From Worked Examples to Independent Reasoning: A Document Analysis of a Grade 6 Strategic Intervention Material for Decimal Multiplication

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Abstract

This study examined the instructional design of Find and Analyze to Get Me, a 13-page Strategic Intervention Material (SIM) intended to support Grade 6 learners in solving routine and non-routine problems involving multiplication of decimals and mixed decimals, including money. A structured qualitative document analysis coded the material for curriculum alignment, problem-solving structure, worked-example design, task breadth, cognitive demand, assessment and feedback, mathematical accuracy, editorial quality, and accessibility. The corpus contained one strategy overview, four fully worked examples, two assessment cards, two enrichment cards, a 20-response answer key, and a brief reference card. The material's principal strength is its stable five-part routine: identify what is asked, identify the given facts, select an operation, write a number sentence, and state the answer. Four contextualized worked examples make this routine visible and may reduce unnecessary processing for learners who need explicit guidance. However, all eight mathematical tasks are single-step and routine, seven use money contexts, and every product pairs a decimal or money amount with a whole-number multiplier. The assessment and enrichment cards retain the same five multiple-choice prompts, so they measure recognition of the scaffold more strongly than independent construction of a solution. The audit also identified one incorrect answer-key entry, imprecise use of the term decimal points, inconsistent units and notation, language errors, and incomplete source documentation. No learner data, expert-validation report, readability evidence, or field-test results were supplied; consequently, effectiveness cannot be inferred. The SIM is best regarded as a promising worked-example resource that requires mathematical and editorial correction, broader task variation, gradual fading of support, explanatory feedback, accessibility improvements, and staged validation before outcome claims or large-scale use.

Keywords: decimal multiplication; strategic intervention material; worked examples; word problems; document analysis; Grade 6 mathematics

Introduction

Decimal multiplication is a consequential part of elementary mathematics because it connects place value, proportional reasoning, measurement, and financial literacy. Learners must coordinate the meaning of the situation, select an operation, compute accurately, interpret the unit, and judge whether an answer is reasonable. A correct algorithm alone is therefore insufficient for word-problem competence. The Philippine K to 12 Mathematics Curriculum explicitly expects Grade 6 learners to solve routine and non-routine problems involving multiplication of decimals and mixed decimals, including money, using appropriate problem-solving strategies (Department of Education, 2016).

Strategic Intervention Materials are commonly developed to provide focused support for competencies that learners find difficult. Their value depends not only on attractive presentation or the presence of practice items but also on the coherence of the instructional sequence. Effective intervention materials should make mathematical structure visible, use accurate language and representations, offer sufficient guided practice, and then transfer responsibility to the learner. Evidence-based guidance for elementary mathematics interventions similarly emphasizes systematic instruction, concise mathematical language, representations, deliberate word-problem instruction, and opportunities to explain reasoning (Fuchs et al., 2021).

Worked examples can be especially useful early in learning because they display how an expert moves from a problem statement to a solution. Research syntheses indicate that well-designed examples should integrate the problem with its solution steps, emphasize the conceptual structure, vary surface features, sit close to matched practice, and prompt learners to explain why each step is valid (Atkinson et al., 2000). Their instructional value is reduced, however, when examples become templates that learners imitate without understanding or when support never fades toward independent performance.

The supplied material, Find and Analyze to Get Me, was prepared as a Grade 6 Mathematics SIM for the competency coded M6NS-Ie-113.2 (Bartolome, 2022). It introduces an Understand-Plan-Solve routine, provides four worked examples, and follows with assessment and enrichment cards. Because the file contains no learner results or validation report, a document analysis is a more defensible scholarly approach than an intervention-effectiveness study. Such an analysis can identify what the material teaches, how it structures thinking, what evidence its assessments produce, and what revisions are needed before efficacy is tested.

Purpose and Research Questions

This study evaluated the instructional architecture and publication readiness of Find and Analyze to Get Me. It asked four questions: (1) How closely does the material represent the target Grade 6 decimal-multiplication competency? (2) How are worked examples and problem-solving prompts used to scaffold learner performance? (3) What breadth of contexts, number structures, response modes, and cognitive demands appears across the tasks? and (4) Which mathematical, assessment, editorial, accessibility, and validation issues should be addressed before broader use?

Methods

Design and Corpus

The study used structured qualitative document analysis with descriptive content counts. The corpus was one 13-page PDF comprising a cover, a table of contents, and 11 numbered instructional pages. The cover identifies Felicitas F. Bartolome as the preparer of the SIM; the present article analyzes that supplied material and does not attribute its original design to the article author. No learner records, scores, classroom observations, teacher interviews, or experimental data were included.

The unit of analysis was a document component or mathematical task. A task was defined as one complete word-problem context, whether presented as a worked example, assessment card, or enrichment card. The five repeated prompts attached to each assessment or enrichment problem were counted as subitems because they separately ask the learner to identify the question, facts, operation, number sentence, and final answer.

Table 1

Document Components and Instructional Functions

Component	Count	Instructional function
Strategy overview	1	Introduces Understand, Plan, and Solve through five recurring prompts
Worked examples	4	Models interpretation, operation choice, number sentence, computation, and answer
Assessment cards	2	Presents two problems with five multiple-choice subitems each
Enrichment cards	2	Adds two problems but retains the same five-prompt selected-response format
Answer key	20 entries	Provides letters only; one entry is incorrect
Reference card	3 sources	Lists abbreviated instructional sources without complete bibliographic details

Analytic Framework

Coding categories were derived from the stated curriculum competency and from research on worked examples, formative assessment, feedback, mathematical intervention, and accessible design. The audit examined: curriculum alignment; explicitness of the solution routine; integration of words, operations, and numerical work; variation in context and number structure; distinction between routine and non-routine demand; degree of learner independence; quality of feedback; mathematical and editorial accuracy; source documentation; and options for representation and response.

A problem was classified as routine when the operation and pathway were directly cued and the task could be solved by applying the demonstrated template. A non-routine problem would require learners to select, adapt, justify, or compare strategies in a less familiar structure. This distinction concerns the demand created by the item, not the real-life topic used in its story.

Procedure and Trustworthiness

Analysis proceeded in three passes. The first inventoried the document structure and transcribed the number sentences. The second coded every mathematical task for context, multiplier type, solution format, response mode, and cognitive demand. The third independently recomputed all products, checked every answer-key entry against the corresponding item, and reviewed language, notation, references, and accessibility features. Counts were then reconciled against the table of contents and visible page sequence.

The analysis is auditable because each claim is tied to an observable component or count. Arithmetic was verified directly rather than inferred from the answer key. Because one analyst coded one document, no inter-coder agreement coefficient was calculated. This limitation is addressed by reporting the code definitions and task-level evidence rather than presenting unsupported precision.

Results

Instructional Architecture and Alignment

The SIM has a clear, compact architecture. Guide Card 1 introduces the goal and a three-phase routine: Understand, Plan, and Solve. These phases are unpacked into five prompts: identify what is asked, identify the given facts, determine the operation, write the number sentence, and state the answer. Guide Cards 2 through 5 apply the same routine to four complete examples. Two assessment cards and two enrichment cards then present one problem each, followed by a separate answer key and reference card.

At the topic level, the material aligns with M6NS-Ie-113.2 because it asks learners to solve multiplication problems involving decimal quantities and money. Alignment is only partial at the level of performance breadth. The stated competency includes both routine and non-routine problems, but the analyzed tasks preserve the same structure and explicitly prompt the operation and number sentence. The material therefore gives substantial attention to a routine problem-solving schema but does not visibly assess non-routine strategy selection.

Worked Examples and Scaffolding

The four worked examples are the material's strongest instructional feature. Each example connects the story, relevant quantities, operation, written number sentence, computation, and verbal answer. This consistency may help a learner notice that a word problem is not solved by calculation alone; it requires interpretation before and after the arithmetic. The examples also use locally recognizable contexts such as sayote tops, weekly allowance, and restaurant purchases.

The routine resembles the early phases of Polya's problem-solving cycle: understand the problem, devise a plan, and carry out the plan (Polya, 1945). What is largely absent is a deliberate look-back phase. Learners are not prompted to estimate, verify the unit, compare another method, test the reasonableness of the product, or explain why multiplication fits the relationship. Adding these actions would move the routine from procedural completion toward mathematical control.

Support also remains at nearly full strength from the first worked example through the final enrichment card. The later cards remove the displayed computation but retain all five prompts and convert every response to multiple choice. A stronger progression would use example-problem pairs, then partially completed examples, then independent constructed responses. Self-explanation prompts such as Why is multiplication appropriate? and How does the decimal point placement relate to the factors? would help learners extract general principles rather than copy surface steps (Atkinson et al., 2000).

Task Breadth and Cognitive Demand

Across the four worked examples and four assessment or enrichment problems, seven of eight tasks use money and one uses distance. All eight require a single multiplication. The multiplier is always a whole number: 100, 6, 10, 17, 100, 4, 8, or 10. This selection provides practice in decimal or money amounts multiplied by whole-number counts, including multiplication by powers of ten, but it does not sample decimal-by-decimal products, estimation, multi-step situations, irrelevant information, missing information, or more than one defensible pathway.

The story settings vary, but the deep structure does not. Each task gives the necessary quantities, signals a multiplicative relationship, and leads to one numerical answer. Even the items labeled enrichment use the identical five-question frame as the assessment cards. Accordingly, the material changes surface context more than cognitive demand. A publishable and valid intervention resource should distinguish guided routine practice from transfer tasks that require learners to decide what matters, choose a strategy, justify it, and evaluate the result.

Table 2

Profile of the Eight Mathematical Tasks

Task	Context	Number sentence	Response mode
Example 1	Peso-centavo conversion	120.75 x 100	Fully worked
Example 2	Six bundles of sayote tops	25.00 x 6	Fully worked
Example 3	Weekly savings for 10 weeks	15.75 x 10	Fully worked
Example 4	Restaurant cost for 17 people	235.45 x 17	Fully worked
Assessment 1	Peso-centavo conversion	251.50 x 100	Five multiple-choice prompts
Assessment 2	Distance traveled in four hours	64.25 x 4	Five multiple-choice prompts
Enrichment 1	Meal cost for eight people	125.50 x 8	Five multiple-choice prompts
Enrichment 2	Cost of 10 cans of sardines	19.50 x 10	Five multiple-choice prompts

Assessment and Feedback

The two assessment cards and two enrichment cards contain 20 selected-response subitems in total. Their repeated structure can reveal where a learner's process breaks down: interpreting the question, locating facts, selecting the operation, constructing the equation, or computing the answer. This diagnostic potential is useful, particularly for teacher-led intervention.

However, every subitem is multiple choice, and the alternatives often make the intended operation or quantity highly visible. The evidence therefore favors recognition over generation. A learner may select the correct number sentence without being able to construct one independently or explain the relationship between quantities. The answer key supplies letters only, so it cannot correct a misconception or show why a distractor is wrong. Formative assessment becomes more useful when evidence changes the next instructional action (Black & Wiliam, 2009), and feedback is stronger when it clarifies the goal, current performance, and next step (Hattie & Timperley, 2007).

One keying error directly threatens score interpretation. For Assessment Card 1, item 4, the correct number sentence is 251.50 x 100 = N, which is option c, but the answer key lists option a. If used as written, a correct learner response would be marked wrong. This error should be corrected before any classroom administration or validation study.

Mathematical Language, Editorial Quality, and Accessibility

Several statements require mathematical copyediting. The worked examples repeatedly say that a multiplicand has two decimal points and that the product must also have two decimal points. A number has one decimal point; the intended term is two decimal places. More importantly, the placement rule should be explained in relation to the total number of decimal places in both factors rather than attached only to the multiplicand. In the centavo example, the expression Php 120.75 x Php 100 is dimensionally imprecise because 100 is a conversion factor of 100 centavos per peso, not another peso amount.

Editorial errors include inconsistent spacing in currency values and thousands separators, subject-verb disagreement, irregular use of Direction and Directions, motor cycle instead of motorcycle, fired sardines in place of fried sardines, and incomplete or awkward sentences. Such errors are not merely cosmetic in an intervention material. Learners who already experience difficulty need concise, stable language that does not compete with the mathematics.

The PDF uses large headings, decorative frames, and some visual cues, but the mathematical representations are limited to text and vertical computation. No area model, place-value chart, bar model, table, diagram, or estimation benchmark is used to connect the algorithm with magnitude. Accessibility would be strengthened by readable tagged text, verified alternative text for meaningful images, high-contrast uncluttered layouts, adjustable digital display, and options to respond orally, with a diagram, or with manipulatives. These revisions accord with Universal Design for Learning guidance on clarifying symbols, using multiple representations, varying response methods, and building fluency through graduated support (CAST, 2024).

The reference card lists a 2016 curriculum guide, a teacher's manual, and a learner's material with page ranges, but it does not provide complete bibliographic details. The origin or permission status of decorative graphics and the teacher photograph is not documented in the supplied PDF. A publication-ready version should include complete citations and an image-rights record.

Discussion

Find and Analyze to Get Me demonstrates a practical instructional instinct: difficult word problems become more manageable when learners are taught a repeatable way to identify the question, facts, operation, equation, and answer. The module also makes multiplication meaningful through familiar purchases, saving, travel, and currency conversion. These features give the material a sound foundation for targeted remediation.

The central design tension is that a scaffold meant to support thinking can also replace thinking when it is never faded. The four worked examples show the same procedure clearly, but the assessment and enrichment tasks continue to name every decision the learner should make. Because all tasks are routine and all later responses are selected, the material cannot demonstrate that learners can independently analyze a new situation or handle the non-routine portion of the competency.

A revised sequence should retain the five-part routine while adding progressive independence. The first phase can present one fully integrated example and one matched practice problem. The second can omit selected steps and ask learners to complete and explain them. The third can introduce varied problem types, including comparison, rate, area, scaling, estimation, and two-step money situations. The final phase should include constructed-response tasks with no pre-labeled operation, plus a short rubric for interpretation, strategy, computation, unit, and justification.

Representations should also be purposeful rather than decorative. A place-value chart can explain multiplying by 10 or 100; an area or partial-products model can show why decimal placement is reasonable; a bar model can expose the multiplicative relationship in a word problem; and estimation can provide a quick reasonableness check. The What Works Clearinghouse guidance supports systematic instruction, clear mathematical language, representations, and deliberate word-problem teaching in elementary intervention (Fuchs et al., 2021).

Revision and Validation Priorities

Revision should proceed before outcome testing. Mathematical and keying errors must first be corrected because unreliable content cannot yield interpretable learner scores. The instructional sequence can then be broadened and the assessment strengthened. After expert review and readability testing, a small pilot should examine usability, completion time, misconception patterns, and fidelity of implementation. Only after these stages should a pretest-posttest or comparison-group study evaluate learning outcomes.

Table 3

Priority Revisions Before Validation

Priority	Observed issue	Required revision
Correctness	Assessment Card 1, item 4 is miskeyed; terminology and units are imprecise	Correct the key to option c; replace decimal points with decimal places; standardize units and notation
Task breadth	All eight tasks are routine and single-step; seven use money	Add non-routine, multi-step, estimation, measurement, scaling, and decimal-by-decimal tasks

Priority	Observed issue	Required revision
Scaffold fading	Five prompts remain through enrichment	Move from complete examples to completion problems and then independent constructed responses
Feedback	The answer key gives letters only	Provide worked solutions, misconception notes, and a short analytic rubric
Representation	Instruction relies on text and vertical algorithms	Add place-value, area or partial-products, bar-model, and estimation representations
Language and access	Copyediting, source, image-rights, and response-access issues remain	Professionally edit; complete references; document image permissions; verify accessible text and alternative response modes
Validation	No expert review, readability, pilot, or learner outcome evidence is supplied	Conduct expert validation, learner usability testing, item analysis, and a staged outcome study

Limitations

This study analyzed one supplied version of one SIM. It did not observe classroom use, interview the developer, or measure learner performance. The classification of cognitive demand is based on the written tasks and prompts, not on how a teacher might adapt them orally. Counts describe the document but do not establish instructional effectiveness. A future study should combine expert validation, learner think-alouds, item analysis, and outcome data to determine which design features work for which learners and under what conditions.

Conclusion

Find and Analyze to Get Me offers a coherent worked-example routine for Grade 6 decimal-multiplication word problems. Its consistent emphasis on what is asked, given facts, operation, number sentence, and answer is a useful basis for intervention. The current version, however, samples a narrow range of routine tasks, retains heavy prompting through enrichment, relies entirely on selected responses, and contains a consequential answer-key error together with mathematical and editorial imprecision. The material should be described as a promising instructional-design prototype, not as proven intervention. Careful correction, scaffold fading, broader mathematical representations, non-routine constructed-response tasks, explanatory feedback, accessibility work, and staged validation can transform it into a stronger and more defensible resource for publication and classroom research.

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