

STEM Teacher Support Pack



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An introduction to self-regulation and metacognition (teacher pack)

Introduction

With 50 years of research-proven benefits and support from a 2018 EEF report, **metacognition** provides teachers with a low-cost opportunity to bring huge attainment benefits to students. However, despite the benefits of metacognitive teaching, tangible strategies that are truly metacognitive and also suitable to a classroom environment are few and far between. The aim of this pack is to introduce you to a set of the best metacognitive strategies that are ready for use in the classroom with little additional planning required!

The pack will begin with a brief overview of the definition of ‘metacognition’, before moving onto strategies that can be implemented in the classroom. These strategies are split into the three main metacognitive areas of planning, monitoring and evaluation. Each strategy will be investigated with a consideration of when, why, and how to use it.

Metacognition

Though typically known as ‘thinking about thinking’, metacognition is far more than that. It is better explained with the following definition from one of the key metacognitive theorists, John Flavell (1976), who wrote:

‘I am engaging in metacognition if I notice that I am having more trouble learning A than B; if it strikes me that I should double check C before accepting it as fact’¹

To truly understand metacognition, the difference between ‘meta’ and ‘cognition’ needs to be made clear. ‘Cognition’ refers to the mental skills and abilities we have, such as being able to learn to drive a car or being able to use BIDMAS to apply mathematical operations in the correct order. ‘Meta’ comes into play when we begin to consider and evaluate our cognition. Which strategy should I use to do x ? What worked well last time? How can I improve? There are many more questions not mentioned here but we can group these into three areas: planning, monitoring and evaluation.



Planning

Planning is an incredibly important part of any successful project or task. Without effective planning, you are likely to omit key information, misunderstand key parts of the task, sequence your work incorrectly, or go off on unhelpful tangents. However, despite the importance of effective planning, it is typically not a skill that students are strong in.

¹ Flavell, J. H. (1976) Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), *The Nature of Intelligence*. Hillsdale, NJ: Erlbaum. p. 232.

Planning may not seem like a natural metacognitive area. Planning is focused on *cognition*: it addresses the knowledge we have and the skills we have to apply that knowledge. However, the way we understand our strengths and weaknesses, the tools that we choose to help us plan, and the strategies we choose to tackle tasks are all examples of *metacognitive* planning.

During our teaching, we need to find a way to support students in developing their metacognitive planning abilities. Though not an exhaustive list, the strategies that follow will provide some surefire ways to help improve your students' planning abilities. These strategies are: 'Knowledge of' planning grids; comprehension, connection, strategies, and reflection; exam answer analysis; strategy evaluation; knowledge organisers.

'Knowledge of' planning grids

This strategy helps you plan for a task by considering three areas: knowledge of task; knowledge of strategies; knowledge of self.

So, what do these three things mean?

Knowledge of task – your understanding of what the task is asking you to do.

- Do you need to write a description, calculate a value, or make a hypothesis?
- What information are you being asked to include? What format are you being asked to present it in?
- Is there one specific answer that the task is looking for? Is there a range of potential answers? Do you need to justify your answer?

Knowledge of strategies – the different ways you can go about completing the task that you have been given.

- Are there multiple different strategies that you can use to complete the same task?
- How do these methods differ?
- What are the benefits and drawbacks of each of these strategies?

Knowledge of self – considering how confident you are with the subject knowledge that the task requires.

- What are your strengths in this topic (e.g. key formulas, characteristics, equations)?
- What are your weaknesses (e.g. applying information to problem-solving questions)?
- Which strategies are you most comfortable using when tackling tasks and questions?

Successful students need to be aware of, and actively consider, all three of these areas when they complete a task. However, students are not typically considering these factors, or, if they are, they are doing it subconsciously. To make this thinking more conscious, and thus more beneficial to students, you need to make it explicit. The 'Knowledge of' planning grid shown here uses these three areas as points of planning for answering a given question.

Explain how tides occur. (4)

Knowledge of task	Knowledge of strategies	Knowledge of self
<ul style="list-style-type: none"> – Provide an explanation. – Need to provide the process for tides forming. – Need to include two well-explained points to get four marks. 	<ul style="list-style-type: none"> – Could start with a definition and then explain the reason why tides occur. – Could draw a diagram and label it. – Could explain the process of tides in chronological order. 	<ul style="list-style-type: none"> – Know one reason why but not how to explain it. – Confident drawing a diagram so favour that strategy.

This grid can be used for any activity. To begin with you will need to train students on the type of information that they should be putting in each column. You can use the guided questions just mentioned to help with this. The more students make use of this planning grid, the more conscious they will become of their own thinking, their own strengths and weaknesses, and the requirements of different tasks. As students use this strategy more frequently, you will not need to provide as much guidance on what goes into each column. The hope is that, with time and practice, they will be considering their 'knowledge of' without needing the formal planning grid.

Key points:

- Ensure you, as the teacher, are confident on the differences between knowledge of task, knowledge of strategies and knowledge of self, and that you are aware of some 'key questions' for each category.
- When first using the grid, coach students through completing all columns. Provide scaffolds, such as example questions, to aid students' understanding.
- Use this planning grid frequently so that the thinking behind it becomes second nature for students.

Comprehension, connection, strategies, and reflection

Research shows that when you approach new tasks, especially problem solving, there are four things that you need to consider: comprehension, connection, strategies, and reflection. So, what do each of these areas involve?

Comprehension – this is about your understanding of what the task requires of you.

- What is the task requiring you to do?
- What type of answer or solution is it expecting, and in what format?
- Is there just one answer or a range of answers?
- Are you required to justify your answer?
- What are the key words in the task instructions, and what do these mean?
- Is there subject-specific vocabulary or exam-specific vocabulary? How does this impact your understanding of the task?

Connection – this is about considering similar tasks or problems you have tackled in the past.

- Consider when you may have seen the task, or parts of the task, in different contexts.
- What strategies have you used previously for this type of task or for the topics covered in the task?
- What were the strengths and weaknesses of the strategy that you used last time?

Strategies – this is about the different strategies that you could use to tackle the task or problem.

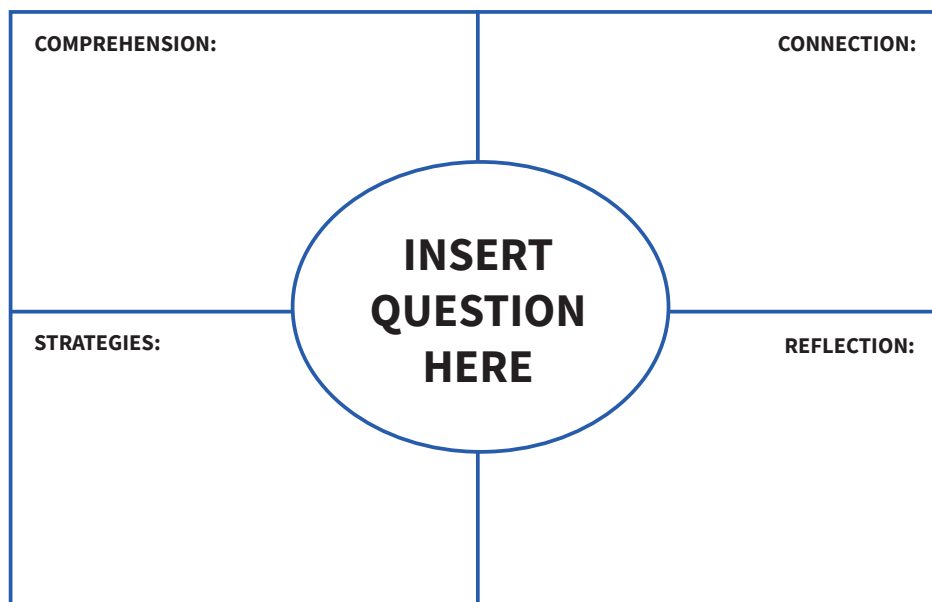
- How many alternative methods do you have? What are the strengths and weaknesses of each method?
- Are you more confident using one strategy over another?
- Is one method quicker than the others? Is one method more likely to give you a higher quality or more accurate answer?

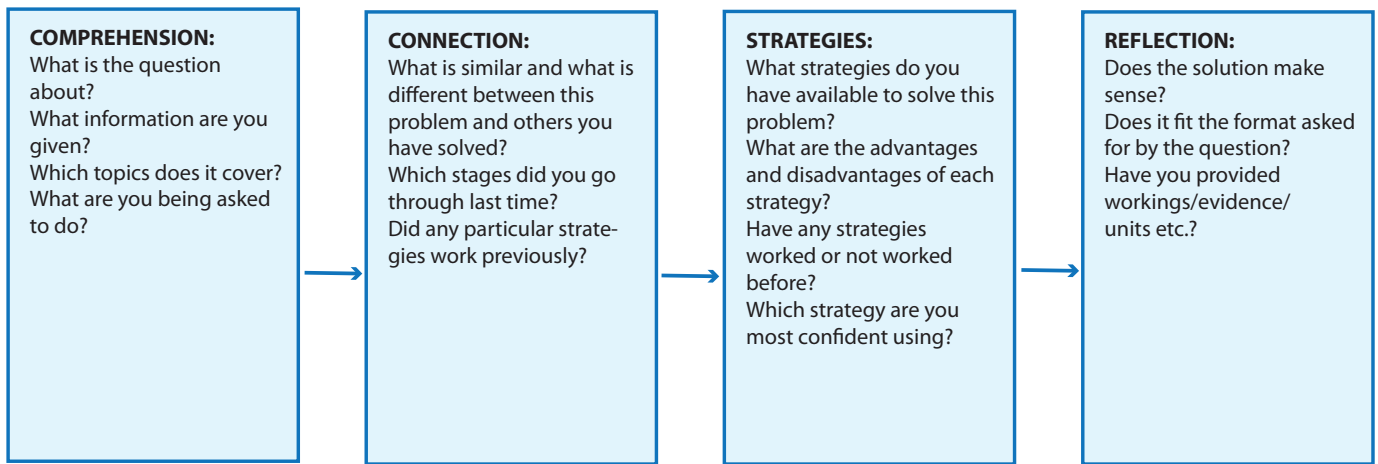
Reflection – this is about taking time after the task is done to consider if your comprehension was correct, whether the connections you made were accurate, and whether the strategy or strategies that you used were suitable.

- What went well in the task?
- What could have gone better?
- Did you understand the task? How do you know?
- Did your strategy work?
- What are the strengths and weaknesses of the strategy you chose?
- Would you choose the same strategy again? Why?
- Did you know enough information to complete the task?
- Are there areas you need to revise?

To help put this theory into practice, the two templates provided here can be used. These **problem-solving grids** require students to work through the four key parts of successful problem solving. Without guidance, students might not work through all four parts, or they might not work through them in a consistent or logical way. The grids provide this guidance, thus increasing their likelihood of success when tackling a problem.

The first template adapts the Frayer Model in order to support problem solving. It does this by placing the problem or task in the centre of the grid, where the topic or vocabulary section would usually be. Students can then work through the four stages of problem solving while consistently referring to the problem they are tackling.





The second grid is in a similar format to the ‘Knowledge of’ planning table. It can be given to students for any task that they are completing. No additional work, planning or copying is required. These templates could even be printed and laminated so that students can write on them repeatedly with wipeable markers. This reduces planning further (as well as printing costs) and should help students to use these grids on a more consistent basis.

When students start using these grids, they will require guidance as to what they need to record in each box or column. The questions presented earlier in this strategy can be used to support students’ thinking. You might decide to build these questions into the templates, ensuring that students have the scaffolding they require to use the grid effectively, without increasing your planning time.

! Key points:

- Successful problem solvers need to work through the four stages of comprehension, connection, strategies, and reflection. Ensure that these stages guide your teaching and the problem-solving tasks you set.
- Problem-solving grids can be given to students to ensure they are thinking about the four areas of problem solving.
- Students will need scaffolding to understand what each of the four areas means and what they must include.

Exam answer analysis

This strategy will not only increase students’ ability to plan, but also their ability to evaluate their answers. The idea behind this strategy is to present students with a range of high-quality exam answers, and to spend time with the students, questioning and discussing what makes these answers so exceptional. Once students have identified the strengths of these answers, they then need to build these into their own planning. This ensures that when they next attempt a task they are aware of all the aspects of a high-quality answer that they *should* include.

When this strategy is first used, students are going to need a significant amount of modelling and scaffolding from you, as their teacher. They will need help identifying the factors which make the model answers so strong. You will need to ensure they are aware of how they would naturally integrate these factors into their answer (rather than shoe-horning something in because they know it is ‘good’).

It is also important to consider the type of answers you analyse. If you are considering a range of high-quality answers, ensure they are all of a similar standard. Moreover, the analysis of these answers should be focused on the factors that make each one exceptional, not on what makes one answer better than another. The focus here should be on overall quality, rather than on the differences between answers.

This analysis can feed into any other planning template or strategy that you may use with your students. For maximum benefit, it is best to give students an opportunity to apply the key factors they have identified to their own planning straight away. To avoid overloading their working memory, give them this opportunity with a template they are already familiar with.

Key points:

- Question students on the factors that make your chosen exam answers so strong. Remember to guide and support their discussions.
- Focus on factors that make each answer exceptional, rather than on factors which might make one answer better than another.
- Allow students to use their new understanding of factors that make a strong answer by getting them to instantly apply their understanding to a new task using a planning template they are familiar with.

Strategy evaluation

In most tasks or problems that you attempt, there are multiple strategies that you could use to reach a successful conclusion. However, it is rare for students to take a step back to consider the alternative strategies available to complete a task. They are often on autopilot: completing the same task or similar tasks in the same way they always have. Even when considering alternatives, they will often use the strategy or method they always use simply because they are comfortable with that method.

If you consider a topic such as solving an equation, there are a handful of alternative strategies that you might teach students so that they can complete the task, such as using backwards BIDMAS, a flow map, or the balancing method. Once students have a favoured technique though, they will rarely consider alternatives.

Strategy evaluation encourages discussion about the alternative strategies available when completing a given task. The aim of such a discussion is to establish the strengths, weaknesses and utility of each strategy in relation to the problem they face, before concluding which strategy would be the most successful.

Through this type of discussion, students will begin to understand the importance of considering the strategy that they are using to complete tasks (and not just focusing on the content they need to include). This will make them better thinkers and more successful at problem solving.

Key points:

- Develop a conversation with students about the range of strategies that can be used to complete a task or solve a problem.
- Discuss the strengths, weaknesses and utility of the strategies identified for addressing the task at hand.
- Emphasise to students that they need to consider how they go about completing a task, not just the content they need to include within their answer.

Knowledge organisers

Knowledge organisers have proliferated across schools in recent years and can be used to support students with planning. The beauty of knowledge organisers is that they contain the **core content** required by students for the unit that they are studying. If a fact, date or formula is not in the organiser, then it is not a required piece of information.

The idea is to provide students with a knowledge organiser at almost all times when they are planning an answer or their method for completing a task. Through providing this type of resource, the focus of students' thinking can be moved away from the content (i.e. the direct cognition – recalling dates, formulas, theories and so forth) and towards factors such as which formulas are most appropriate or which diagrams are most suitable (metacognitive thinking).

It would be sensible to use this strategy when you are confident that students have learnt most or all of the required content for a unit. This strategy is not about helping students to learn content, but about getting them to focus on improving the quality of the way they approach task completion and problem solving. By removing the cognitive load on students (the need to recall the key information required for the task), their working memory is freed up to focus on, and improve, their metacognition and planning for the given task or problem.



Key points:

- Provide students with a knowledge organiser that contains all the core information required for a unit.
- By providing students with the content required for a task or problem, students' working memory is freed up to consider their planning and approach to a task (i.e. their metacognition).



Monitoring

Monitoring is the process of considering whether your current strategy is moving you towards successful task completion. In effect, monitoring is evaluation carried out simultaneously with task completion.

Monitoring is the most complicated part of self-regulation and metacognitive thinking. It is the area where the most mistakes are made.

Consider the following examples.

1. Have you ever been working on a task and realised after a long time of working on it that there is actually a quicker and far easier method that you could have used all along? But you really don't want to just give up and start again (even if that would be quicker)?
2. Have you ever been completing a task and realised you have made a mistake, just as you were getting close to finishing? And that mistake means that you have got to go right back to the beginning? Or maybe you need to trace back the last few things that you have done to find your mistake?

These examples are incredibly common. It is possible to overcome these problems though, through monitoring.

Monitoring is the process of ensuring that your work is heading in the right direction and is being done in good time and without mistakes. Monitoring helps you to avoid the two painful scenarios just discussed. It is also possibly the hardest aspect of metacognitive thinking to teach or train your students to do. All of metacognition is invisible and abstract, but monitoring is the most abstract aspect. We will now look at four strategies you can teach your students to support their ability to monitor. These strategies include: content checklist; key questions; flow map; and warning signs.

Note:

It is unreasonable to expect all students to be able to monitor their work as they complete it. This is especially true where students are unfamiliar with the content. Completing a task and monitoring both use working memory. When these two functions place too much strain on the working memory, one or both functions will cease to work correctly. Therefore, students may be successfully monitoring, but their work may also be dropping to a far lower quality than usual. Choose carefully when to introduce monitoring – target it on students who have already mastered the content being covered by the task.

Content checklist

This first strategy is about identifying the key content that needs to be included within an answer to a question in order to be successful. This could include key dates, formulas, important definitions, or examples. These key factors are identified through students reading and properly comprehending a task. Once identified, these factors can be recorded in a short list. When students begin to complete a task or answer a question, they can tick off each content requirement as they go. This ensures that students are including all the key information required (and not wasting time including information that isn't required) for successful task completion.

When initially using this strategy, you will need to put in place some scaffolding. For example, for the first few tasks, you could produce a content checklist for a task. You can then talk students through it and explain to them how you generated it. Alternatively, you could question the class in a group discussion and encourage them to identify the required information for that task and thus produce a combined class checklist. With practice, you could get students to identify their own list of key criteria, and then compare it to a list that you have produced to see how 'correct' they are.

By breaking down a task into key content requirements, students will improve their comprehension of that task, as well as their overall attainment and their ability to work independently.



Key points:

- Develop a checklist for each task or question so that students know what content they should include (and hence what not to include).
- Model to students how to develop a checklist. With time and practice, begin removing this scaffolding so that students develop checklists independently.
- Students 'tick off' the checklist as they add the content into their answer, helping to ensure that they are covering all the key parts.

Key questions

Often, a question will have lots of different parts to it. It is common that students start answering a question and then get confused about which part of the question they are now answering and which parts they have already covered.

This is where the next strategy comes into play. *Key questions* focuses on **comprehension** of the question. The question or task is broken down into a list of parts or sub-questions. These sub-questions are smaller questions that need to be answered to address the overall question. This is particularly useful for longer exam questions where there are more marks available and multiple stages of working that students need to go through. Once a task has been broken down into sub-questions, students then work through answering each of these in turn. By answering all the sub-questions, the overall task will be completed. Students can tick off each sub-question as they go, as a visual reminder of what they have and have not yet answered.

When you begin using this with students, modelling will be crucial. An option is to present your list of sub-questions first and explain to students how you got it. Then you could get the class to produce their own list of sub-questions. With time and practice, students will be able to produce their own lists and compare their lists against yours.

By breaking down a larger task or problem-solving question into multiple parts, there are four main benefits.

- 1. A barrier is removed to students.** Students will no longer be able to say they cannot access a question because 'it's too long and confusing'.
- 2. There is reduced strain on students' working memory.** Often students try to comprehend a problem all in one go, overwhelming their working memory. By breaking a task down into sub-questions, they reduce the cognitive load of the question into manageable chunks.
- 3. Students will become better problem solvers.** By breaking a problem-solving task down, students can ensure that they are tackling the task in a logical and ordered way, and in the way the task requires (earning them marks for problem solving).
- 4. Students will be able to meet all the content requirements of the task.** Breaking the task down will allow students to easily identify the content they need to include at each stage of their answer or workings. This will stop them losing marks because of missing content.

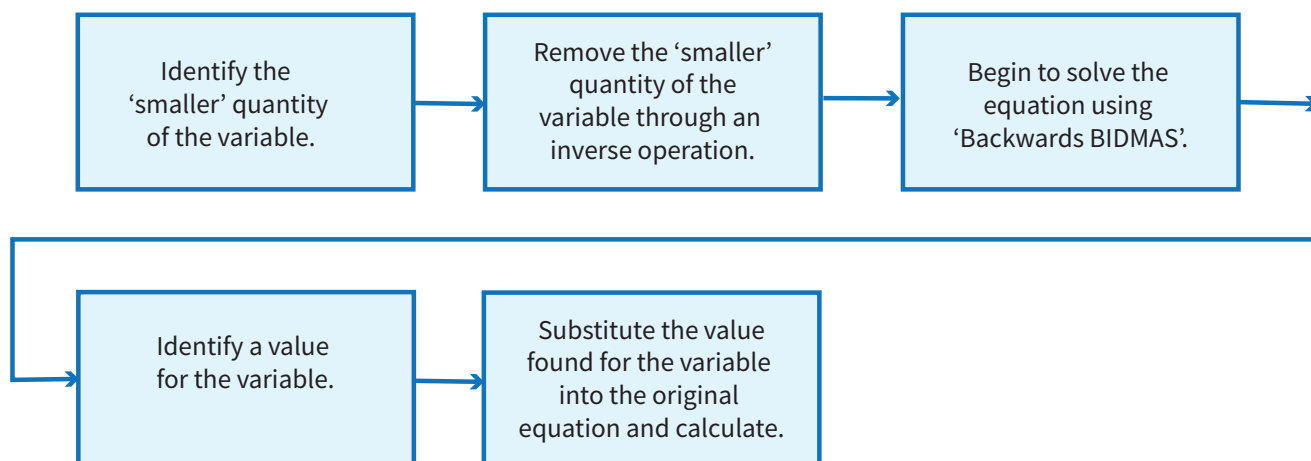
Key points:

- Break complex tasks and problem-solving questions down into a range of smaller sub-questions.
- Students work through each sub-question in turn.
- As the expert, you will need to model to students how to identify these key sub-questions.

Flow map

This monitoring strategy is a type of graphic organiser. It typically helps to put events into **chronological order**, linking them together with arrows. This is particularly useful for instructions and storyboarding. In this context, a flow map is used to help students sequence the steps that they need to take to complete a problem, as shown in the example.

SOLVING AN EQUATION WITH A VARIABLE ON BOTH SIDES



Students often struggle to plan for longer-term projects, such as revision or coursework. The purpose of a flow map in these situations is to help students record all of the stages that they need to go through to help ensure that they go through all of them in the correct sequence. Students can tick off each stage as they complete it. This can be especially rewarding for students with longer projects, since each stage may take a greater period of time to complete.

To support students in using this method, it may be worth producing some flow maps with pre-drawn boxes and arrows, so that students can focus on what is happening at each stage, rather than having to consider how many stages there are. In time, this scaffold can be removed so that students start to independently consider how many stages there are and produce a flow map accordingly.

! Key points:

- Use a flow map to help students understand the stages they need to go through to successfully complete a task and the sequence of those stages.
- Provide students with flow map templates to begin with so that they are concentrating on what happens at each stage. In time, remove the templates so that students are forced to consider how many stages there are for themselves.
- Students can tick off each stage as they complete it to make sure that they are staying on the right path.

Warning signs

How often do you look at a student's answer to a question and wonder how they could have possibly got that question wrong?

Warning Signs helps students to overcome common misconceptions. It also helps you, as the teacher, to overcome expert blindness. This strategy is perhaps the best strategy within the guide at also supporting students in developing their subject knowledge. As another list, this strategy focuses on helping students to identify what an incorrect answer might look like. Students will typically focus on common misconceptions, but some students may also be aware of the mistakes that they make frequently, even if these are not common to all.

A list of common misconceptions is produced. The focus here is on collecting as many misconceptions as possible. When students are completing or have completed a task, they can ensure they are on the right track by checking that they have not included anything that appears in their list of warning signs. The additional benefit with this strategy is that by reflecting on their own mistakes, students are more likely to ensure that they do not repeat them.

This strategy will require you to do a large amount of modelling and discussion-leading. However, as students become more familiar with identifying non-examples and common misconceptions, this will become easier for them. It will also be easier for topics where students have a great understanding, though it can also be used to support student understanding in the first instance.



Key points:

- Work with students to identify non-examples and common misconceptions for a particular topic or problem.
- While completing a task or problem, students are simultaneously checking that they are not including any of the points from their list of warning signs.
- Using this strategy will support students' understanding of content more than most other metacognitive strategies.



Metacognitive Evaluation

Evaluation – the process of considering the strengths and weaknesses of a strategy; whether task expectations have been met; weaknesses in your own skillset; changes to your future approaches; and much, much more!

Evaluation is perhaps the strongest skill in a teacher's toolkit. As a teacher, you are an expert evaluator. Students, on the other hand, are typically not expert evaluators. It is crucial that you support your students in getting better at evaluating.

Evaluation is an important part of the metacognitive process. If students fail to consider the strengths and weaknesses of strategies, as well as their own strengths and weaknesses, their improvements over time will be limited. 'Deliberate practice' is a phrase you may have heard a lot. It is the consideration of an area of weakness, investigation into how to address that area, applying a new strategy, and evaluating its relative success. This process is then repeated. No amount of practice or evaluation makes perfect, but it certainly makes better. It is this idea of deliberate practice and evaluation that you should look to build into your lessons and into students' toolkits.

The strategies that follow will present ways in which you can start getting students to consider the strengths and weaknesses of different metacognitive strategies and their own strengths and weaknesses. These strategies include: exam wrappers; plenary task; answering directed questions; informing future planning; new strategy; good, better, best answers; PMI grids; and learning diaries.

Exam wrappers

Though this strategy has ‘exam’ in the name, it can also be used for homework tasks or classwork.

An exam wrapper is a table which provides students with an opportunity to consider how they dropped marks in the exam or task they have just completed. It provides them with an opportunity to formally reflect on their preparation and approach to the exam or task.

Students consider, through filling out the table, why they dropped marks on each question they attempted. Here, you can change the reasons to suit your students, though reasons typically tend to be quite similar: failure to read the question carefully, leaving out units, not including enough depth or detail, not revising a specific topic (or at all)...

QUESTION DETAILS			REASON FOR DROPPED MARKS					
QUESTION NUMBER	TOPIC	MARKS DROPPED	NOT READING QUESTION CAREFULLY	NOT UNDERSTANDING QUESTION	IMPRECISE ANSWER E.G. MISSING UNITS	FAILURE TO SHOW WORKINGS	RAN OUT OF TIME	OTHER (SPECIFY)
1								
2								
3								
4								
5								
6								
7								
8								
9								
Total								

This provides students with a personal and actionable question level analysis so that they can improve their performance. This strategy forces students to face up to why they lost marks across a whole paper. It removes excuses for a student, as they are the ones who record the reasons why they dropped marks. On the reverse of the document, a range of structured questions can be provided (such as those from the comprehension, connection, strategies, and reflection section) which can again be adapted to suit your students or the task that they are evaluating.

For an exam, it is good practice to get students to consider how they revised, what they revised, and the time spent on revision. It is also advisable to provide students with some questions on how they can improve their performance next time. This is a great opportunity to address any misconceptions students might have about effective revision strategies or conditions (‘I work better revising with my friends and listening to music’). It also provides you with an opportunity to quickly do some whole-class assessment, where you can evaluate students’ self-identified issues. For example, if all your students identified running out of time as a major issue, this is something that you will need to work with them on.

It is easy to edit these documents so that they suit longer homework tasks, as well as some in-class working. Students will become clearly aware of reasons why they struggled and what they need to do next time to improve.

Key points:

- Students self-identify reasons for dropping marks on each question on an exam paper, homework, or classwork task.
- Students work through guided reflection questions designed to make them consider their own task preparation and revision strategies.
- This strategy allows you an opportunity to evaluate whole-class issues and address misconceptions around effective revision practice.

Plenary task

Used well, the plenary is a superb way to get a little bit of metacognitive evaluation into each lesson. There are numerous different ways that you can approach this. The priority is on students determining at least one key evaluation from that lesson. This could be a topic that they are confident they understand or one they need to revise more, for example. Whatever it is, students need to identify one clear priority to inform their future learning. So, how can this be done?

- Students could answer one or more content-based questions. They could then mark themselves and use their marking to determine their confidence and ability with the content covered in that lesson. (**Note:** You will need to go over the basic ideas of reliability – the likelihood of getting the same results in different circumstances – and validity – inferences drawn from the activity – with students).
- Students could answer a structured question that is not based on content, but on evaluation more specifically. Some examples might be: ‘which strategy are you most confident using and why?’ or ‘which area of this lesson do you need to revisit before our next lesson?’
- Students could update a learning diary where they consider what went well in the lesson and what they need to focus on next lesson. This might just involve a short sentence or two in their books.
- Students could engage in a peer discussion, where they discuss what they have learnt in the lesson and consider the different strategies they have encountered, as well as the struggles they have overcome and those they need to work on.

Key points:

- There are many ways that a plenary can be delivered. One type does not fit all.
- A plenary that allows students to identify one key priority for their future learning, such as a topic to revise or a newly identified strength, is an effective plenary.

Answering directed questions

Directed questions fit into many other strategies, but they can also form a whole strategy on their own. The idea with this strategy is not to prescribe when you must use it, but rather to give you questions to introduce when you feel they would be beneficial.

You will need to provide scaffolding. If you asked a student to evaluate the effectiveness of their revision strategies, they would probably not know where to begin. With some structured and directed questions, students can be guided to evaluate the effectiveness of their revision strategies (or anything you want them to evaluate).

There are many different questions that could be asked. Your priority should be for you to decide on one piece of evaluation that you want your students to do, and then produce sub-questions that students can work through in order to answer the overall question.

For example, 'How effective was your planning for each exam question?' can be broken down into:

- How did you manage your time when approaching the questions? How might you approach it next time?
- What types of planning tool did you utilise?
- Which planning tools helped you the most?
- Which planning tools were the least helpful?
- Which planning tools might you prioritise using next time?
- How effective was your planning in supporting you in answering the questions?
- How would you prioritise your planning if you were to complete these questions again?

This example just gives you a flavour of how you can break down evaluation questions to support students. As students become more familiar and confident in answering questions, the scaffolding can start to be withdrawn.



Key points:

- Directed questions can be used whenever you believe they might be helpful.
- Directed questions scaffold a student's ability to evaluate. In time, this scaffolding can be reduced and then removed.
- Directed questions can be split down into sub-questions to further support students' ability to evaluate.

Informing future planning

This strategy does what it says on the tin. The idea here is that students utilise their evaluation (in whatever format) straight away, to inform their planning for a new task.

For example, a student may have just completed a mathematical problem-solving question using the 'Comprehension, connection, strategies and reflection' technique. Following their evaluation of this task, students would use their reflections and conclusions to inform their planning for a new task that is similar to the original one. Once students have planned their approach, they would then complete the new task, making sure to incorporate their evaluation. Once the new task is completed, they then re-evaluate their success.

The reasoning behind this is that students often evaluate and then do nothing with that evaluation. By ensuring that students instantly utilise their evaluation, this strategy helps to guarantee that students are putting this important information straight back into practice and are thus improving their individual abilities.

Provide students with an instant opportunity to apply their evaluation to support their improvement. Do not leave it or you risk students not receiving the full benefits of their evaluation.

! Key points:

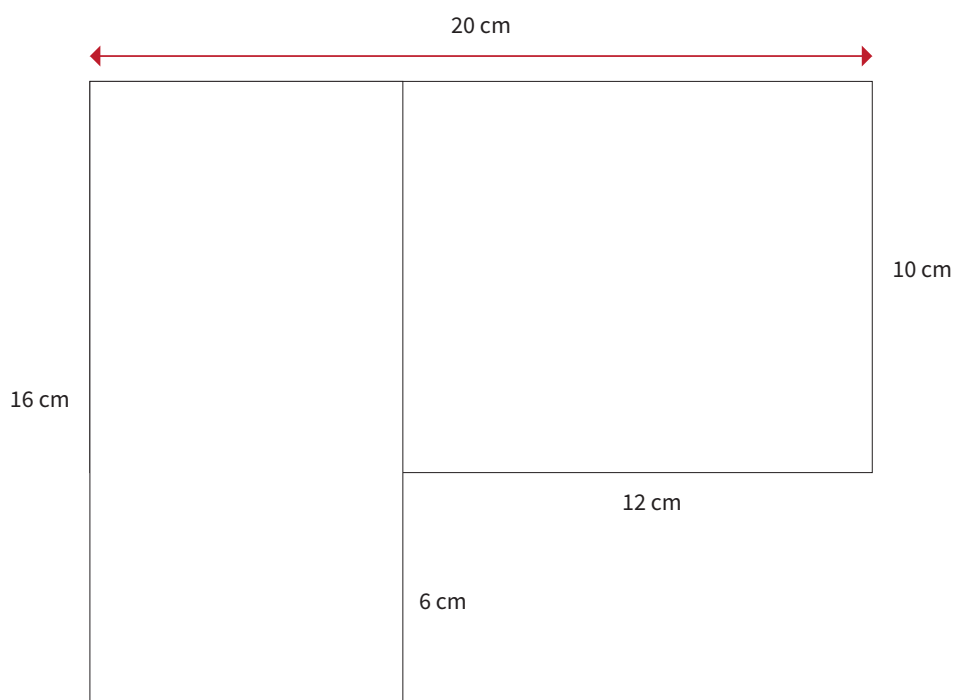
- Provide students with a similarly structured task to one they have just completed. Encourage students to utilise their evaluation of the initial activity to inform their planning for the latter activity.
- Ensure that evaluation is acted on as soon as possible. A failure to act on evaluation will mean that evaluation gets forgotten.

New strategy

In order for students to build a deeper understanding of subject content, as well as to improve their chances of being more successful in an assessment or exam, students need to have a strong understanding of different methods of thinking and problem solving and the relative strengths and weaknesses of these strategies.

An easy way to do this is to get students to complete a task and then repeat the very same task, but by utilising an alternative strategy. You could repeat this for as many different alternative strategies as exist to complete the given task or question. To ensure that students' limited working memory and focus is on the strategy, as opposed to the content, students could be provided with the values, calculations, and so on that they require to complete the task. Here is an example of using two different strategies to solve a maths problem.

Calculate the area of the compound shape. Show your workings.



STRATEGY 1

$$\begin{aligned}16 \text{ cm} \times 8 \text{ cm} &= 128 \text{ cm}^2 \\12 \text{ cm} \times 10 \text{ cm} &= 120 \text{ cm}^2 \\128 \text{ cm}^2 + 120 \text{ cm}^2 &= 248 \text{ cm}^2\end{aligned}$$

STRATEGY 2

$$\begin{aligned}16 \text{ cm} \times 20 \text{ cm} &= 320 \text{ cm}^2 \\6 \text{ cm} \times 12 \text{ cm} &= 72 \text{ cm}^2 \\320 \text{ cm}^2 - 72 \text{ cm}^2 &= 248 \text{ cm}^2\end{aligned}$$

For the example here, when students are attempting to work out the area of the compound shape constructed from two rectangles, they could first attempt the question by splitting the shape into two and adding their separate areas together. A different strategy would be working out the total area of the compound shape (if it were a complete rectangle) and subtracting the missing square or rectangular piece.

After a few repetitions, students can then discuss the pros and cons of each strategy. This will help students to understand the relative utilities of those strategies. Students can also be presented with several problems where they must use all the strategies available to them, so that they can begin to develop not just an understanding of pros and cons, but of which type of question is suited to the different strategies.

This strategy provides students with the opportunity to evaluate their confidence with different strategies and consider the importance of learning the other strategies available to them. It also gives you an opportunity to evaluate students' fluency with different strategies.

Key points:

- Get students to repeat the same task using alternative strategies to develop understanding of the pros and cons of each possible strategy.
- Provide students with the content required to answer the task or problem, so that student focus is on the utility of each strategy as opposed to the content and skills required to complete the task.
- Develop discussions around the utility of the different strategies. Repeat with multiple tasks so that students can identify which strategies suit which type of tasks and problems.

Good, better, best answers

This strategy involves providing students with good, better, and best answers, and developing conversations around the merits of each answer. It also focuses on the key variances which take an answer from good to better to best.

Historically, this task has been done with graded answers. For example, comparing an E-grade answer to a C-grade answer to an A* answer. However, when the variances between answers are so great, students cannot identify the subtle differences that make such a huge difference to the quality of those answers. Considering grade differences between answers, you do not want more than two grades between them ideally (for example, you would look at answers graded 3, 4 and 5, or 7, 8 and 9).

This activity can be done in different ways. You could initially model to students the subtle differences between the good, better, and best answers. This is so students get an insight into your expert knowledge. Students could then attempt identifying the key differences themselves. Alternatively, students could re-attempt the task and then discuss it amongst themselves in small groups. This will only be possible if students have a thorough understanding of the key differences between answers.

The evaluation outcomes from this activity can be used to support other strategies, such as to inform future planning or a learning diary. Either way, the greater a student's understanding of what makes an answer better, the more successful they will be when they attempt a similar problem or task themselves.



Key points:

- Identify a good, better, and best answer to stimulate discussion on the subtle differences in approach and content that improve an answer.
- Ensure that there are subtle, rather than drastic, differences in quality between answers, otherwise the utility of the evaluation is reduced.
- Guide students through this task with modelling first, before questioning students, and finally allowing small groups to discuss the key differences amongst themselves.
- Link key evaluations from this task to support students' future planning, learning diaries, target setting and so forth.

PMI grids

A PMI grid – or plus, minus, interesting grid – is a very simple way for students to quickly evaluate a task, lesson or unit (with very little teacher input or support required). Students generally only need to be shown how to effectively use a PMI grid once!

The plus section of a PMI grid allows students to record something that went well within the lesson. For example, achieving success on a problem that they had not done previously. Any opportunity for students to celebrate success is important. This makes the plus section of this grid highly beneficial to student motivation.

The minus section of the grid allows students to record something that they might have struggled with or found more complex. It is important that whatever is recorded here is not just left as a negative. Students should mention a specific point of difficulty (e.g. 'I'm still struggling to determine which method I should use for different questions'). This should be followed up, wherever possible, with a specific target to help address this issue (e.g. 'I will go through a selection of questions and determine which strategy I think I should use, and then check this with the teacher'). Evaluation is not very useful if it is not acted upon. You want to ensure that students utilise evaluation to seek out instant improvement, where possible.

Finally, students should record a point of interest in the interesting section. This could be something that they enjoyed, an area that they want to investigate more, or a real-life application that they can see for that unit of learning. Whatever it might be, it is always a positive when students can identify points of interest in a topic you have taught them.

PMI Evaluation

Evaluation of:

Plus:

Minus:

Interesting:

Future Targets:



Key points:

- A PMI grid is a simple tool that allows for quick and independent student evaluation.
- The grid allows students to record a plus (success), a minus (an area to improve and how they will do this), and a point of interest (what they particularly enjoyed).

Learning diaries

The idea of a learning diary is again in the name: a diary or record of student learning. All the evaluation strategies mentioned in this pack can feed into a student learning diary. This strategy is not highly prescriptive and can take any format you or the student likes, as long as the focus is on recording the students' key points of evaluations and their targets moving forward.

Students could utilise the plenary task used in each lesson to support their target-setting. Perhaps they have identified that their current focus ought to be on time management. On the next review of their learning diary, students might have mastered (or at least improved on) this target, and thus be ready to review their progress again to determine a further target for themselves.

This log of learning is a superb way to support student motivation. Where students can see that they are completing targets and meeting their new, higher, expectations, their sense of achievement improves. All students want success, regardless of what they might say. This strategy provides a positive way to show students that they are succeeding on a regular basis. Depending on your school setting, this learning diary could be a very good way for you to demonstrate student progress across a unit or year, as well as providing a useful evaluation tool for you to determine the current strengths and weaknesses of a class.

! Key points:

- A learning diary allows students to record their evaluations and targets in a clear and concise manner, so they can continually review their progress.
- There is no one set format for a learning diary. It could be a grid, a sentence at the end of each lesson, or a more thorough log that is kept in a separate book.
- Students can track their progress and improvement, boosting their motivation and engagement.

Conclusion

Metacognition is an incredibly powerful tool that can have a huge positive impact in the classroom. The aim of this pack has been to put together a range of ready-to-go strategies that require little planning or preparation, so you can instantly introduce them into your lessons. For most practitioners, this pack will support a tweaking of strategies, rather than ripping up the rule book. Metacognition should not be controversial. It encompasses traits of high-quality teaching that most in the profession would agree on.

The focus when using this pack is on small changes that make already good teaching even better. Cherry-pick the strategies that you see working for you, your school, and your students. Some strategies may not work for you or your groups at this time, but others may slip seamlessly into your current practice. Continue to make your students consider their strengths and weaknesses, to review the strategies they use, and to constantly utilise evaluation to improve, and you will see long-term improvements in their metacognitive development and their success in the classroom. Happy teaching!

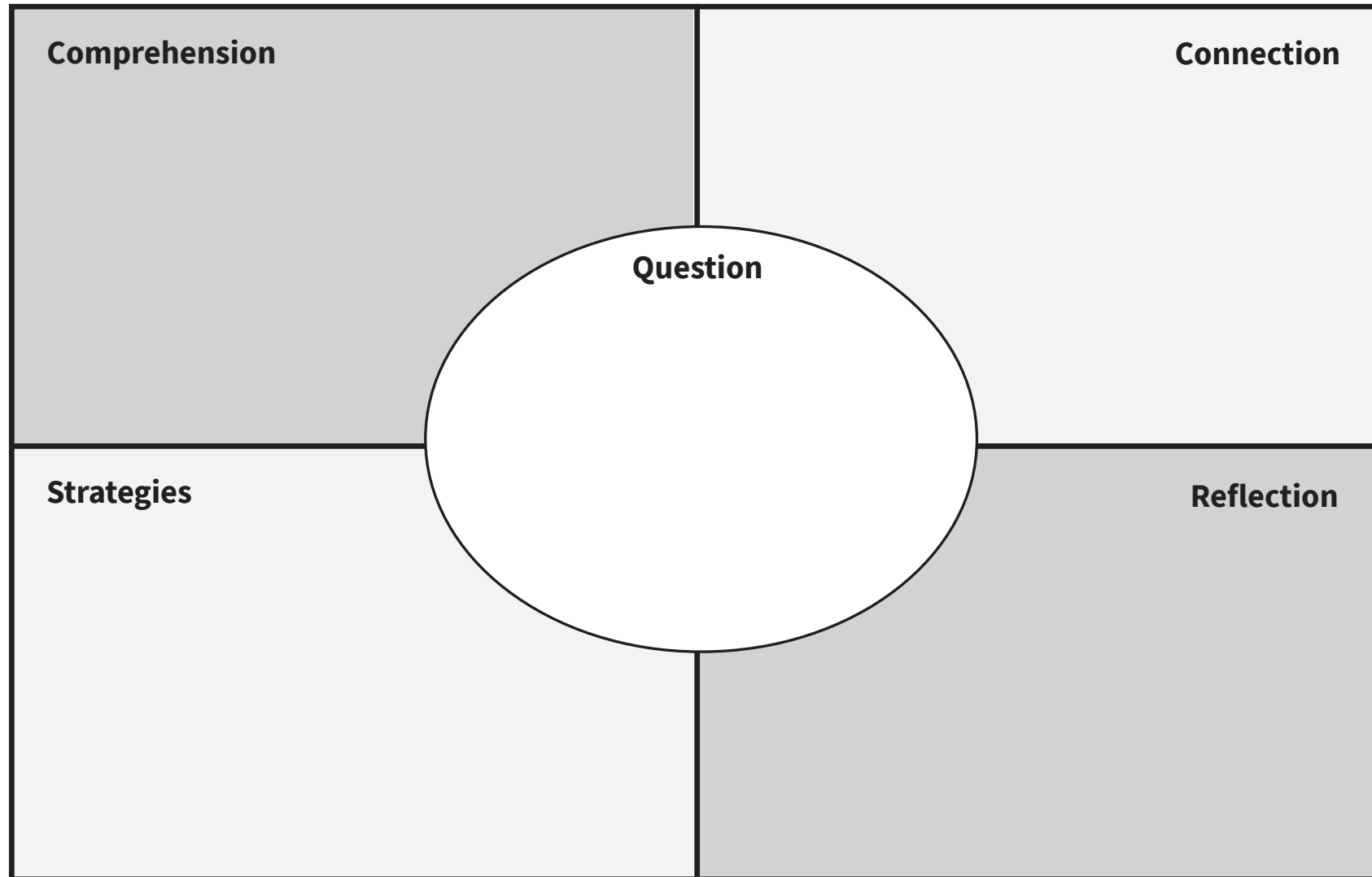


Diagram templates

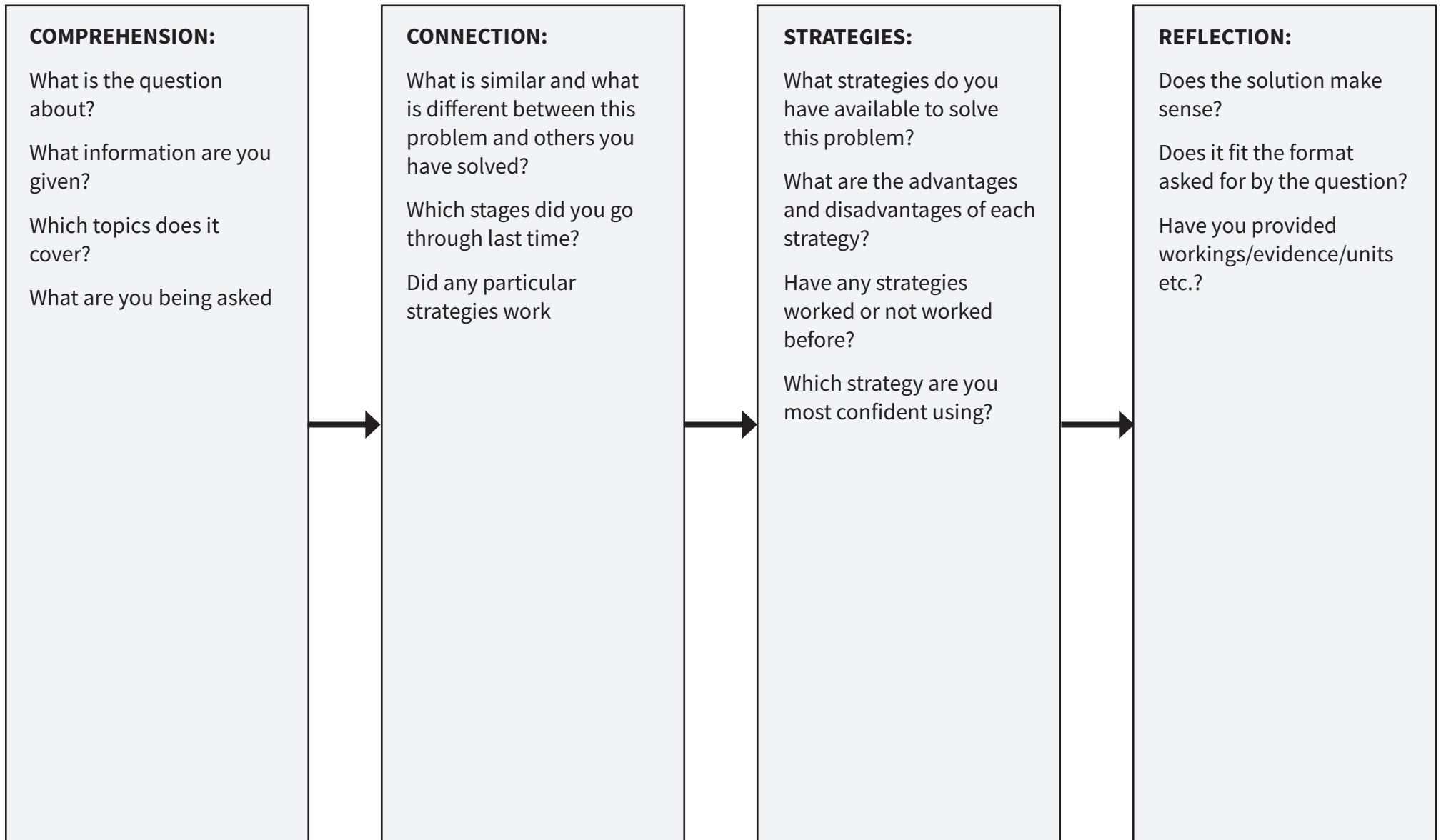
'Knowledge of' planning grid

Knowledge of task	Knowledge of strategies	Knowledge of self

Frayer Model



Comprehension, connection, strategies, and reflection flowchart



Flow map

Question

Step 1

Step 2

Step 3



Step 4

Step 5

Step 6

Exam wrapper

QUESTION DETAILS			REASON FOR DROPPED MARKS					
QUESTION NUMBER	TOPIC	MARKS DROPPED	NOT READING QUESTION CAREFULLY	NOT UNDERSTANDING QUESTION	IMPRECISE ANSWER E.G. MISSING UNITS	FAILURE TO SHOW WORKINGS	RAN OUT OF TIME	OTHER (SPECIFY)
1								
2								
3								
4								
5								
6								
7								
8								
9								
Total								

PMI grid

PMI Evaluation

Evaluation of:

Plus:

Minus:

Interesting:

Future Targets: