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An exploratory study of student question-asking in science classroom

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Abstract

Despite the significance of students' questions for both teaching and learning, much of this potential remains untapped due to the fact that students do not often ask questions in the classroom. Several attempts were made to shed light on this dearth of classroom questioning, there is, however, a lack of contemporary research, especially with a particular focus on secondary school students. To investigate students' perceptions of question asking and to understand barriers to the expression of questions, the current study employed a mixed-method research design. The first phase involved a qualitative survey to elicit deeper insights into students' perspectives and experiences. The insights obtained from this phase were then used to validate the content of the questionnaire in the subsequent quantitative phase. Results showed that most students were aware of how asking questions is of great importance in different facets of their own learning and could be helpful to their classmates and teachers to some degree. However, they may refrain from asking due to the language difficulty and a fear of asking. In particular, students are often afraid of receiving negative responses and bothering others. Significant differences between boys and girls were found. The study also highlighted the role of perceived importance and fear of asking in predicting the frequency of student questions and suggested a new direction for research on student questioning. In addition, relevant implications for teaching practices were discussed.

Key words: *student question-asking, questioning, science learning, fear of asking, perceived importance*

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1 Introduction

He who asks is a fool for five minutes, but he who does not ask remains a fool forever

- Mark Twain

Student questioning lies at the heart of effective learning, especially in science education.Many authors (e.g., Biddulph et al., 1986; Chin & Osborne, 2008; Cuccio-Schirripa & Steneir, 2000; White & Gunstone, 1992) have emphasised student questioning as a key driver of critical thinking, knowledge construction, and meaningful engagement. When students ask questions, they are not merely seeking comprehension of what is being taught but also addressing their own lack of knowledge, puzzlement, and curiosity or interests, which leads to increased engagement and a deeper understanding of the learning materials. The generation of questions also compels students to direct their attention, identify key ideas and elaborate on their existing knowledge (Schmidt, 1993), which plays an essential role in promoting critical thinking, problem solving and creativity (Cuccio-Schirripa & Steneir, 2000; Zoller, 1987). Research has shown that students who engage in questioning demonstrate higher levels of comprehension, retention, and critical thinking skills (King, 1994; Palinscar & Brown, 1984; Roseshine et al., 1996). Additionally, students' questions can serve as formative assessments, providing teachers with insights into their gaps in knowledge, confusion, reasoning, and interests (Chin & Obsborne, 2008). This source of information, in turn, helps teachers reflect on their teaching practices and adjust future instruction to support student learning.

However, despite the value of students' questions for both teaching and learning, much of this potential remains unexploited due to the fact that students do not often ask questions. This infrequent incidence of student questions in the classroom has been extensively documented in literature across various countries (Commeyras, 1995; Graesser & Person, 1994). An observational study by Dillon (1988b), for example, found that high school students asked an average of about 2.4 questions over the class hour, accounting for approximately 3% of all classroom questions. Notably, these questions were posed by only eight out of 721 students in 27 different classrooms. Similar trends were observed in other classroom studies (e.g., Fahey, 1942; Good et al., 1987; Susskind, 1969), where elementary and secondary school students asked about one question per student per month, and the entire class asked around two questions per lesson. Surprisingly, this dearth of student questions goes beyond K-12 and extends even into university years (e.g., Pearson & West, 1991).

In general, there are two possibilities when students do not ask questions: they have no questions or feel no need to ask, or they have questions in mind but refrain from asking for some reason. Nevertheless, Dillon (1981a) indicated that 95% of the student teachers in his study agreed with the latter. In other words, they indeed have questions but are hesitant to ask them aloud in the classroom, which he reffered to as "a norm" against student questioning. This finding was further supported by various studies, Graesser and Person (1994), for example, observed that undergraduate and secondary school students asked a significant amount of more questions in tutoring settings. Preschool and primary students also tend to ask considerably more questions at home (Tizard et al., 1983) and at play (Van Hekken & Roelofsen, 1982) compared to in classroom. As summarised by Dillon (1988b), students may ask even a lot of questions, but not in school. In other words, the classroom factors appear to play an essential role in the frequency of student question-asking.

Given its theoretical and practical importance, several authors have attempted to understand this universal phenomenon; why don't students ask in the classroom? However, most of these studies have either focused on university students (e.g., Aitken & Neer, 1991; Dillon, 1981a; Nadile et al., 2021; Kuniawati, 2021) or explored aspects other than question-asking itself (e.g., Daly et al., 1994 - asking comfort; Van der Meij, 1988 - help-seeking). One of the earliest studies by Applegate (1969) specifically examined 9th graders, yet little is known about the extent to which the barriers to question-asking influence the frequency with which students ask questions. There is also a lack of contemporary research on this topic, especially in science and classrooms in different contexts (i.e., Asian countries where students are often ranked at the top in science subjects in such international assessments as TIMSS and PISA). Furthermore, given the constant evolution of education, it is crucial to recognise that students today may not, for example, harbour the same fears as those some five decades ago. Failure to address these concerns could possibly serve as an alarm for future teaching and educational reforms.

The present study thus aims to investigate the reasons why secondary school students do not ask questions in science classrooms and to determine the extent to which these factors influence the frequency of student question-asking. To achieve these overarching aims, the study employs a mixed-method research design, which is divided into two main phases. The first phase involves a qualitative survey to elicit deeper insights into students' perspectives and experiences regarding asking questions about the lesson content. The insights obtained from this phase are then used to validate the content of the questionnaire in the subsequent

quantitative phase. The findings of this study will help teachers to understand the barriers to student questioning better and adapt their teaching strategies to enhance student learning and classroom interactions.

It is worth noting that although questioning, question asking, and question-asking may have slightly different meanings, they will be used interchangeably in the present study as the act of formulating and asking questions to the teacher.

The next chapter (*Chapter 2*) examines the literature on student questioning. It will provide an overview of the theoretical background, possible frameworks and previous research on the constraints to student questioning in the classroom that inform the current research. *Chapter 3* begins with an exploration of my own worldview, professional experience and personal reasons for selecting the research approaches. The paper then describes the research design, participants, data collection, instruments and data analysis procedures in both phases. *Chapter 4* presents qualitative and quantitative findings from the study. *Chapter 5* discusses the key findings, implications for teaching practices, limitations, and recommendations for future research. Finally, *Chapter 6* concludes the paper by summarising key ideas.

2 Theoretical Background

In order to provide a foundation for the research topic, this chapter will expound on existing literature on student questioning. The first section will begin with the significance of student question asking, explaining why it is essential to understand and tackle the lack of student questions in the classroom. The second section briefly presents the complexity in classifying student questions and the author's point of view. The third section describes existing componential models of student question asking and establishes the potential theoretical framework for understanding the constraints on student question asking. The fourth section focuses on prior research on student question asking and related variables influencing the frequency of student questions. The last section clarifies the need for the present research, research goals and questions.

2.1 The values of student questioning

A key driver of effective learning

Questioning is an integral part of effective learning as it promotes thinking skills, knowledge construction, and meaningful engagement with the lesson content. The value of student questioning has been underscored as a key driver of intellectual growth and science learning by many authors, such as Biddulph et al. (1986), Fisher (1990), White and Gunstone (1992), Penick et al. (1996), Cuccio-Schirripa and Steneir, (2000), Chin and Brown (2002), Chin and Osborne (2008), and Vale (2013). When students ask questions, they are not merely seeking for comprehension of the learning materials but also posing questions that may address their own lack of understanding, puzzlement and interests. As these questions hold personal significance to the students, they tend to establish "the kinds of mental connections between concepts that are memorable to them" (King, 1995, p.13) and gain greater motivation for learning (Chin & Kayalvizhi, 2005; Pedrosa de Jesus et al., 2003). In addition, the act of formulating questions, as an internal talk with oneself, fosters the habits of metacognition and self-regulation, helping students to become more self-directed, reflective, and independent in their learning (Ciardiello, 1998; Chin & Obsborne, 2008; Marbach-Ad & Sokolove, 2000; Marksberry, 1979).

Quesitioning can also serve as a link between thinking and learning (Cuccio-Schirripa & Steneir, 2000). Because the generation of questions compels learners to activate their prior

knowledge, focus their learning efforts, and enable them to elaborate on their existing knowledge and experiences (King, 1994; Schmidt, 1993). Through this active engagement, students can make sense of complex concepts, identify key ideas, and develop a deeper understanding of the materials (King, 1994; Roseshine et al., 1996). According to the cognitive theory, learning is not simply the absorption of external information available (Resnick, 1989) but rather the creative reconceptualisation of internal knowledge (Iran-Nejad, 1990). Questioning therefore may act as a catalyst for the changing and restructuring of these cognitive schemas. Research has shown that students who engage in questioning demonstrate higher levels of knowledge comprehension and retention (e.g., King, 1989; 1994; Palinscar & Brown, 1984; Roseshine et al., 1996).

Furthermore, questioning has been identified as a critical mechanism embedded in the operations of critical thinking, creative thinking, and reasoning (e.g., Cuccio-Schirripa & Steneir, 2000; Eason et al., 2009; Ennis, 1985; Graesser et al., 1996; Hilton, 1990; Koralus & Mascarenhas, 2013; Savage, 1998; Shodell, 1995; Starko, 2014), as well as problem solving and decision making (Chin & Brown, 2002; Hayes, 1981; Pizzini & Shepardson, 1991; Zoller, 1987;). It is also regarded as a doorway to productive thinking, which entails a variety of cognitive processes ranging from memorising to decision making (Newton, 2017), and high-order thinking skills (e.g., analysing, synthesising and evaluating) (Beyer, 1987; Ciardiello, 1998; Gallas, 1995).

Another function of student questioning, which is often overlooked, is its role in providing students with opportunities to interact with not only their teachers but also their peers. When students ask questions, they can stimulate other students to actively participate by providing answers, sharing their thoughts or simply expressing their common interest in the matter. In this way, asking questions can provoke further discussions and help students to build up on each other's idea and consider diverse perspectives, thereby enhancing peer collaboration and co-contruction of knowledge (Aguiar et al., 2009; Commeyras, 1995; Chin & Osborne, 2008; King, 1990). This approach to student questioning is line with the sociocutural perspectives on learning, where knowledge and understanding are seen to be socially constructured (Driver et al., 1994). In terms of science learning, Chin and Osborne (2008) also argued that student questions may foster the process of meaningful argumentation and debates, enabling students to recognise their faulty reasoning and invalid assumptions, as well as develop better hypotheses and explanations.

A valuable resource for teacher work and learning

Besides faciliating student learning, question-asking can provide valuable insights to guide teachers' work and formative assessment (Chin & Obsborne, 2008). Student questions can expose their thinking and conceptual understanding (Dogan &Yucel-Toy, 2022; Watts et al., 1997a; White & Gunstone, 1992; 2014; Woodward, 1992), new perspectives (Maskill & Pedrosa de Jesus, 1997; Marbach-Ad & Sokolove, 2000), interpretations (Commeyras, 1995), misconceptions and confusion regarding certain concepts (Dillon, 1981c; Harper et al. 2003; Olde Bekkink et al., 2016) and reasoning skills (Donaldson, 1978). Such insights enable teachers to not only assess the quality of student learning and provide in-time feedback but also identify their learning difficulties and adjust future instruction to meet the needs of the students.

In a broader context, students' questions can be used to develop curriculum and pedagogy practices (Dale, 1937; Gallas, 1995; Marksberry, 1979). Maskill and Pedrosa de Jesus (1997), for example, found that questions raised by students when studying heat, energy, and temperature revealed a need for comprehensive explanations of the interconnectedness of ideas within the topic and recommended teachers pay more attention to the logical organisation when teaching science. Similarly, by analysing questions writtten in weekly reports, Harper et al. (2003) found that students in an introductory physics course struggled with grasping physical quantities (i.e., force, field, velocity, acceleration) and used such insights to modify subsequent teaching.

Students' questions tell us what they want or see as important to know and very often what they are interested in or curious about (Commeyras, 1995; Elstgeest, 1985). Their questions may offer the impetus for further inquiry into a topic through open investigations, problem-based learning, and group work (e.g., Chin & Obsborne, 2008; Chin & Chia, 2004; King, 1993; Herranen & Aksela, 2019; Pedrosa de Jesus et al., 2005). Teachers, therefore, can exploit students' questions as a source of scientific inquiry and classroom discussions that are personally meaningful to them. This will likely resolve the lack of motivation and interest in learning (e.g., Harackiewicz et al., 2016; Schiefele, 2009), particularly in science, where its content is said to be boring, repetitive, and meaningless (Stipek, 1996).

Furthermore, student questioning can have profound impacts on teachers' learning and professional development. In this regard, Watts et al. (1997b) contended that powerful student questions may challenge even the most well-prepared teachers and provoke critical incidents

through which teachers critically reflect on the essense of the subject matter and the dynamics of teaching and learning. Such constructive reflections may result in transformations in their thinking and classroom practices, ultimately contributing to their professional growth. In their study, a primary science teacher, for example, was made aware of gaps in her scientific knowledge and prompted to rethink the nature of science by her students' questions. In a different case, a biologist and A-level teacher frequently asked by her students noted that "he has taken me beyond my own secure constructs and I am forced to explore my own understanding to become a co-learner ... I find myself under pressure as I am continually challenged to justify my position even if I am justifying what is to me, a topic that I think I understand" (p. 1032). The teacher also changed her views of teaching science and attitudes towards students' questions. Similarly, primary teachers in Dogan and Yucel-Toy's (2022) study percieved student questions as a force for continuous learning and development, as well as help them to realise what is missing in the class. All these examples of teacher learning are reminiscent of Paley's belief that "children have much to teach us, if we stop and listen" (p.142, as cited by Commeyras, 1995).

2.2 Types of student questions

Questions are often classified according to the nature of knowledge or the cognitive level required for the answers (Chin & Osborne, 2008; Raphael & Pearson, 1985). One of the most cited taxonomies is Bloom's (Bloom et al., 1956), classifying questions into six major classes of thinking: knowledge, comprehension, application, analysis, synthesis, and evaluation. The taxonomy was later revised by Anderson and Krathwohl (2001) to accommodate different cognitive processes, including remembering, understanding, applying, analysing, evaluating, and creating. The revision also made explicit connections between cognitive levels and different types of knowledge (i.e., factual, conceptual, procedural, and metacognitive in addition to the original one).

Congruent to these classifying schemes, Graesser and Person (1994) distinguished between low-level questions, which concern the content and interpretation of the learning materials, and high-level questions, which involve multiple cognitive processes such as application, reasoning, synthesis, and evaluation. Chin and Brown (2002) categorised questions in relation to learning approaches: surface (or basic) questions, which are typically based on factual and procedural information, and wonderment questions (originally used in Scardamalia & Bereiter, 1992), which aim at explanations, causes, predictions, or addressing discrepancies in

knowledge. Similarly, Watts et al. (1997a) divided questions into three categories according to the developmental progress of conceptual change, namely consolidation, exploration, and elaboration.

A new approach to question classfication was offered by Pedrosa de Jesus et al. (2003), who used bipolar constructs to describe student questions. These authors argued that most taxonomies are value-directional, presuming the superiority of high-level questions and disregarding the importance of context, preference and intention with which students ask questions. Therefore, they placed questions on a continuum of confirmation and transformation questions and asserted that quality questioners ask a mix of questions, depending on their purpose and the nature of the learning task.

The present study does not attempt to sort or classify questions into categories; instead, it supports the view that all questions have their own values and should be encouraged. This is in line with Carlsen's (1991) belief from a sociolinguistic that the meaning of question is dependent on their context in discourse and should be acknowledged. However, as students may ask personal questions during the class, the main focus is lesson-related questions, which arise from the subject matter knowledge and learning activities.

2.3 Models of student question-asking

To obtain a comprehensive understanding of barriers to student question-asking, it is essential to consider the process through which students develop and ask questions. One such framework that breaks down questioning into components and traces its causes and effects was initially proposed by Dillon (1988; 1990) and was further analysed by Van der Meij (1994) through a review of literature on educational questioning. He suggests that questioning is an ordered event and can be divided into three main stages: (1) the onset of questioning, (2) the development of a question, and (3) the search for and processing of an answer.

At the onset of questioning, a person experiences perplexity as a result of reflection on what he knows and what he perceives from the environment. Such reflection may cause uncertainty in one's knowing, the contradiction between current knowledge and new information, or curiosity in the matter. Many researchers have regarded perplexity, also referred to as disjunct (Dillon, 1988; 1990), variance (Marton & Booth, 1997), or disequilibrium (Graesser & McMahen, 1992) as a critical impetus for questioning and can be triggered by external cues, events or

phenomena (e.g., Berlyne & Frommer, 1966; Chin & Brewer, 1993; Gerner et al., 1991; Graesser & McMahen, 1993; Marksman, 1979). However, questioning being prompted by self-reflection tends to generate higher-level questions compared to that being prompted by external stimuli such as textbooks or teachers' instruction (Brown, 1992; King, 1992; Scardamalia & Bereiter, 1992; Van der Meij, 1993; Van Zee & Minstrel1, 1997). This somewhat resembles Dewey's idea that we do not learn from experience; we learn from reflecting on experience.

In the second stage, perplexity is transformed into something more tangible, a question. The transition from the onset to the development of a question is complex and may be best illustrated by the difference between finding a problem and acting on that problem (Dillon, 1982; Getzels, 1988). This stage entails two sub-phases: formulation and expression. Formulation refers to the verbal form of the question through which the person needs to find the right words and structure in order to get what they want to know from the respondent (Allen, 1987; Dillon, 1990). Expression, also referred to as social editing (Graesser et al., 1992), involves the act of putting the question in words. According to Dillon (1988a), it is the most difficult to take. This expression of question in a particular social setting can be obstructed by either personal factors (e.g., achievement, achievement motivation and self-esteem) or contextual factors (e.g., teachers' and peers' reactions, classroom structure and social norms) (Van der Meij, 1994). Graesser and McMahen (1993) suggested that students do not utter the question when, for example, it involves too much mental effort or potentially leads to social embarrassment.

The answering stage involves the search for an answer from personal (e.g., teachers, friends) or non-personal sources (e.g., books, computers) and the processing of the answer. According to Dillon (1988) and Van der Meij (1994), obtaining an answer is not the end state of the inquiry because the student must do something with the response, which ultimately results in the so-called learning. However, processing an answer can be as challenging as that of formulating and expressing. In this context, students with high levels of verbal ability tend to better process the responses to their questions (Van der Meij, 1990).

More recently, Ronfard et al. (2018) proposed a model to describe the development of questioning in children. The model encompasses four main stages similar to Van der Meij's (1994) and Dillon's (1988; 1990), namely initiation, formulation, expression, and response evaluation and follow-up. The initiation stage involves the realisation of information that is lacking or needed. The questioner then proceeds to the formulation stage, where he or she

identifies what particular information to ask for and how to phrase it in a way that can be clearly understood in the communicative context. As the model particularly focuses on the search for an answer from other people, they argued that the articulation of questions is influenced by cultural norms, conventions, and the identity of the person being asked (Ronfard et al., 2018).

At the expression stage, the questioner decides whether it is worthwhile to ask the question. This stage involves identifying whether someone is able and available to answer and assessing the social context to see if it is acceptable to utter the question. The final decision is most likely dependent on the importance of the question to the questioner, the availability of reliable sources of information and alternative means for obtaining the answers, as well as the social settings. Finally, when an answer is given, the questioner assesses and decides whether to follow-up or terminate the search if she or he is already satisfied.

In both models, the questioning begins with the raising of a question, which, among others, depends on one's existing knowledge, commitment, goals and tolerance of uncertainty (Chinn & Brewer, 1993; Pedrosa de Jesus et al., 2003; Van der Meij, 1988). The questioner then needs to formulate the question and decide whether to articulate it to someone. It is, therefore, unfortunately, difficult to ascertain whether students do not ask questions because they have no questions or because of some barriers to asking. Research on student questioning has approached this issue from both perspectives: the extent to which students raise questions and their willingness to present the question to someone. Both of these may result in the low frequency of student questions in the classroom and contribute to the complexity of research on student questioning. For example, many students never or do not often ask questions during the class hour because they could ask their friends, look up the answer themselves or ask the teacher after the class (Nadile et al., 2021) as well as they understand everything and thus have no questions (Kurniawati, 2022).

Determinants of each phase of questioning, especially in the initiation or the onset of questioning, have been extensively studied. The present study will only concentrate on the question asking - that is, when students have questions in mind but, for some reason, do not ask the teacher.

2.4 Prior studies on student question-asking

Most studies on barriers to student question-asking have focused on the asking of questions, in other words, on the formulation and the expression of questions. One of the earliest studies by

Applegate (1969), for example, used two-wave questionnaires to investigate the verbal participation of ninth-grade students in social studies classes. In the study, a large number of students reported being shy, afraid of being wrong or laughed at, and feeling stupid when surrounded by too many "smart" kids in the class. These findings indicate a fear of publicly showing ignorance and a tendency to ask more questions in smaller groups (Appleage, 1969; Graesser & Person, 1994; Fuhrer, 1987). However, being unable to say what they mean, among others, was found to be the most popular reason why students do not participate verbally in classroom discussions. Similarly, Van der Meij (1990) and Van der Meij and Dillon (1994) found that fifth-graders with low levels of verbal ability often struggled to articulate questions to find the meaning of a word and ended up asking nothing. The same concern regarding communication skills was also raised in those studies with English as a medium of instruction. Students experience difficulties in expressing their ideas fully in English due to the lack of vocabulary and grammatical knowledge, as well as making themselves understood due to poor pronunciation (Hanh, 2020). These students, therefore, often keep silent to avoid making such mistakes and losing their faces (Kurniawati, 2022; Liu & Littlewood, 1997). Conversely, students with higher levels of language proficiency feel more comfortable asking questions (Daly et al., 1994).

Another study by Dillon (1981a) explored why university students ask only a few questions in the classroom. He sorted the reasons into three main categories: the question (10 percent), the situation or the teacher (18 percent), and the fear of asking (72 percent). In the first category, a student is unsure of his or her question or may find it irrelevant, uninteresting, or not pressing enough and decides not to ask the teacher. The second category involves the situations in which the student questions are blocked by class size, norms, or teaching approaches; for example, the teacher does not allow enough time or often puts down the questions. Among others, what refrains students from asking is a fear of negative reactions from the teacher and peers. Many students described how classmates can be judgemental and make fun of them for asking "dumb" questions. However, negative reactions from the teacher were more concerned by the students and were expressed in their anecdotes as the key inhibitors.

The influence of teachers on student question-asking has generally been focused on studies concerning classroom help-seeking (e.g., Karabenick & Knapp, 1991; Karbenick & Sharma, 1994; Ryan et al., 2001; Van der Meij, 1986, 1988). For example, Van der Meij (1986, 1988) found that unwillingness to respond and anticipation of negative reactions from the teacher are

the major factors that constrain question-asking among primary students. In contrast, thanking, praising, showing interest in students' questions or giving high-quality answers are likely to increase their confidence and motivation to ask, potentially leading to a higher frequency of questions (Aitken & Neer, 1991; Dillon, 1981a). Similarly, Karbenick and Sharma (1994) suggested a link between perceived teacher support and the threat attached to question-asking. They found that students who construe their instructor as supportive and open are more likely to ask for help regardless of their confusion. In this context, some researchers (e.g., Karabenick, 1994; Schunk & Meece, 1992; Winne & Marx, 1982) argue that how students perceive teacher's and peers' reactions may be more important than their actual behaviours and could influence student question-asking behaviours.

Besides classroom rules and structures, several studies have examined the effect of personal characteristics, particularly achievement motivation and self-esteem (e.g., Good et al., 1987; Good et al., 1988; Newman, 1992; Ryan et al., 2021; Shell & Eisenberg, 1992; Van der Meiji, 1990). Shell and Eisenberg (1992), for example, argued that one's self-esteem can influence perceived costs and benefits attached to question asking. That is, students with low levels of self-esteem are more sensitive to the costs of expressing questions in social settings and, therefore, are unlikely to express their questions (Van der Meij, 1994). Good et al. (1987) reported that low-achieving students begin school by asking as many questions as their peers, but over time, they have learned to become less involved and ask fewer questions during their schooling. This, according to his passivity theory (Good, 1981), is caused and reinforced by certain teacher behaviours (e.g., wait less, criticise more). Ryan et al. (1997) and Butler and Neuman (1995) argued that achievement goals affect the propensity for asking, as lower achieving students feel more threatened and tend to avoid asking when needed compared to higher achieving students. Similarly, Chin and Osborne (2008) also suggested that learning goals might influence the student's question asking.

Gender has received substantial attention in classroom research. Good et al. (1987), for example, found that males asked about two and one-half times more questions than their counterparts in kindergarten. As they grow older, girls catch up, and noticeably, in the seventh grade, they ask even more questions. After the reversal, female questioning rates again fall slightly below those of males. This is in line with Pearson and West (1991), where no considerable difference in the frequency of questions asked by university students was found across sexes. In the same study, Good et al. (1987) found that seventh-graders asked

significantly more questions than both sixth-graders and ninth-graders, which was also confirmed in a later study (Good et al., 1988).

To date, however, only a few studies have attempted to examine students' perceptions of the role of question-asking in the classroom. A recent study by Dogan and Yucel-Toy (2022), for example, interviewed elementary school students to understand their motivation for asking. They found that most students viewed question-asking as important and necessary to understand the lesson, learn new topics, increase curiosity, and get higher exam grades. The study also categorised barriers to student question-asking into student-originated, such as students not expressing themselves or feeling embarrassed when interrupting the lesson, and teacher-originated, such as teachers being irritated or ignoring the questions. Another study by Nadile et al. (2021) explored the extent to which undergraduate students perceived other student questions as helpful and what discouraged them from asking questions using a mixed-methods approach. They first conducted semi-structured interviews with a small sample of students and then used the results to create the survey for a larger sample. They found that 90 percent of the students agreed that other students voluntarily asking is helpful as they might have the same question and can learn from others. Over half of the students reported feeling anxious or fearing others would judge them when asking questions. Other students sometimes do not ask because they have other options rather than asking the teacher in class.

2.5 The present study

Given its importance for teaching and learning, numerous studies have attempted to understand the lack of student questions in the classroom, focusing on the barriers to the asking of questions. However, most of these studies have primarily concentrated on either university students (Aitken & Neer, 1991; Dillon, 1981a; Kuniawati, 2021; Pearson & West, 1991; Nadile et al., 2021) or elementary students (Dogan & Yucel-Toy, 2022; Van der Meij, 1988). Although some authors have examined secondary school students, for example, Applege (1969) with ninth-graders in social studies classes and Good et al. (1987) with seventh- and ninth-graders in mathematics and English classes, little is known about question asking in science classrooms, where questions are seen as a key driver of student learning. There is also a scarcity of contemporary studies in other contexts, such as Asia, which could provide a more comprehensive picture of research on student question asking.

In addition, the significance of student questioning for learning, especially for science, has been extensively discussed in the literature; however, students' perspectives on this universal consensus have been limitedly explored, with only a few exceptions (i.e., Dogan & Yucel-Toy, 2022; Nadile et al., 2021). It is thus important to gain more insights into students' views of question asking, including its role and barriers. These insights will offer a better understanding of the lack of student questions and suggest practical ways teachers can foster questioning in their classrooms.

Furthermore, some authors (e.g., Van der Meij, 1988; Ronfard et al., 2018) have suggested that questions are posed only when the benefits outweigh the costs of asking or not asking. However, to the best of my knowledge, none of the previous studies have quantified the perceived importance of asking questions and the fear of asking and explored the extent to which they can predict the frequency of student questions. It remains less known about these relationships. For example, would a student ask more questions if they think asking questions is important to themselves or others? Or would a student who is afraid to ask ask questions? While a fear of asking is commonly cited as to why students do not ask questions, there are students who still ask questions even if they are very much afraid of asking. In this context, would perceived importance better predict student question frequency than fear of asking and, therefore, deserve more attention? Quantifying the perceived importance of asking and the fear of asking would certainly substantiate these discussions and fill in the gap in the literature. Moreover, findings from the present study may inform future research on student questioning and offer valuable insights for instrument development.

For those reasons, this study aims to understand students' views of question asking and explores the extent to which perceived importance and fear of asking can predict the frequency of student questions with the following research questions:

1. How do students view question asking in the classroom?
2. To what extent can fear of asking and perceived importance predict the frequency of student question-asking?

3 Method

Philosophical ideas often remain concealed within research (Slife & Williams, 1995), yet they influence research practices and actions (Creswell & Creswell, 2018). Creswell and Creswell (2018) recommend that researchers should explicitly articulate the larger philosophical ideas, as they help elucidate the approach used in the research. For that reason, I will begin this chapter by reflecting on my own beliefs, which are commonly referred to as worldviews (Creswell & Creswell, 2018) or paradigms (Mertens, 2010), including my professional background, experiences and how they have shaped my research.

Prior to pursuing this degree, I was a secondary physics teacher with a strong commitment to enhancing practical work and experiments in teaching and learning. I firmly believed that the most effective way to learn and understand science is through doing science. Consequently, the scientific method had a profound impact on my ways of thinking and approaching various matters. I held the belief that the world is governed by laws and theories, which can be tested, verified or refined to advance our understanding of how it works. To achieve this, we can make observations, measure variables, and test hypotheses, as well as identify possible causes and effects on outcomes. My professional background is undoubtedly aligned with the postpositivist worldview, which asserts that certain assumptions "hold true for quantitative research more than qualitative research" (Creswell & Creswell, 2018, p.7). Indeed, I had a set of initial hypotheses regarding students' hesitation to ask questions in class and endeavoured to test them, which partially explains my decision to use quantitative as the dominant method in the study. Nevertheless, it is crucial to acknowledge that objectivity is essential to competent inquiry, necessitating researchers to critically examine their methods and conclusions for biases (Phillips & Burbules, 2000).

In addition to the need to establish the validity of the measurements, exposure to a multicultural learning environment throughout my degree has helped me realise that individuals often develop subjective meanings towards certain objects or phenomena based on their own experiences and cultural norms. These meanings can be varied and multiple, so it is important for researchers to look into the participants' views of the problem or situation under research (Creswell & Creswell, 2018). In other words, the barriers to student question-asking in class that I perceive may not necessarily align with what students actually think and experience. This disparity could bring the whole research to no practical use. Therefore, I recognised the need to use constructivism in the qualitative phase to validate and generate theories before shifting

to positivism in the quantitative phase to verify the theories. In addition, integrating quantitative and qualitative methods will enable me to answer the research questions in depth (Enosh et al., 2015) and enhance the generalisation of findings and implications to a more significant population (Dawadi et al., 2021).

However, there was a moment when I reflected on my entire journey and asked myself whether I only wanted to test out hypotheses. The answer was a resounding NO. I was deeply concerned with the problem of why students hesitate to ask questions in my physics class despite my best efforts to encourage them. My focus, therefore, was on understanding the problem and exploring how real-world practices may address it, which aligns reasonably well with the pragmatic paradigm. According to Creswell and Creswell (2018), pragmatism draws on various worldviews rather than being confined to a single philosophical system and reality. Instead of prioritising research methods, pragmatists pay more attention to the importance of the research problem and question and employ flexibly all available approaches that suit their needs and purposes (Creswell & Creswell, 2018; Morgan, 2007). The use of mixed methods has thus become popular for the pragmatist worldview, as researchers can use both quantitative and qualitative methods to better understand the problem or situation being studied (Creswell & Creswell, 2018).

3.1 Research design

Adding to researcher's worldview and experiences, the choice of research approach is driven by the nature of research questions or problems (Creswell & Creswell, 2018; Fetters et al., 2013). In the present study, I chose the mixed methods approach as it is suited to answer the main questions of how and to what extent. While qualitative methodologies are often employed to explore the reasons behind a phenomenon, develop theories or hypotheses, and describe individual expreiences, quantitative methodologies are used to examine research questions related to causality, generalisability, or the extent of effects (Fetters et al., 2013). Using mixed methods enables researchers to leverage the advantages of both quantitative and qualitative approaches (Fetters et al., 2013; Johnson & Onwuebuzie, 2004).

For the present study, an exploratory sequential mixed methods design was employed. This design involves an initial qualitative exploration with a small sample to understand the phenomenon, identify variables and develop an appropriate instrument, followed by testing with a large sample. Recommended by Creswell (2009), a qualitative approach is particularly

appropriate where previous research on the topic or a certain group has yet to be addressed or is limited. Given the lack of literature, the qualitative phase aimed to explore students' perceptions of question asking in science class through the use of survey and open-ended questions. The collected data were then analysed to extend and develop the content validity for the questionnaire in the subsequent phase. The final research design is shown in Figure 1 below.

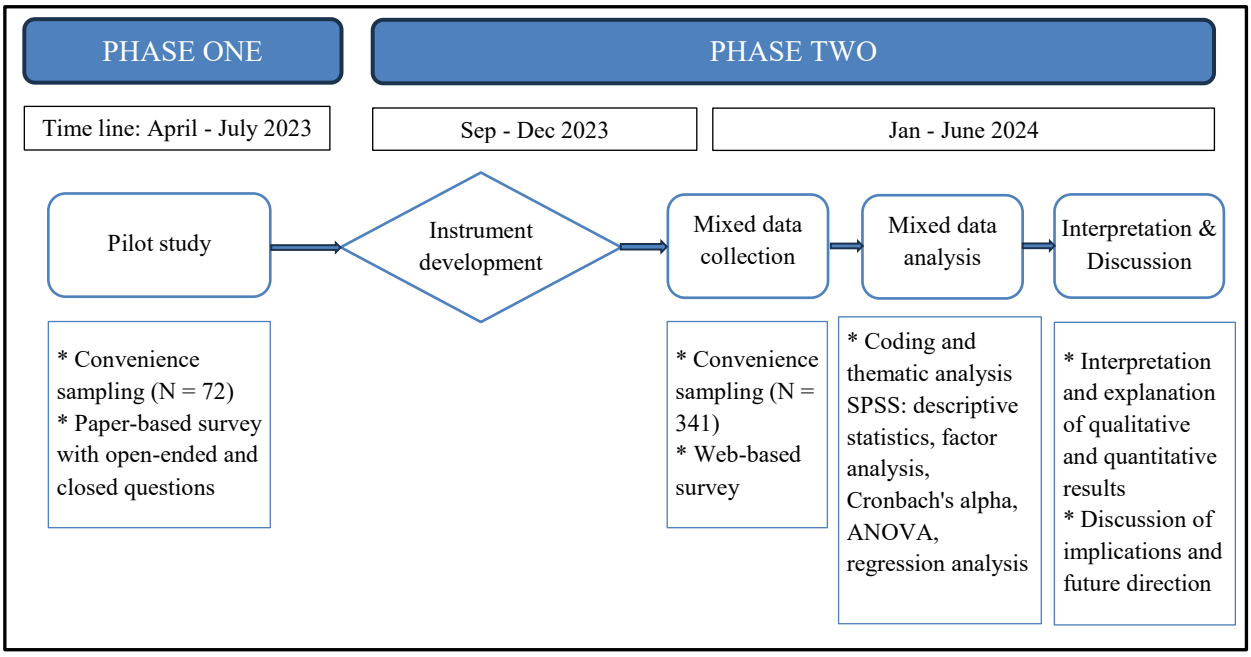

Figure 1: Overview of the research design

3.2 Pilot study

Data was collected through a survey conducted between April and may 2023. The sample consisted of 72 ninth-grade students (38 females, 34 males, all aged 15) from different classes in an urban school in Vietnam. The class size is between 25 and 30. According to the teachers (one biology and one chemistry) who administered the survey and taught the classes, their academic performance (GPA) in biology and chemistry ranged from low to high.

Because metacognitive skills develop significantly during adolescence (Weil et al., 2013) and become fully generalised at the age of 15 (Van der Stel & Veenman, 2014), the study targeted older adolescents for the qualitative phase of which required participants to reflect on their own behaviours and thoughts. They were thus expected to provide more insightful information about the phenomenon.

The questionnaire consisted of a combination of open-ended and closed questions. Students were asked to express their opinions on asking questions during lessons (e.g., do you think

asking questions is important, and why?) and to identify any factors that made them hesitant to do so. Following the open-ended questions, the students were presented with a predefined list of potential reasons for not asking questions to the teachers drawn from prior research, where they could then select all statements that resonated with their own experiences. This specific question format was intentionally designed to facilitate student responses, recognising that individuals may struggle to reflect on what influences their behaviours or express their thoughts.

3.3 Participants

The sample (N = 341) comprised of 113 six-grade students (51 boys, 62 girls), 166 seventh-grade students (96 boys, 70 girls), and 62 eighth-grade students (27 boys, 35 girls) in an urban school in Vietnam. Their ages ranged from 10 to 14 years (M =11.87; SD = 0.75). As the study aimed to explore student question-asking in science classroom, this phase focused on those who study science as a standalone subject due to the availability of a large sample size. It is noteworthy that all students study science in English, which differs from their native language.

3.4 Procedure

Data was collected through an online survey on Webropol between November and December 2023. Four science teachers first introduced the project's purpose, encouraged student participation, and allocated time for completion during class. Some students were given the link to complete at home. The privacy notice and consent form were integrated into the online survey, and student participation was voluntary.

A total of 416 students began responding to the survey; 342 students submitted responeses, however, one questionnaire was completed with personal information and was therefore not included in the sample. No personal information that can be used to identify the student was collected, ensuring students' comfort and honesty in completing the questionnaire. In other words, confidentiality and anynomity were ensured for all students.

3.5 Instrument development

To date, there has been limited quantitative research on the correlations between the rate at which students ask questions and specific variables. As a result, there was no estabished questionnaire avaible to effectively address the study's goal. A questionnaire was thus

developed for the present study through a comprehensive literature review, qualitative findings, and consultation with a diverse group of experts, including two science teachers and an experienced researcher. Following Onwuegbuzie et al. (2010)'s recommendation, student inputs were integrated into the development process. The steps are briefly explained below.

Step 1: Creating the item pool

The literature on student questioning, including why students do not ask questions and influencing factors, was examined. This was used to create the item pool concerning variables of the author's interest, along with the findings derived from the qualitative phase. Most of the items were measured on a 5-point Likert scale.

Step 2: Evaluating and revising the items

After establishing a pool of possible items, the author had multiple meetings with two science teachers who had been teaching school science for years to gather their opinions on potential factors contributing to students' hesitation to ask questions and to ensure the clarity and appropriateness of each item. The estimated number of questions students might ask per week was also discussed. After that, the priminary questionnaire was forwarded to an experienced researcher for a comprehensive evaluation, including constructs, meaning, phrasing, and scale clarity.

Step 3: Finalising the questionnaire

In the final step, the questionnaire was sent to a 7th-grade class to assess the clarity of all items and to allow for any necessary modifications before the massive data collection. Responses were submitted by 27 students, and the science teacher documented any questions and concerns raised by the students, for example, some did not fully understand the words "willing" and "hesitate". All feedback were subsequently used to refine the questionnaire, mostly in terms of wordings by using alternatives or adding translations. Potential issues and mean time needed for a response were communicated to all other teachers who responsible for administering the questionnaire. Students involved in this phase were excluded from the dataset for analysis.

Furthermore, this pilot confirmed the validity of the scale used for the frequency item (i.e., How often do you ask questions about the content of the lesson in science class? 1 = never, 2

= 1 to 2 questions per week, 3 = 3 to 4 questions per week, 4 = 5 to 6 questions per week, 5 = 7 or more questions per week).

3.6 Data analysis

3.6.1 Qualitative data analysis

Thematic analysis was used to analyse the qualitative data gathered from the survey because of its flexibility and accessibility in relation to research question, sample size, and meaning generation (Braun & Clarke, 2006; Nowell et al., 2017). This method is useful for identifying patterns of participants' perspectives, behaviours, and feelings and allows the researcher to capture both semantic (explicit) and latent (underlying) meanings across the data (Braun & Clarke, 2012; Clarke & Braun, 2017). King (2004) contends that the use of thematic analysis is particularly suitable for a large data set, as it compels the researcher to adopt a methodical approach in handling the data and helps to produce a coherent and structured final report.

While some studies (e.g., Applegate, 1969; Dillon, 1981a; Nadile et al., 2021) have explored student question-asking behaviours in the classroom, an inductive approach - defined as a bottom-up, data-driven approach - was employed in the present study since the study was set in a different context. This approach provides a rich description of the data, rather than focusing on a specific aspect, and can yield unanticipated insights within the data (Braun & Clarke, 2020). It is important to acknowledge, however, that no researcher can begin with absolutely no ideas (Gibbs, 2007) and completely detach themselves from their epostemological commitments (Braun & Clarke, 2006). Therefore, the researcher's awareness of pre-existing research and teaching experiences to some extent influenced the data analysis.

In the present study, the researcher adhered to the six-phase process for thematic analysis outlined by Braum and Clarke (2006) and followed some of the corresponding means of eastablishing trustworthiness recommended by Nowell et al. (2017). While the six phases are sequenced, the analysis is recursive, instead of strictly linear, requiring the researcher to move back and forth between the phases (Braun & Clarke, 2020; Nowell et al., 2017).

Table 1. Phases of thematic analysis and means of establishing trustworthyness (adapted from Nowell et al., 2007)

Phase of Thematic Analysis	Means of Establishing Trustworthiness
Phase 1: Familarising with data	Prolonging engagement with data. Storing raw data in organised archives and documenting thoughts on potential codes/ themes.
Phase 2: Generating initial codes	Keeping an audit trail of code generation. Peer debriefing.
Phase 3: Searching for themes	Diagramming to elucidate connections. Keeping detailed notes on the evolution of hierachy of concepts and themes.
Phase 4: Reviewing themes	Testing for referential adequacy by revisiting to raw data.
Phase 5: Defining and naming themes	Peer debriefing. Documenting theme naming and definition.
Phase 6: Producing the report	Describing the coding and analysis process in sufficient details. Providing rationales for theoretical, methodological, and analytical decisions throughout the study.

Familarising with data: As the survey was conducted in a paper-based format, the researcher first transferred all reponses into Microsoft Word files, where each participant was assigned a code. Through this process, the researcher familarised himself with the data by reading, re-reading and transcribing. Despite the sample being relatively large, the manageable lenght of students' responses facilitated the aforementioned procedures. During this phase, the researcher also noted down any initial thoughts and potential codes relevant to the research questions. A small number of responses given in Vietnamese were translated to English before proceeding to the second phase.

Generating initial codes: All transcripts were loaded into the qualitative analysis software NVivo, where inital codes were inductively derived, with the units of analysis being sentences, phrases or words. The majority of the initial codes were descriptive. Following Braun and Clarke's (2006) guidance, the researcher coded for a wide range of potential patterns to ensure that no crucial insights were overlooked in the subsequent analysis.

Searching for themes: This phase involved consolidating or clustering codes that exhibit a common feature, thereby illustrating a cohesive and meaningful pattern within the data (Braun

& Clarke, 2012). All the codes emerged across the data were put together and sorted into potential themes, forming a thematic diagram. Similar codes were merged or discarded.

Reviewing, **defining and naming themes**: After the identification of candidate themes, the researcher carefully reviewed and refined them in conjuction with the coded data extracts and the entire data set, ensuring the themes are coherent and distinctive. Feedback on the themes was informally sought from another researcher with a similar educational background. Codes were also refined and relocated to more accurately capture the relevant data. This phase culminated in the production of a final thematic map comprising of themes and sub-themes for which definitions and names were primarily derived from the data and supported by references to the literature review.

3.6.2 Quantitative data analysis

Data were analysed using Statistical Package for Social Sciences (SPSS 27). As the first step of data analysis, mising values were checked through data screening and handled with the series means. Normal distribution and collinearity were also investigated to ensure the requirements for the analyses were met.

Perceived importance of asking consisted of three items on a 5-point Likert scale, from 1 = not at all agree to 5 = completely agree. The items are constructed based on the students' responses in the pilot study. They include "I think asking questions is important for my learning", "I think my questions are important for my classmates", "I think my questions are important for my teacher". Although three items are not ideal for factor analysis, they meet the minimum number of items required for statistical identification of a factor (Fabrigar & Wegener, 2012; Watkins, 2018). In addition, the Kaiser-Meyer-Olkin (KMO) is .673, exceeding the acceptable limits of .60 (Child, 2006; Kaiser, 1974) and the Bartlett's test of sphericity is significant, $p < .001$. Pincipal component analysis (PCA) was thus performed to construct the validity of the measure. Three items were loaded on a single factor, with factor loadings of .77, .80, and .82 respectively. All together explain 63.9 % of the total variance. A Cronbach's alpha was also calculated for the internal consistency, giving a value of $\alpha = .72$, which lies within the desired range (Van Griethuijsen et al., 2015; Taber, 2018).

Fear of asking consisted of 12 items on a 5-point Likert scale, from 1 = not at all agree to 5 = completely agree. An example of an item is "I am afraid of being judged by my classmates". These 12 items were extracted from an initial pool of 24 items indicating possible reasons why

students do not ask questions in the classroom developed from a review of literature and the pilot study (see Appendix 1). Principal component analysis with varimax rotation was first performed, with KMO = .942, $\chi^2 = 4890.9$, p < .001. The items and factor loadings are given in Table 2. However, while three factors were obtained, they were not all theoretically useful. For the purpose of the study, only factor one was reported as fear of asking. This factor encompasses 12 items with factor loadings ranging from .517 to .836, which are considered to be stable (Guadagnoli & Velicer, 1988). Cronbach's alpha level for the fear of asking measure is .935.

Table 2. Rotated factor loadings from the factor analysis (PCA)

Item No	Factor 1	Factor 2	Factor 3
Item 1			.707
Item 2			.796
Item 8			.490
Item 9			.586
Item 3		.707	
Item 4		.537	
Item 6		.761	
Item 7		.670	
Item 11		.435	
Item 12		.722	
Item 24		.524	
Item 14		.536	
Item 5	.558		
Item 10	.517		
Item 13	.539		
Item 15	.751		
Item 16	.836		
Item 17	.783		
Item 18	.604		
Item 19	.797		
Item 20	.734		
Item 21	.646		
Item 22	.661		
Item 23	.712		

4 Results

The data from the pilot study were analysed and used in the development of questionnaire, however, it will not be presented in the study as they were covered under the data of the second phase. This chapter only presents the qualitative and quantitative findings in the second phase of the study. All participants were assigned with letter S and a random number.

4.1 Qualitative results

The analysis of students' views of question-asking revealed three major themes: (1) students' perceptions of the importance of question-asking, (2) barriers to the asking of questions, and (3) enhancing student question-asking. Each theme includes various sub-themes, which will be discussed below.

4.1.1 Students' perceptions of the importance of question asking

The analysis revealed three sub-themes: (1) enhancing oneself's learning, (2) helping classmates to learn, and (3) informing the teacher. An overview of students' perceptions of the importance of question-asking is presented in Figure 2.

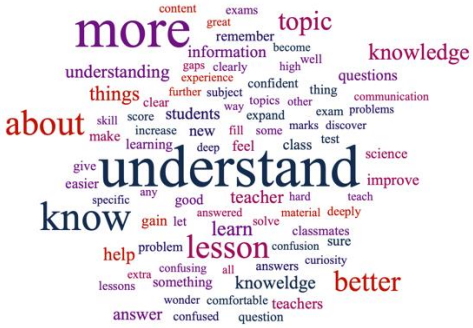

Figure 2: Word cloud for students' perceptions of the importance of asking questions

Enhancing oneself's learning

Almost all students agreed that asking questions plays an essential role in different aspects of their learning, including (1) comprehending what is taught, (2) gaining "additional" knoweldge, (3) remembering better, (4) getting good grades, (5) increasing confidence, (6) provoking interest in learning science and (7) improving communication skills. These aspects, or sub-themes, are related but also distinct.

Comprehending what is taught among others appears to be the most popular function. However, students put this function of question-asking differently from simply getting answers for their questions to specifically addressing certain confusion or making sense of difficult concepts within the topic. They very often emphasised the understanding of classroom materials and used words such as "know", "learn", and "understand" along with "better", "clearly", "easily" and "deeply". For example, as students expressed:

> *"I think asking the teacher about the lesson helps me understand the lesson better as well as get my questions answered." S11*

> *"I think asking questions is important because it will solve the things that we don't understand and help us know and understand more deeply what we are studying. It also helps me understand hard concepts in science." S9*

> *"I often don't understand some things and always make them complicated, so if I ask questions, it will be easier for me to understand the lesson." S60*

Many students believed that asking questions may provide them with some additional information that is not included in textbooks, as well as something that the teacher does not cover in the lesson. They often referred to this information as "new" or "extra", which supplements the key ideas they are supposed to learn, thereby expanding their knowledge. Although the distinction between the first and the second sub-themes is subtle, students perceived knowing more and understanding better as distinct concepts. These students are most likely to detach from the formal curriculum to pose questions that may address their own curiosity and interests.

> *"It is important because we would know more about other stuff that the teacher doesn't teach us in the books." S35*

> *"My opinion is that it's important to ask questions, because sometimes we might get some confusion during class - and staying silent wouldn't help. Also, sometimes you can ask questions to gain new knowledge of a specific topic from the teacher." S37*

A small number of students referred to asking questions as a strategy to better remember the lesson content. For example, "*I think asking questions is very important when I don't know or understand something in the lesson, because it helps me learn and remember those things* "

(S53) and "*Asking questions is a crucial part of your learning as it could assist you in having an insight about the parts you probably find confusing. This can help you to memorize all the key things and factors*" (S136). These quotes imply an underlying mechanism that understanding what they study may aid their memory retention. It could be partly explained as the act of asking questions forces students to commit their attention to the information (e.g., their confusion, complex concepts), direct their learning effort, and make connections between the new information and what they may already know. In addition, the answers given by the teacher in such situations are often individualised to fit with students' academic levels or learning styles, making them personally meaningful and memorable to the students.

Question-asking was also viewed as a condition for performing well in exams and tests. Although this can be seen as a consequence of lesson comprehension, some students clarified that this can be a parallel or ultimate goal of asking questions in class. In addition, keeping this theme separated from comprehending what is taught can be helful in distinguishing between students who are extrinsically motivated (e.g. for getting good grades) and those who are intrinsically motivated (e.g., for the sake of learning).

> *"We get to know new things and if we aren't sure about the lesson, we need to ask for help. If we don't, we can get bad marks or we won't/never understand the lesson." S27*

> *"Asking questions to the teachers would guarantee a better understanding of information that would appear in end of chapter tests and final term exams." S3*

> *"Asking questions is important for me because if we don't understand something teachers are saying, you should ask questions. We can get good marks on exams if we ask relatable questions." S4*

At the same time, some students asked questions to evaluate or consolidate their knowledge and understanding, which, in turn, increases their confidence in the topic that they are learning. For example, "*I think asking question in the class is good because I can check my understanding and feel more confident about the lesson*" (S125), "*Asking questions helps everyone to revise their knowledge and improve your confidence*" (S120), and "*I think asking question will make you more confident and feel more secure and sure whenever you answer a question in a test or in class*" (S82).

For some students, question-asking has the potential to provoke their interest in learning science. For instance, "*Asking questions is important because asking your question could help you improve your knowledge and also boost your curiosity about science*" (S88), and "*I think asking questions will help me understand more about that topic, expand my knowledge and become more interested in the topic*" (S135). While it can be implied that better understanding will lead to increased interest in the subject, another student expressed a slightly different view, "*Because the questions I ask are all things that I still don't understand and are still confused. Maybe those questions will give us new knowledge or maybe even more interest in the subject*" (S61). In this case, the student seemed to expect that the answers may contain, for example, some novel, surprising facts that can act as a source of interest in learning science.

Finally, question-asking was considered a way to practice and improve communication skills. For example, "*Asking questions not only helps me to learn more about science but also helps me to practice my English when speaking to the teacher*" (S68), "*I can understand the knowledge more and also practice more my communication skills*" (S126), and "*Because asking questions can help students understand the lesson deeply. Besides that, it can help the communication skill of some students become better*" (S57).

Helping classmates to learn

Some students emphasised the potential of asking questions, not just for their own understanding, but also for the learning and engagment of other students in the class. They acknowledged that posing questions could spark a collective interest or curiosity among their peers and help the whole class learn through listening to teachers' answers, as well as creating opportunities for classroom discussions and learning from each other's perspectives.

> *" I think asking questions in class is important because it helps the student and also the whole class understands to the lesson more." S51*
>
> *"Sometimes my question is also the question of many other students, teachers can explain it to the whole class instead of only me, helping students grasp the knowledge better. We can also discuss more about the question." S38*
>
> *"And when I receive the teacher's answer, not only I have more awareness about that question, but also my classmates can know more about the topic, as well as I sometimes I can learn from their opinions" S20*

Informing the teacher

Besides faciliating oneself's and peers' learning, students believed that student question-asking may be useful for the teacher. The information contained within the act of asking questions and its content may guide teacher's work, as it may signify whether students are paying attention or how well they are understanding the lesson. For example, "*also, for the teachers to know if their students are paying attention in class. Because if you were not paying attention, you would not be able to ask questions*" (S98) and "*asking questions will help the teachers to assess your ability and let her know which area you are weak in*" (S147). Furthermore, other students refered to question-asking as a co-construction of knowledge, "*it helps students and teacher to understand more about each other's problem and help solve it together*" (S94), and "*If we ask quesitons, both we and the teacher can maybe learn something new*" (S101). A student even thought of question-asking in relation to fostering the classroom dynamics, making it more interactive and showing the support to the teacher.

> *"To myself, I like science and I'm very good at it, too! So I really like building the lessons and an atmosphere which enthusiastic and full of energy! Asking questions also make the teachers feel that class respect them and feel more comfortable and confident." S71*

Extent to which students perceived that asking questions is important

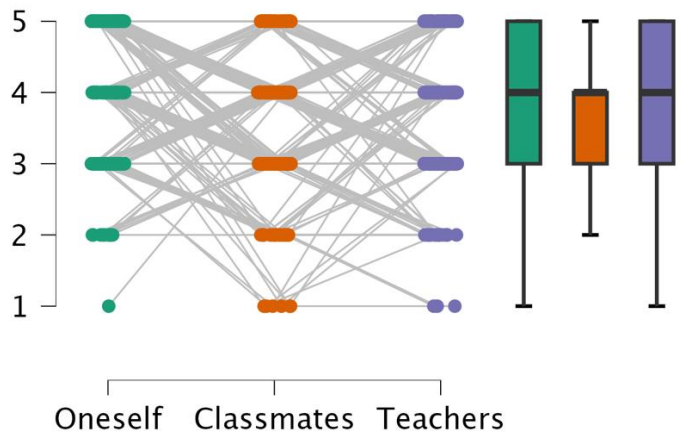

Figure 3: Extent to which students perceived that asking questions is important

While most students only described the role of question asking for their own learning, they seemed to be well aware of how their questions could, to some degree, be helpful for their classmates and teacher (shown in Fig 3). It can be seen that majority of students perceived

question asking as moderately important to extremely important in all three categories. However, there are more students who view asking questions as not at all important or slightly important for their classmates and the teacher. Astonishingly, only a few students perceived asking questions as equally important for themselves and for others, which can be seen by the lack of horizontal lines.

In particular, perceived importance for oneself is strongly correlated with perceived importance for classmates ($r = .416$, $p < .001$) and for the teacher ($r = .452$, $p < .001$). A repeated measures ANOVA revealed a statistically significant difference between at least two groups, $F (2, 680) = 23.69$, $p < .001$. A post hoc comparison using the Bonferroni correction further indicated that perceived importance for onself ($M = 4.11$) significantly differed from that for classmates ($MD = 3.79$; $p < .001$) and for the teacher ($MD = 3.82$; $p < .001$).

Table 3. Means, standard deviations, and Pearson correlations of perceived importance of quesiton asking for onself, for classmates and for the teacher

	Mean	SD	1	2	3
1. For oneself	4.11	.88			
2. For classmates	3,79	.91	.416**		
3. For the teacher	3.82	.91	.452**	.505**	

**. Correlation is significant at the .001 level (2-tailed).

There are statistically significant differences between males and females in the perceived importance of asking for oneself and for classmates, with $MD = 0.31$, $t (339) = 3.31$, $p = .001$, $d = .87$, and $MD = 0.33$, $t (339) = 2.78$, $p = .006$, $d = .90$ respectively. No significant difference was found across different grade levels.

4.1.2 Barriers to student question asking

The analysis revealed two sub-themes regarding barriers on student question-asking in the classroom: (1) language difficulty and (2) fear of asking. The two themes are related but also distinct.

Language difficulty

Some students highlighted language as a barrier to question-asking in the classroom. This is because they can not say what they mean due to a lack of vocabulary, grammar or poor

pronunciation. Consequently, they worry that teachers may not understand what they are asking and therefore, do not ask questions aloud.

> *" Because Science is taught in English so I usually have problems with vocabulary and grammar. Even though I have questions, sometimes I can't find the perfect word to use instead of that word in Vietnamese. It could feel quite timid when the teacher doesn't understand my questions" S99*

> *"Thing that makes me feel quite hesitate to ask question is I am not confident about my speaking skill. I am afraid that I cannot explain my problem in another language and make some silly mistakes while try to do that". S98*

> *"I am afraid teachers wouldn't understand what I was saying because I could hardly explain in English, and my pronunciation is not very good as well." S67*

For some students, what prevents them from asking is not choosing the right words for their questions but understanding the answers given by the teacher. They often fear that they can not understand what teachers explain. For example, a student expressed, "*I'm afraid that when the teacher answers my questions in English and I won't be able to understand*" (S84). However, while these students tend to focus more on the language of instruction, particularly English, the subject matter knowledge may also influence their ability to understand the answers. This worry was evident in another student's response, "*I hesitate to ask questions because I don't usually understand what the teacher explains for me". For me, I was very, very shy and didn't understand anything. If I were to ask, I would probably ask if he could start the lesson again. So, I am stick to "Better learn your friend than your teacher*" (S4). Similarly, lacking knowledge of the subject, in other words, "the language of the subject", might cause difficulty in expressing their own questions, for example, "*Sometimes I don't even know what I am asking. It is not really about English, but more about the content, and I am nervous that the teacher doesn't understand the question*" (S73) and "*I often don't know what to say when I want to ask a question*" (S74).

Fear of asking

Majority of students reported that they were afraid of receiving negative responses, including verbal comments and reactions, from their classmates or teachers. They, therefore, would rather not ask questions that they think might be "easy", "dumb", "silly", "wrong", "stupid", "too

obvious", " weird", or "everyone knows except me" aloud to avoid such possible negativity. These students saw the questions they asked as a reflection of their knowledge and understanding of the topic or lesson and expressed a considerable reluctance of asking impacted by other's reactions. Words that these students frequently cited were "laugh", "judge", "tease", "make fun", "ridicule" and "criticize".

> *"I think when I ask a question that is hard to me but easy to everyone else then my classmates will laugh and judge me that I don't understand the lesson. It makes me feel I'm dumb or intelligent and embarrassed." S48*

> *"Many times, I feel that people would be ready to laugh at me if the question were something that everyone knew for sure? I really have insecurities about people mocking me or making fun of me (calling me "dumb") for asking any questions" S56*

> *"I often hesitate to ask questions, because I am uncertain about what I want to say, as it could be wrong, and I'm often afraid that people would make fun of me. I think that my friends will criticize me, for example: "That's why he has to ask?" or "Haha, he doesn't know what xx means." I feel like they hate me but I don't know why. Maybe, just feelings." S72*

As most students responded with "think" and "feel", it is unclear whether they have actually received such negative evaluations from peers or just imagined what could happen when they ask questions. However, some highlighted their past experience with unfavourable reactions from the class, for example, "*As a student, it might feel stupid asking obvious questions (easy question) plus the fear in the past of me and many students getting laugh for asking questions*" (S22) and "*I don't feel too reluctant, but there are some cases where my friends didn't understand the lesson, they asked and were ridiculed by other students*" (S50). One student specifically indicated asking questions as a sign of "unintelligence" if not "dumb". She thus does not go on asking questions to retain a good self-image of herself to others.

> *"A lot of people call me "Nerd", I don't actually mind it, I love it. But it's hard to keep that status if I ask any questions about the lesson (after the teacher explained but I dont understand). You know it's like you do not that smart. So, I try my best to focus and understand. It's very hard trying to keep something you love." S89*

It is worth noting that language proficiency may cause students' fear of negative responses, for example, "*I'm afraid that I'm pronouncing English wrong, using wrong grammar, and my friends will laugh at me. It would be very embarrassing*." (S84).

Apart from negative reactions from peers, students expressed the same concern with teachers' responses, for example, "*I think my questions are stupid and dumb and the teacher will be angry and not answer my questions. Also, she may think that you don't understand the lesson*." (S68). It was also found that many students are afraid that asking something that may have been already covered may lead the teacher to think that they weren't paying enough attention to the lesson and get them in trouble.

> *"Because I think that the teacher would tell me that I am not paying attention to the lesson, that's why I have to ask questions." S104*

> *"I think the fact that maybe the question has already been covered in the class so you will sound like you haven't listen and didn't pay attention to the lesson." S76*

> *"Sometimes I just think asking questions can get you in trouble, like with teachers sometimes it means you did not pay attention in class, and with the other classmates they might think you're stupid for asking such an obvious/easy question." S39*

Besides a fear of getting negative responses, some students reported not asking because a of fear of bothering others. In simple words, while students with fear of negative responses consider themselves as a target of others' judgement, students with fear of bothering see themselves as a cause and place little value on what they want to know. These students expressed a strong desire not to impose the teacher's time and often described their questions as "not important", "unnecessary", "not worth", "not good enough", or "a waste of time", and therefore do not want to interrupt the class with such questions. Similarly, some students also raised the concern that asking too many questions might take away the class time.

> *"I'm scared that my questions are not very important or novel, which can disrupt the lesson and waste time. I just really don't like taking others time and pull the class backward compared to the other classes." S53*

> *"I don't feel confident when standing up and asking the teacher about things that I don't understand, I am not good at science, I am afraid my questions would be unneccessary,*

and therefore, will bother my friends and the teacher. Also, the teacher might need to spend a lot of time answering questions and cannot continue the class." S78

"According to my observations, I feel that some of my friends asked some questions that were not very important. Many teachers also said that, so I was afraid that me asking questions might be quite meaningless and might affect class time!" S102

What students fear the most

Table 4: Reasons for not asking in order of popularity based on the mean (1 = not at all agree to 5 = completely agree)

Reason for not asking	Mean (N =341)	SD
I am not sure if my questions are good	2.96	1.40
I am afraid of being judged by my classmates	2.70	1.44
I don't want to interrupt the teacher	2.61	1.37
I am afraid of being embarrased my classmates	2.53	1.40
I don't want to seem unintelligent	2.49	1.42
I think my questions are unnecessary	2.46	1.31
I am nervous when asking questions	2.45	1.36
I don't want to draw attention	2.43	1.36
I don't want to take away time from the class	2.43	1.40
Nobody asks so I do not ask	2.29	1.35
I previously had bad experiences with asking questions in class	2.07	1.28
I am afraid of the teacher's response	2.04	1.24

There are two general possibilities when students do not ask questions: they have no questions, and they have questions in mind but for some reason do not ask aloud. In the study, about 20 % of the students rejected the first possibility and 80% agreed with the latter. Reasons for not asking are given in Table 4. Among others, being unsure whether the question is a "good" (M = 2.90) is the most popular reason they fear to ask questions, followed by a fear of being judge (M = 2.70), interuptting the teacher (M = 2.61) or being embarrassed by fellow students (2.53). Surprisingly, teachers' response (M = 2.04) appears not to be their main concern.

Besides, while many studies have emphasised the role of teachers in providing students with question-asking opportunities, only less than 3% of the students totally agreed that they do not have the opportunity to ask in the science classroom.

4.1.3 Enhancing student question-asking

In the survey, students were asked what would encourage them to ask questions more often in the class. The analysis revealed three sub-themes: (1) question-provoking situations, and (2) positive classroom environment, and (3) incentives for asking.

Question-provoking situations

Question-provoking refers to the situation in which students "need or want to know something". This can be triggered by experiencing confusion, realising gaps in their knowledge, or lacking understanding of a certain topic. For example, "*Complicated concepts and stuff that I completely don't understand and I don't think anyone will so I ask*" (S70), "*When I get confused with something, I want to ask more to be more clearly. For example, the chapters with a lot of hard questions, I asked many questions*" (S97), and "*Harder topics. If studying Science was hard for me, I would ask questions more. But that's just me personally as others do have problems with topics that I would find easy*" (S28).

Some other students, however, looked at question-asking as what they wanted rather than what they got to do. These students often reported that they would ask more questions if the lesson is "more interesting, as well as emphasise their love for the subject and curiosity over other things. For example, "*I think if the topic is very interesting, so there will be more questions I want to ask*" (S65), "*My passion to science would really encourage me to ask question since when my passion to science increases, I will want to know more about it so I will ask advanced question on the topic*" (S41), and "*In fact, I exactly don't know how but I think some topics that I am interested in maybe can encourage me to ask questions in class more often*" (S47). The distinction between "need" and "want" was made clearly by a student.

> *"I think that that the more difficult lesson will encourage me to ask question, or if there is something very interesting, I will be more excited and ask more questions" S55*

While a lack of understanding is a precondition for question-asking, it may become an obstacle for those students who think that knowing more would make them more confident about what

they ask. For instance, "*I think what would encourage me to ask more is the subject that I understood well and knew a lot about. So at least I know what to ask and expect*" (S52) and "*I would probably ask more if I understand the problem well, because even If I want to, I don't know what I can ask*" (S83). This contradiction in promting student question-asking presents the complexity of student question-asking research and provides more evidence to the dilemma regarding whether prior knowledge influences the type and the number of questions students ask in the classroom.

Positive classroom environment

Students emphasised the importance of being encouraged and valued by their teachers and peers. This result is in line with what makes them reluctant to ask in the first place, that is, fear of negative responses and fear of bothering. For example, "*If my classmates don't judge and laugh at me when I ask something, even if the question is easy for them. So, I will ask questions without feeling unintelligent*" (S11), "*Friends not laughing at me and being more supportive of my questions*" (S9), and "*I think if everyone in the class would stop being kinda judgmental then I would have more courage to. My classmates usually joke about small details and mistakes people make*"(S35). As some students are often afraid to be the only one who does not understand, they thought friends' "confusion", "not knowing", or "asking more" may be a cue that they are not alone and therefore increase their confidence in posing questions.

> *"I thought that my classmates' confusion would help me be more certain that my question was useful." S46*

> *"Something that the entire class doesn't understand, and no one asks the question. Only then I will not be called stupid." S91*

The dynamics of the classroom may also impede the act of asking. As one student mentioned, "*I will feel more comfortable asking questions if my classmates show respect to me when I ask questions by being silent, not laughing, or interrupting me (even if they think the question is not necessary) while I am asking or listening to the answers from the teacher.*" (S101). This implies a need for establishing a mutual understanding regarding the dynamics of classroom interactions, which is important, however, often neglected.

Besides worrying about fellow students' responses, some students expected their teachers to have positive attitudes towards listening and answering questions, such as "*I like if teachers*

are more willing to respond and answer student questions with the highest quality and very specific answer" (S75), and "*I think the teacher could be nice or open-minded when students ask him question*" (S85). They also described the situations in which the teacher could stop and ask "any questions?" and give more time for questioning. By doing this, they are given opportunities to ask more freely, which may explain the fact that they can come up with more questions on paper. Furthermore, praising or complimenting student questions may encourage them to ask more often as they mentioned "*If I have a good question I will ask*" (S14) and "*I would be encouraged to ask more if the question I just asked is a good question*" (S16). While it remains unknown how students define "a good question", it is clear to them that it is good when the teacher says it is good.

> *"I would ask more questions when the teacher told me my questions are pretty good or a classmate answered it nicely without insulting me." S31*

> *"I like it when the teacher encourages me to ask questions, or my question is very interesting and I thought the teacher would like to answer it instead of thinking it's annoying." S76*

Incentives for asking

Besides making the lesson more challenging or interesting, giving incentives for asking was reflected in some students' responses, such as "*I will ask more questions if the teacher gives points for that or I am marked excellent in the school system*" (S48), and "*Higher mark in the class will encourage me to ask many questions in class*" (S61). This result is in line with the purpose of asking in the earlier section, where students saw question asking as a way to improve their grades in the exams or in some circumstances, get rewards for asking. In addition, some students highlighted the need for asking, "*When I really need to understand the question like it will be tested in the exam, and I think it really hard to understand* (S23). This quote, to some extent, infers a tendency to ask questions when they really think it is useful for their learning even if they might have a fear to ask.

It is worth mentioning that the availability of other sources of information, such as friends, books, or the internet, can impact the need for asking questions. Many students idicated that they would typically ask their friends first, where no potential embarrassment is present, and then approach the teacher if the questions remain unanswered or unsatisfied. Similarly, some

students expressed a strong belief in self-reliance, preferring to figure things out on their own by reading textbooks or looking up on the internet, rather than seeking help from the teacher.

> *"I need to think about the question or ask my friends about it first then if they can't answer it, I'll ask the teacher." S82*

> *"I think it's the teachers have already taught all of the content during class, so you're supposed to already understand what was taught, therefore no need to ask questions. Even if you have questions, you should look for the answers yourself." S93*

4.2 Quantitative results

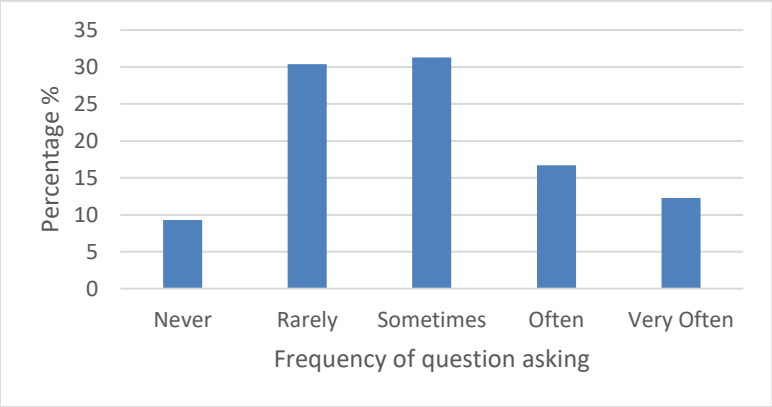

Figure 4: Reported frequency of student question-asking

In total, 90.7 % of the students reported that, on average, they ask at least one question per week, while 9.3 % never ask questions in the science classroom. Of the students who reported asking at least one question per week: 30.4% reported asking rarely (1-2 questions per week), 31.3 % reported asking sometimes (3-4 questions per week), 16.7 % reported asking often (5-6 questions per week), and 12.3 % reported asking very often (7 or more questions per week). With a median of 3 (3-4 questions per week), the mean number of questions per week is roughly 3.5. Given that a regular week has six science sessions, each lasting approximately 40 minutes, the estimated number of questions a particular student asks per class hour is 0.87. This rate of student questions is approximately eight times the rate of student questions documented in the literature - that is, 0.11 per student per hour (for reviews, see Graesser & Person, 1994).

4.2.1 Frequency of question asking, perceived importance and fear of asking

Descriptive statistics of the study variables and their inter-correlations are shown in Table 5. A repeated measures test revealed that students reported significantly higher levels of perceived

importance than their fear of asking, F (1, 340) = 383.5, p < .001. The frequency of student question-asking is positively correlated with perceived importance (r = .404, p < .001) and is negatively correlated with fear of asking (r = - .175, p < .001).

Table 5: Means, standard deviations, and Pearson correlations of the study variables

	Mean	SD	1	2	3	4	5
1. Gender			-				
2. Grade level			.062				
3. Frequency of question asking	2.93	1.15	-.315**	-.014			
4. Perceived importance	3.90	.720	-.175**	-.087	.404**		
5. Fear of asking	2.46	1.04	.249**	.037	-.168**	-.175**	-

**. Correlation is significant at the .001 level (2-tailed).

Multiple regression analysis was performed to explore the extent to which perceived importance and fear of asking predict the frequency of question asking, as shown in Table 6. Together, they explained 16.8 % of the total variance, F (2, 338) = 35.3, p < .001. Nevertheless, while both variables are significant in predicting the frequency of which students ask questions, the perceived importance is far more effective than the fear of asking, with β = .386, p < .001 and β = -.100, p = .047 respectively. Put the fear of asking away, perceived importance explained 16 % of the total variance in the frequency of question asking, F (1, 339) = 73.5, p < .001, β = .404.

Table 6: Multiple regression model (dependent variable: frequency of question asking)

Predictors	β	t	p	R^2
				.168**
Perceived importance	.386	7.68	<.001	
Fear of asking	-.100	-2.00	.047	

**. Model is significant at the .001 level.

Supplement analysis

Another analysis was performed based on a single-item measure, namely hesitancy, asking students to what extent they feel hesitant to ask questions in the science classroom (from 1 = not at all to 5 = extremely). Hesitancy alone explained 18.4 % of the variance in fear of asking, F (1, 339) = 77.7, p < .001.

Figure 4 shows the variation of frequency of asking, perceived importance, and fear of asking with varying levels of hesitancy. It is intriguing that those who reported extremely hesitant to ask questions (M = 3.20, SD = 1.53) asked as frequently as those who reported not at all (M = 3.33, SD = 1.19) or slightly (M = 3.10, SD = .97); p > .05. While this finding may seem coincidental due to the relatively small number of respondents within the category (N = 25), it can be possibly explained by the high levels of perceived importance (4.07), which were as high as those in the first two categories (4.04 and 3.99 respectively). This reiterates the crucial role of perceived importance in anticipating the frequency of question asking.

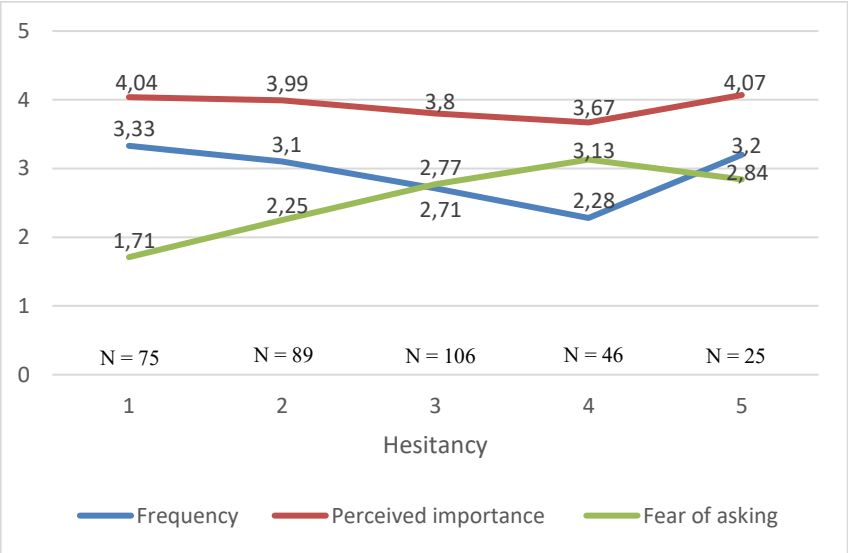

Figure 5: The variation of perceived importance, fear of asking, and frequency of asking with hesitancy

4.2.2 Analyses based on gender and grade levels

Table 7 shows the means and standard deviations of the study variables in terms of gender and grade levels. On average, male students (M = 3.26, SD = 1.17) asked significant more questions than their female couterparts (M = 2.53, SD = 1.00); t (339) = 6.11, p < .001. The effect size was large (1.10 > .80, Cohen, 1988). However, no significant difference was found in the frequency of student questions across the grade levels (F (2, 338) = [0.045]; p = .956).

Table 7: Discriptive statistics of study varibales between gender and across grade levels

	Male		Female		Grade 6		Grade 7		Grade 8	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Frequency of asking	3.26	1.17	2.53	1.00	2.94	1.13	2.93	1.22	2.89	1.01
Perceived importance	4.02	.72	3.77	.70	3.96	.74	3.92	.73	3.76	.67
Fear of asking	2.22	.95	2.74	1.07	2.36	1.09	2.53	1.03	2.43	.98

Male students (M = 4.02, SD = 0.72) perceived question asking as more important than female students (M = 3.77; SD = 0.70); t (339) = 3.27, p < .001, Cohen's d = .71. No significant difference was found across different grade levels; (F (2, 338) = [1.55]; p = .214).

Male students (M = 2.22, SD = .95) appeared to be less afraid of asking questions compared to their counterparts (M = 2.74, SD = 1.07); t (339) = - 4.73, p < .001, Cohen's d = 1.01. Astonishingly, it was applied to every single item of the fear of asking measure, with ten out of twelve items significant at the .001 level and two at the .05 level. One-way ANOVA revealed no statistically significant difference across the grade levels (F (2, 338) = [.841]; p = .432).

Multiple regression analysis was performed to explore the extent to which perceived importance and fear of asking predict the frequency of question asking in terms of gender. The results are shown in Table 8. For boys, perceived importance and fear of asking together explained 19.8 % of the total variance in the frequency of asking, F (2, 184) = 23.7, p < .001. For girls, perceived importance and fear of asking together explained only 5.8 % of the total variance in the frequency of asking, F (2, 155) = 23.7, p = .004. Surprisingly, fear of asking turned out to be not predictive of the frequency of asking in both models for boys and girls, with β = -.035, p = .601 and β = -.058, p = .463, respectively.

Table 8: Multiple regression models (dependent variable: frequency of question asking)

Predictors	Male				Female			
	β	t	p	R^2	β	t	p	R^2
Perceived importance	.448	6.69	<.001	.198	.253	3.22	.002	.058
Fear of asking	-.035	-.524	.601		-.058	-.736	.463	

4.2.3 Additional analyses

The study also investigated three additional variables, namely self-efficacy (one item - I am good at science - rated on a 5-point Likert scale), interest (one item - I like learning science - rated on a 5-point Likert scale), and liking (one tiem - I like asking questions in science class - rated on a 5-point Likert scale). However, as these variables only emerged from the pilot study and were not included in the initial goals, they will only be reported in this section to provide additional insights and suggestions for future research. Table 9 shows an overview of the inter-correlations of all the variables.

Students with high levels of self-efficacy and interest in science tend to ask more questions in the classroom. This was further explored by multiple regression analysis, with self-efficacy and interest as predictors. Together, they explained 14.3 % of the total variance in students' frequency of asking, F (2, 338) = 29.3, p < .001. The standardised coefficients are .221 (p = .001) and .200 (p = .003) respectively. Self-efficacy and interest are also significant in predicting students' fear of asking, F (2, 338) = 22.0, p < .001, R^2= .110. In more detail, self-efficacy is more predictive of fear of asking rather than interest, with β= -.215, p = .002 and -.156, p = .023, respectively.

Table 9: Means, standard deviations, and Pearson correlations of selected variables

	1	2	3	4	5	6	7	8
1. Gender	-							
2. Grade level	-							
3. Frequency of question asking	-	-						
4. Perceived importance	-	-	-					
5. Fear of asking	-	-	-	-				
6. Interest	-.381**	-.109*	.347**	.252**	-.299**			
7. Self-efficacy	-.296**	-.109*	.354**	.267**	-.319**	.666**		
8. Liking	-.359**	.015	.676**	.520**	-.286**	.469**	.402**	-

**. p < .001 (2-tailed). *. p < .05 (2-tailed).

In terms of gender difference, boys (M = 4.09, SD = 0.82) demonstrated a significantly higher interest in learning science compared to girls (M = 3.28; SD = 0.90); t (339) = 7.60, p < .001, Cohen's d = .86. Similarly, they (M = 3.43, SD = 0.94) exhibited a higher level of confidence in their ability to learn science than their female counterparts (M = 2.85; SD = 0.91); t (339) = 5.68, p < .001, Cohen's d = .92. An one-way ANOVA revealed no significant differences in both variables across the grade levels.

It can be seen that students with high levels of interest, self-efficacy, and perceived importance tend to like questioning in the science classroom. In addition, liking is strongly correlated with the frequency of student questions. Multiple regression analysis was performed, taking into account all the variables, as shown in Table 10. Together, they explained 46.3% of the total variance in students' frequency of asking, F (2, 335) = 59.6, p < .001. In this model, only liking and perceived importance are significant in predicting the frequency of student questions, with

β= .120, p = .029 and .621, p < .001 respectively. Interestingly, leaving liking alone explains 45.5% of the total variance, F (1, 339) = 285.4, p < .001, β = .676.

Table 10: Multiple regression model (dependent variable: frequency of question asking)

Predictors	β	t	p	R^2
Perceived importance	.120	2.20	.029	.463
Fear of asking	.052	1.21	.228	
Interest	-.070	-.427	.670	
Self-efficacy	.064	1.37	.171	
Liking	.621	12.0	< .001	

5 Discussion

While previous studies have concentrated on the fear of expressing a question in a social setting, this study is one of the first attempts to measure the fear of asking and explore the extent to which it influences the frequency of student questions. The study has also elicited valuable information about students' perceptions of the importance of question asking and revealed the significance of perceived importance in predicting the frequency of student questions. The new findings have provided more comprehensive knowledge to fill current research gaps in student questioning and suggest a new direction for future research. Some key findings from the study are discussed below.

5.1 The importance of question asking perceived by students

As indicated, the majority of students demonstrated a keen awareness that asking questions plays a pivotal role in different facets of their own learning. Asking questions serves as a means for them to comprehend the lesson content by simply obtaining an answer to what they want to know or disentangling their confusion regarding complex problems. Students may pose questions to confirm what they know but may be unsure about, thereby becoming more confident with their knowledge and understanding. For some, questioning is considered a strategy to improve their academic performance because they can grasp what is taught and potentially what will be tested in the exams. Adding to this, Dogan and Yucel-Toy (2021) found that fourth-grade students ask questions in order to understand difficult problems and thus avoid making mistakes in their exams.

In line with King's (1995) proposition, students perceived asking questions to the teacher as a better way to enhance their memory and knowledge retention. This can be attributed to the cognitive processes triggered by questioning, prompting students to engage with the subject matter, connect with their existing knowledge, and thereby establish lasting mental associations between the new concepts (King, 1994; Schmidt, 1993). Similarly, Markant et al. (2016) argue that question-asking as a form of active learning involves the process of exerting control on the learning (i.e., deciding what questions and when to ask), which leads to improved memory through various enhancing mechanisms. Moreover, when teachers answer to an individual student, they may tailor their explanation to fit the student's academic level and learning style, making it personally meaningful. In this way, the student could better understand and remember what he or she asked compared to generic instruction, ultimately leading to a more

effective learning experience. Research has shown that students who ask questions after reading texts demonstrate higher levels of knowledge comprehension and retention (King, 1989, 1994; Palinscar & Brown, 1984; Roseshine et al., 1996).

Students also perceived question-asking as a means to acquire additional information that extends beyond the confines of prescribed curriculum and textbooks. This sort of information has the potential to pique their interest in the subject. On the one hand, students often inquire about the topics that intrigue them (Commeyras, 1995; Elstgeest, 1985). In this way, asking questions leads to increased knowledge and understanding, which may, in turn, sustain and increase their interest in the topic (Laine et al., 2020; Rotgans & Schmidt, 2014; Renninger, 2000). On the other hand, some students may seek information they deem necessary or at least they believe will benefit their learning process. It is thus not uncommon for students to pose questions on the subject matter they may not find inherently captivating but consider essential for their academic success. This finding underscores the notion that students can develop an interest in a subject based on, for example, listening to surprising or novel facts given by the teacher (Schiefele, 2009; Silvia, 2006). In this view, student-generated questions may be integrated into open scientific investigations (Biddulph et al., 1986; Watts & Alsop, 1995; Watts et al., 1997) to arouse feelings of excitement and happiness (Chin & Kayalvizhi, 2005).

Besides enhancing one's learning, the study indicated that some students perceived their questions as potentially beneficial to their classmates. This belief stems from the notion that their peers may harbour similar questions and, therefore, gain insights by listening to the responses provided by the teacher. This finding is echoed in Nadile et al.'s (2021) study, wherein 96 % of students agreed sharing the same questions with their peers, and 83 % agreed that their thinking can be clarified through other questions. As suggested by Chin and Osborne (2008) and Aguiar et al. (2009), students also highlighted that asking questions will not only prompt critical thinking among their peers but also expose them to diverse perspectives on the topic being discussed. This, in turn, may enhance classroom interactions and co-construction of knowledge, where students can learn from each other and learn together (Commeyras, 1995; King, 1990).

Interestingly, students demonstrated an awareness that asking questions in the classroom could be valuable for teaching. The act of formulating and posing questions signals whether students are paying attention and actively engaged in the lesson. This aids teachers, to some extent, in evaluating students' participation in the classroom. More importantly, the information

contained within their questions helps inform the teacher what they know, what they want to know, or what they lack (Dillon, 1988; White & Gunstone, 1992; Harper et al., 2003; Maskill & Pedrosa de Jesus, 1997). In other words, their questions, to some extent, reveal their understanding and thinking, allowing the teacher to assess their learning and thus tailoring their future instruction.

Some students also expected that their questions have the potential to provoke critical incidences through which the teacher may learn something new from being questioned (Watts et al., 1997b). For example, student questions may challenge teachers' perceptions of teaching and learning, indicate their knowledge gaps, or expose them to a new perspective on a familiar subject matter. Furthermore, the study indicated that students may not only use questioning as a strategy to create a favourable impression on others (Huang et al., 2017; Van der Meij, 1994) but also use questioning as doing a favour to the teacher - that is, to provide emotional support. These students see questions as a sign of interest and attention. Hence, asking questions means being focused and interested in the lesson, which signals to the teacher that he or she is doing a "good" job. As a student described, "It could make the teacher feel happy because they love it when we ask questions" (S67).

5.2 Barriers on the asking of questions: A fear of asking

The findings of the present study support the question-asking models of Van der Meij (1994) and Ronfard et al. (2018). As the formulation of a question involves the choice of the right words and structure to ensure that the question is clearly understood, language ability, therefore, plays an essential role in facilitating or hindering the generation of questions. This aspect becomes particularly important in circumstances where students learn the subject matter in a language different from their mother tongue. Students in the study experienced difficulties in expressing their questions fully in English due to the lack of vocabulary, grammar, or pronunciation. This is in line with the findings of Hanh (2020) and Kurniawati (2022) in terms of language students and Apleage (1969), whereby students generally cannot say what they mean. In addition, for some students, language does not just influence the generation of questions but also the understanding of teachers' responses. The possibility of not understanding what the teacher says may constrain their question asking. However, it also raises the question of whether prior knowledge may obstruct the asking of questions. In this view, Good et al. (1987), for example, found that low-achieving students asked fewer questions than average-achieving students.

Even if students can articulate the questions and come to the expression, most of them expressed a fear to ask in the classroom. What are students afraid of? In general, they are often afraid of receiving negative responses from peers and teachers (Appleage, 1969; Dillon, 1981a; Nadile et al., 2020) and afraid of bothering others, in other words, imposing on the class or teacher's time (Karabenick & Sharma, 1994; Newman, 1992; Van der Meij, 1988). Unlike Dillon's (1981a) finding that the primary fear to ask comes from teacher's negative reactions, the present study aligns more closely with Applegate's (1969). In particular, being afraid of teachers' responses, among others, was the least common reason why students did not ask questions in the classroom. Students in the study would rather be concerned with their peers' comments and reactions. They described how their classmates could be mean and judge and make fun of them for asking wrong or stupid questions.

Besides the fear of public scrutiny, they are afraid of being perceived as intellectually inferior to their classmates. According to Ryan et al. (1997), a student is less likely to ask for help when they are concerned with their status or image among their peers. Fairly enough, students often view their questions as a reflection of what they know, and therefore, having a question usually means they are "the only one who does not know or understand", if not "the stupid one". This fear of standing out and appearing ignorant has ingrained itself as a hidden norm against student question-asking, perpetuating a culture of silence in the classroom settings (Dillon, 1981a). However, it is essential to recognise that the fear of asking may stem from their personal experiences or observations of what happened to their peers who posed the questions.

Contrary to the popular notion that students may lack opportunities to ask questions in the classroom, students rather expressed their concerns about interrupting the teacher or taking away the class time when they, for example, ask too many questions. This fear of bothering others may stem from the uncertainty of their question, whether the question is "a good one", and whether they are being perceived as bothersome. Being uncertain about the quality of their question, among others, was the most popular reason why students did not go on uttering their questions aloud. In other words, these students tend to put little value on the questions they want to ask, which can be relevant to their personal characteristic - that is, self-esteem. Individuals with lower self-esteem may be more inclined to protect their self-image and thus unlikely to pose questions (Van der Meij, 1994). In this way, these students are more sensitive to the anticipated cost of seeking help (e.g., admitting failure and increasing dependence) and rely more on themselves (Fisher et al., 1988; Nadler, 1997; Nadler & Fisher, 1986).

5.3 Towards a new research direction for student question-asking

Most studies on student questioning have focused on the fear of asking, which has also been indicated in the present study. However, the question is: Do students who have a fear of asking ask questions? The answer is yes. They ask a question when the benefits of asking outweigh the costs of asking (Graesser & McMahen, 1993; Van der Meij, 1988; Ronfard et al., 2018). In simple words, when they think the question is important and is greater than their fear of asking. This internal process of considering whether to ask a question has been demonstrated in students' discoures, for example, *"I was afraid to communicate because in the past, something unfortunate happened to me in class, which made me still nervous and haunted until now. But I will try to ask more questions if I think they are very important" (S52)* and *"If it doesn't take so long to answer the questions or probably not waste the class's time because thats just make a bad impression about me wasting everyone's time. But if there is a really important and necessary question, I will still ask" (S62).*

The study suggests that the cost-benefit consideration occurring in one's head operates upon two primary questions: (1) how important the question is perceived by the questioner (e.g., to comprehend the lesson content, to gain additional knowledge, to remember better, to get good grades, to increase confidence, to improve communication skills, or to provoke interest) and (2) what the costs of asking are, particularly fear of negative responses (the personal cost), such as being judged or laughed at, and fear of bothering (the social cost), such as interrupting the teacher or wasting the class time. As it may not be feasible to examine this internal process for a single question, the present study among the first attempted to measure the general fear of asking and the perceived importance of asking questions and explored the extent to which they influence the frequency of student questions, which is obtainable and observable.

As expected, both fear of asking and perceived importance are significant in predicting the frequency of student questions. Nevertheless, perceived importance is far more predictive than fear of asking and better justifies the gender difference. In other words, students with high levels of perceived importance tend to ask more questions regardless of their fear of asking. This finding highlights the importance of students' understanding and awareness of the benefits of asking questions and suggests a new direction for research on student questioning, which seems to be ignored in the research on student questioning.

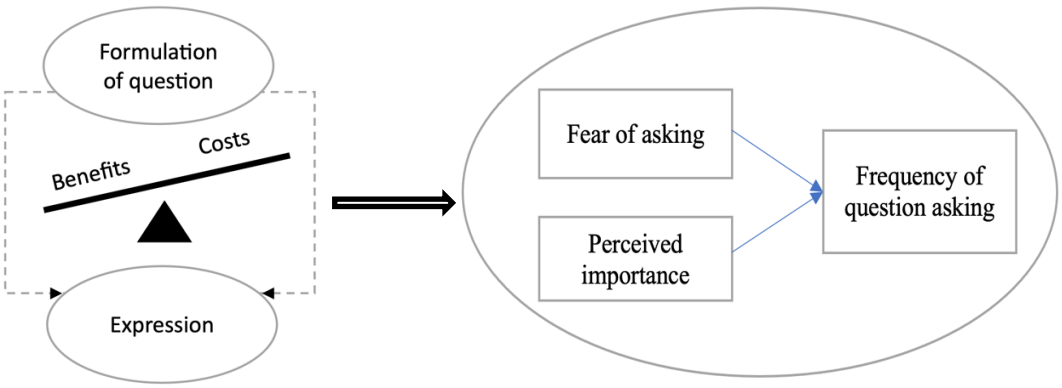

Figure 6: A hypothesised model of frequency of question asking, percieved importance and fear of asking

Based on the suggested model, there are two primary strategies to encourage students to ask questions in the classroom: (1) increasing the perceived benefits and (2) reducing the perceived costs. Increasing the perceived benefits may include provoking intrinsic motivation for question-asking (e.g., making the lesson more challenging and interesting), emphasising the usefulness of questions for others (i.e., classmates and teacher), or giving stimuli for asking (e.g., praising or giving points). Reducing the perceived costs may involve creating a positive classroom environment where student questions are valued and encouraged (e.g., inviting and welcoming student questions), providing asking opportunities that mitigate social embarrassment (e.g., free question time or individual question sessions) and making it as assignment or homework in which diminish the fear of bothering others. For example, students who perceived a high level of teacher support are more likely to have and pose questions than those who perceived teachers as unwilling to answer their questions or answer with low quality (Karabenick & Sharma, 1994; Van der Meij, 1988). Graesser and McMahen (1993) found that students would ask significantly more questions in a task-induced setting that obligates them to ask questions compared to a self-induced setting, even when social barriers are removed.

5.4 Gender difference in the frequency of student questions

In the present study, boys reported asking significantly more questions than girls. This finding aligns with many other classroom studies, underscoring the active participation of male students (Aziz et al., 2018; Crombie et al., 2003; Howard, 1998). It also highlights the tendency of male students to pose more questions in the classroom than their female peers (Aguillon et al., 2020; Leraas et al., 2008), and their greater comfort in asking questions in mathematics and science classes (Daly et al., 1994). This disparity in the frequency of student questions can be

plausibly attributed to variations in students' perceived importance and fear of asking. Male students in the study perceived asking questions as more crucial for their own learning and that of their classmates compared to female students. This observation is consistent with Howard's (1998) findings, which found that males often asked questions to seek information and clarification and showed less concern about participation grades.

At the same time, females exhibit a significant fear of asking, which is evident in all aspects. They show great doubt regarding their questions, a fear of peers' and teachers' judgment, and a strong desire to not interrupt the class or call attention to themselves. This fear is likely rooted in their sensitivity to how they are perceived by others. In this regard, Good et al. (1987) noted that "adolescent females are generally reluctant to compete in the classroom, apparently because they want to appear less aggressive than male students, or they are hesitant to ask questions because of their concern about how teachers and peers will perceive their questions (e.g., its appropriateness) (p.194). Badini and Rosenthal (1989) also suggested that female students are better at interpreting teachers' expectations, whether the teacher wants a question. Despite the fact that what they think may not necessarily be what the teacher actually means, girls tend to be more sensitive to and anticipate more negative responses from the teacher or peers.

It is also suggested that their questioning behaviours may be influenced by gender stereotypes or societal expectations, preventing them from asking for help from the teacher (Sadker & Sadker, 1994; Bigler & Liben, 2007). According to Sadker and Sadker (1985), male students at all grade levels and in all subjects had more opportunities to interact than their female counterparts. An observational study by Bassi et al. (2018) found an imbalance in teachers' attention and interactions favouring boys in 237 classes of fourth grade. They often call on boys and ask them questions that encourage critical thinking and evaluation, while female students are asked to regurgitate facts (Cooper, 1987). Unfortunately, teachers often fail to notice this bias (Bassi et al., 2018; Sadker & Sadker, 1986) as much as they fail to anticipate the lack of student questions.

5.5 Limitations and future research

The findings of the present study should not be interpreted without acknowledging some limitations. Firstly, the data was only collected from certain age groups in a single school in the central area of Vietnam and thus may not be generalisable to students of, for example,

different ages, ethnicities, and cultural backgrounds. Because they may socialise differently, leading to different perceptions of question asking. Furthermore, English was used as a medium of instruction in the sample, and therefore, students essentially became more aware of the language difficulty compared to those, for example, studying with their mother tongues. In this regard, it would be interesting for future studies to examine a larger sample and include participants from more diverse backgrounds to scrutinise the presented findings.

Secondly, the use of student's self-report for data collection may only provide a limited picture, as it relies on the memory and recall of the respondents, which can be influenced by various factors, such as emotions, motivation, and especially honesty and may cause the problem of common method variance and measurement bias (Spector & Brannick, 2009; Reio, 2010). With regard to the high frequency of asking, it may be fair to assume that students may have over-reported, as well as males tend to report asking more questions than females. Future research can address this limitation by combining self-report with classroom observations (e.g., through videotapes, in person), as in other classroom studies (e.g., Bassi et al., 2018; Dillon, 1981a; Suskind, 1969; Good et al., 1987). It may also be useful to explore the possible disparity between the number of questions reported by students and the actual number of questions posed in the classroom.

Thirdly, no inferences about causality may be proven in the cross-sectional study (Van der Stede, 2014), as it does not follow individuals up over time (Wang & Cheng, 2020). Although the study identified leveraging perceived importance and diminishing fear of asking as ways to foster student question-asking, the relationships are possibly reversed or reciprocal. That is, for example, a student who asks questions often is more likely to think asking questions is important. It is similar to many students, on the one hand, thinking that they would ask more questions if they find the topic interesting; others, on the other hand, think asking questions will provoke their interest in the topic. Future research may address this issue by collecting longitudinal data or conducting interventions to explore the effects of perceived importance and fear of asking in a controlled environment.

Finally, among the first studies to measure the perceived importance and fear of asking and explore their relationships with the frequency of asking, the study highlights a need for further research into students' perceptions, especially on the role of question asking in the classroom. However, the theoretical foundation and validity should be further scrutinised and constructed in future studies. It is recommended that future studies employ interviews to gain more insights

into students' perceptions of question asking, particularly how students think their questions may be useful to their classmates and teachers. More items may then be added to the measures of the perceived importance and fear of asking. While the current study found no differences across grade levels, Good (1981) suggested that some students learn to become intellectually passive in classrooms due to differential teacher feedback. Therefore, it may be intriguing to examine the variations of perceived importance and fear of asking with a larger age gap.

Gender difference has received substantial attention in classroom studies. In the present research, boys report asking significantly more questions than girls, which may be attributed to the limitation of self-reporting. However, there are still clear differences in perceived importance and fear of asking between boys and girls. The study suggests future research to look into this unresolved but important issue - that is, what causes these differences? Literature has suggested that girls tend to be more sensitive to self-image (Good et al., 1987) and good at interpreting teacher's expectations (Badini & Rosenthal, 1989). It would be interesting to investigate the qualitative difference between genders in how they perceive and interpret, for example, a question asked in the classroom and a behaviour signalled by the teacher.

As recommended by Chin and Osborne (2008), additional analyses also suggest an area that is little explored but may offer potential further work - that is, how learners' motivation, self-efficacy, achievement goals, and goal orientations influence their question asking, particularly the number or types of questions. Students who perceive asking questions to learn additional knowledge regarding the topic may, for example, ask more advanced questions compared to those who aim to get good grades. Similarly, students with high levels of interest and self-efficacy in science are likely to ask more questions compared to those who think they are not good at science and are uncertain about their questions. Furthermore, while students who like asking questions appear to ask considerably more questions, it remains unclear how to instill a love of asking in students.

Students often express their concern about whether their questions are good and therefore, do not ask them aloud in the classroom. It may be useful to gain more insights into their definition of a good question and how it is influenced by the way in which teachers define and communicate their expectations to the students. In addition, most students only focused on the learning aspects of questioning, little is known about how they use questioning as an affective "tool" in the classroom, for example, to emotionally support the teacher.

While the present study supports the idea that questions are asked only when the benefits of asking attached to the question are greater than the costs of asking, there is a lack of empirical evidence and exploration in this internal process. It would be interesting to have students write down any questions that they had in the class but did not go on asking, justify their reasons, and perhaps rate on a benefit-cost scale, which can be tasked as homework in the natural classroom setting.

5.6 Implications

Implications for teaching

Despite its limitations, the present study provides several implications for teaching practices. First, the findings indicate that students very often have questions regarding the lesson, yet they do not ask aloud due to a number of reasons. Some students may struggle with choosing the right words and take quite some time to articulate their questions effectively in a single instance. These feelings can lead students to believe that they should not, cannot, or are better off not asking for the sake of the teacher and class time. Teachers, therefore, may demonstrate patience and give them enough time to speak out or clarify their poorly articulated questions if needed. Inviting students or responding with a welcoming and appreciative attitude, regardless of the essence of the question, can considerably and effectively encourage more students to pose their questions. In addition, while it is not necessary to overly praise every single question, some students described teachers' compliments as helping confirm that their questions are good and essentially eliminating their uncertainty regarding the quality of the questions, which, among others, is their greatest concern.

The study suggests a need to create a collaborative and supportive classroom learning environment. While this may not be directly linked to teachers' attitudes and reactions, teacher pedagogical knowledge and skills play an essential role in shaping classroom norms and interactions. Many students during their schooling have likely accumulated experiences that may hinder their willingness to ask questions. They, for example, may have encountered negative reactions to their own questions or those posed by their classmates. As a teacher, it does not take much effort to prevent this from happening, yet these negative experiences may be attached to a student forever throughout schooling. For a long time, they will have learned to keep the confusion and uncertainties for themselves better by remaining silent. Asking questions, especially in front of the whole class, requires a lot of courage. A positive classroom

climate without the presence of judgment, embarrassment, or ridicule is undoubtedly essential for fostering student questions.

It is very much dependent on the teachers' perceptions of student question asking, yet many students may have no clue how their questions could be, to some degree, helpful for their classmates and teacher. As indicated in the study, these perceptions may effectively encourage them to ask more questions. It would be effective if, for example, teachers could open up discussions about classroom questioning. Such discussions may help cultivate students' empathy for others and awareness of questioning benefits and proper behaviours. In addition, as students ask themselves, "What makes a good question?" they may possibly expect teachers to say, "Every question is a good one". If the teacher does not think that way, he or she may already have the answer to why students do not ask questions in the classroom.

That said, student questions can undoubtedly pose challenges for teachers at the same time. By encouraging students to ask more questions, we must acknowledge inevitable interruptions. It can be difficult and slightly irritating to put aside our planned activities and then concentrate on someone else's "problems", which may even be irrelevant, poor-articulated, and probably not very "smart" ones. However, while these questions may not always be stimulating, they are the natural way to provide insightful information about the mind of the individual we are striving to teach and expect to inspire.

Question asking and theories of learning

In a broader context, students' perceptions of question-asking serve as a lens through which various learning theories can be understood and supported. Aligned with the transmission view of learning, some students see learning as the process by which knowledge is transferred to the students. They tend to put the teacher at the center of the learning process as an authority figure and see themselves as a mere absorber who is responsible for understanding what is taught. These students often perceive that asking questions may signal a lack of attentiveness and thus get them in trouble with the teacher. In simple words, there is no need to ask. Even if they have questions in mind, they would rather ask their friends or look up the answer themselves, diminishing the role of question-asking in the learning process.

For other students, learning is viewed as an active process of constructing knowledge and understanding, which aligns reasonably well with constructivism. Students who subscribe to this view see question-asking as an integral part of their learning. That is when they have a

question, it needs to be asked, otherwise, they would not be able to understand. These students tend to ask questions not only to broaden their existing knowledge but also to deepen their understanding of the learning materials. Some may also view questioning as a strategy to enhance knowledge and memory retention through the activation of relevant cognitive processes. While not explicitly articulated, some students may adopt a socio-cultural perspective on learning, emphasing the significance of social interactions. Within this view, students perceive the teacher as a knowledgeable body and prioritise seeking clarification from them over alternative sources of information, such as textbooks and the Internet. Question-asking is also considered an opportunity to stimulate classroom discussions, promote collaborative learning, and facilitate knowledge exchange among peers.

As obvious as it seems, question-asking can be perceived as either positive or negative, depending on the individual's view of learning. On the one hand, the act of formulating and asking questions indicates that students are actively thinking and participating in the learning process. This way, asking is desirable as it enhances knowledge acquisition and classroom interactions. On the other hand, posing questions is a sign of ignorance, passivity, and lack of self-directedness. Students who ask questions appear foolish and dependent on others for their learning's sake. This leads to the question of whether learning theories should be taught and discussed in school if they, to some extent, influence students' perceptions and behaviours on their learning. Similarly, one may wonder whether students should be trained to ask "good" questions.

6 Conclusion

The present study has indicated that most students indeed have questions in mind but often refrain from asking for two primary reasons. They may struggle to articulate their thoughts due to a lack of language ability or fear of asking in the classroom setting, which is negatively correlated with the frequency of student questions. As such, teachers should be aware of language use, especially when teaching a subject in a second language, and more importantly, strive to cultivate a positive learning environment where student questions are valued and encouraged.

The findings also underscored that recognising the significance of asking questions is positively associated with the frequency of student questions and is a stronger predictor than the fear of asking. In this context, increasing students' understanding of the importance of questioning may prove effective in fostering classroom questions and discussions. Although many students may acknowledge that questioning can benefit their own learning, there remain opportunities to emphasise its value for peers and teachers.

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Appendices

Appendix 1 Factor analysis (PCA)

Rotated Component Matrix[a]

		Component		
		1	2	3
Item 1	I do not want to ask			.707
Item 2	I have no questions to ask			.796
Item 8	I rather ask someone else (e.g. my friends)			.490
Item 9	I rather seek for answers myself (e.g. reading textbooks, searching on the internet)			.586
Item 11	I assume others will ask my questions so I do not ask		.435	
Item 3	I don't know what to ask because I lack understanding		.707	
Item 4	I don't know how to express my ideas		.537	
Item 6	I'm not interested in the topic being taught		.761	
Item 7	I don't feel I have the opportunity to ask		.670	
Item 12	I don't expect to get a proper answer from the teacher		.722	
Item 24	I think I am not supposed to ask questions		.524	
Item 14	I am not confident about my English		.536	
Item 5	I am not sure if my questions are good	.558		
Item 10	Nobody asks so I do not ask	.517		
Item 13	I previously had bad experiences with asking questions in class	.539		
Item 15	I don't want to draw attention	.751		
Item 16	I am afraid of being judged by my classmates	.836		
Item 17	I don't want to seem unintelligent	.783		
Item 18	I am afraid of the teacher's response	.604		
Item 19	I am afraid of being embarrased my classmates	.797		
Item 20	I don't want to interrupt the teacher	.734		
Item 21	I think my questions are unnecessary	.646		
Item 22	I don't want to take away time from the class	.661		
Item 23	I am nervous when asking questions	.712		