# ASKING MEANINGFUL QUESTIONS

## *STUDENTS WORK COLLABORATIVELY TO GENERATE, CATEGORIZE, AND REFINE MEANINGFUL QUESTIONS*

Dagmara Sokołowska

Jagiellonian University, Kraków, Poland

| SUITABLE FOR AGE(S) | SUBJECT(S) | KEY FOCUS |
|---|---|---|
| 11-18 years | Mathematics, all science subjects; possible extension to other subjects | Generating questions<br>Reflective dialogue |

## INTRODUCTION

Asking meaningful questions is one of the fundamentals of learning. The ability to ask good questions is developed from early childhood throughout life and underpins individual and societal development. However, students' ability to ask questions at school is often hindered - first by the traditional structure of asking questions mainly to monitor students' knowledge, and second by students' fear of asking "stupid" questions in class.

> *High achievers, for the most part, long to answer questions. Answering questions earns the high grade. Answering questions pleases the teacher. Answering questions is safe, comfortable, and familiar. Asking questions? Not so safe. What if my peers think I'm stupid? What if the teacher thinks I don't have all the answers? How will asking a question help my grade? For these kids, it's the teacher's role to ask, and their role to answer. But if I'm asking all the questions, they're only learning what I'm teaching. And that, I decided, is not enough. (Lauren Carlton).*

This rich task is designed to address this issue and reverse the traditional dynamic of question-asking in education.

The task is built around a central issue expressed with the use of the Initial Question Focus (IQF) via a statement, picture, or short video on any topic. It gives students opportunities to:

- Practice formulating different types of questions
- Distinguish between types of questions
- Develop critical thinking about how questions function in learning and life.

## TASK DESCRIPTION

Students work collaboratively to practice generating different types of questions in response to visual or textual prompts. They classify questions, transform them between open and closed forms, and develop inquiry-driven questions for deeper exploration.

This task comprises four parts.

The first part of the task is based on the Question Formulation Technique (QFT), a structured method for formulating and refining questions. QFT integrates divergent, convergent, and metacognitive thinking into an accessible, step-by-step technique that supports lifelong learning. It fosters critical and creative thinking, enhances self-efficacy and confidence, and is valuable not only in school but also in civic life.

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The next three parts of the task expand on this idea by helping students understand the different functions of questions and developing the skills to distinguish them in various situations, enabling students to formulate targeted questions in a meaningful way.

The task can be used on various occasions:

- at the beginning of the curriculum section – as the introduction to the topic
- at the end of the curriculum section – as the revision of the topic
- at the beginning of the semester – as a warming-up activity
- at the end of the semester – as a wrapping-up activity
- during developmental classes or school trips – as the activity in which students reflect on big questions (concerning life, career, attitudes, ethics, etc.)

## TASK PREPARATION

The teacher prepares IQF (Initial Question Focus) material, such as a picture, statement, short video, or brief demonstration, without explanation, to trigger questions relevant to the subject or broader inquiry themes. It may relate to an upcoming or recently completed curriculum section, or broader topics (big questions, passions, etc.). The IQF should be presented without any comment on its source or the information it contains. [See Appendix 1 for example IQFs].

Students work in groups of 3 to 4. In remote classes, this is done via breakout rooms. The task is organised in the classroom, but its realisation in the outside environment is also possible.

**Materials Needed:**

• IQF materials (photos, statements, videos)

• Flip charts or A3 paper

• Collaborative tools (e.g. Jamboard, Google Drive, OneNote, Miro, Mural, etc) for remote learning

## TASK IMPLEMENTATION

**Part 1: Question Formulation Technique (QFT)**

Students are triggered by a photo, a general statement, a short video or a short experiment demonstration without receiving any clue or additional comment from the teacher. For any chosen IQF, the following scenario applies.

**Scenario**:

- Groups of 3–4 students. Each member takes a role: Chairperson, Timekeeper, Reporter, Recorder/Scribe, or Graphic Designer.

- Groups may all receive the same IQF or different ones.

**Steps:**

1. **Brainstorming** (20–25 min) - Groups write as many questions as possible about the IQF. They must focus only on asking questions (not answering or judging them). Questions are numbered and spaced apart.
2. **Check for format** (5 min) - Groups review their lists to ensure each entry is a genuine question (convert statements to questions as needed).
3. **Classify** (5 min) Groups label each question as:
   a. C (Closed)- requires a yes/no or one-word answer
   b. O(Open)- requires an elaborate explanation
4. **Transform** (15 min) - Groups rewrite all closed questions as open ones and vice versa, recording alternate versions.
5. **Prioritise** (10 min) — Groups select the eight most important, meaningful or relevant questions from their list of questions (original or alternative questions).
6. **Deep Dive** — from those 8, select 3 key questions and discuss:
   a. Why did you select these specific questions as the most relevant, important, or meaningful for the entire group??
   b. What do you need to know to answer them?
   c. What do you need to do to find this information?
7. **Sharing** — Each group presents its three key questions and reasoning in a brief 2-minute report to the whole class, following the structure in step 6.

**Thinking skills involved**

Step 1: Convergent thinking

Steps 2–4: Divergent thinking

Steps 5–7: Metacognitive thinking

**<u>Part 2 - "What if" Questions</u>**

In this part of the task, groups of 3-4 students work on "what if questions". The challenges go in N turns (0<N< number of groups).

Each group comes up with 2–3 "what if" questions related to the teacher's chosen topic or subject, along with their answers, (20 minutes). For every question, students write down their personal responses.

Groups are paired to challenge each other:

- Each group poses one 'what if' question to its partner group.
- Partner groups have 10–15 minutes to prepare answer using scientific reasoning and write down their answers.

**Scoring (teacher's choice):**

The answers go to the authors of the question. Depending on the teacher's decision:

- Groups score each other with the use of rubrics or a matrix of categories prepared in advance by the teacher (younger students) or groups (high-school students)
- Both groups read out their answer to the same question and the rest of the class decides who wins
- The teacher collects the questions and answers and, by comparing the answers of both groups to the same question, awards the winners of the encounter.

Groups rotate and repeat with new partner groups. After all rounds, a winner group is announced based on accumulated wins.

**Example "what if" questions:**

- What if the rotation of the Earth around its own symmetry axis stops immediately?
- What if there were no friction?
- What if the arrow travels in the air drug, but the gravitational force is missing?

**Part 3- Clarifying, Probing, Inquiry, and Research Questions**

Using the same IQF (or another), students explore different types of questions working in groups of 3-4. The teacher selects a picture used in Part 1 or another IQF visual or audio-visual material.

**Step-by-Step Instructions**

Step 1: The teacher displays the chosen visual or audio-visual material to the class.

Step 2: Generate Clarifying Questions (5 minutes): In their groups, students generate as many clarifying questions as possible. The purpose of clarifying questions is to learn about the details and additional facts missing in the initial presentation in order to disambiguate the description.

Step 3: Share Clarifying Questions (5–10 minutes): Each group takes turns sharing their clarifying questions and monitors whether other groups' questions are of the same type.

Step 4: Generate Probing Questions (5 minutes): Groups prepare as many probing questions as possible. The purpose of probing questions is to ask about the merit and to enhance reflection on the project realisation, conditions, opportunities and risks etc.

Step 5: Share Probing Questions (5–10 minutes): Each group takes turns sharing their probing questions and monitors whether other groups' questions are of the same type.

***Optional Extension***

Step 6: Generate Inquiry Questions (5 minutes): Groups create as many inquiry questions as possible. The purpose of inquiry questions is to seek explanations for phenomena using scientific reasoning or short experiments.

Step 7: Share Inquiry Questions (5–10 minutes): Each group takes turns sharing their clarifying questions and monitors whether other groups' questions are of the same type. They reflect on the similarities and differences between questions.

Step 8: Generate Research Questions (5 minutes): Groups develop as many research questions as possible. The purpose of research questions is to plan in-depth investigations that explain phenomena and trends through a thoroughly designed and conducted investigation.

Step 9: Share Research Questions (5–10 minutes): Groups take turns to share their research questions. They compare and evaluate the types of questions asked by others.

**Part 4 (Extension): Research Project Development**

Students work in groups of four to design a short, research/inquiry-based science project and refine their research questions through structured peer feedback.

**Steps:**

Step 1: Group Project Planning (15–20 minutes): Students form groups of 4. Each group selects a science topic of interest, designs a basic plan for a short project, and thinks through as many details as possible.

Step 2: Splitting and Mixing into Pairs: Each group splits into two pairs (e.g., Group A becomes Pair A1 and A2). Pairs then mingle and join two other pairs from different groups to form triads of pairs (i.e., 3 pairs from 3 different original groups).

Step 3: Structured Presentation and Feedback (30 minutes total): Each of the 3 pairs takes turns presenting their project idea while the other two pairs listen and provide feedback. Each round follows the same structure. Each pair gets 10 minutes to present.

For each presenting pair:

- Project Presentation (3 minutes) - Present the project idea without stating the research/inquiry question.
- Clarifying Questions (2 minutes) - The four listeners (two pairs) ask questions to better understand the project. Presenting pair only takes notes, does not answer yet.
- Clarifying Answers (90 seconds) -Presenting pair responds to all clarifying questions.
- Probing Questions (2 minutes) - Listeners ask deeper, critical questions (e.g., about assumptions, methods, scope). Presenting pair takes notes without answering.
- Probing Answers (90 seconds) - Presenting pair answers all probing questions.

This process is repeated so that all three pairs present and receive feedback (3 rounds x 10 minutes = 30 minutes).

Step 4: Independent Work on Inquiry Questions (6 minutes): Each pair independently writes research/inquiry questions appropriate for the two projects presented by the other pairs in their triad.

Step 5: Comparison and Reflection: The three pairs reconvene to compare and discuss the original research/inquiry questions of each presenting pair and the questions suggested by the listening pairs.

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## KEY LEARNINGS

Different parts of this rich task have been implemented at several workshops with teachers. The activity engaged all participants in distinguishing different types of questions used for various purposes. Teachers agreed that such activities are urgently needed, as the overall consensus was that students are afraid to ask questions at school.

**Teachers' feedback:**

- The task is applicable to many subjects (not only science).
- It offers great flexibility across curricula, including classes in which ethical, behavioural, and value issues are discussed (developmental classes).
- The task develops the skills of asking meaningful questions, often poorly developed in students who do not want to ask questions at all.
- It activates and motivates students due to diverse aspects (group work, discussion, challenge, reflection).
- The task sets the space for students' creativity.
- The activities give opportunities for respectful group discussion.
- The task creates space for healthy competition between groups.

All workshop participants agreed that they could find various opportunities to implement this task in their teaching practice across all levels of schooling, with different scenarios frequently used to develop the skills listed above. Many of them expressed enthusiasm to try the module in their science or developmental classes.

## CONCLUSION

This task proved to be one of the most successful activities during the STAMPEd project and gained a significant place in workshops for other groups of teachers not directly involved in the project. Its success can be attributed to its great flexibility, broad scope of implementation, ability to engage teachers and students at various levels, development of different aspects of skills related to asking meaningful questions, and high motivation driven by the purpose.

## REFERENCES


- [1] https://rightquestion.org/resources/questions-lead-to-insightful-original-analysis-in-ap-literature/

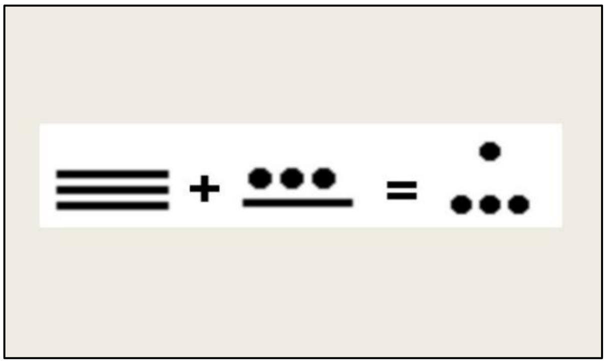
- The Right Question Institute. *What is Question Formulation Technique?* https://rightquestion.org/what-is-the-qft/.

## APPENDIX

The Examples of the Initial Question Focus materials. The explanation for every picture is provided only for the teacher and should not be revealed to the students during the session.

**<u>For mathematics, science or history classes:</u>**

Example 1. Adding in Mayan positional number system



Example 2. Pisa tower

(picture credit: Deensel, CC BY 2.0, flickr)

## For science classes:

Example 3. Sunset Beach Eclipse 2012 (composition of "phases" of the eclipse during 2h duration)


(credit: jimnista, CC BY 2.0, flickr)

Example 4. Antarctica landscape with blue ice formed when the snow gets compacted over years.

(credit: Pedro Szekely, BY-SA 2.0, flickr)

**Examples of statements that can be used for asking questions in science classes:**

1. Friction influences our everyday lives.
2. The world's energy supply system is at risk.
3. The assessment system at school must stay numerical.
4. The world's drinking water resources are shrinking.
5. Water is our life.
6. Humans should conquer other planets.

**Examples of statements that can be used for asking questions in developmental classes:**

1. Leaving home to continue education can be alienating but also enriching for students.
2. Students struggle to understand key concepts.
3. The assessment system at school must stay numerical.

**Examples of short demonstration experiments**

*Floating and sinking*

1. The teacher puts an aquarium on the table and fills it half with tap water (in front of students).
2. One by one, the teacher places in water: a wooden block, a steel ball, a marble ball, a plastic cap from a drinking bottle (bottom-up), three wooden spoons of different sizes, three metal spoons of different sizes, three plastic spoons made out of different types of plastic (preferably made out of different plastic - one which floats, the other, which sinks).
3. The teacher waits a few minutes.
4. The teacher takes out all the objects.
5. One by one, the teacher places different fruits and vegetables into water in the aquarium: grapefruit, onion, orange, apple, pear, carrot, parsley root, and others. At the end, a potato is placed in water.
6. The teacher takes an orange out of the water, peels it off, and places it back into the water.

*Singing glass*

1. The teacher places a glass bottle on the table.
2. The teacher makes a whistling sound with the empty bottle by blowing over its neck.
3. The teacher pours some tap water into the bottle and makes a whistling sound again. This step is repeated a few times, resulting in having more and more water in the bottle.
4. The teacher places a wine glass on the table.
5. The teacher makes a whistling sound with an empty glass by a rhythmic rubbing of its upper edge in a circular motion.
6. The teacher pours some tap water into the bottle and makes a whistling sound again. This step is repeated a few times, resulting in having more and more water in the wine glass.

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