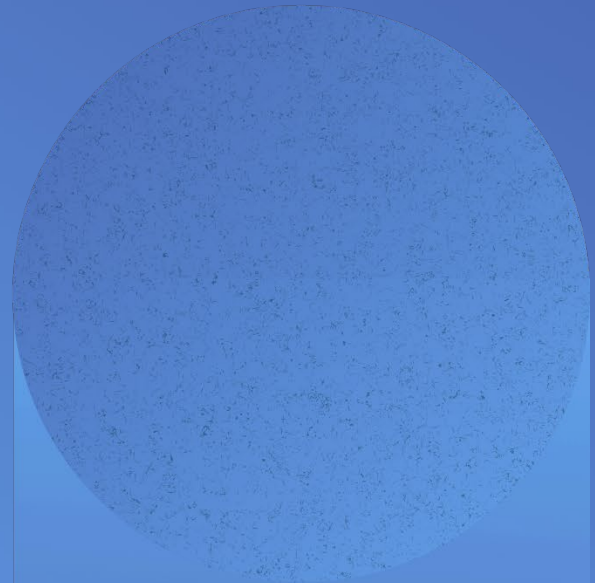




Metacognition and Self-Regulated Learning

A summary of new evidence from the Teaching and Learning Toolkit





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1. Introduction

In 2018, The Education Endowment Foundation (EEF) published its *Metacognition and Self-Regulated Learning Guidance Report*, which set out seven key recommendations for schools. This report has since become one of the EEF's most widely used and influential resources, both in the UK and internationally. According to the 2021 update of the *Teaching and Learning Toolkit*, strategies related to metacognition and self-regulated learning have the potential to accelerate pupil progress by an average of eight months, highlighting their strong potential for narrowing the attainment gap. However, the 2018 Guidance Report was based on a conceptual review rather than a full systematic review. To ensure the recommendations are grounded in a rigorous evidence base, a more comprehensive review of the literature was deemed necessary.

This document summarises the findings of an internal review of 297 studies in the Teaching and Learning Toolkit and considers how this can support, refine or replace content in the original guidance report.

2. Summary of research questions

The update of the Guidance Report is being completed alongside an update to the Teaching and Learning Toolkit strand on Metacognition & SRL. Therefore, there may be some overlap and additional research questions for the Toolkit update that feed into our findings.

However, the current review was guided by the following research questions:

1a. Which metacognitive approaches are associated with increased attainment outcomes?

1b. Which teaching strategies appear in interventions aiming to support the development of pupils' metacognition?

- i. teaching strategies for self-directed learning
- ii. promoting metacognitive talk
- iii. supporting pupils to plan their work
- iv. providing opportunities to reflect on learning
- v. teachers modelling thinking aloud
- vi. other

1c. What is the impact of these approaches on pupil attainment?

2. In metacognition interventions, what is the relationship between intervention population, topic and pupil outcomes?



- a. In metacognition interventions, what is the relationship between intervention population, topic and pupil outcomes?
 - b. Are there differential pupil outcomes between subject areas?
 - c. How important is relating metacognitive practices to a topic or context when improving pupil outcomes?
 - d. Are there differences in outcomes between pupil ages and/or school phase?
 - e. Are there differences in outcomes for pupils experiencing disadvantage?
 - f. Is there a difference in effectiveness between individual and collaborative approaches?
 - g. What is the impact of metacognition interventions on other outcomes?
3. What is the role of professional development in metacognitive interventions?
 - a. What are the key elements of this training?

3. Methodology

The full methodology of the review can be found here:

[Metacognition guidance report update - protocol | Education Endowment Foundation](#)

At the outset of this review, a series of internal and external consultations were conducted - including with colleagues in school-facing roles - to inform the review of new evidence. These discussions shaped a set of research questions exploring the impact of various metacognitive strategies, teaching approaches, population groups, and professional development on pupil outcomes.

Subsequently, 297 studies from the Teaching and Learning Toolkit strand were identified. The findings from these studies were synthesised and summarised in relation to the research questions outlined above. This evidence, alongside input from internal EEF colleagues and an external advisory panel, will inform the scope of updates to the guidance report and provide valuable insights to support future guidance on high-quality teaching.

A full list of references can be found [here](#).



4. Type of metacognitive approach

Research Question 1a. Which metacognitive approaches are associated with increased attainment outcomes?

This translates to 8 months additional progress using the toolkit methodology. These results have a high security rating and we can be confident in this result.

This research question sought to determine which approaches are associated with increased attainment outcomes. It is answered through the subgroup analysis taken from the *Teaching and Learning toolkit*. Each metacognitive approach is briefly defined and the outcome on pupil attainment is summarised.

More detailed analysis of **how** strategies are actively taught in the interventions is found in **response to research question 2**.

i. Reading and comprehension strategies

There were 90 studies focused on developing understanding of texts. Activities in the interventions involved strategies such as reciprocal reading, using self-questioning prompts and modelling thinking aloud.

Our analysis shows a positive effect of 0.679 for studies coded as including reading and comprehension metacognitive strategies.

RE Model: $Q = 1574.635$; $\tau^2 = 0.463$; $I^2 = 97.127\%$ 0.679 [0.532, 0.826]

ii. Problem solving strategies

There were 72 studies focused on problem solving. These were often interventions embedded in teaching of mathematics. Activities in the interventions included thinking aloud during problem solving, providing scaffolding such as worked examples and promoting collaborative learning approaches.

Our analysis shows a positive effect of 0.733.

RE Model: $Q = 1463.750$; $\tau^2 = 0.448$; $I^2 = 96.270\%$ 0.733 [0.599, 0.867]

iii. Recall or metamemory strategies



There were 21 studies focused on promoting the recall of information. Interventions activities included the teaching of mnemonics, concept mapping and knowledge organisation.

Our analysis shows a positive effect of 0.860.

RE Model: $Q = 195.017$; $\tau^2 = 0.588$; $I^2 = 93.254\%$

0.860 [0.507, 1.214]

iv. Critical thinking reasoning and argumentation strategies

There were 58 studies focusing on developing critical thinking, reasoning and argumentation strategies. These interventions focus on aspects of critical thinking, reasoning, inductive reasoning, logical thinking, argumentation and debating. This is often achieved through dialogic approaches including metacognitive talk.

Our analysis shows a positive effect of 0.760.

RE Model: $Q = 807.873$; $\tau^2 = 0.388$; $I^2 = 97.214\%$

0.760 [0.584, 0.935]

5. Teaching strategies

Research Question 1b. Which teaching strategies appear in interventions aiming to support the development of pupils' metacognition?

What is the impact of these approaches?

Below is a summary of the evidence gathered. First, narrative synthesis explores the activities and actions undertaken by the teacher and common features of interventions. Secondly, a meta analysis demonstrates the overall effect of interventions featuring this approach on pupil outcomes.



i. Teaching strategies for self-directed learning

Summary

Promoting self-directed learning was the most reported teaching approach; 223 studies were coded as including strategies to promote self-directed learning. In 183 studies this was a major element of the intervention and a key aim of the researchers.

Details

Approaches that promoted self-directed learning often mirrored Zimmerman's metacognitive cycle of planning, monitoring and evaluating learning. These behaviours were elicited from pupils through a variety of other teaching approaches such as the use of metacognitive talk, demonstrating thinking aloud and explicitly teaching pupils to use tools to improve planning, reflection and goal setting.

Most of the teaching strategies are covered in detail in the other summarised approaches, but **some reoccur and appear intrinsically linked to promoting self-directed learning**.

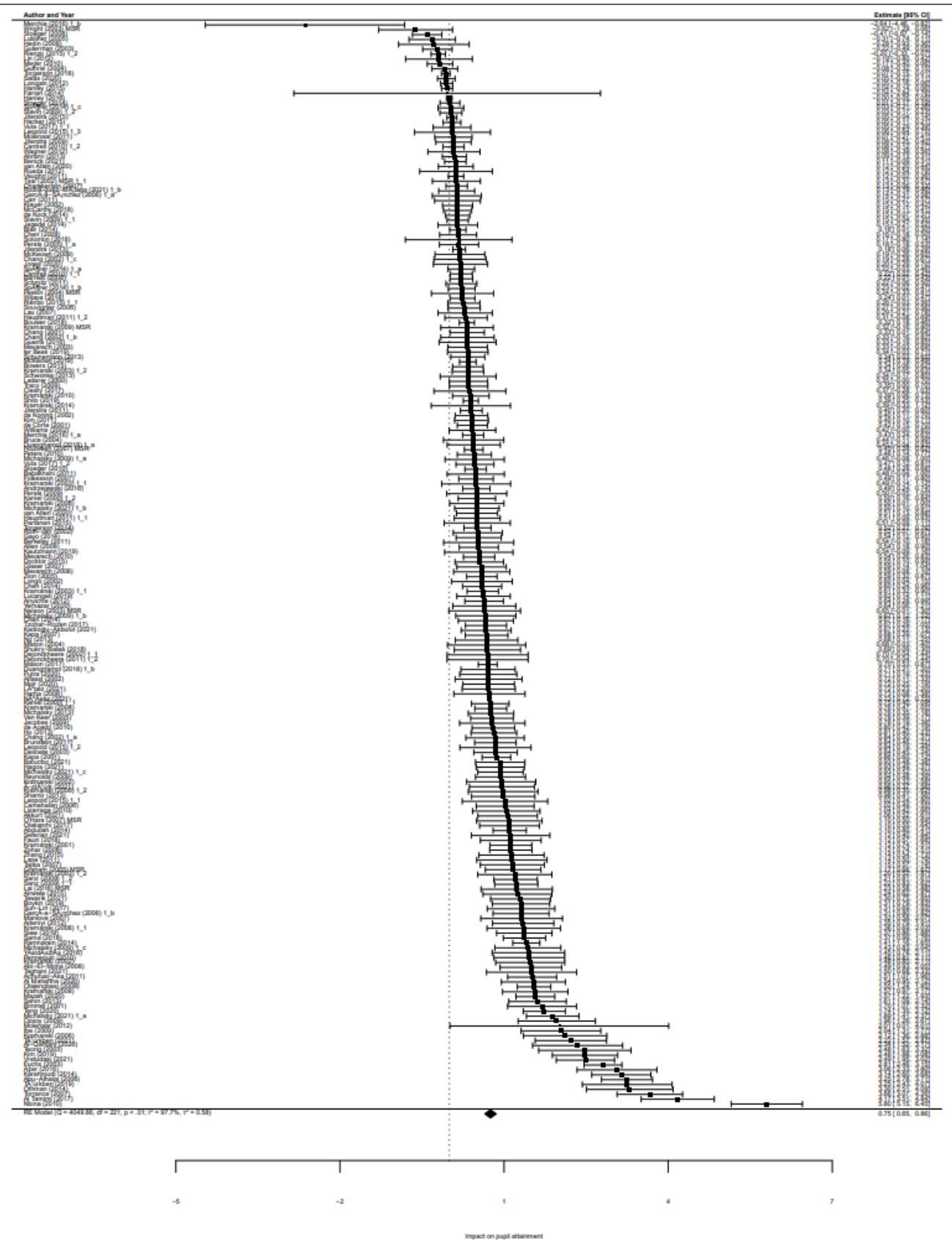
One example is teachers **supporting pupils to manage their cognitive load** through knowledge organisation tools such as mind-mapping, use of mnemonics, and resources to support with summarisation and self-assessment. Interventions focus on actively teaching pupils how to use supporting tools and apply strategies. They encourage reflection on *both* learning of curriculum content *and* on application of learned metacognitive skills.

Additionally, **promoting and supporting pupils to develop independence** appears throughout the evidence for teaching self-directed learning. Interventions move from guided practice to independent practice and pupils are encouraged to take ownership over both their learning and application of metacognitive skills.

Finally, a large proportion of the evidence base focuses on **encouraging and motivating pupils to apply a metacognitive strategy**. Often this is achieved through feedback or providing social support. Interventions appear more likely to focus on **intrinsic motivation**, for example pupils' self-assessing their skill and progress, rather than providing extrinsic rewards.



Research Question 1c. Impact of strategies for self-directed learning on pupil attainment





ii. *Promoting metacognitive talk*

Summary

109 studies were coded as promoting metacognitive talk. 65 of these included **peer to peer** metacognitive talk, 39 included **teacher to pupil or pupil to teacher** metacognitive talk, and 33 described pupils engaging in metacognitive **self-talk**.

The purpose of metacognitive talk varied slightly, mostly it was to embed a metacognitive strategy and/or encourage reasoning, justification and argumentation to deepen learning. Metacognitive talk with teachers or peers was often part of guided practice before encouraging independent application of metacognitive skills. Occasionally, metacognitive talk was used to increase social motivation to engage with metacognitive thinking or processes. Feedback, reflection and goal setting was closely linked to metacognitive talk.

Details

Self-talk

Metacognitive talk involves the explicit externalising of internal thought processes to deepen understanding. In interventions incorporating 'self-talk' teachers had an important role to play. **Sometimes teachers followed metacognitive models** such as the IMPROVE model **to promote self-questioning during a task**. (IMPROVE provides self-questioning prompts across the teaching stages represented by the acronym. These are: Introducing the new concepts, **M**etacognitive questioning. **P**racticing, **R**eviewing and reducing difficulties. **O**btaining mastery, **V**erification, and **E**nrichment). Self-talk scaffolds of this type encourage pupils to follow the metacognitive cycle of planning, monitoring and evaluating learning.

Sometimes self-talk was elicited during a task by teachers posing questions that **encouraged pupils to articulate steps taken to solve a problem, connect learning to prior knowledge and extend thinking**. Examples of questions include, 'What do you know already?' and 'What steps do you need to take?' and 'What is important to remember?'. Whilst interventions implementing strategies to encourage self-talk targeted a range of outcomes, writing and reading comprehension outcomes were most common.

Pupil to teacher and teacher to pupil metacognitive talk

Teachers both model metacognitive talk and elicit metacognitive talk. For example, **teachers model self-talk or demonstrate how thinking aloud can support problem solving and then pupils emulate and practice this skill**. Often, metacognitive talk with the teacher takes place during guided practice before pupils develop the skillset to engage in self-talk independently.



Sometimes **teachers employ a particular strategy**, for example, reciprocal teaching to aid reading comprehension. In interventions of this type teachers take pupils through the process of predicting, clarifying, questioning and summarising; they use metacognitive questioning at each stage to promote metacognitive talk. In some interventions teachers encourage pupils to share thinking aloud and **engage in metacognitive dialogue with pupils while solving a problem together**. Finally, a common element of these interventions is **teachers providing feedback on how well a pupil has applied a metacognitive strategy** and supporting them to reflect on learning and support with goal setting.

Peer to peer metacognitive talk

Across the interventions explored, peer-to-peer talk is highly structured and supported by teachers. For example, teachers provide talk protocols or guidelines to ensure that pupils engage in metacognitive talk. Teachers might provide sentence stems, guidelines for Socratic debate, let pupils lead reciprocal reading or assign roles in groups to ensure talk is purposeful and focused on the externalisation of pupils' internal dialogues and the co-construction of knowledge.

Most interventions involving peer to peer talk involved pupils **sharing reasoning and justification** when completing a task. Several interventions focused on pupils sharing their ideas and views on a topic. In some interventions pupils taught one another how to complete an activity by verbalising their own ideas and thoughts. It was common practice for pupils to work in pairs or small groups to solve a problem and **co-construct a solution using metacognitive talking prompts**.

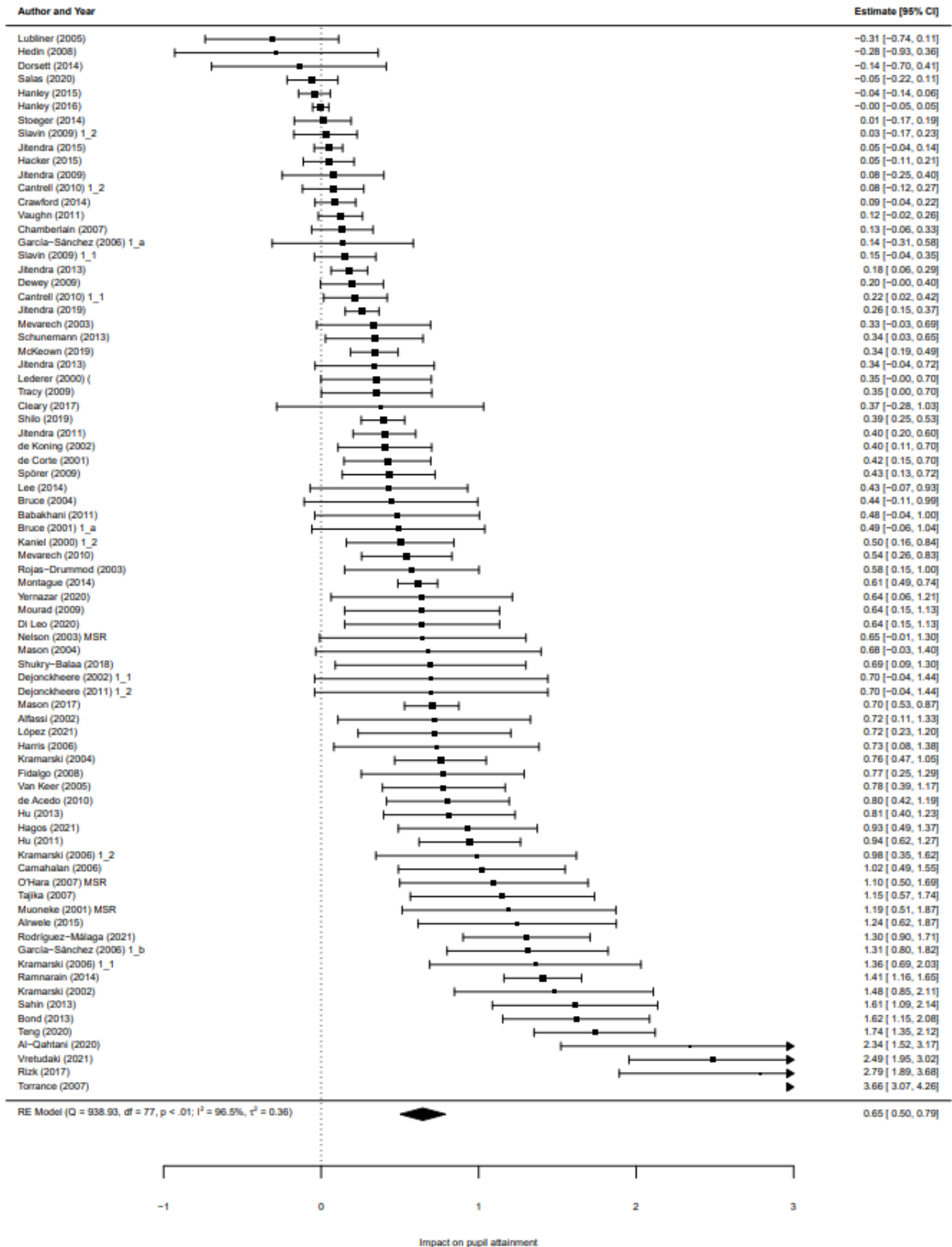
When pupils were engaging in debate and reasoning, it was common practice to encourage pupils to reach a shared consensus on how best to proceed. **Teachers often provided language and vocabulary** to support pupils to engage in metacognitive talk of this type.

The amount of collaboration required varied. Sometimes learning cooperatively was a key mechanism in the theory of change, sometimes it was used more informally to encourage pupils to talk through ideas or practice strategy application ahead of an independent task. Metacognitive talk appears at any point during the metacognitive cycle; for example when planning, monitoring, evaluating and reflecting on learning.

Metacognitive talk was **almost always embedded within the teaching of a particular topic** such as reading comprehension, science, mathematical reasoning.



Research Question 1c. Impact of promoting metacognitive talk on pupil attainment





iii. *Supporting pupils to plan their work*

Summary

99 studies in this review were coded as including the planning work teaching approach, strategies that are undertaken prior to a task to aid success. Half of these studies (50 studies) had the planning work as a major element of their programmes, and four studies had the planning work as the sole focus of the interventions. This teaching approach was featured across various subjects including maths, literacy, science and others in both primary and secondary settings.

Details

Teaching students to **select strategies beforehand** was a common and most prominent practice of the planning work teaching approach. Students were sometimes probed to a deeper level to give justification for their strategy choices at this strategy selection stage. Strategies were not limited to ways to solve a given problem but sometimes focused on steps needed before attempting the tasks such as looking up words, revising the previous content, identifying resources to use to overcome the challenges/difficulties, and seeking relevant information. Similarly, it was not always 'selecting' but sometimes 'reviewing' procedures and steps, commonly in reading and writing interventions. There were a few programmes which also included minimising distractions such as identifying what to avoid and strategies to help them focus and manage the workload.

Activating prior knowledge was also a key part of the planning work approach. Teachers often encouraged students to reflect on similar tasks they had worked on previously and existing knowledge related to the given tasks. Several programmes, drawing on the IMPROVE model (a self-questioning model – see the narrative synthesis for Metacognitive Talk), all had a step of making connections between existing and new knowledge by asking “What are the similarities/differences between the problem at hand and the problems we solved in the past?”.

Many programmes featured **goal setting** as a key practice of planning work. In some programmes, teachers taught the importance of setting goals before working on tasks and how to set learning goals. Some programmes introduced different types of goals such as process goals, outcome goals, goals of the content, and goals of the skills. In some cases, teachers emphasised the importance of setting realistic goals. In a few programmes, teachers also taught students to specify the 'evaluation criterion' to judge their learning before they work on tasks.

As a part of planning their work, students were taught ways to **break down tasks/problems** into manageable chunks. For example, one programme incorporated a few steps to break down reading comprehension questions such as by prompting students to describe the problems in their own words to understand the questions better. Some maths programmes incorporated schematic

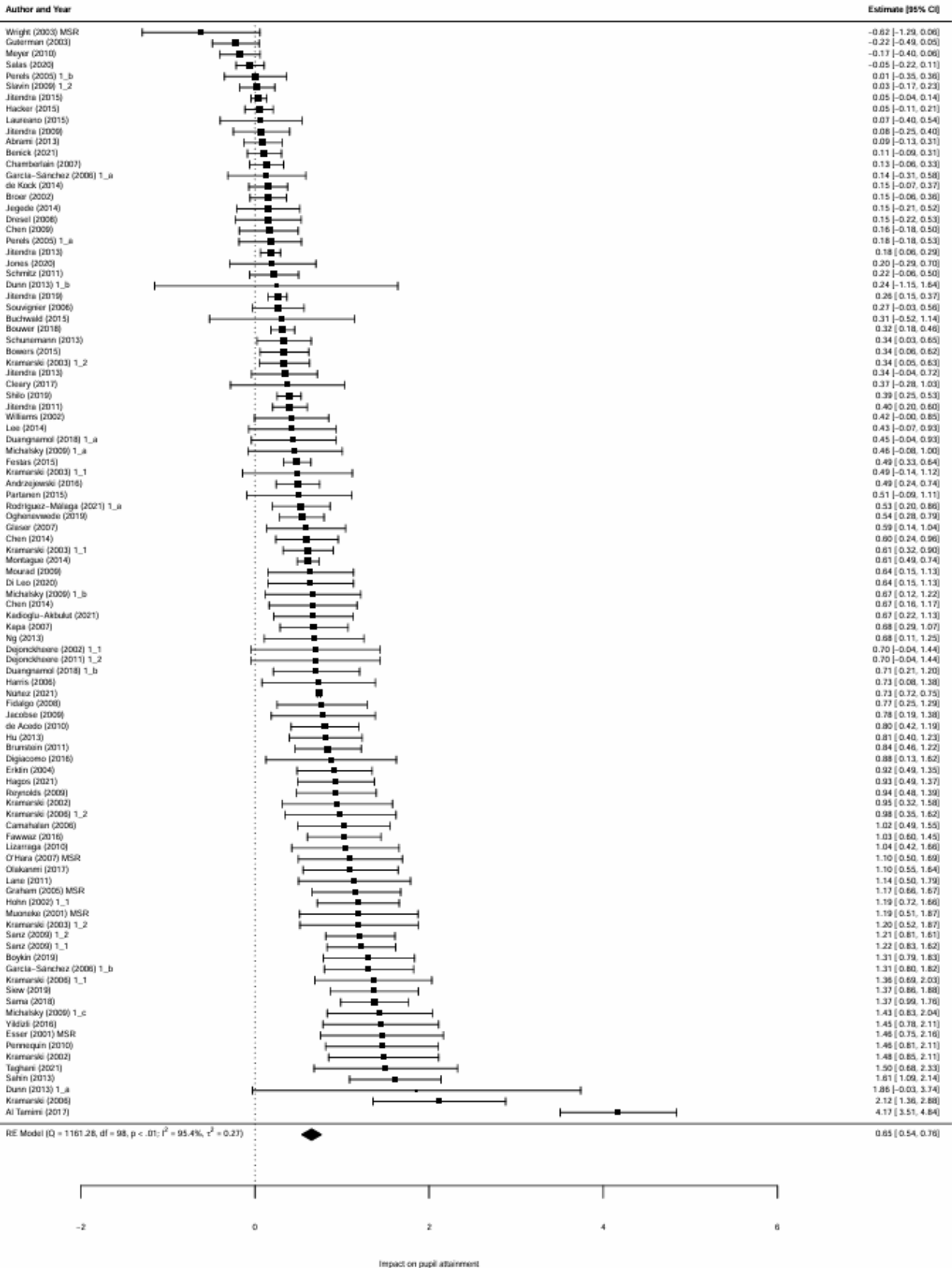


diagrams to help students break down the problems.

Some programmes employed **visual tools** to aid students' planning. For example, teachers introduced a technique of visually mapping information in the problem to help students plan their answers for mathematical problems. In a writing intervention, students learnt to use drawings to plan their writings/generate their ideas before drafting. Similarly, a few programmes used knowledge organisers to help students make connections with their existing knowledge and skills.

A small group of programmes also taught students how to manage their work in terms of **sequence and pace** of their learning. For example, teachers taught students how to pace their work when working on mathematical problems. In other examples, students were encouraged to predict the learning time they needed to manage their attention level.

Research Question 1c. Impact of supporting pupils to plan their work on pupil attainment





iv. Providing opportunities to reflect on learning

Summary

144 studies in this review were coded as including the reflecting on learning teaching approach which encourages students' reflection on a learning goal or task. Around half of these programmes had the reflecting on learning as a major element of their programmes while the rest embedded it in a broader self-regulated learning cycle.

Details

A high proportion of these studies featured **structured reflection** such as securing dedicated time to reflect on their work and learning. This looked differently in various studies and was often embedded in the holistic self-regulated learning cycle of planning, monitoring and evaluation. Some programmes taught students how to reflect on their learning such as by teaching them self-marking criteria and self-questioning techniques whereas others just secured some time for reflection. To aid the structured reflection, some programmes incorporated **tangible tools** such as journals, diaries and digital diaries.

The **focus of reflection** varied across the programmes, and one common focus was broadly on **task performance**. Reflection on task performance not only focused on outcomes but also processes. For example, a few programmes specifically prompted students to reflect on **the success and failure attributes** of their performance. One programme taught students to reflect on their strengths and weaknesses. Reflection on learning in some programmes further focused on students' **emotions and feelings during their task performance**. For example, one programme secured the time to discuss the motivational aspects of students' task performance. Similarly, several programmes encouraged students to reflect on how they felt and how they managed their emotions and motivations.

Another common focus of the structured reflection was on broader **learning goals**. Teachers often invited students to reflect on whether their learning goals were met after their lessons, units of learning or tasks. Some of these studies also encouraged students to set future goals based on their current level of understanding.

It is worth noting that the structured reflections sometimes pointed towards their **previous learning** before attempting a new task or learning. This closely links to the planning work teaching approach.

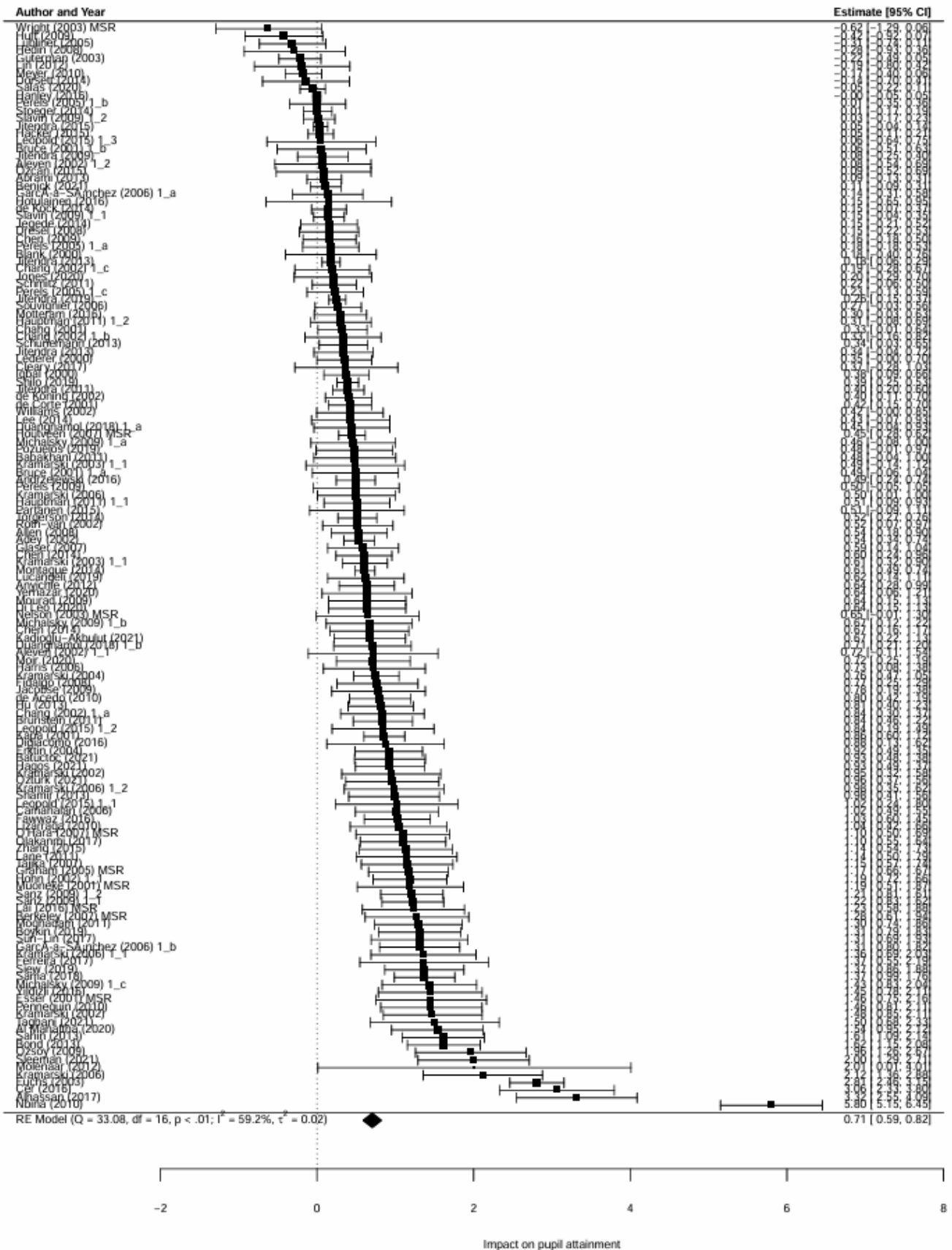
Some programmes taught students how to **judge their learning** and/or to **self-mark** their work with



given criteria. The basis of judgement and marking criteria were often pre-established by teachers before students worked on tasks, and students could make use of these during and after their task performance. For example, some writing interventions gave students checklists or taught them mnemonics so that they could self-assess their writing. In most cases, teachers introduced a set of self-questioning techniques, and examples include '*Does the answer make sense?*' (Jitendra, 2009) and '*What strategies did I actually use?*' (Lai, 2016). (See more examples of self-talk in the metacognitive talk narrative summary). Some programmes further prompted students to **reframe and redirect** their next steps by asking to consider alternative solutions – '*What could I have done differently?*' (Hagos, 2021). A few programmes also invited students to take corrective actions.

Lastly, metacognitive talk was featured in some programmes to support students' reflection on their learning. Some programmes incorporated **feedback and dialogue** to elicit students' reflection. Some computer-assisted programmes gave students immediate feedback to direct them to the next steps. Peer feedback was also embedded in several programmes such as by incorporating group discussion and setting up online peer discussion forums. **Self-explanation** was also a technique used in several studies. This group of studies often invited students to give rationales for their approaches, share ideas and express their thinking, all of which served as opportunities to reflect on their learning and performance.

Research Question 1c. Impact of providing opportunities to reflect on learning on pupil attainment





v. *Teachers modelling thinking aloud*

Summary

78 primary studies in the toolkit strand were coded as including teachers modelling thinking aloud.

Details

A high proportion of these studies included teachers **explicitly modelling the use of a chosen metacognitive strategy**. For example, the teacher might demonstrate the use of an acronym that provides prompts to support reading comprehension. An example of this is DISSECT (discover context, isolate prefix, separate suffix, say stem, examine, check, try). Likewise, teachers model writing strategies such as POW (pick idea, organise ideas and write) and TREE (Topic sentence, reason, explain reasons). Teachers verbally take pupils through the steps to applying a strategy and guide pupils to monitor and evaluate their learning.

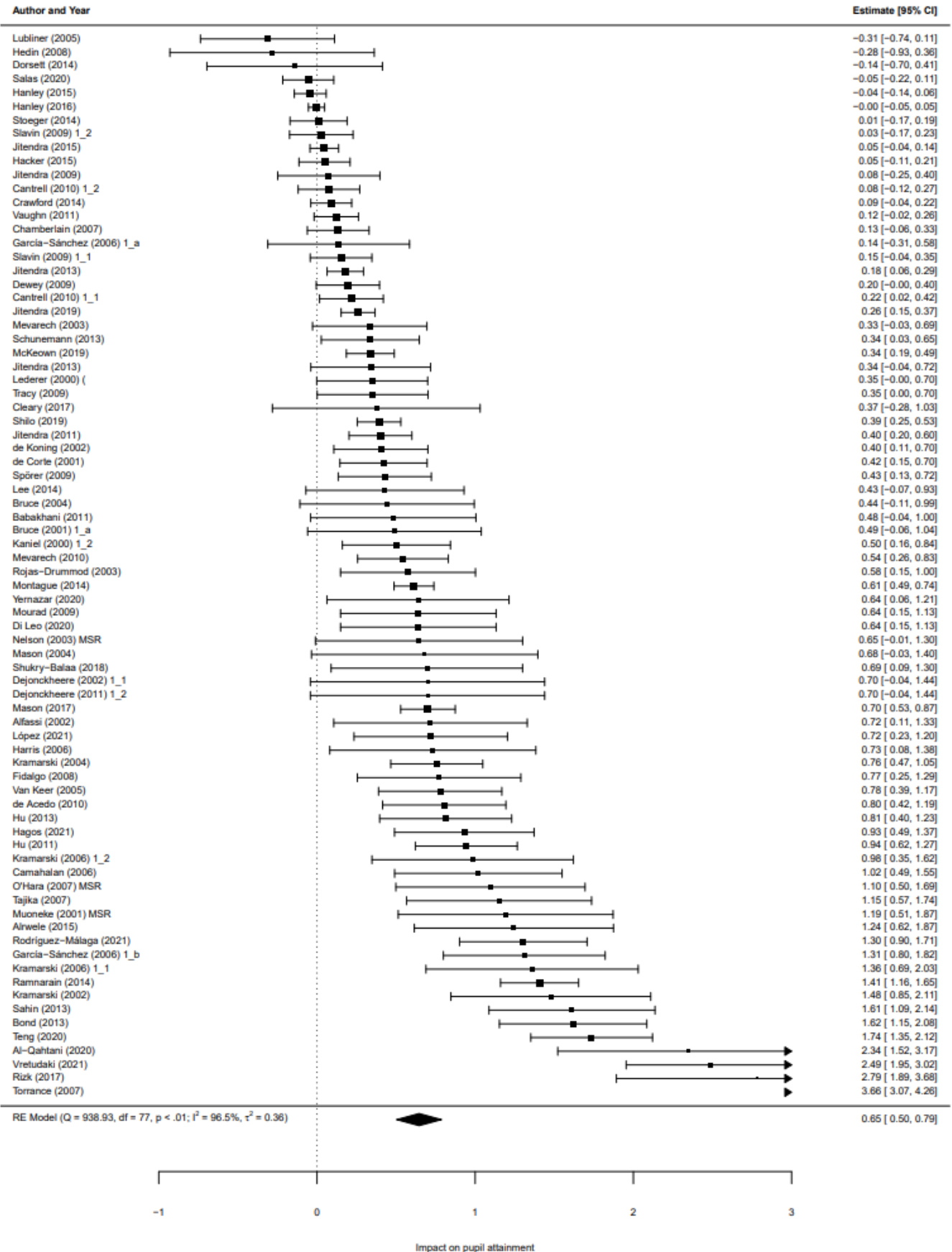
Similarly, a high proportion of studies include teachers **modelling the steps of their thinking during problem solving**, including the correction of mistakes. Tasks are often broken down into manageable chunks with teachers making their internal thought processes at each stage of a problem explicit to pupils. Sometimes this occurs alongside the use of visualisers or interactive whiteboards to allow for demonstration. Another common practice is questioning pupils to help co-construct the solution to problems.

Over half of the studies included **modelling self-questioning, self-talk and self-reflection**. This technique is commonly used to demonstrate how to monitor and evaluate success during a task and support pupils to develop accuracy in their judgement of learning. Sometimes this is more structured through the use of a predetermined check list, or less structured and verbalised by the teacher at any point during a task and then elicited from pupils through questioning.

In several studies, modelling thinking aloud supports pupils to **make predictions** during reading, **connect work to prior learning** and/or model how a **strategy might be committed to memory**. For example, teachers model thinking when repeating an activity or prompt pupils to consolidate learning and consider how to relate the activities in the intervention to future learning.



Research Question 1c. Impact of teachers modelling thinking aloud on pupil attainment





vi. *Other*

49 studies were coded as 'Other'. However, 37 of these were interventions that were also coded under other approaches such as promoting metacognitive talk or supporting pupils to plan their work. Of the 12 that were coded only as 'other', **several were pre-school executive function programmes** focusing on impulse control, on-task behaviour and social communication skills. A small proportion were studies that focused on **learning behaviours of older children** including self-monitoring, self-awareness and motivation. The majority were interventions that were primarily delivered through **digital technology**. For example, a computer programme that offered metacognitive 'hints' during writing to promote planning or goal orientated behaviours.

Interestingly, several studies coded as 'other' related to **reading comprehension**. There appears to be a set of metacognitive strategies that are specific to promoting reading comprehension skills. For example, supporting with activating prior knowledge, summarisation and prediction.

Finally, a small number of studies coded as 'other' explicitly **referenced cognitive science** theory and **schema-based learning**. For example, encouraging pupils to concept map, organise knowledge and categorise ideas.

6. The relationship between population, topic and outcome

This research question is answered through the strand specific analysis taken from the Teaching and learning toolkit

a) *Are there differential pupil outcomes between subject areas?*

The scope of this review allowed for analysis of outcomes, rather than direct comparison of subject areas. However, the evidence suggests that metacognitive and self-regulated learning interventions are effective at improving outcomes across the curriculum such as reading, maths, science and other literacy outcomes.

Moderator analysis suggested that interventions targeting spelling, writing and oral language had slightly higher effect sizes. Likewise, studies that targeted reading outcomes had slightly lower effect sizes – however this was marginal.

The evidence allows us to confidently conclude that the approaches are effective across subject areas.



b) How important is relating metacognitive practices to a topic or context when improving pupil outcomes?

256 studies in this review were coded as embedding the intervention in a topic or context. The interventions were mainly embedded in two ways. One common approach was embedding an intervention in an existing school syllabus and national curriculum. For example, some programmes taught self-questioning, which was applied to schools' curricula such as English, history and science without developing additional materials. Another common approach was embedding a programme in a certain subject topic but with additional subject content developed for the research. For example, some reading comprehension programmes taught the strategies using reading materials developed for the programme. There was a good spread of subjects, with English and math being the dominant two. Other less prominent subjects included sciences (e.g., chemistry and biology), history and modern foreign languages. In cases where the intervention was not embedded in a specific topic, the target skills were taught generally. Some programmes were not embedded as they were stand-alone computer-assisted programmes.

The weight of the evidence in this review sits behind the programmes that are taught through a topic, not as general thinking skills. Considering this, it seems important, and perhaps effective, to teach metacognition and self-regulated learning strategies through a certain topic. However, it is beyond the scope of this review to assert the importance of relating programmes to a topic in improving pupil outcomes.

c) Are there differences in outcomes between pupil ages and/or school phase?

Subgroup analysis indicates that the intervention has a positive effect across all age groups and school phases, with no significant differences in outcomes based on age. However, the current evidence base is predominantly drawn from studies involving pupils aged 7 to 16, with limited research focusing on the early years or post-16 age groups. Expanding research in these underrepresented phases is a clear priority for future investigation.

d) Are there differences in outcomes for pupils experiencing disadvantage?

Moderator analysis suggests that interventions involving a higher proportion of pupils eligible for free school meals are associated with larger effect sizes. This tentative finding indicates that such approaches may hold promise for supporting teachers in narrowing the attainment gap. However, Metacognition and Self-regulated learning interventions appear to be effective across all pupil groups, and the evidence base is still developing.

e) Is there a difference in effectiveness between individual and collaborative approaches?



Subgroup analysis indicates that both individual and collaborative approaches are effective, with no significant difference between these intervention types in improving pupil attainment. However, moderator analysis reveals that interventions delivered in whole-class settings are associated with higher effect sizes compared to those targeting individuals. This finding aligns with the theoretical and conceptual literature, which highlights the importance of social interaction and the co-construction of metacognitive awareness. Further research is needed to explore this relationship in greater depth and to draw more definitive conclusions

f) What is the impact of metacognition interventions on other outcomes?

Due to the toolkit methodology, it has not been possible to assess the impact on other outcomes in this internal review. Data extraction for the teaching and learning toolkit focuses on reporting the academic attainment outcomes. However, coders do report *which* other outcomes are targeted in intervention. These can be grouped as follows:

Outcome	Total
Metacognitive awareness	19
Metacognitive/SRL application of skills	59
General cognitive outcomes	48
Self-efficacy	22
Attitudes to learning	20
Judgement of learning/knowledge of self	17
Behaviour	13
Motivation	13
Social skills and relationships	8
Working memory/sustained attention	7



A large proportion of the studies report on pupils' awareness of metacognition and application of metacognitive or self-regulated skills. This is often gathered through observation, Likert scale self-assessment or teacher reporting. A third of studies also report a cognitive outcome such as problem solving or inductive reasoning. There are several studies that also look at pupils' attitudes to learning, self-efficacy and intrinsic motivation. Similarly, pupils' accuracy in their judgment of learning of knowledge of self is a common additionally reported outcome.

Whilst it has not been possible to ascertain the impact of metacognitive or SRL interventions on these outcomes, it seems feasible to suggest that, as part of the researchers' theory of change, some of these outcomes may also be positively affected. For example. Higher self-efficacy scores are likely to increase motivation to apply metacognitive strategies and bolster pupil progress. Success on task is likely to increase positive attitudes to learning.

Our analysis did consider the efficacy of studies which included other outcomes in their programme design, all of which showed a high positive effect. However, we cannot make causal claims about the interaction between the component and the outcomes, but can conclude that studies that included a focus on these other aspects were effective at improving cognitive outcomes.

The meta-analysis for these are presented below:

Studies that included an element focused on understanding task value and celebrating success:

RE Model: Q = 1495.285; τ^2 = 0.843; I² = 98.107%	0.851 [0.654, 1.047]
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Studies that included an element focused on managing motivation and effort:

RE Model: Q = 2340.074; τ^2 = 0.755; I² = 98.846%	0.795 [0.592, 0.998]
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Studies that included an element focused on developing personal capability and self efficacy:

RE Model: Q = 2686.886; τ^2 = 0.592; I² = 98.092%	0.755 [0.613, 0.898]
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This initial analysis suggests metacognition and other non-cognitive outcomes are likely to be closely related and together lead to improvement in attainment. Whilst it goes beyond the scope of this review, more detailed analysis of other outcomes would be a good direction for future research.



7. The role of professional development

Research Questions 3. What is the role of professional development in metacognitive interventions?

a. *What are the key elements of this training?*

Coding questions & Frequency results:

Is professional development provided?		
Yes	129	43%
No	168	57%
If yes, does professional development relate to the following?		
Appropriate level of challenge ¹	15	5%
Cognitive Load Theory ²	10	3%
Other	101	34%
Not Applicable	179	60%

NB: The number of studies coded 'No' and 'Not Applicable' do not match because some studies lack a description of professional development other than briefly mentioning that the training was delivered to teachers.

Summary

129 studies (119 primary studies) in the Metacognition and Self-Regulated Learning Toolkit Strand (post-2000) were coded as providing professional development. This amounts to 43% of the studies included in this review. Most studies coded as not providing professional development were

¹ Appropriate level of challenge refers to training for teachers on how to scaffold learning effectively and provide deliberate difficulty to ensure metacognition is necessary and purposeful.

² Cognitive load theory refers to cognitive science research on not overwhelming a learner.



researcher-implemented programme, computer-based programme or without any information.

Details

More than half of this group of studies provided professional development which focused on key teaching approaches for the given intervention. For example, reading comprehension programmes trained teachers on a theoretical background of reading comprehension strategies and ways to implement them into their teaching.

The **duration** of the professional development varied across the studies with some lasting over weeks to others completing within a day.

Some programmes introduced a **theoretical background** of a given approach in their professional development (20 studies). For example, a programme focusing on developing students' self-regulated strategies gave a seminar for teachers to explain the theory of self-regulated learning. Another programme introducing inquiry teaching introduced both the scientific and educational theoretical information on this approach. As such, some programmes not only taught the teaching approaches to the teachers but also introduced broader and underpinning theories.

In relation to the EEF **14 effective professional development mechanisms**³, most of the programmes featured elements of the teaching techniques mechanisms. Some programmes also featured elements of the embedding practice mechanisms often in the form of action planning.

The most prominent element of the PD was giving **instruction** to teachers wherein the research teams explained the teaching techniques and approaches so that they could implement the interventions (98 studies). More than half of these programmes only provided instruction but no other PD mechanisms. This may be due to the limited description within the studies.

Some programmes provided **practical social support** as a part of their professional development (24 studies). This practical support took various forms such as researcher-led support wherein research teams offered email and telephone support to troubleshoot challenges teachers faced. Some programmes set up coaching and mentoring by research teams, designated and trained coaches/trainers, or peers. Two programmes provided site visits to support teachers. Lastly, a few programmes focused on setting up discussion opportunities where the teachers could ask questions or share their experiences.

A small portion of programmes further provided **modelling** of the given teaching approaches (15

³ PD effective mechanisms are coded based on the Appendix 5 Full Mechanisms Coding Frame in the evidence review by Sims et al. (2021).



studies). The target teaching approaches were often modelled by the research teams and/or designated trainers. Some programmes provided modelling using digital technology such as disseminating video clips of modelled practice and giving access to online platforms storing videos.

Some programmes explicitly stated that teachers **rehearsed** the practices within the professional development sessions. A few programmes dedicated a portion of professional development to practice teaching sessions. Half of the programmes featuring rehearsal also provided **feedback** to teachers' practising the target teaching approaches.

The most prominent 'embed practice' mechanism was **action planning**, featured in 15 studies. These programmes often spend some time planning how to implement the target teaching approaches into their teaching and how to adopt them to meet the needs of their students. Sometimes, this action planning was collaborative rather than prescriptive as the research teams held discussions with the teachers.

A small portion of programmes featured **self-monitoring** in their professional development to support teachers' behaviour change. For example, a few programmes provided teachers with logbooks and/or journals to encourage them to reflect on their teaching practices. One programme provided a checklist of the instructional procedures for teachers to monitor their instructions.

Two programmes also **managed teachers' cognitive load** by chunking up professional development sessions throughout the programme delivery period. Three programmes featured **goal setting** whereby agreeing on behaviours to be implemented. A few programmes had a thorough professional development featuring multiple PD mechanisms⁴ (i.e., more than four effective PD mechanisms).

Nine of the programmes that provided professional development were **computer-assisted programmes**. Professional development in these programmes often focused on clarifying the teachers' role in enabling the use of technology in classrooms and some wrap-around teaching approaches they need to implement.

It is worth noting that quite a few studies had limited descriptions of the professional development. These studies mostly only featured instruction which explained and taught teaching approaches to be implemented. The EEF gives a high bar on professional development, defined in our Effective Guidance Report as 'a structured and facilitated activity for teachers intended to increase their teaching ability' (EEF, 2021, p.7) and does not count briefings and information sessions as professional development. Therefore, this portion of the studies coded to have provided professional development needs to be interpreted with caution. Likewise, it is worth highlighting that studies

⁴ Studies featuring more than four effective PD mechanisms: Berkeley, 2011; Bruce, 2001; Crawford, 2014; Festas, 2015; Hacker, 2015; Hanley, 2016; Harris, 2006; Kitmitto, 2018; McKeown, 2019.



often have a limited scope to report their programmes, so the absence of the description does not mean that the PD and/or certain PD mechanisms did not feature.

7. Conclusion

The findings of this review provide robust support for the recommendations outlined in the existing Metacognition and Self-Regulated Learning Guidance Report. The analysis addressing research questions related to the teacher's role also highlights specific practices and activities that can effectively promote metacognition and self-regulation. An updated version of the guidance report should more explicitly delineate the teacher's role in cultivating these essential skills.

While it is not feasible to definitively determine which teaching strategy is most effective, the evidence suggests that various approaches can directly improve pupil outcomes and there may be overlap in their application. For instance, teachers may foster self-directed learning by providing planning scaffolds or by modelling their thought processes aloud.

There remain gaps in the evidence that warrant further investigation. The impact of metacognition and self-regulation interventions on non-cognitive outcomes, such as motivation and self-efficacy, is not yet fully understood. Although toolkit studies indicate that these factors are often assessed during interventions, the methodology of this review does not permit measurement of their effects.



Additionally, there are notable overlaps with other pedagogical domains, including approaches informed by cognitive science, oral language development, and reading comprehension strategies. It would be beneficial to examine the core components shared across these approaches that contribute to student progress.



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