

Exploring Secondary Students' Questioning Behaviour and Skills: A Needs Analysis for Formative Assessment Development in Indonesia

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ABSTRACT

Students' questions reveal how they are constructing knowledge, yet secondary students ask few questions in class, and this is commonly attributed to a lack of teacher-provided opportunity or to students' fear. Little is known about how secondary students themselves account for their questioning, and formative assessment instruments for questioning seldom start from such accounts. This exploratory study, the needs analysis phase of a design-based project, examined Indonesian secondary students' self-reported questioning to inform a formative assessment instrument for questioning skills. Fifty-two students in grades 7–12, recruited online through non-probability convenience sampling, completed a researcher-developed questionnaire (four closed and three open items) that had not undergone expert validation or pilot testing. Data were analysed using descriptive statistics, cross-tabulation, double coding of question depth, and thematic analysis. Although 90.4% of students reported that teachers frequently invite questions and 90.4% reported feeling comfortable asking, only 40.4% reported asking often; all measures were self-reported, and classroom behaviour was not observed. All 14 students who rarely asked reported frequent opportunities. Only 25.0% of the recalled example questions sought an explanation or a reason, and one third of students did not provide a formulated question, a result that may partly reflect recall difficulty. Students' suggestions largely repeated teacher-led question-and-answer. The findings tentatively suggest that permission alone is insufficient and that students may need stimuli that provoke curiosity and support in formulating questions. Five design principles are proposed to guide instrument development; their effectiveness has yet to be evaluated, and the small, self-selected sample limits generalisation.

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1. INTRODUCTION

Asking a question is one of the clearest signs that a student is thinking about what is being taught. A question shows where understanding stops, what the student finds puzzling, and which connection the student is trying to make. For this reason, students' questions are regarded as a resource for both learning and teaching: they direct the learner's own knowledge construction and give the teacher a window into that process [1]. From a constructivist standpoint, knowledge is built by the learner in interaction with others, and a question is the learner's own move in that interaction [2].

Student questioning is not a single attribute. At least four aspects can be distinguished: questioning frequency, that is, how often a student actually asks; willingness to participate, that is, whether a student is prepared to ask in front of the teacher and classmates; question formulation ability, that is, whether a student can turn a vague sense of not understanding into a well-formed question; and question quality, that is, how clear, relevant, and deep the resulting question is [1], [3]. These aspects are related but not interchangeable. A student may be willing to ask yet unable to formulate a precise question, or may ask often but only about procedures. Theories of curiosity help to explain how the aspects are connected. Curiosity arises when learners perceive a gap or an incongruity in what they know, and the perceived gap motivates them to seek information [4]; cognitive conflict, the experience that new information does not fit what one expected, is a typical source of such a gap. Recognising a gap, however, already requires some knowledge: learners who understand too little of a topic may not know what they do not know [5]. Classroom interaction then determines whether a recognised gap becomes a spoken question, because asking in public carries social costs that some students prefer to avoid [6], [7]. Questioning skills link curiosity to interaction: they allow a student to articulate the gap in a form to which a teacher or a classmate can respond, which is how a question contributes to active knowledge construction [2], [3].

Classroom reality is different from this ideal. Studies of classroom discourse have consistently found that students ask very few questions and that most of their questions are shallow, concerning procedures or isolated facts [8], [9]. Recent studies confirm this picture: lower-order questions made up more than four-fifths of the questions written by Indonesian grade 8 students in science [10], and what secondary students ask about differs with their educational level [11]. Two explanations are most often offered: teachers do not give the opportunity, and students are afraid or shy. In a survey of undergraduates in large science classes, for example, only about half reported voluntarily asking questions, and fear of negative evaluation was a main reason for holding back [7]. Research on questioning in Indonesian classrooms has also mostly observed teachers' questions, which tend to be low-level and convergent [12]; students' own accounts of why they ask or do not ask are rarely collected.

Much of this evidence comes from science classrooms [1], [7], [10], [11]. The pattern is not confined to science, however: Dillon's analysis of student questioning [8] and Graesser and Person's study of tutoring [9] were not limited to one subject; elementary students' inquiry questions in social studies were found to be mostly closed-ended [13], and questioning in an Indonesian English-as-a-foreign-language classroom was dominated by

low-level teacher questions [12]. Low and shallow student questioning therefore appears to reflect general features of classroom discourse, which justifies asking students about their questioning without restricting the study to one subject. Questioning also changes with schooling: what students ask differs between lower and upper secondary levels [11], and student questioning tends to decline as students move up through school [8]. An instrument intended for secondary classrooms should therefore be informed by students at both the junior and the senior secondary level, which is why both were included in this exploratory study.

Formative assessment offers a way to foster questioning skills. Formative assessment gathers evidence of learning during instruction and uses it to give feedback that closes the gap between current and desired performance [14], [15], [16]. Recent meta-analyses report a positive, if modest, effect of formative assessment on learning in K-12 settings [17], [18], with larger effects where the assessment or feedback is initiated by students [17], [19]. Previous research that connects student questioning with formative assessment can be grouped into four strands, summarised in Table 1.

Table 1. Previous Research on Student Questioning and Formative Assessment

Strand	Studies	Focus and typical setting	What is known and what remains unclear
Low student questioning and its causes	[7], [8], [9], [10], [11], [12]	Classroom discourse, tutoring, and surveys; mainly science, also EFL; primary to university	Students ask few, mostly low-level questions; lack of opportunity and fear of negative evaluation are the usual explanations. Unclear: secondary students' own accounts, especially in Indonesia
Formative assessment and inquiry	[20], [21], [22], [23], [24]	How teachers' questions and feedback elicit student thinking; formative strategies for inquiry skills; science classrooms	Teacher questioning and feedback can make student thinking visible and strengthen inquiry. Unclear: the student's own question as evidence of learning
Assessing student-generated questions	[25], [26], [27], [28]	Question posing as an evaluation method; web-based question posing; aligning teaching and assessment; a Bloom-based instrument for senior secondary biology	Questions can be classified by number, orientation, complexity, and cognitive level. Unclear: instruments designed from students' reported needs and usable across subjects
Teaching students to generate questions	[29], [30], [31], [32], [33], [34]	Interventions with prompts, models, and the Question Formulation Technique; children to undergraduates	Prompts and models raise the number and level of questions and can raise curiosity. Unclear: how such strategies fit a formative assessment cycle with feedback on the question itself

Table 1 shows three patterns. First, work on formative assessment and inquiry has largely examined the teacher's side: how teachers' questions and responses elicit student thinking [20], [21], and how formative strategies strengthen inquiry skills [22], [23], [24]. Second, a smaller body of work assesses students' questions themselves, for instance by their number, orientation, and complexity [25], or uses them to align teaching and assessment [26], [27]; in Indonesia, an instrument based on the revised Bloom taxonomy has been developed to evaluate senior secondary students' questions in biology [28]. Third,

intervention research shows that students can be taught to generate questions when given prompts and models [29], [30], and protocols such as the Question Formulation Technique start from a focus statement instead of a teacher question [31]; studies of this protocol report gains in adolescents' curiosity [32] and in the number and level of young children's questions [33], and practising question generation has also been associated with better performance on higher-order test items [34]. In all three strands, the design of instruments and interventions starts from the researcher's or the teacher's assumptions about what students need, while explanations of why students do not ask come mainly from undergraduates or from observations of teachers. What is still lacking is a formative assessment instrument for questioning skills whose design starts from secondary students' own accounts of their questioning.

Before such an instrument is designed, it is necessary to know what students actually need. If the obstacle is opportunity, the instrument only has to provide room for questions. If the obstacle is fear, a safe space is required. If the obstacle lies elsewhere, a design resting on those two assumptions will miss its target. In design research, a needs analysis of this kind is the first phase and sets the direction of the design [35].

The novelty of this study lies in deriving formative assessment design principles from secondary students' own reports of their questioning, namely how often they ask, whether lessons trigger their questions, what questions they can formulate, and what they think teachers should do, rather than from teachers' practices or from assumptions about opportunity and fear. The study therefore aims to analyse Indonesian secondary students' self-reported questioning as a basis for designing a formative assessment instrument for questioning skills. It addresses four research questions: (1) How do secondary students report their frequency of asking, the opportunities given by teachers, the extent to which lessons trigger questions, and their comfort in asking? (2) How deep are the questions students recall having asked? (3) Do students who report asking more often write deeper questions? (4) What do students think teachers should do, and what design principles can be derived for a formative assessment instrument for questioning skills? The study contributes in two ways. Theoretically, it separates perceived opportunity, comfort, lesson-triggered curiosity, reported frequency, and question quality, and shows how they relate in students' reports. Practically, it offers needs-based design principles that can guide the development of an instrument teachers can use to elicit, assess, and give feedback on students' questions.

2. METHOD

2.1. Research Design

This is an exploratory survey study combining quantitative and qualitative data from a single questionnaire. It constitutes the needs analysis phase of a design-based research project to develop a formative assessment instrument for questioning skills [35]; the design and trial of the instrument are outside the scope of this article. The study is descriptive: it tests no hypotheses, and associations are reported to generate questions for the development phase, not to establish causes.

2.2. Research Setting and Time

Data were collected online through Google Forms from 8 March to 24 April 2025. The questionnaire was administered in Indonesian; the student responses quoted in this article were translated into English by the authors.

2.3. Participants and Sampling

The target population was students in grades 7–12 at Indonesian junior secondary schools (grades 7–9) and senior secondary schools, general and vocational (grades 10–12). Respondents were recruited through non-probability online convenience sampling [36]: the link to the questionnaire was shared through social media and teacher networks, and students completed it voluntarily. Eligibility was established through the self-reported grade item; all 52 students who completed the questionnaire were in grades 7–12, and all 52 responses were included in the analysis without exclusion (Table 2). No sample size was calculated in advance, because the purpose was to describe needs rather than to estimate population parameters or test hypotheses.

Table 2. Respondent Profile (N = 52)

Characteristic	Category	n	%
Gender	Female	37	71.2
	Male	15	28.8
Level	Junior secondary (grades 7–9)	15	28.8
	Senior secondary, general and vocational (grades 10–12)	37	71.2
Grade	7	6	11.5
	8	3	5.8
	9	6	11.5
	10	13	25.0
	11	16	30.8
	12	8	15.4

The sample is unbalanced: senior secondary students and female students each made up 71.2% of respondents. Overall percentages are therefore weighted towards the experience of senior secondary girls, and the junior secondary and male subgroups (15 students each) are too small for meaningful comparison; subgroup differences are reported descriptively only. The questionnaire did not ask for the name or location of the school, so the geographical distribution of respondents and the characteristics of their schools (for example, public or private, school or madrasah, urban or rural) are unknown. This prevents the findings from being interpreted against particular regional or school contexts.

2.4. Data Collection and Instrument

The questionnaire contained four closed items and three open items, preceded by items on gender and grade; the complete instrument with response options is given in Appendix Table A1. The closed items asked how often the student asks questions in class and how often the teacher opens room for questions (both on a five-point scale from very often to never), whether the lessons presented by the teacher trigger the student to ask (strongly triggers, triggers, does not trigger), and whether the student feels comfortable asking in class (a four-point scale from very comfortable to very uncomfortable). The open items asked for the subject in which the student most likes to ask, an example of a question

the student had asked in class, and what teachers could do to encourage students to ask more. The items were written by the researchers and distributed without expert review or piloting.

The response categories were set by the researchers using common verbal frequency and rating formats; they were not adopted from an existing validated scale. Two features of these categories may have pushed responses towards the positive end: the comfort item had no neutral midpoint, and the trigger item offered two positive options but only one negative option. Both should be revised when the instrument is validated.

2.5. Variables and Measurement

Six aspects were measured. Questioning frequency, perceived opportunity, perceived lesson trigger, and comfort in asking were each measured by one closed item. Question depth was measured by coding the example question written in the open item, and students' views on how teachers could encourage questioning were captured by the last open item. The item on the preferred subject was used only to understand the context of the example questions and is not analysed separately. All measures are self-reports: frequency of asking is the student's estimate, not an observed count, and the example question was recalled, not collected during a lesson.

Each closed construct was measured by a single item. A single item cannot yield an internal consistency estimate, captures only one facet of a construct, and is more exposed to random response error; it is acceptable for narrow, concrete questions in exploratory screening, but not for conclusions about broader constructs [37]. Accordingly, each item is interpreted in this article as one self-report indicator (for example, how often a student says they ask), not as a measure of an underlying construct such as questioning motivation or classroom climate.

2.6. Validity, Reliability, and Trustworthiness

The closed items were not reviewed by experts or piloted, and with single items, no reliability coefficient could be calculated; the validity and reliability of the quantitative measures therefore cannot be demonstrated, which is a significant limitation of this study and a task for the development phase. For the qualitative analyses, several steps were taken to support trustworthiness. The coding categories for question depth were adapted from established frameworks [1], [38]; both open items were coded independently by the two authors, without sight of the answers to the other items; agreement was calculated, and disagreements were resolved by discussion; and the coding sheets were kept as an audit trail. Quotations are reported with the student's grade so that readers can judge how far the interpretations are grounded in the data. Because the schools and regions of respondents are unknown, transferability to other contexts should be judged with caution.

2.7. Data Analysis

Closed items were analysed using frequencies and percentages, and their distributions are displayed graphically (Figure 1). For cross-tabulation, frequency of asking was grouped into three levels: often (very often and often), sometimes, and rarely (rarely and

never). Because the sample is small and non-random, group comparisons are reported descriptively; one Fisher's exact test is reported as exploratory information.

The example questions written by students were coded by depth into four categories (defined in Section 3.2), adapted from the cognitive process dimension of the revised Bloom taxonomy [38] and the classification of student questions by Chin and Osborne [1]. When a student wrote more than one question, the code was assigned on the basis of the deepest one. What was coded was the type of question, not whether its premise was correct. Coding was carried out separately by the two authors without sight of the answers to other items. They agreed on 47 of 52 responses (90.4%), with Cohen's $\kappa = 0.87$ [39]; all five disagreements concerned responses that named a topic or copied an exercise, and after discussion these were coded as "no question formulated". The suggestions for teachers were analysed thematically [40]; one response could contain more than one theme. The themes of each response were also assigned separately by the two authors; the sets of themes they assigned were identical for 50 of 52 responses (96.2%). In two long responses containing several suggestions, each coder recorded a theme the other had not; after discussion, all of these themes were retained.

2.8. Ethical Considerations

Participation was voluntary and anonymous. The first page of the form explained the purpose of the study and contained a statement of consent to participate, which respondents accepted before answering. To protect respondents' confidentiality and comfort, the questionnaire did not ask for names, school names, contact details, or any other identifying information, and the data were accessible only to the authors. The study was not submitted for institutional ethical review, and consent from parents or guardians was not obtained for respondents under 18; the anonymous design was intended to minimise risk to these respondents, but the absence of formal ethical approval and parental consent is acknowledged as a limitation (Section 3.8).

3. RESULTS AND DISCUSSION

This section first presents the findings for each research question: students' reported questioning activity (Section 3.1), the depth of the questions they recalled and its relation to frequency (Section 3.2), and their suggestions for teachers (Section 3.3). The respondent profile was described in Section 2.3. A summary of key findings (Section 3.4) is followed by the discussion (Section 3.5), the design principles derived for the instrument (Section 3.6), implications (Section 3.7), and limitations and directions for future research (Section 3.8).

3.1. High Reported Opportunity and Comfort, Low Reported Frequency of Asking

Figure 1 shows the responses to the closed items; exact frequencies are given in Appendix Table A1. Almost all respondents reported that teachers often or very often open room for questions (47 of 52; 90.4%), that lessons trigger them to ask (90.4%), and that they feel comfortable asking (90.4%). However, only 21 students (40.4%) reported asking questions often or very often; 17 (32.7%) reported asking sometimes, and 14 (26.9%) rarely or never.

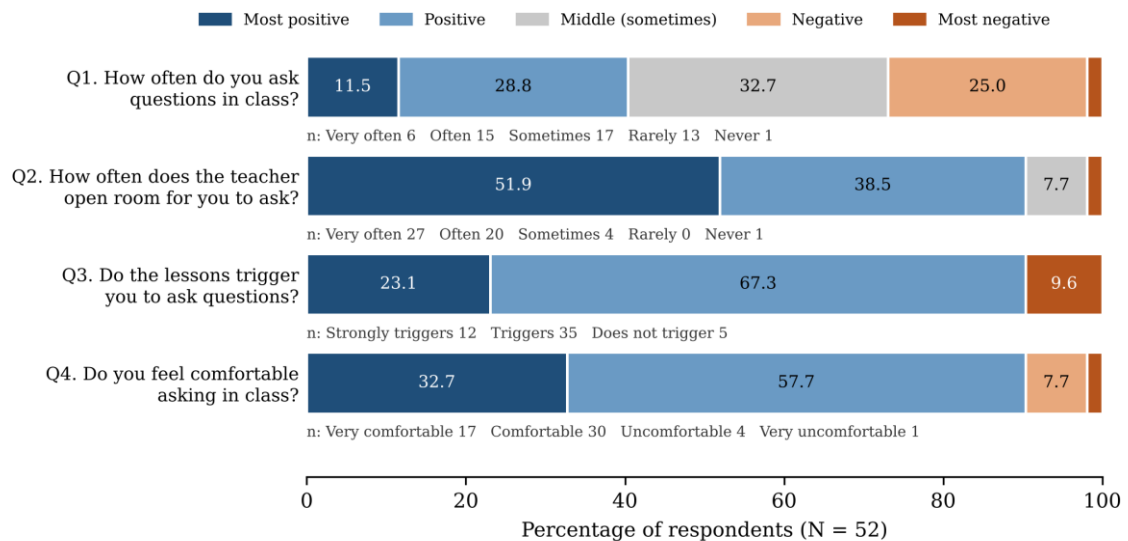


Figure 1. Distribution of Responses to the Four Closed Items (N = 52; segment labels are percentages)

This gap of fifty percentage points between reported opportunity and reported frequency of asking is the central finding of the study. Because all four measures are students' self-reports, it is a difference between what students perceive about their classrooms and how often they say they ask, not a difference between observed opportunities and observed behaviour. Table 3 examines it further by comparing the three frequency groups.

Table 3. Opportunity, Trigger, and Comfort by Frequency of Asking, n (%)

Frequency of asking	n	Teacher often/very often opens room	Lessons trigger/strongly trigger	Comfortable/very comfortable
Often / very often	21	17 (81.0)	21 (100.0)	20 (95.2)
Sometimes	17	16 (94.1)	17 (100.0)	16 (94.1)
Rarely / never	14	14 (100.0)	9 (64.3)	11 (78.6)

All 14 students who rarely or never asked reported that their teachers often or very often open room for questions. Perceived opportunity therefore does not distinguish students who ask from those who do not; if anything, the rarely-asking group reported opportunity slightly more often than the often-asking group (100.0% against 81.0%). This deserves closer examination, because it runs against the most common explanation of low participation. Within the rarely-asking group, 9 students felt triggered by lessons, and 11 felt comfortable; since at most 14 students can be counted, at least six of them (9 + 11 - 14) reported all three favourable conditions, namely frequent opportunity, lessons that trigger questions, and comfort, and still rarely asked. For these students, neither opportunity, nor comfort, nor lesson triggers as measured here accounts for their low questioning.

Lesson triggers were nevertheless associated with frequency of asking: all five students who said that lessons do not trigger them to ask were in the rarely-asking group, whereas every student in the other two groups reported feeling triggered. Because only five students gave this response and the data are cross-sectional, this co-occurrence indicates an

association worth investigating, not a cause. Comfort showed a weaker association: four of the five students who felt uncomfortable were outside the often-asking group, three of them in the rarely-asking group.

By gender, male students more often reported asking often or very often (9 of 15; 60.0%) than female students (12 of 37; 32.4%). By level, reports of rarely or never asking were more common in senior secondary (13 of 37; 35.1%) than in junior secondary (1 of 15; 6.7%). Given the small and unequal subgroups (Section 2.3), these differences are indications only and are not interpreted further.

3.2. Depth of Students' Questions

When asked to write an example of a question they had asked in class, one third of the students (17; 32.7%) did not provide a formulated question: they named only a topic or gave no example (Table 4). Another third wrote factual or definitional questions, and five wrote procedural ones. Only 13 students (25.0%) wrote a question that sought an explanation, a reason, or an evaluation. This last category appeared among 10 of 37 senior secondary students (27.0%) and 3 of 15 junior secondary students (20.0%). The example given for this category, "Why can sin, cos and tan only be used in right-angled triangles?", rests on an imprecise premise, since only the side-ratio definition is restricted to right-angled triangles; yet a question of this kind shows the teacher exactly where the student's understanding ends, and that is its formative value.

Table 4. Depth of Example Questions Written by Students (N = 52)

Category	Description	Example of student response	n (%)
No question formulated	Names a topic only, or gives no example	"About trigonometry" (grade 10)	17 (32.7)
Procedural / clarification	Asks about the task or for repetition	"What does this mean?" (grade 10)	5 (9.6)
Factual / definitional	Asks for a fact, term, or meaning	"What is meant by a negotiation text?" (grade 10)	17 (32.7)
Explanatory / higher-order	Asks why, how, what if, or for an evaluation	"Why can sin, cos and tan only be used in right-angled triangles?" (grade 10)	13 (25.0)

The 17 responses without a formulated question should not all be read as evidence of insufficient questioning skills. The item required recall, so some students may simply have forgotten, and some responses that copied an exercise from a textbook (for example, " $2 \sin 60^\circ$ ") suggest that the instruction was misunderstood. However, responses consisting of a topic ("about ASEAN", "explanation of the function formula") suggest that for some students, "asking" means requesting a re-explanation of some material, and has not yet taken the form of a formulated question.

Table 5 cross-tabulates reported frequency of asking with depth of question. Among the 21 students who reported asking often, 9 (42.9%) wrote an explanatory question, compared with 4 of the 31 other students (12.9%); the difference is significant on Fisher's exact test ($p = 0.022$), reported here as exploratory information. Frequency and depth thus tend to go together. The tendency is not absolute, however: 6 of the 21 students who said they asked often (28.6%) did not write a formulated question, and 3 others wrote only procedural questions. Asking often does not necessarily mean asking skilfully.

Table 5. Depth of Question by Frequency of Asking, n (%)

Frequency of asking	n	No question	Procedural	Factual	Explanatory
Often / very often	21	6 (28.6)	3 (14.3)	3 (14.3)	9 (42.9)
Sometimes	17	5 (29.4)	2 (11.8)	8 (47.1)	2 (11.8)
Rarely / never	14	6 (42.9)	0 (0.0)	6 (42.9)	2 (14.3)
Total	52	17 (32.7)	5 (9.6)	17 (32.7)	13 (25.0)

3.3. Students' Suggestions for Teachers

Table 6 presents the themes in students' answers about what teachers could do so that students ask more. The most frequent theme was that the teacher should ask questions or hold question-and-answer sessions (12 students), followed by interesting lessons (9) and opportunity and time to ask (8).

Table 6. Themes in Students' Suggestions for Teachers (N = 52; one response may contain more than one theme)

Theme	Example of student response	n (%)
Teacher asks questions, question-and-answer, open questions	"If nobody asks, the teacher asks" (grade 11)	12 (23.1)
Interesting lessons that arouse curiosity	"Give information that is very interesting and makes us curious" (grade 7)	9 (17.3)
Opportunity, invitation, and time to ask	"Give plenty of spare time for asking" (grade 10)	8 (15.4)
Rewards (points, extra marks, prizes)	"Extra marks will be given to those who want to ask" (grade 11)	6 (11.5)
Clear and complete explanation	"Give clear and complete material" (grade 8)	5 (9.6)
Safe and fair classroom climate	"Not favouring certain students" (grade 9); "patient and not often angry" (grade 10)	4 (7.7)
Discussion	"Often invite us to discuss together" (grade 11)	3 (5.8)
Examples of questions and feedback	"Give examples of questions, encourage creativity, and give positive feedback" (grade 7)	2 (3.8)
Other	"Maybe reducing the explanation a little could make students ask more" (grade 9)	4 (7.7)
Don't know / no answer.		5 (9.6)

Two things stand out. First, the most common suggestion keeps the teacher as the one who asks. Teacher-led question-and-answer and the invitation "please ask" are patterns that, according to the closed items, are already in place and do not produce enough questions. Students propose more of the same. This is understandable: it is hard for students to imagine a form of questioning activity they have never experienced. Second, a small number of students pointed directly at what the cross-tabulation showed to be associated with asking, namely a trigger. A grade 8 student wrote that teachers could carry out experiments or demonstrations "because students usually tend to ask when they see something interesting". Two students asked for examples of questions, and one asked for time to think.

The themes of rewards and explanation call for caution. Points or extra marks may raise the number of questions without raising their quality. The request that teachers explain

more clearly and completely stands in contrast to one student's suggestion that explanation be reduced; an explanation that answers everything leaves nothing to ask about.

3.4. Summary of Key Findings

In students' reports, (1) opportunity and comfort were high but frequency of asking was low, and all students who rarely asked reported frequent opportunity; (2) a lack of lesson-triggered curiosity co-occurred with rarely asking, although at least six rarely-asking students reported opportunity, trigger, and comfort together; (3) only a quarter of recalled questions were explanatory, and one third of students did not provide a formulated question; (4) students who reported asking often wrote explanatory questions more often, but not consistently; and (5) students' suggestions mostly repeated teacher-led question-and-answer, with a few pointing to triggers, examples of questions, and time to think.

3.5. Discussion

Why students remain passive despite reported opportunity. The two usual explanations, that teachers give no opportunity and that students are afraid, account for only a small part of the picture in this sample. Having permission to ask is different from having something to ask. This is consistent with Dillon's [8] argument that the invitation "any questions?" does not by itself produce questions, because a question arises from perplexity or curiosity about something, not from the availability of a turn to speak. It also fits the information-gap view of curiosity, in which a question is motivated by a perceived gap in one's knowledge [4]: an invitation to ask provides a turn but not a gap. From a constructivist standpoint [2], an invitation to ask without such a gap leaves the learner with no move to make in the interaction.

The present data, however, do not establish that a lack of curiosity is the primary cause of low questioning. Lesson triggers were reported by most rarely-asking students, and at least six of them reported every favourable condition measured. Several alternative explanations, none of which was measured here, are plausible. Students' comprehension may be too limited for them to locate what they do not understand, since a question requires knowing enough to know what is not known [5]. Students may not see the material as relevant enough to be worth asking about. Classroom norms may treat questions as the teacher's prerogative, so that students answer rather than ask, a pattern visible in students' own suggestions that the teacher should ask. Individual motivation also matters: students may avoid asking because they want to appear competent in front of peers or prefer to work things out alone [6], and fear of negative evaluation was a main reason for not asking among undergraduates [7]. The finding that comfort was reported by most students does not rule this out, because feeling comfortable in class is not the same as being willing to expose one's ignorance in public. These explanations should be examined directly in future research, for example by asking students why they decided not to ask.

Question depth. The depth profile agrees with the literature showing that students' questions are mostly low-level unless questioning is deliberately taught [1], [9]. It also matches the predominance of lower-order questions reported for Indonesian grade 8 science students [10]; elementary students' inquiry questions have likewise been found to be mostly closed-ended [13]. The association between frequency and depth suggests that practice in

asking and the ability to ask deeply may develop together, but the exceptions show that frequency cannot stand in for quality. An instrument therefore needs to assess the quality of questions and not only their number, as Dori and Herscovitz [25] did. Question quality also carries information that other measures miss: in one study, some students with the lowest reading comprehension scores nevertheless generated insightful questions [41].

Moving students from factual towards explanatory and analytical questions is a matter of deliberate question-generation activity. Intervention studies show that prompts and models, such as question stems that ask how two ideas are similar or why something happens, raise the level of students' questions [29], [30], and students' questions that express wonderment about explanations and causes are those most closely tied to meaningful learning [3]. The requests of a few students in this study for examples of questions and time to think correspond to these intervention findings. A sequence that starts from a stimulus, asks students to write questions, then classifies them and asks students to turn a factual question into a why or how question would give students repeated practice in the move from fact to explanation.

3.6. Design Principles for the Instrument

The findings suggest five design principles for a formative assessment instrument for questioning skills (Table 7). These principles are proposals derived from the needs data; their effectiveness has not been tested.

Table 7. Design Principles Derived from the Findings

Finding	Design principle
Reported opportunity is already high; not feeling triggered by lessons co-occurred with rarely asking (Table 3)	The instrument starts from a stimulus, namely facts, phenomena, or data that arouse curiosity, and not from a teacher question or an invitation to ask.
One third of students did not provide a formulated question; an oral invitation to the whole class is taken up by few (Figure 1; Table 4)	Every student writes their questions, with time to think, so that all students' questions become visible.
Most questions are factual; students ask for examples of questions (Tables 4 and 6)	Model questions or prompts are provided at the initial stage and withdrawn gradually.
Asking often does not always mean asking deeply (Table 5)	What is assessed is the quality of questions (clarity, relevance, depth), not their number
Students ask for feedback; rewards in the form of points risk encouraging quantity only (Table 6)	The teacher gives written feedback on the question itself: what makes it good and how to sharpen it.

The first and second principles reverse the structure of a conventional worksheet, which presents questions for students to answer; this approach is in line with the focus statement of the Question Formulation Technique [31] and with problem posing in mathematics learning [42], and with meta-analytic evidence that formative assessment is most effective when it is initiated by students [17], [19]. The third principle is a form of scaffolding, that is, support withdrawn as competence grows [43]. The fourth and fifth principles make the student's question the evidence on which formative assessment operates: effective feedback tells students how good their work is and how to improve it, and does

more than praise [15], [16]. This extends earlier work in which the teacher's question was the formative tool [20], [21].

Several elements of the Question Formulation Technique [31] can be adapted directly. Its question focus corresponds to the stimulus in the first principle. Its rules for producing questions (ask as many questions as possible, do not stop to discuss or answer them, write each question down as stated, and change statements into questions) fit the written, individual question generation of the second principle. Its step of classifying questions as closed or open and changing one type into the other provides a concrete activity for the third principle. Its steps of prioritising questions and reflecting on what was learned give students a role in judging question quality, which supports the fourth and fifth principles. Because the instrument is meant for formative use, these steps would be followed by the teacher's written feedback rather than ending with the students' own reflection.

Written question generation also matters for students who are reluctant to ask orally. Writing removes the public exposure that makes some students avoid asking [6], [7], gives every student time to think, and makes the questions of quiet students visible to the teacher. For this reason, the instrument should assess questioning competence separately from questioning confidence, motivation, and classroom participation. The written questions, scored with a rubric for clarity, relevance, and depth, would indicate competence; a few short self-report items, kept apart from the competence score, would indicate confidence and willingness to ask; and oral participation, if recorded, would be reported as a third, separate indicator. Keeping these apart prevents a student who asks well in writing but rarely speaks from being judged as unskilled, and shows the teacher whether a student needs help in formulating questions or encouragement to voice them.

Teachers could use the results in a simple cycle. After each stimulus, students submit their written questions; the teacher scores them with the rubric and writes a short comment on one question per student, stating what makes it good and how to make it deeper. Recording the proportion of each student's questions in the explanatory category across several cycles would allow the teacher to monitor improvement in question quality, to give individualised feedback, and to decide when model questions can be withdrawn. Selected student questions can also be used as the starting point for the next lesson, which shows students that their questions shape the learning.

3.7. Implications

Theoretically, the findings support treating questioning frequency, perceived opportunity, comfort, and question quality as distinct aspects: in this sample they did not move together, and opportunity in particular was not associated with asking. This points to the source of questions, namely curiosity provoked by a perceived knowledge gap, and the ability to formulate them, as aspects that deserve more attention than the availability of a turn to speak. Practically, teachers may gain more from presenting stimuli that provoke curiosity, asking every student to write questions, providing model questions, and giving feedback on the questions themselves than from repeating the invitation to ask. For curriculum developers and teacher education, the findings suggest that questioning skills

could be assessed and developed explicitly, using student-generated questions as formative evidence, rather than being left to emerge from open invitations.

3.8. Limitations and Future Research

This study has several limitations. The sample is small and was obtained through non-probability convenience sampling via social media and teacher networks, so the results cannot be generalised; students willing to complete a survey about asking questions are probably more active than average so the true gap may be larger. The sample is also dominated by senior secondary and female students, and respondents' schools and regions were not recorded. The study did not obtain institutional ethical approval or parental consent for respondents under 18, although no identifying information was collected. All data are self-reported: frequency of asking and teacher-provided opportunity are students' perceptions, and the example questions depend on memory. The questionnaire items were not reviewed by experts or piloted before distribution, and each construct was measured by a single item, so the validity and reliability of the measurement cannot be demonstrated. Some responses to the example-question item appear to copy an exercise from a textbook and not a question the student put to the teacher; this indicates that some students misunderstood the instruction for that item, so the proportion in the "no question formulated" category may partly reflect a weakness of the item and not only students' ability. The questionnaire did not ask why students decided not to ask, so the explanation of the gap is inferred from the cross-tabulation and the open responses, not from students' direct statements.

Future research should (1) validate the instrument through expert review and pilot testing, including cognitive interviews to check how students understand each item, and replace single items with multi-item scales; (2) use a larger and well-defined sample, ideally stratified by level, gender, region, and school type; (3) observe students' questions directly in class and collect questions during lessons rather than from memory; (4) ask students directly why they do not ask, covering comprehension, perceived relevance, classroom norms, and motivation; and (5) develop and test an instrument designed on the principles above.

4. CONCLUSION

This study set out to identify, from secondary students' own reports, what a formative assessment instrument for questioning skills needs to address. In this sample of 52 self-selected students, almost all reported having opportunities to ask and feeling comfortable doing so, yet fewer than half reported asking often, and every student who rarely asked reported sufficient opportunity. Not feeling triggered by lessons was associated with rarely asking, although some rarely-asking students reported every favourable condition. Only a quarter of the questions students recalled sought an explanation or a reason, and one third of students did not provide a formulated question in a retrospective questionnaire task, which may partly reflect recall difficulty rather than inability. Students who reported asking often tended to write deeper questions, but not consistently, and students' own suggestions mostly repeated teacher-led question-and-answer.

As a preliminary interpretation, rather than a demonstrated causal explanation, these findings suggest that students may need a trigger for curiosity and support in formulating questions more than permission to ask. The main contribution of the study is to identify design needs for a formative assessment centred on student-generated questions, summarised in five principles: start from a stimulus, have every student write questions, provide models at the initial stage, assess quality rather than number, and give feedback on the questions themselves. In practice, teachers can use questioning prompts, written question-generation activities, and formative feedback on question quality. The conclusions are limited by convenience sampling, self-reported data, and an unvalidated questionnaire. Future research should involve classroom observation, expert validation and pilot testing of the instrument, and broader student samples, and should test the proposed principles in subsequent development research.

APPENDIX

Table A1. Questionnaire Items, Response Options, and Response Distribution (N = 52; English translation of the Indonesian original)

No.	Item	Type and response options	n (%)
A	Gender	Closed: female / male	37 (71.2) / 15 (28.8)
B	Grade	Closed: 7 / 8 / 9 / 10 / 11 / 12	See Table 2
1	How often do you ask questions in class?	Closed: very often / often / sometimes / rarely / never	6 (11.5) / 15 (28.8) / 17 (32.7) / 13 (25.0) / 1 (1.9)
2	How often does the teacher open room for you to ask?	Closed: very often / often / sometimes / rarely / never	27 (51.9) / 20 (38.5) / 4 (7.7) / 0 (0.0) / 1 (1.9)
3	Do the lessons presented by the teacher trigger you to ask questions?	Closed: strongly triggers / triggers / does not trigger	12 (23.1) / 35 (67.3) / 5 (9.6)
4	Do you feel comfortable asking in class?	Closed: very comfortable / comfortable / uncomfortable / very uncomfortable	17 (32.7) / 30 (57.7) / 4 (7.7) / 1 (1.9)
5	In which subject do you most like to ask questions?	Open	Not analysed separately
6	Write an example of a question you have asked in class.	Open	Coded by depth (Table 4)
7	What could teachers do to encourage students to ask more?	Open	Analysed thematically (Table 6)

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REFERENCES

- [1] C. Chin and J. Osborne, "Students' questions: a potential resource for teaching and learning science," *Studies in Science Education*, vol. 44, no. 1, pp. 1–39, Mar. 2008, doi: 10.1080/03057260701828101.
- [2] L. S. Vygotskij and M. Cole, *Mind in society: the development of higher psychological processes*. Cambridge, Mass.: Harvard Univ. Press, 1978.
- [3] C. Chin and D. E. Brown, "Student-generated questions: A meaningful aspect of learning in science," *International Journal of Science Education*, vol. 24, no. 5, pp. 521–549, 2002, doi: 10.1080/09500690110095249.
- [4] G. Loewenstein, "The psychology of curiosity: A review and reinterpretation," *Psychological Bulletin*, vol. 116, no. 1, pp. 75–98, 1994, doi: 10.1037/0033-2909.116.1.75.

- [5] N. Miyake and D. A. Norman, "To ask a question, one must know enough to know what is not known," *Journal of Verbal Learning and Verbal Behavior*, vol. 18, no. 3, pp. 357–364, 1979, doi: 10.1016/S0022-5371(79)90200-7.
- [6] A. M. Ryan, P. R. Pintrich, and C. Midgley, "Avoiding seeking help in the classroom: Who and why?," *Educational Psychology Review*, vol. 13, no. 2, pp. 93–114, Jun. 2001, doi: 10.1023/A:1009013420053.
- [7] E. M. Nadile *et al.*, "Call on me! Undergraduates' perceptions of voluntarily asking and answering questions in front of large-enrollment science classes," *PLoS ONE*, vol. 16, no. 1, p. e0243731, Jan. 2021, doi: 10.1371/journal.pone.0243731.
- [8] J. T. Dillon, "The remedial status of student questioning," *Journal of Curriculum Studies*, vol. 20, no. 3, pp. 197–210, May 1988, doi: 10.1080/0022027880200301.
- [9] A. C. Graesser and N. K. Person, "Question Asking During Tutoring," *American Educational Research Journal*, vol. 31, no. 1, pp. 104–137, Mar. 1994, doi: 10.3102/00028312031001104.
- [10] A. N. Salamah, E. Erman, and E. Susiyawati, "Analisis Keterampilan Bertanya Siswa Kelas VIII pada Mata Pelajaran IPA," *pendipa. jurnal. pendik. sains*, vol. 6, no. 3, pp. 704–711, Oct. 2022, doi: 10.33369/pendipa.6.3.704-711.
- [11] J. Flašar, L. Krajňáková, and M. Hanus, "From inquiry to insight: analysing lower and upper secondary students' questioning in geoscience education," *Research in Science & Technological Education*, pp. 1–23, Jan. 2026, doi: 10.1080/02635143.2025.2609630.
- [12] D. R. Lestari and D. Puspitasari, "Exploring Teachers' Questioning Strategies in an EFL Classroom Interaction: A Case Study of A Vocational High School," *Berumpun: International Journal of Social, Politics, and Humanities*, vol. 5, no. 2, pp. 72–85, Aug. 2023, doi: 10.33019/berumpun.v5i2.96.
- [13] R. E. Hughes and P. Marhatta, "Learning to ask their own questions: How elementary students develop social studies inquiry questions," *Teaching and Teacher Education*, vol. 127, p. 104094, Jun. 2023, doi: 10.1016/j.tate.2023.104094.
- [14] P. Black and D. Wiliam, "Assessment and Classroom Learning," *Assessment in Education: Principles, Policy & Practice*, vol. 5, no. 1, pp. 7–74, Mar. 1998, doi: 10.1080/0969595980050102.
- [15] J. Hattie and H. Timperley, "The Power of Feedback," *Review of Educational Research*, vol. 77, no. 1, pp. 81–112, Mar. 2007, doi: 10.3102/003465430298487.
- [16] D. R. Sadler, "Formative assessment and the design of instructional systems," *Instructional Science*, vol. 18, no. 2, pp. 119–144, Jun. 1989, doi: 10.1007/BF00117714.
- [17] H. Lee, H. Q. Chung, Y. Zhang, J. Abedi, and M. Warschauer, "The Effectiveness and Features of Formative Assessment in US K-12 Education: A Systematic Review," *Applied Measurement in Education*, vol. 33, no. 2, pp. 124–140, Apr. 2020, doi: 10.1080/08957347.2020.1732383.
- [18] Q. Xuan, A. Cheung, and D. Sun, "The effectiveness of formative assessment for enhancing reading achievement in K-12 classrooms: A meta-analysis," *front. Psychol.*, vol. 13, p. 990196, Aug. 2022, doi: 10.3389/fpsyg.2022.990196.
- [19] P. Karaman, "The Effect of Formative Assessment Practices on Student Learning: A Meta-Analysis Study," *International Journal of Assessment Tools in Education*, vol. 8, no. 4, pp. 801–817, Dec. 2021, doi: 10.21449/ijate.870300.
- [20] M. Araceli Ruiz-Primo and E. M. Furtak, "Informal Formative Assessment and Scientific Inquiry: Exploring Teachers' Practices and Student Learning," *Educational Assessment*, vol. 11, no. 3–4, pp. 237–263, Nov. 2006, doi: 10.1080/10627197.2006.9652991.
- [21] C. Chin, "Classroom Interaction in Science: Teacher questioning and feedback to students' responses," *International Journal of Science Education*, vol. 28, no. 11, pp. 1315–1346, Sep. 2006, doi: 10.1080/09500690600621100.
- [22] P. Bernard, K. Dudek-Różycki, and K. Orwat, "Integration of inquiry-based instruction with formative assessment: the case of experienced chemistry teachers," *Journal of Baltic Science Education*, vol. 18, no. 2, pp. 184–196, Apr. 2019, doi: 10.33225/jbse/19.18.184.
- [23] M. Ganajová, I. Sotáková, S. Lukáč, Z. Ješková, V. Jurková, and R. Orosová, "Formative Assessment As A Tool To Enhance The Development Of Inquiry Skills In Science Education," *JBSE*, vol. 20, no. 2, pp. 204–222, Apr. 2021, doi: 10.33225/jbse/21.20.204.
- [24] M. Grangeat, C. Harrison, and J. Dolin, "Exploring assessment in STEM inquiry learning classrooms," *International Journal of Science Education*, vol. 43, no. 3, pp. 345–361, Feb. 2021, doi: 10.1080/09500693.2021.1903617.
- [25] Y. J. Dori and O. Herscovitz, "Question-posing capability as an alternative evaluation method: Analysis of an environmental case study," *J. Res. Sci. Teach.*, vol. 36, no. 4, pp. 411–430, Apr. 1999, doi: 10.1002/(SICI)1098-2736(199904)36:4<411::AID-TEA2>3.0.CO;2-E.

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- [26] Y.-F. Lan and P.-C. Lin, "Evaluation and improvement of student's question-posing ability in a web-based learning environment," *Australasian Journal of Educational Technology*, vol. 27, no. 4, Aug. 2011, doi: 10.14742/ajet.939.
- [27] H. Pedrosa De Jesus and A. C. Moreira, "The role of students' questions in aligning teaching, learning and assessment: a case study from undergraduate sciences," *Assessment & Evaluation in Higher Education*, vol. 34, no. 2, pp. 193–208, Apr. 2009, doi: 10.1080/02602930801955952.
- [28] A. S. Kusuma, D. Setiadi, and B. S. Handayani, "Pengembangan Instrumen Questioning Skills Berdasarkan Domain Kognitif Taksonomi Bloom Revisi Untuk Evaluasi Kemampuan Bertanya Siswa SMA Pada Pembelajaran Biologi," *Jurnal Ilmiah Profesi Pendidikan*, vol. 8, no. 4, pp. 2668–2680, Nov. 2023, doi: 10.29303/jipp.v8i4.1764.
- [29] A. King, "Guiding Knowledge Construction in the Classroom: Effects of Teaching Children How to Question and How to Explain," *American Educational Research Journal*, vol. 31, no. 2, pp. 338–368, Jun. 1994, doi: 10.3102/00028312031002338.
- [30] B. Rosenshine, C. Meister, and S. Chapman, "Teaching Students to Generate Questions: A Review of the Intervention Studies," *Review of Educational Research*, vol. 66, no. 2, pp. 181–221, Jun. 1996, doi: 10.3102/00346543066002181.
- [31] D. Rothstein and L. Santana, *Make just one change: teach students to ask their own questions*. Cambridge, Mass: Harvard Education Press, 2011.
- [32] S. Clark, A. G. Harbaugh, and S. Seider, "Fostering adolescent curiosity through a question brainstorming intervention," *Journal of Adolescence*, vol. 75, no. 1, pp. 98–112, Aug. 2019, doi: 10.1016/j.adolescence.2019.07.007.
- [33] C. Causey and A. Spencer, "Student-generated questions: An exploration of an instructional strategy with young children," *Thinking Skills and Creativity*, vol. 53, p. 101608, Sep. 2024, doi: 10.1016/j.tsc.2024.101608.
- [34] E. Aflalo, "Students generating questions as a way of learning," *Active Learning in Higher Education*, vol. 22, no. 1, pp. 63–75, Mar. 2021, doi: 10.1177/1469787418769120.
- [35] The Design-Based Research Collective, "Design-Based Research: An Emerging Paradigm for Educational Inquiry," *Educational Researcher*, vol. 32, no. 1, pp. 5–8, Jan. 2003, doi: 10.3102/0013189X032001005.
- [36] I. Etikan, S. A. Musa, and R. S. Alkassim, "Comparison of Convenience Sampling and Purposive Sampling," *American Journal of Theoretical and Applied Statistics*, vol. 5, no. 1, p. 1, 2016, doi: 10.11648/j.ajtas.20160501.11.
- [37] M. S. Allen, D. Iliescu, and S. Greiff, "Single item measures in psychological science: A call to action," *European Journal of Psychological Assessment*, vol. 38, no. 1, pp. 1–5, 2022, doi: 10.1027/1015-5759/a000699.
- [38] L. W. Anderson and D. R. Krathwohl, Eds., *A taxonomy for learning, teaching, and assessing: a revision of Bloom's taxonomy of educational objectives*, Complete ed. New York: Longman, 2001.
- [39] J. Cohen, "A Coefficient of Agreement for Nominal Scales," *Educational and Psychological Measurement*, vol. 20, no. 1, pp. 37–46, Apr. 1960, doi: 10.1177/001316446002000104.
- [40] V. Braun and V. Clarke, "Using thematic analysis in psychology," *Qualitative Research in Psychology*, vol. 3, no. 2, pp. 77–101, Jan. 2006, doi: 10.1191/1478088706qp063oa.
- [41] L. Maplethorpe, H. Kim, M. R. Hunte, M. Vincett, and E. E. Jang, "Student-Generated Questions in Literacy Education and Assessment," *Journal of Literacy Research*, vol. 54, no. 1, pp. 74–97, Mar. 2022, doi: 10.1177/1086296X221076436.
- [42] E. A. Silver, "On Mathematical Problem Posing," *For the Learning of Mathematics*, vol. 14, no. 1, pp. 19–28, 1994.
- [43] D. Wood, J. S. Bruner, and G. Ross, "The role of tutoring in problem solving," *Child Psychology Psychiatry*, vol. 17, no. 2, pp. 89–100, Apr. 1976, doi: 10.1111/j.1469-7610.1976.tb00381.x.
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