algebraic form, roots, sign and graph.

The resulting coherence is selective. By privileging a limited set of organizing tools, especially the discriminant and symbolic – graphical transitions, the textbook ties symbolic manipulation to interpretation while defining which connections among equations, inequalities and functions become central in the student-facing algebra.

The Textbook Carries Part of the Cognitive Work

A third implication concerns how pedagogic mediation distributes cognitive work between the textbook and the learner. Important strategic and representational decisions are often prepared in advance, leaving students to work within a structured route.

Stein et al.'s distinction between task features and cognitive demands is useful here. Tasks may include features associated with rich mathematical work, such as multiple representations, explanation or justification. These features do not by themselves determine the level of cognitive demand. Demand also depends on the amount of decision-making, interpretation and mathematical responsibility required from students (Stein et al., 1996). Since the present study examines textbook design rather than classroom enactment, it cannot claim how students actually worked with the tasks. It can identify the designed opportunities and constraints inscribed in the textbook.

From this perspective, the focal tasks combine meaningful mathematical work with a strong support structure. Students are asked to classify, transform, interpret and justify, often after the strategy space has been reduced by preceding explanations, propositions or worked examples. The resulting work is often demanding in content and more restricted in strategic choice.

Lithner's framework helps clarify this point. Algorithmic reasoning can be meaningful when it is connected with mathematical properties. The issue is the extent to which students must construct a strategy and support it through mathematically grounded argumentation (Lithner, 2008). In the focal textbook, reasoning is often attached to known or recently modelled procedures. Students are asked to explain why a transformation is valid, why a sign conclusion follows, or how a graph relates to algebraic information. These are legitimate reasoning opportunities, although they usually operate within routes already established by the textbook.

The textbook therefore promotes algebraic reasoning that is structured and locally justified. Procedures are connected with algebraic properties, graphical relations and interpretive outcomes. The space for fully creative mathematical reasoning in Lithner's (2008) sense remains more limited because the learner usually receives the main strategic route before working independently on the task.

This analysis sharpens the meaning of pedagogic mediation. The textbook reduces ambiguity, makes expected procedures visible and supports movement between representations. This design increases accessibility and sets tighter conditions for students' independent formulation of strategies, choice of representations and decisions about how to proceed.

Reform Practices as Textbook Tasks

A fourth implication concerns how reform practices are recontextualized as textbook tasks. Investigation, modelling, reasoning and communication acquire more bounded forms in the student-facing material.

Skovsmose (2001) distinguishes landscapes of investigation, where students take over processes of exploration and explanation, from the exercise paradigm, which is organized around externally given tasks and expected answers. Seen through this distinction, the exploratory opportunities identified in the focal corpus remain embedded within a broader pattern of explanation, modelled technique and practice. They create carefully framed spaces for exploration rather than open-ended investigative activity.

A related pattern appears in modelling. Blum and Borromeo Ferri (2009) describe modelling as movement between the real world and mathematics, involving the construction and simplification of a situation, mathematizing, working mathematically, interpreting and validating results. In the focal textbook, this cycle is compressed mainly into the mathematization and solution of already structured situations. The situation is often already simplified, the relevant mathematical form is strongly cued by the section, and validation or revision of assumptions is less prominent than mathematization and solution.

Modelling is therefore recontextualized as a school algebra task. Students are invited to connect algebra with situations, usually through conditions already shaped for algebraic treatment. In Skovsmose's (2001) terms, some tasks work through references to semi-reality: the context provides a situational reference while the expected mathematical route remains available and controlled.

The same transformation applies to investigation and justification. Investigation becomes guided comparison, observation or representation within an already bounded setting. Justification becomes local explanation linked to a known algebraic relation or graphical feature. Communication becomes the articulation of expected mathematical meanings. These forms of activity are educationally meaningful and textbook-compatible.

The main critical implication is that reform practices are retained in changed form. The textbook makes them teachable by giving them structure, sequence and limits. This reduces the space designed into the material for independent modelling, open investigation and student-generated strategy construction.

Overall, Textbook C recontextualizes broad curriculum orientations into a coherent and accessible route through grade 10 algebra by selecting central algebraic connections, structuring expected forms of reasoning, and delimiting the openness of modelling and investigation in the student-facing material.

CONCLUSION

The study examined how one newly approved Greek grade 10 algebra textbook recontextualizes the new mathematics curriculum and the official teacher guide into student-facing algebra. The analysis showed that reform becomes materially visible through the coordination of three elements, namely the sequencing of algebraic knowledge, the recurrent forms of algebraic activity offered to students, and the pedagogic guidance through which this activity is structured. Across the selected sequences, algebra is organized as a cumulative pathway from symbolic transformation to equation solving, sign analysis, functions, representation and structured applications. This pathway gives the reform a coherent and navigable textbook form.

The study contributes to curriculum and textbook research by specifying a mechanism of textbook recontextualization in a current reform context. In the focal case, broad curricular aims concerning reasoning, representation and modelling are translated into a structured algebraic pathway supported by worked examples, coordinated representations and graded tasks. This mechanism makes the reform teachable by organizing content and activity in a stable sequence, while also shaping the degree of openness, strategic responsibility and modelling activity available in the student-facing material. The case therefore shows that textbook design shapes curriculum reform at the point where students encounter school algebra as organized text, activity and guidance.

The study is limited by its single-case design, its focused corpus of four algebraic sequences and its document-based evidence. Its findings should therefore be read as a case analysis of textbook recontextualization rather than as a general evaluation of all approved Greek algebra textbooks. Further research should compare the approved textbooks through deeper sequence-level analysis, examine the accompanying digital and teacher-support resources, and study classroom use through teacher interviews, lesson observations and student work. Such work would clarify how textbook mediation is taken up, adapted or resisted in actual algebra teaching.

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AI statement: During the preparation of this manuscript the authors used the free version of Grammarly for spelling, grammar, and punctuation checks. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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