

A Process for Designing Grade 1 Mathematics Questions and Tasks with Reference to Selected Techniques from the Sea-PLM Assessment Framework

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ABSTRACT: Appropriately designed questions and tasks play an important role in organising instruction and collecting evidence of students' attainment of expected learning outcomes. In Grade 1 Mathematics, question and task design must ensure mathematical accuracy while remaining suitable for beginning learners' reading ability and visually oriented thinking. Using document analysis, synthesis, and pedagogical design, this study proposes a process for designing Grade 1 Mathematics questions and tasks with reference to selected techniques from the SEA-PLM assessment framework. The findings identify four design principles and a five-step process: (1) identifying expected learning outcomes, mathematical content, and purpose of use; (2) specifying the mathematical task and response format; (3) selecting the context and mode of representation; (4) constructing the question, answer, and anticipated responses; and (5) reviewing, trialling, and refining the task. The process is illustrated through an addition task without regrouping within 100. The proposed process provides teachers with an operational framework for developing questions and tasks for concept formation, practice, consolidation, and assessment in Grade 1 Mathematics. It is an adapted pedagogical use of selected design ideas rather than a transfer of the complete large-scale SEA-PLM assessment methodology to Grade 1 classrooms.

KEYWORDS: questions and tasks; Grade 1 Mathematics; task design; SEA-PLM; competency-based assessment.

1. INTRODUCTION

In mathematics instruction, questions and tasks are not merely means through which students practise or demonstrate final answers; they are also learning tasks that structure cognitive activity, create opportunities for students to mobilise knowledge and skills, and reveal their approaches to problem solving [7], [8]. When appropriately designed, questions and tasks can be used at multiple points in the instructional process: introducing a problem, constructing knowledge, practising, consolidating, applying, and assessing. Under the orientation of Vietnam's 2018 General Education Curriculum, assessment in Mathematics should provide valid information about students' progress and attainment of expected learning outcomes, while also emphasising their ability to apply knowledge and skills in appropriate situations [1]. Consequently, the quality of questions and tasks directly influences both the learning activity undertaken by students and the evidence available to teachers.

Designing questions and tasks for Grade 1 students entails particular requirements. Students have only recently entered a systematic learning environment; their vocabulary and reading comprehension remain limited, their attention is not yet sustained, and their thinking is still closely associated with images, objects, and concrete actions [5]. A question may be mathematically accurate yet still create a barrier if its prompt is lengthy, contains unnecessary data, or includes distracting images. Conversely, if a task is overly simple and merely requires the repetition of a familiar calculation, teachers may obtain little evidence of whether students understand the underlying meaning or can use the knowledge. Grade 1 Mathematics questions and tasks therefore need to be designed through an integration of expected learning outcomes, mathematical content, learner characteristics, and the intended instructional purpose. The Southeast Asia Primary Learning Metrics (SEA-PLM) is a large-scale assessment programme for students at the end of primary education. In Mathematics, the SEA-PLM assessment framework considers the interaction among mathematical content, the processes students perform, and the context of a problem; items are developed from a conceptual framework and undergo development, review, and trialling before use [2], [3]. Publicly released SEA-PLM documents also demonstrate how context, images, data, and varied response formats can generate more informative mathematical tasks than questions that merely require students to reproduce an answer [4]. These features offer useful ideas for the design of classroom questions and tasks.

However, SEA-PLM was developed to assess Grade 5 students at a regional scale; therefore, its purpose, content, standardisation process, and technical requirements do not correspond directly to Grade 1 Mathematics instruction. Referring to SEA-PLM cannot mean transferring Grade 5 items intact to Grade 1, nor does it mean applying the full measurement, coding, and data-processing procedures of a large-scale assessment programme in the classroom. The central issue is to select relevant design ideas and then

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adjust them through two important filters: the expected learning outcomes of the Grade 1 Mathematics curriculum and the cognitive and linguistic characteristics of students at the beginning of primary education.

Accordingly, this article addresses two research questions: (1) What principles should guide the design of Grade 1 Mathematics questions and tasks, and what process can ensure alignment with curriculum learning outcomes and learner characteristics while selectively adapting relevant techniques from the SEA-PLM assessment framework? (2) How can the proposed process be applied to the design of a specific question in the Number and Operations strand?

2. RESEARCH METHODS

The study employed three main methods. First, document analysis and synthesis were used to examine Vietnam's 2018 Mathematics Curriculum, the SEA-PLM assessment framework, guidance on good-quality assessment practice, and studies concerning questions and tasks and the characteristics of primary school students. Second, pedagogical design was used to select techniques that could be adapted, formulate principles, and develop a sequence of design actions appropriate for Grade 1 Mathematics. Third, illustrative analysis was used to apply the process to a question on addition without regrouping within 100, thereby clarifying the activity undertaken and the product expected at each step. The study focuses on design; it does not seek to reproduce SEA-PLM's standardisation procedures or test the impact of the process on a large scale.

3. RESULTS AND DISCUSSION

3.1. Foundations for the Proposed Process

3.1.1. Questions and tasks as learning activities and tools for collecting evidence

In this study, Grade 1 Mathematics questions and tasks are understood as learning or assessment tasks developed on the basis of curriculum content and expected learning outcomes. They require students to perform one or more specified actions in order to construct knowledge, practise, or demonstrate their level of understanding. This conception emphasises three closely related components: the mathematical content addressed by the task; the activity students are required to perform; and the evidence made visible in students' answers, products, or actions.

To be useful, questions and tasks need to be accurate, aligned with their objectives, clearly formulated, and capable of eliciting observable responses. In assessment for learning, evidence is meaningful only when teachers can use it to identify what students understand, where they are experiencing difficulty, and what support they need [6], [10]. Question design should therefore begin not with the search for an attractive image or a change in presentation, but with the intended learning outcome and the type of evidence to be collected.

3.1.2. Grade 1 Mathematics requirements and learner characteristics as grounds for adaptation

The Grade 1 Mathematics curriculum focuses on foundational content in the Number and Operations and Geometry and Measurement strands. Students perform tasks such as counting, reading, writing, and comparing numbers within 100; adding and subtracting within specified ranges; recognising the practical meanings of addition and subtraction; writing number sentences that match situations; identifying selected two- and three-dimensional shapes; measuring length; telling time to the hour; and using a calendar [1]. These curriculum requirements set the mandatory content boundaries for every Grade 1 question and task. A novel context or format must neither alter the mathematical content nor raise the demand beyond what students have learned.

The cognitive characteristics of students at the beginning of primary education provide a second basis for adaptation. Their perception is often strongly influenced by visual cues; their capacity to sustain attention and process multiple pieces of information simultaneously is limited; and their written language is still developing [5]. Prompts should therefore be concise, use familiar words, and focus on one principal task. Images should provide or organise information needed to solve the task rather than serve merely as decoration; details that do not support the task can impose unnecessary cognitive load [11]. Students should be able to demonstrate understanding through appropriate forms such as circling, matching, entering a number, writing a number sentence, pointing to an image, giving a brief oral answer, or manipulating objects. Such adaptations do not reduce the mathematical demand; rather, they help prevent a question from inadvertently measuring reading ability instead of the intended mathematical competence.

3.1.3. Techniques that may be adapted from the SEA-PLM assessment framework

The SEA-PLM assessment framework organises the Mathematics domain through the interaction of three dimensions: content, process, and context [2]. Content identifies the mathematical knowledge and skills to be mobilised; process describes the cognitive activity through which students translate a problem into a mathematical representation, apply knowledge, and interpret results; and context specifies the situation in which the problem is set. Integrating these dimensions enables a question to examine not only the performance of a calculation but also students' capacity to use knowledge in a meaningful situation.

Five features can be adapted for question design. First, the content and required performance should be clearly specified before the question is written. Second, the selected context should support the mathematical task. Third, words, images, and data should be coordinated appropriately. Fourth, response formats should be varied; in selected-response questions, distractors should reflect plausible misconceptions rather than be generated arbitrarily. Fifth, questions should be reviewed, discussed, and trialled before

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broader use [2]-[4], [9]. When adapted for Grade 1, these features must be simplified and adjusted. Specialised techniques for large-scale assessment, such as sample design, test linking, measurement models, or multilevel coding procedures, fall outside the scope of the proposed process.

The design logic arising from these three foundations can be summarised as follows: expected learning outcomes define the boundaries and destination of the task; Grade 1 learner characteristics determine how the task is worded and represented and how responses are elicited; and selected SEA-PLM techniques add a perspective on the relationship among content, process, and context. The final product is a question or task that can be used flexibly in instruction, not a standardised SEA-PLM test item.

3.2. Principles for Designing Grade 1 Mathematics Questions and Tasks

Principle 1. Ensure alignment with Grade 1 Mathematics expected learning outcomes. The content, numerical data, operations, and level of demand must remain within what students have learned. Reference to SEA-PLM supports the organisation of a task but does not alter the curriculum's expected learning outcomes.

Principle 2. Ensure suitability for students' cognitive characteristics and reading comprehension. Prompts should be clear, concise, and expressed in familiar language. Each question should focus on one principal task, with a manageable amount of information and a reasonable number of steps. Images should be easy to interpret, free from distracting details, and directly involved in solving the task.

Principle 3. Integrate mathematical content, the required student activity, and context appropriately. Context should be selected only after the mathematical content and task have been identified. It should be used when it helps students recognise the meaning or application of knowledge. A lengthy story or decorative image should not be added if it provides no information necessary to the task.

Principle 4. Vary modes of representation while ensuring usability in instruction. Questions and tasks may ask students to circle, match, complete, write a number sentence, draw, manipulate objects, or give a short answer. The response format should be selected according to the objective and learner characteristics rather than for superficial novelty. Every task should include an answer, anticipated responses, or guidance for teacher feedback so that it can be used for constructing knowledge, practice, consolidation, and assessment.

3.3. A Process for Designing Grade 1 Mathematics Questions and Tasks

On the basis of the stated principles, the study proposes a five-step process. The steps are sequentially related but not entirely linear; designers may return to an earlier step when review reveals an inconsistency. Importantly, each step produces an intermediate product, enabling teachers to exercise quality control rather than relying solely on intuition and experience.

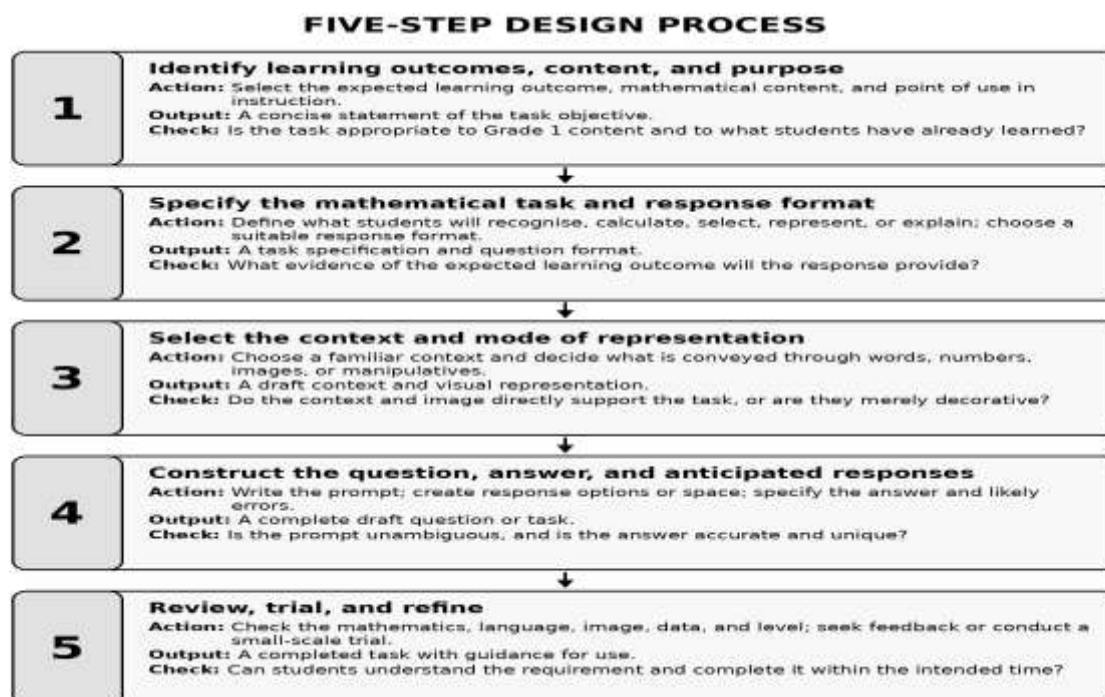


Figure 1. A five-step process for designing Grade 1 Mathematics questions and tasks

Source: Proposed by the authors.

Step 1 - Identify expected learning outcomes, content, and purpose of use. The designer should begin with the curriculum document and the specific instructional sequence. Even within the same addition content, a question used to develop the meaning

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of 'combining' will differ from one used to practise calculation skills or apply them in a situation. This step helps prevent two tendencies: choosing an engaging task that is not linked to an expected learning outcome, or using data and operations beyond what students have learned. The product of Step 1 is a brief statement specifying the expected learning outcome, content, purpose, and point of use.

Step 2 - Specify the mathematical task and response format. The learning goal must be translated into a concrete action for students: counting, comparing, calculating, selecting a number sentence, representing a relationship, identifying a shape, or explaining a method. Only then should the question format be selected. If the objective is to check a calculation result, students may enter a number; if the objective is to investigate their capacity to translate a situation into a number sentence, they should write or select that sentence; if the objective is to observe their thinking, students may point to an image or provide a brief oral answer. The response format must be appropriate to Grade 1 students' expressive capabilities and sufficient to provide evidence of the target task.

Step 3 - Select the context and mode of representation. The context should arise from experiences likely to be familiar to students, such as family, the classroom, everyday objects, animals, games, or daily activities. It must serve the mathematical content; unnecessary characters, details, and information should not be added. The designer determines which information is best conveyed through numbers, words, pictures, or physical objects. For Grade 1 students, images may replace some written text, but quantities in the image must agree with the given data and relationships among groups of objects must be clearly represented. If an image neither provides nor organises information, it should be removed to avoid unnecessary cognitive load.

Step 4 - Construct the question, answer, and anticipated responses. The prompt should direct students explicitly to the required action. A selected-response question should have only one correct answer, while the remaining options should be plausible and related to likely errors, such as confusing addition with subtraction or tens with ones. For a short-answer question, acceptable forms of the response should be specified. Anticipating responses need not become a complex coding system; its purpose is to help teachers distinguish a correct answer, a partially correct answer, a computational error, and an error arising from failure to understand the mathematical relationship.

Step 5 - Review, trial, and refine. The review should address alignment with expected learning outcomes; the accuracy of the content, data, and answer; the clarity of the prompt; the function of the image; suitability for students' reading comprehension; completion time; and usability within an instructional activity. A colleague should review the question, or it should be trialled with an appropriate group of students before broader use. If students interpret the prompt in multiple ways, ignore the image, select two options simultaneously, or lack sufficient space to write, the designer should return to the earlier steps and make adjustments.

3.4. Illustration of the Process

The example concerns addition without regrouping within 100. Students observe a picture of a classroom book corner and write an appropriate number sentence to find the total number of books in the bookcase.



Figure 2. An illustrative question on addition without regrouping within 100

Source: Designed by AI

Step 1 - Identify expected learning outcomes, content, and purpose of use. The question addresses the expectation that students recognise the practical meaning of addition in a situation involving the combination of two groups, write an appropriate addition number sentence, and perform addition without regrouping within 100. It may be used for practice or consolidation after students

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have learned to add two-digit numbers without regrouping. The purpose is not only to check the result of $33 + 22$, but also to determine whether students recognise that 'the books on both shelves' requires the combination of two quantities.

Step 2 - Specify the mathematical task and response format. Students perform three consecutive actions: identify the two data values, 33 and 22; recognise the need to combine the numbers of books on the two shelves; and write and calculate the number sentence. Entering numbers and a symbol in the blank boxes is appropriate for Grade 1 students' writing ability and provides evidence of both their selection of the operation and their calculation. During whole-class feedback, the teacher may ask students to explain briefly why they used addition, but students are not required to write a lengthy explanation.

Step 3 - Select the context and mode of representation. A classroom book corner is a familiar context. The two values are positioned directly on the upper and lower shelves, helping students identify the corresponding locations and quantities. The image does not require students to count 55 individual books; the numerical labels provide the data, while the two-shelf layout represents the two groups to be combined. Decorative details should be kept to a minimum so that they do not obscure the data or response boxes.

Step 4 - Construct the question, answer, and anticipated responses. The prompt is: 'Look at the picture and write an appropriate number sentence to find the total number of books in the bookcase.' The expected answer is $33 + 22 = 55$. Possible responses include writing $33 - 22$ because the combining relationship is not understood; writing $33 + 22$ correctly but calculating inaccurately; or writing only 55 without completing the number sentence. These responses help the teacher determine whether a student's difficulty concerns selecting the operation, performing the calculation, or following the required response format.

Step 5 - Review, trial, and refine. The content and numerical data fall within addition without regrouping within 100; $33 + 22$ does not require regrouping in the ones place. The prompt is concise and contains only one central requirement. The two numerical labels should be sufficiently large and use the same notation, while the response boxes should be wide enough for students to write in. In classroom use, the teacher may read the prompt aloud to students who need support without explaining the mathematical relationship. After students complete the task, the teacher may ask, 'Where are the books represented by 33 and 22?' and 'What should you do to find the number of books on both shelves?' to collect additional evidence of understanding.

The example demonstrates the distinct roles of the design foundations. The curriculum determines the content and number range; Grade 1 learner characteristics inform the prompt, image, and response format; and SEA-PLM's content-process-context perspective helps organise the task so that students must interpret the data and translate the situation into a number sentence. Combining these foundations yields a more appropriate task than merely adding a picture to an existing calculation.

3.5. Discussion

The proposed process offers three main contributions. First, it shifts task design from a practice based primarily on experience to a sequence of actions with identifiable products and review criteria. Teachers can clarify why they are designing a question, what evidence they need to collect, and why they have selected a particular context or response format. This is consistent with good-quality assessment practice, in which alignment among the objective, task, and interpretation of responses is essential [3], [6].

Second, the process places expected learning outcomes and the characteristics of Grade 1 students at the centre of adaptation. This differs from copying an item from a large-scale assessment programme or merely changing the surface form of a textbook exercise. Elements adapted from SEA-PLM are retained only when they clarify the content, cognitive activity, or context of the task. The resulting products should therefore be described as Grade 1 Mathematics questions and tasks designed with reference to selected techniques from the SEA-PLM assessment framework, not as 'SEA-PLM questions for Grade 1'.

Third, the process can be used flexibly in instruction. Teachers may use the same process to design tasks for constructing knowledge, practising, consolidating, or assessing. Nevertheless, the purpose must be specified at the first step because it affects the question format, level of support, mode of organisation, and feedback. A question used to elicit ideas during a lesson may permit follow-up prompts and manipulatives; if the same question is used in an individual assessment, its prompt, answer, and conditions of administration must be more tightly specified.

An important limitation is that a real-world context and visual representation do not automatically make a question more valuable. If a context contains excessive incidental information, students may devote cognitive resources to reading or searching for details while engaging in little mathematical activity. Conversely, excessive simplification may remove the practical relationship the question is intended to represent. The decisive criterion is therefore not whether a question includes a picture or a story, but whether every contextual element helps clarify the data, mathematical relationship, or required response. This perspective also positions review as a feedback loop in the design process: designers should be prepared to remove images, shorten prompts, or change response formats when these features increase cognitive load without generating additional meaningful evidence [10], [11].

The process has so far been analysed and illustrated only for selected Grade 1 Mathematics content. The study does not claim that it improves learning outcomes in every context or that it can replace specialist procedures for developing standardised assessments. Future research may seek teachers' views, trial questions with different groups of students, and analyse student work to refine the review criteria, particularly for open-response questions and tasks that permit multiple forms of representation.

4. CONCLUSION

This article has identified four principles and proposed a five-step process for designing Grade 1 Mathematics questions and tasks through the selective and adapted use of techniques from the SEA-PLM assessment framework. The process begins with expected learning outcomes and the evidence to be collected, then specifies the task, selects the context, constructs the question, and concludes with review, trialling, and refinement. The example of addition without regrouping within 100 demonstrates that adapted techniques are meaningful only when aligned with curriculum content and the characteristics of Grade 1 students. The process may serve as a reference for teachers designing questions and tasks for different instructional activities; it should also be further reviewed and evaluated in a wider range of practical contexts.

REFERENCES

- 1) Ministry of Education and Training. (2018). General Education Curriculum for Mathematics, promulgated together with Circular No. 32/2018/TT-BGDĐT dated 26 December 2018.
- 2) UNICEF & SEAMEO. (2017). SEA-PLM 2019 Assessment Framework (1st ed.). Bangkok: UNICEF and SEAMEO, SEA-PLM Secretariat.
- 3) ACER Centre for Global Education Monitoring & UNESCO Institute for Statistics. (2017). Principles of Good Practice in Learning Assessment. Montreal: UNESCO Institute for Statistics.
- 4) UNICEF & SEAMEO. (2024). Compendium of SEA-PLM Reading and Mathematics Items for Public Release. Bangkok: UNICEF and SEAMEO, SEA-PLM Secretariat.
- 5) Le Van Hong, Le Ngoc Lan, & Nguyen Van Thang. (2002). Developmental Psychology and Educational Psychology. Hanoi: Vietnam National University Press.
- 6) Black, P., & Wiliam, D. (2009). Developing the theory of formative assessment. *Educational Assessment, Evaluation and Accountability*, 21, 5-31. <https://doi.org/10.1007/s11092-008-9068-5>.
- 7) Tran Khanh Duc. (2023). Learning Competence and the Assessment of Learning Competence. Hanoi: Hanoi University of Science and Technology Publishing House.
- 8) Pham Thi Kim Anh. (2021). Teaching for student competency development: Nature, characteristics, and distinguishing features. *HNUE Journal of Science: Educational Sciences*, 66(1), 14-22.
- 9) Quality Management Department, Ministry of Education and Training. (2024). Training Materials on Applying the Southeast Asia Primary Learning Metrics (SEA-PLM) to Student Assessment. Internal document. [In Vietnamese].
- 10) Shute, V. J. (2008). Focus on formative feedback. *Review of Educational Research*, 78(1), 153-189. <https://doi.org/10.3102/0034654307313795>.
- 11) Sweller, J., Ayres, P., & Kalyuga, S. (2011). *Cognitive Load Theory*. New York: Springer. <https://doi.org/10.1007/978-1-4419-8126-4>.



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