Developing trainee teachers in secondary schools: the effect of whole-class metacognitive questioning on trainee teachers' confidence in understanding pupil progress.

Alan Potts

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Abstract

A study to see if whole-class metacognitive questioning techniques can improve trainee teachers' confidence in understanding their pupils' progress. The study took place in a national teacher training organisation that works with schools with socioeconomically disadvantaged populations. The organisation does not currently carry out in-practice metacognitive training in any of the hundreds of schools involved in the programme. A review of literature examined the value of metacognition in secondary education and its relevancy to the organisation; what metacognition actually is, and if the iterative nature of metacognition means it is well defined and understood nationally; how progress is defined in this instance and where metacognition sits in initial teacher education programmes – flourishing or floundering; and finally trainee confidence as a construct in understanding pupil progress using metacognitive questioning. Following an initial mixed methods study of personal views, and current practices employed by semi-autonomous teacher trainers, it was found that varied belief systems in the field of metacognition mirrored current literature in the initial teacher training space and that metacognition was particularly effective with socioeconomically disadvantaged students. Extensive collaborations took place across two domains within the organisation – strategically and operationally. A longitudinal intervention with trainee teachers was conducted in the form of a downloadable toolkit. A constructivist ontology and interpretivist epistemology using mixed methods with explanatory sequential design was used. It acknowledged the subjective nature of confidence, and explored the complex, interpretive processes trainee teachers engage in. By focusing on personal experiences and perceptions, this approach facilitated an understanding of the intervention's impact. The intervention took place nationally in all subjects across many English secondary schools. All trainees reported that they were more confident understanding pupil progress following the intervention, and 91% of trainees reported that it had improved their confidence generally as a trainee teacher. Whilst the literature suggests participant overconfidence in self-reporting metacognitive benefits, and other limitations are noted in this study, there is nevertheless promising scope for future follow-up within my organisation to facilitate metacognitive support of socioeconomically disadvantaged pupils.

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Abbreviations used in this Dissertation

Abbreviation	Definition
DL	Development Lead
CCF	Core Content Framework (England and Wales)
CK	Content Knowledge
CUREC	Central University Research Ethics Committee
DfE	Department for Education (UK)
DREC	Department of Education Research Ethics Committee
EEF	Education Endowment Foundation
ERIC	Education Resources Information Centre
FOK	Feeling Of Knowing
HE	Higher Education
ITaP	Intensive Training and Practice
ITT	Initial Teacher Training
MLT	Master of Learning and Teaching
NFER	National Foundation for Educational Research
PCK	Pedagogical Content Knowledge
PCP	Personal Construct Psychology
QTS	Qualified Teacher Status
RCT	Randomised Control Trial
SLT	Social Learning Theory
SRL	Self Regulated Learning
SRT	Self-Regulation Theory
TS	Teachers Standards (England and Wales)

Introduction

I work at a registered charity, which began more than 20 years ago with the mission of helping to close the attainment gap between socioeconomically disadvantaged pupils, and their better-off peers across England. It places high quality graduates into schools in deprived hard-to-staff schools and grows leadership potential. I joined the charity in September 2023 as a Development Lead (DL) following many years of teaching in the UK and overseas. A priori there was no offering specifically in teaching metacognitive techniques to trainees, other than some brief online reading material. The UK government 'what works well' research organisation EEF[1], states that metacognition can improve learning by seven months, with a low-cost rating. I was surprised to notice its absence, and therefore its trial formed the basis of my intervention. If successful, this could improve outcomes for our pupils and trainees. My colleagues are other teacher trainers, either in London, or across England.

I have a portfolio of trainees in secondary schools across London and regularly observe and meet with them, their subject mentors in school, and relevant leadership staff. I also give online seminars for up to 90 trainees at a time online, and lead school-based Intensive Training and Practice (ITaP) sessions in hub schools. DLs have a high degree of autonomy in content covered with trainees face to face, and anecdotally in my own regional hub, it appeared that very few DLs discussed metacognition with trainees, although I had no means of knowing the national picture at the time.

I had already carried out a large-scale study of homework and perceptions of value in my old school last year. This year I wanted my intervention to be equally impactful. Most new young teachers are the Covid-19 generation, who will have experienced disruption to both their A Level assessments and university classes. There have been discussions that current trainees may not be as robust due to some life experience being curtailed in the lockdown, mirrored in recent studies (Wiedemann et al., 2022; Appleby et al., 2022; Zarowski et al., 2024). My organisation has certainly offered more support and counselling than ever before, with an increase in employed councillors already rolled out. In effect, trainee confidence has been a discussion point, and my reasoning was any intervention that could support trainee confidence in understanding pupil progress would be a very good idea for my organisation. My thought was that if trainees can use the answers they receive from deep live metacognitive questioning, or, prepared metacognitive answers to questioning, then they have a better appreciation of pupil understanding – their progress from one lesson to another – and can better adapt their teaching accordingly, creating in effect, more engaging lessons.

It was my hope that my Year 2 MLT dissertation will inform my organisation's offer to trainees through collaboration and an intervention that will be shared with my colleagues, to improve trainees' understanding of their pupils' progress and development, and thereby improve the learning of those pupils, and their own fidelity in hundreds of schools, impacting

[1] Education Endowment Foundation, funded by the Sutton Trust. Both organisations form the UK Government's only 'What Works' initiative to publish educational findings and reports.

up to 15,000 pupils this year directly. On completion, as findings would be shared nationally with colleagues to help improve our practice, it may ultimately influence the training of up to 1200 trainees annually, in thousands of schools reaching more than 200,000 pupils annually.

A critical review of the literature

Initial secondary teacher training in England and Wales has undergone some fairly broad changes in the last 25 years, and it continues to evolve today. Government policy and provider frameworks shape the new teachers of tomorrow trained with an interest in research-informed pedagogy. This intervention sought to improve trainee confidence in understanding pupil progress in day-to-day interactions with pupils, as an essential element of effective teaching. This will integrate metacognitive questioning into initial teacher training. There are a number of key considerations for this review to cover.

Research relating to metacognition is anything but straight forward and can be divisive as we will see. What is metacognition, and are there different sorts? Should we celebrate metacognition as a boost to learning? The UK Government's 'what works well' Sutton Trust/Education Endowment Foundation (EEF, 2021) give it a resounding recommendation, but how well is metacognition understood in education? Are our trainee teachers learning metacognition, or is it missing from Initial Teacher Training (ITT)?

To answer these questions, I have adopted the methods of a systematic literature review. I used keywords across databases and journals to conduct a review of the literature – see Table 1. Any compelling evidence cited in the bibliographies of articles was also investigated.

Table 1 - Sources and Keywords

Databases, journals and other sources	Keywords
SOLO (Oxford). Bodleian Libraries. Tanford online. iDiscover (Raven at Cambridge University); Google Scholar; ERIC; Scopus; BERA; NFER; and the EEF. Journals of: Educational Psychology; Applied Psychology; Educational Research Review; Education (American); Global Educational Studies Review; Frontiers in Psychology; Learning and individual differences; Educational Philosophy and Theory; Metacognition and Learning; Impact; Educational psychology review; DfE; European journal of psychology of education; Review of Artistic Education; Educational psychologist; Education Quarterly; McGill Journal of Education	Metacognition, self-regulation, self-regulation, SRL (and variations), metacognitive questioning, teacher training, trainee teacher confidence (and combinations), ITE (and combinations).

For the purposes of this project, year 1 trainee teachers will be defined as teachers in their first year of training, which usually culminates in the award of Qualified Teacher Status (QTS) in England. Confidence in understanding pupil progress will be defined, for now, as how positive a trainee feels in understanding how much pupils have progressed in terms of knowledge acquisition and the ability to apply that knowledge, and metacognition will be defined, for now, as "thinking about thinking."

The review of literature sought to explore current knowledge and understanding in three areas of enquiry. Firstly, an examination of the value of metacognition in secondary education, and if it is relevant and potentially impactful to my organisation and setting. Secondly, an examination of what metacognition is, and how well it is understood and interpreted in education. Thirdly, where does metacognition sit in initial teacher training? Is it flourishing, or are there barriers; historic or current, limiting its use? The third section concludes considering trainee confidence as a construct, and specifically in understanding pupil progress generally, using metacognitive questioning.

An examination of metacognition in secondary education: Is it relevant and potentially impactful to my organisation and setting?

Perry et al., (2019) argues strongly in favour of the value of metacognition. They point out a high effect size of 0.65 between pupil outcomes and the teaching of metacognition and the data suggests that this applies strongly for disadvantaged pupils. In a robust review of 51 peer-reviewed studies of schools, school-age pupils, and teachers, between 2000 – 2017, Perry et al., found that disadvantaged pupils could equal, or surpass progress from higher socioeconomic groups if they were taught metacognition as part of an integrated school-wide curriculum (Perry et al., 2019). This has a special significance given my organisation seeks to find ways of narrowing the attainment gap between the well off and the disadvantaged by tackling social disadvantage. Why should metacognition have such an impact on the attainment of disadvantaged pupils especially?

I would argue that we can find some answers during the Covid-19 lockdown, when students with metacognitive skills out-performed those without them when working away from the school environment, taking the variables of access to IT into account. McGuire, (2021) argued students who had gained metacognitive skills in conversations around middle class dinner tables, had also acquired as a result what she termed metacognitive capital, and did not sit helpless at home during the lockdown. I would argue that this links with Bourdieu's (2018) ideas of social reproduction, or cultural capital, and, lacking in working-class homes, could explain why metacognition taught to socio-economically disadvantaged students has a higher impact identified by Perry et al., (2019). Is it possible that middle-class pupils isolating due to Covid-19 were able to set goals, and consider strategies to complete work set remotely, with learner-agency in the absence of teacher modelling and direct guidance (Goudeau et al., 2021; Vechiu & Popa, 2021) due to metacognitive skills, that less advantaged pupils could not, during the lockdown? If so, metacognitive interventions should be deemed

desirable if learner-agency is valued as an educational goal across socio-economic disadvantaged backgrounds, and if metacognitive development can lead to it (Worley, 2018).

Again, this could be of great interest to my organisation, in its core aims of narrowing the achievement gap between disadvantaged pupils, and their better-off peers. Ofsted recommended the integration of cultural capital in schools (Harford, 2019), with other studies confirming a redistribution of fostering cultural capital can reduce inequality (Jæger, 2022). However – imagine if it was the case that embedded metacognition could boost learning? Mixed with a positive belief in improvement, Wang et al., (2021) demonstrated that metacognitive skills were essential for students to realize the benefits of a growth mindset in enhancing maths development from socioeconomically disadvantaged schools. In three separate studies totalling more than 3000 US students, this was a longitudinal series of studies over four years with rigorous correlation analysis, and multilevel modelling with consistent patterns highlighting the advantages of metacognition over time. However, not all metacognitive findings are so positive.

There are claims that metacognition can disrupt learning, can be expensive to establish, and lead to feelings of negative self-evaluation on the part of pupils (Norman, 2020). In a balanced article, Norman offsets positives surrounding metacognition such as task planning and decision making, but also notes that it can lead to over confidence, and a belief that a pupil might be better at something than they are – overestimating their success. She goes further to argue that much research focuses on the positives of metacognition, ahead of the drawbacks. Norman is not alone; Coe et al., (2014) argue that the use of observations, value-added models and self-ratings promoting metacognition may not always have the academic rigour that are often taken for granted in some studies.

In the meta-analysis Visible Learning, Hattie (2016) lists metacognition in the top 10 of teaching strategies available to teachers with a high effect size of 0.69. This did not change in its sequel (Hattie, 2023). This has considerable currency, as Hattie's writings are highly cited, and anecdotally, most teachers have heard of this particular study. Hattie's work is a meta-analysis of over 800 studies in the original 2016 publication, and 2,100 in the 2023 follow-up publication. However, I would argue Hattie's findings should be taken guardedly, some argue that his methodology in meta-analysis is not robust and includes miscalculations and inappropriate baseline comparisons, leading to erroneous results and interpretations (Bergeron & Rivard, 2017; Rømer, 2019; Nielsen & KlitmØller, 2021). Hattie stated in a magazine interview[2] that his ranking of interventions was not intended to suggest a hierarchical approach; acknowledging an error in his original figures, but felt it had been blown out of proportion - that the interpretation of evidence was more important than the evidence itself (Severs, 2020).

I would argue the volume of studies that cite positive outcomes for pupils employing metacognition far outweighs the negative. In a scoping review before this systematic review, I found more than 200 studies and categorised 67 peer-

[2] TES – the Times Educational Supplement, widely distributed in school staffrooms.

reviewed studies attesting to the efficacy of metacognition meeting the keywords. Lawson et al., (2019) emphasize the significance of self-regulated learning (SRL) strategies in enhancing student achievement. McGuire, (2021) argues metacognitive strategies have a significant role to play to reduce the achievement gap as we have already seen, while Piret et al., (2020) suggest that metacognitive mediations can enhance students' writing skills and their awareness of their progress – and that metacognition should be incorporated into teacher education programs to name a few. This is significant evidence indeed. However, a note of caution is needed.

Many studies are cross sectional, capturing a brief moment in time, and therefore cannot measure trends of progress. Many studies have small samples, or do not take account of confounding variables such as the expertise of teachers. Perhaps above all of this, the efficacy of metacognition largely relies on self- reporting. As Lawson et al., (2019) points out, successful self-regulation in education requires accurate monitoring, but overconfidence in participant judgements is a potential threat to validity (Pieschl et al., 2023).

Metacognitive processes are *challenging to observe* and measure due to their tacit nature, (Stanton et al., 2021). There is also a significant gap in the development of reliable tools to measure metacognition, in part because of the confusion that arises from the lack of clarity in what metacognition is and how evaluations could occur (Akturk & Sahin, 2011). In a robust study, the authors point out the need for better measurement tools and methodologies to accurately assess metacognitive skills, arguing that the current lack of reliable assessments leads to inconsistent findings and misunderstandings in the literature, a theme I will return to later.

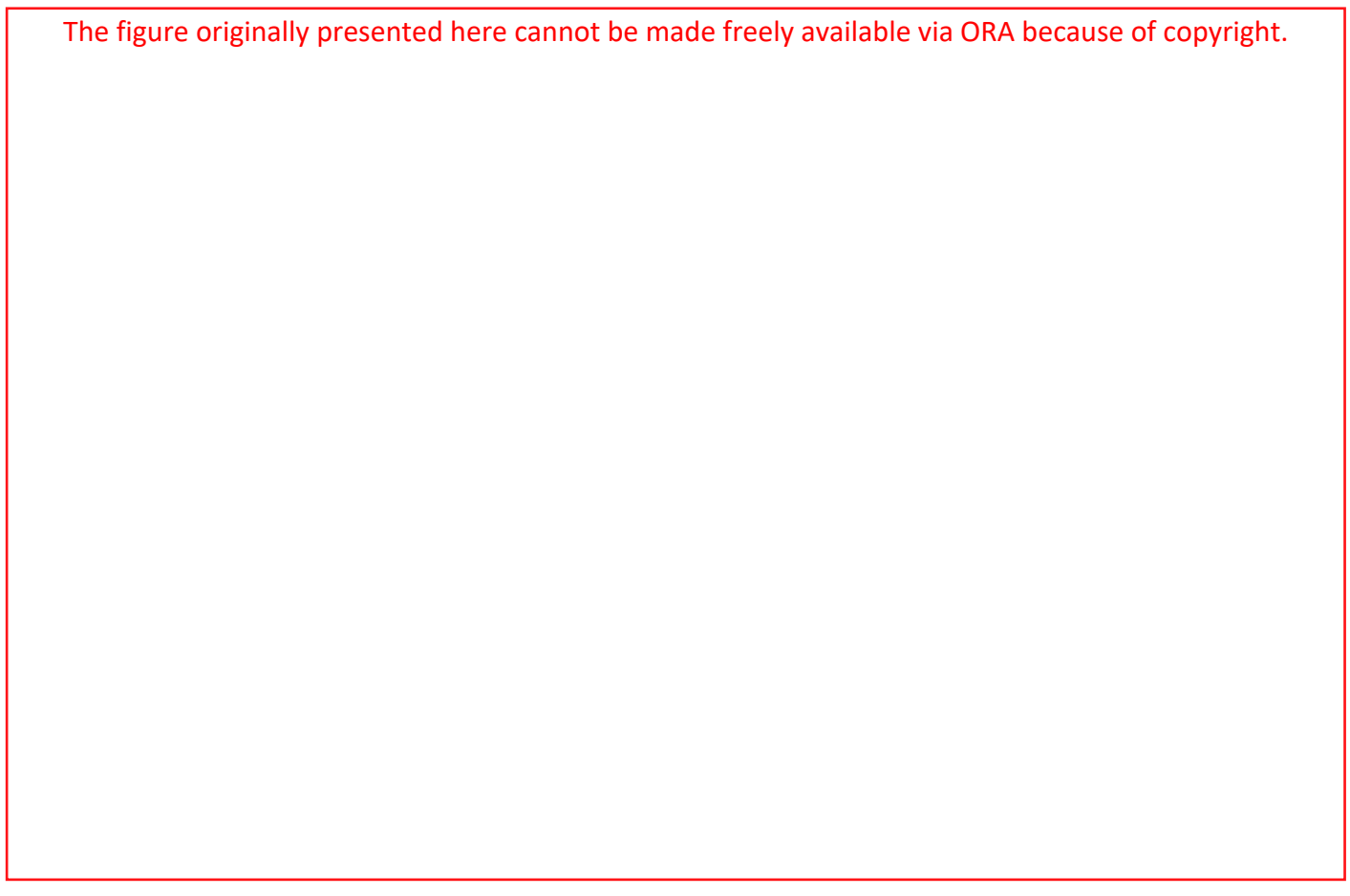
Yet on balance, there is an overwhelming number of studies, of evidence, including a study quoted by my own organisation, the EEF evidence review of metacognition and self-regulation by Muijs & Bokhove (2020), which collectively recommend *a posteriori* for the inclusion of metacognition in schools. The next question to consider, so that I can critically appraise the literature is – what exactly is metacognition?

An examination of what metacognition is, and how well it is understood and interpreted in education.

As a teaching pedagogy, metacognition is different from cognition. While cognition involves the learning process - understanding and remembering facts about a subject, metacognition is about how we get there – it involves thinking about cognition or thinking about our own thinking processes usually with some form of self-regulation. Flavell (1979) coined the term metacognition and divided the act of thinking about one’s own thoughts into goals or tasks, metacognitive experiences, metacognitive knowledge, and actions or strategies. Flavell argued that metacognitive knowledge consisted of three parts – variables in the person, task, or strategy that would interact to impact the outcome

of cognitive action. Metacognitive experiences - brief or long, are moments when one might sense either consciously or *sub-consciously* that a task is not yet accomplished or is still confusing – and can lead to new or revised goals; add to metacognitive knowledge or activate strategies such as re-reading something. Flavell described thinking about thinking. Metacognitive knowledge could occur before, during, or indeed after a task and utilised conscious Metacognitive knowledge, see Figure 1 Flavell's model of metacognition[3].

Figure 1 - Flavell's model of metacognitive monitoring



As a clinical psychologist, Flavell (1979) produced a theory applied to the educational study of memory and cognitive decisions in a modern setting, which he termed metacognition. Influenced by Piaget, Flavell was interested in how children learn – how their introspection interfaced with their subjective view of the world. He was interested in memory and his experiments were focussed on how children could recall a list of items, based on their age. He measured knowledge that included the self-knowledge children had about themselves as learners, and noted they could change their response in light of metacognitive experiences, which in turn changes metacognitive knowledge.

This cognitive monitoring involves being aware of one's own cognitive experiences and evaluating the progress and effectiveness of one's cognitive strategies and actions. It includes the ability to detect errors, assess comprehension,

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[3] Though he may have devised the terminology and set out the first of a number of evolving categories, of note is that the idea of being aware of cognitive process can be traced back to Plato (Worley, 2018).

and evaluate the quality of one's own thinking. Individuals make adjustments and adaptations to their cognitive processes in order to improve performance and achieve desired goals (Flavell, 1979).

So why then, does it not appear to be, anecdotally at least, widely used in my workplace? Might the explanation lie in the perception or development of metacognition since 1979? Was the clinical psychologist's theory too complex to apply to a busy classroom as some have posited (Mannion, 2018)?

There is a school of thought that postulates the first leap forward in metacognition was the critical iteration that developed regulation of cognition (Lajoie, 2008). Whilst it could be argued that Flavell's original theory inherently encompassed self-regulation, actively controlling and orchestrating self-cognitive activities to achieve specific goals, a variant model by Brown (1987) suggested that regulation of cognition was linked to Knowledge of cognition, based on earlier work by Baker & Brown (1984). Learners could step back and survey their reflections. This included planning activities in advance, monitoring and adapting strategies during, and finally evaluating the result of strategies used afterwards, see Figure 2 - Brown (1987).

Figure 2 - Brown (1987)

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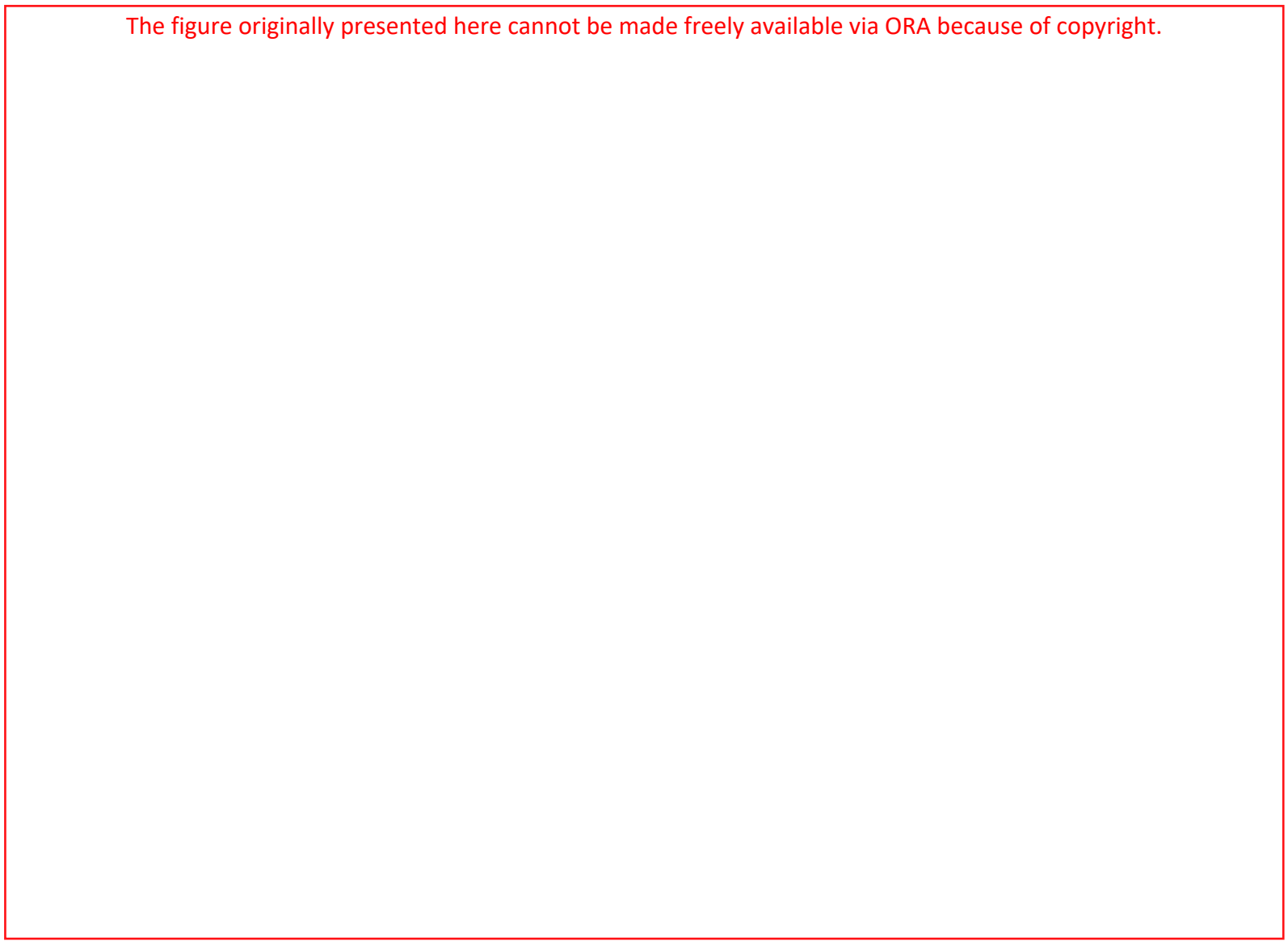
A short time later, Schraw & Dennison (1994) added three additional layers to the Brown (1987) model, dividing knowledge of cognition into declarative knowledge - understanding ourselves as learners and the elements impacting our progress; procedural knowledge - concerning techniques and various methods relevant for problem-solving and improving learning; and conditional knowledge relating to the why and when of applying a specific strategy. Regulation of cognition remained the same with the three categories put forward by Brown (1987). However, planning was subsequently divided into setting goals, allocating resources, and making of choice of appropriate strategies; self-testing and reflective tools were added to monitoring; and assessing outcomes, reviewing learning and reassessing goals were added to evaluation. Further iterations followed – see Figure 3.

Figure 3 - Metacognition (Flavell, 1979; Brown, 1987; Lee et al., 2009; Bryce & Whitebread, 2012; Marulis, 2014; Robson, 2016).



Based on a layout by Monkeviciene et al., (2020)

So does metacognition, or its self-regulation iteration, need to be a conscious act? Perhaps some procedures involved in metacognitive control may not in fact, continually be accessible to the conscious mind or kept as verbalised knowledge? This thinking has led to varied iterations of metacognition, acknowledging both conscious and implicit forms of learning (Sangster-Jokić & Whitebread, 2011). I would argue that this was never Flavell's intention to describe metacognition as an act requiring conscious decisions, and that the crossover between metacognitive experience with metacognitive knowledge, and cognitive strategies and goals, permit a subconscious level of metacognition.

Self-regulation is often used interchangeably with metacognition. However, it has an entirely different meaning. The term was first used by Locke in 1690 (Locke, 1970) and is still in publication 300 years later. The modern concept as Self-Regulation Theory (SRT) was explored by Bandura (1977) in his Social Learning Theory (SLT). He pointed out that people learn not only through direct experience but by seeing how others behave and learning from them. According to Bandura, learning should be viewed as a cyclical process in which individuals observe others, imitate them, and then get feedback on how they perform.

Figure 4 - Bandura's Social Learning Theory

Here, Bandura’s theory of self-regulation takes a different perspective. While metacognition focuses on cognitive processes, Bandura emphasised behaviour, emotions, and motivation as important elements in self-regulation. Self-regulation involves the reciprocal determinism – environment, behaviour and thoughts and feelings impacting each other, and how an individual can manage their constructed reality. As Schunk (2006) points out, the heart of this constructivism, and social nature of learning are clearly rooted in Vygotsky's (1978) theories of social learning.

Self-determination theory posits that motivation arises from three human needs: autonomy, competence, and relatedness. Autonomy can be thought of as our need for control over our lives and actions, competence to our need to feel effective and capable in our endeavours, and relatedness to our need for social connection and belonging. People are motivated when they feel that their actions align with these fundamental needs. For example, a pupil who feels in control of their learning, who believes they can master a subject, and who feels connected to their classmates, may well be more motivated to engage in academic work (Galloway et al., 1998).

The next iteration of metacognition arguably conflated elements of early metacognition and self-regulation. Self-Regulated Learning (SRL) theory has evolved from Bandura's social-cognitive learning theory, emphasizing the transition to autonomous learning and the importance of behavioural, metacognitive, and motivational skills in planning, goal-setting, strategy implementation, and evaluation (Schraw, 2009). SRL occurs when pupils are:

> *“….self-regulated to the degree that they are metacognitively, motivationally, and behaviourally active participants in their own learning process.”*
>
> (Zimmerman, 1989, pp 329)

Zimmerman argued that SRL had distinctive phases: Forethought, Performance, and Self Reflection. We are moving away from possible sub-conscious changes in-action, and toward a definitive process of highly planned self-regulation and control.

Zimmerman (2002) argued that as well as being self-regulated proactive and self-directed learners, SRL learners also have high self-efficacy - a belief their aptitude to accomplish their goals. Various strategies are employed by SRL learners to regulate cognition, behaviour, and environment, such as planning, rehearsal, elaboration, organization, self-instruction, self-reinforcement, self-evaluation, and self-monitoring. Essentially, a comprehensive framework for understanding how learners can take charge of their learning and improve their own performance. First, tasks, goals and strategies are considered in the forethought phase, driven by a desire to learn and motivational self-belief. Next, progress towards goals is monitored in the performance phase. Here self-control strategies adapt to create optimal learning conditions. Finally, the self-reflection phase not only evaluates progress against expectations, but changes that could be applied next time to improve efficacy (Hacker & Bol, 2019) – see Figure 5.

Figure 5 - A model of self-regulation that integrates metacognitive processes and motivation, as put forward by Zimmerman, B., & Moylan, A. (2009).

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Here, SRL can be thought of as dialectical constructivism - rather than passively absorbing information, learners actively engage with it, compare it with what they already know, and sometimes even challenge it to create a new understanding. Both endogenous and exogenous theories influence regulatory focus (Dinsmore et al., 2008). SRL may be considered as an internal conversation between what the learner already knows – including figuring out something individually, inner thoughts, experiences and prior knowledge – the endogenous element; and new information – being taught or reading something new – the exogenous part. Here there is a *conscious adjustment* of learning strategies, based on new information and the learner's own thoughts. It is interesting to contrast the very conscious, self-regulation of behaviour and cognition, and with the original sub-conscious and conscious interplay between metacognitive experiences with metacognitive knowledge, and cognitive goals and strategies. Clearly SRL is a more action based pre-planned and reflective on-action rather than in-action to extend Schön's (1987) meaning for reflective educational practitioners, than

Flavell's (1979) original concept. In Schraw's (2009) interpretation, we can begin to see metacognition now has changes in emphasis, away from metacognitive experiences, to two distinct branches of knowledge and regulation – see Figure 6.

Figure 6 - Stanton (2021) modelled and modified from Schraw and Moshman (1995)

Fast-forward to today, and we can see variations on Flavell's work in such publications such as the Teacher's Toolkit (EEF, 2020), which advocates metacognition as an effective, low cost strategy to improve learning.

Turning to how well metacognition is understood in education, I would argue that there is some confusion in some quarters globally regarding what metacognition is, and that this could not only detract from the efficacy of some findings, it could also be argued that it holds back a larger integration of metacognition in education. I would apply this to academia as knowledge producers, as well as schools in their main role as knowledge distributers and facilitators. There is a lack of linguistic clarity between metacognition, self-regulation, and SRL, with terms used interchangeably in research papers (Dinsmore et al., 2008). In his analysis of 255 studies on metacognition, Dinsmore and his team discovered that 49% of terms were defined explicitly, and 51% were defined implicitly. It was found that explicit definitions were more common in self-regulation (57%) and self-regulated learning (69%) compared to metacognition (32%). Implied definitions were classed as conceptual (48%), referential (10%), or a combination of both (27%). Self-regulation (38%) and self-regulated learning (30%) were defined only by the parameters of measures compared to metacognition (15%). The keywords knowledge, motivation, control, cognition, regulate, behaviour, and monitor, were frequently used in explicit definitions across the three constructs. Does this then lead to misconceptions in the classroom? With conflicting academic views, it is perhaps inevitable that there may be a range of conflicting understandings of metacognition amongst teachers as we will see.

I would suggest that this lack of linguistic clarity might disrupt uptake in the classroom. In a recent survey of 400 teachers by the Chartered College of Teaching, metacognition appeared three times as needing further research, in effectiveness

by age, subject, and independent use. Whilst the demographics of the respondents are not mentioned, and the questions are 34-26 on a longlist of priorities of 58, teachers are clearly asking for clarification in this area (Müller & Cook, 2023).

If the slurring of terms in academia trickles down as teacher misunderstandings in schools, does this explain what Dignath & Karlen (2023) describe as fragmented or deficit knowledge in metacognition amongst teachers? They also suggest that many teachers spend little time on metacognitive strategy instruction and so struggle to activate and support students' metacognitive skills. This in turn would exacerbate perceived efficacy of the pedagogy, and perhaps this culminates in varied teachers' beliefs about metacognition, at the very least with some endorsing a constructive view and others emphasizing student autonomy?

Wilson & Bai (2010) investigated the causality of metacognitive pedagogical approaches employed by teachers and the clarity of their understanding of it. Whilst their study emphasized the crucial role that teachers play in fostering students' metacognitive abilities, I would suggest it did not sufficiently address the variability in teachers' metacognitive understanding and how this impacts the effectiveness of metacognitive instruction to be of much help here. It could be argued it lacked in-depth analysis of teachers' diverse levels of metacognitive knowledge, did not assess the impact of varied metacognitive understanding on instructional strategies, and overlooked the influence of teacher metacognitive diversity on student learning outcomes. Inevitably, it also relied on self-reported perceptions of teachers' metacognitive knowledge, and it did not comprehensively analyse how differences in teachers' metacognitive understanding could affect the implementation of metacognitive instruction in the classroom.

Where does metacognition sit in initial teacher training? Flourishing, or flagging?

Initial teacher education in England and Wales requires an understanding of metacognition, as set out in the Core Content Framework (CCF) which was constructed by a cross-industry group of experts, including from the EEF as well as the organisation I work for. They describe what all teachers are expected to cover in their Initial Teacher Education (ITE):

> *"Learn that: Explicitly teaching pupils metacognitive strategies linked to subject knowledge, including how to plan, monitor and evaluate, supports independence and academic success."*
>
> Standard 4 - 'Plan and teach well-structured lessons' (EEF, 2019)

However, in order to qualify as a teacher in England and Wales, a trainee must meet the Teacher's Standards (TS), and although the CCF is modelled on the TS standard by standard, there is no mention of metacognition in the actual TS. It seems that trainees have to learn about it, but they don't have to show that they can do it.

This links to the TS that all trainees must reach the minimum standard to be awarded Qualified Teacher Status (QTS) in England and Wales (DfE, 2011). For something clearly so effective, low-cost, and mandatory, it should be well understood and used extensively in schools. But is this really the case? There is a growing body of research, as we have begun to see, that suggests teacher deficit beliefs may influence metacognition use as an educational tool.

Positive beliefs in metacognition and the usefulness of a systematic approach, along with beliefs in constructivist teaching principles, may well predict more effective metacognitive practice. Teacher self-efficacy in metacognition, and their belief in their ability within it, is particularly important and is a strong predictor of teacher metacognitive practice (Dignath & Karlen, 2023), and by extension, the training activities of teacher trainers. Belief systems may explain any exclusion of metacognitive strategies and necessitates deeper exploration. Lawson et al. (2019) argue belief systems significantly constrain the advocacy and implementation of metacognitive strategies within educational settings. In a robust study, Dignath & Karlen, (2023) go further and suggest the correlation between positive beliefs and putting metacognition into practice is inconsistent. It could be argued that some teacher trainers may hold negative illusions creating barriers to the potential use of metacognition in teaching (Dunlosky et al., 2009).

Perhaps this relates to the history of metacognition in schools? Should metacognition be taught as standalone skills, or embedded into the teaching of subjects, with adaptions based on what the subject? For a long time, it was taught as a non-domain specific – thinking skills; effective learning; and learning to learn, over the last 40 years. Yet it seems to me that metacognition has shifted in the UK to be more domain specific. Parallel trends can also be identified - in the EEF study mentioned by my organisation (Muijs & Bokhove, 2020) metacognition is regularly used in conjunction with terminologies such as reflection (Epstein, 2003); thinking skills (Costello, 2000); self-reflective learning (Bandura, 1986); thinking intentionally, self-regulation (Kuiper et al., 2009); and independent or autonomous learning (Lüftenegger et al., 2012). I would suggest Muijs & Bokhove, (2020) are correct in their points raised, but fail to point out that not all connections made relate to either primary or secondary education, to which their study relates. Kuiper et al., (2009) for example, were referring to student nurses. Furthermore, there is no mention of metacognition at all in the journal article by Lüftenegger et al., (2012), which describes self-regulation. Whilst metacognition is related to self-regulated learning, Lüftenegger et al., do not specifically address metacognition as a concept or variable in the study at all. Metacognition at very least, is misquoted. The domain specificity question – should metacognition be non-domain or domain specific, requires further examination – as well as partially explaining embedded belief systems, the question of whether my intervention should be tailored to every subject needed guidance from the literature.

Teachers who have taught metacognition in a variety of different ways, may well have formed domain-based belief systems, and it is these belief systems about learning and metacognition that are seen as pivotal in shaping the attitudes and practices of trainees. Lawson et al. (2019) suggest that these beliefs link to form a complex, interrelated system that not only influences teachers' pedagogical decisions, but also their willingness and ability to promote metacognition in some cases. This interconnectedness implies that changing a single belief is unlikely to lead to a significant increase in

the use of SRL strategies. Lawson suggests that the evolution of belief systems is a continuous process, where incoming information is interpreted through existing cognitive frameworks. Often inconsistent or even contradictory, such systems can result in teachers holding conflicting views about the importance, and implementation, of metacognition. Given this complexity, Lawson goes on to argue that a holistic approach to altering belief systems is necessary to bring about meaningful change in teaching practices - a conceptual shift if SRL strategies are to be effectively promoted in classrooms.

Duffy et al., (2009) posit that there are three complications obstructing our understanding of teacher metacognition: nomenclature issues (as we have already seen), situational problems, and methodological problems in studying teacher thinking. Will this be detected where I work? I would suggest that perhaps metacognition is generally understood as whatever type of metacognition a teacher has encountered when they trained, yet metacognition has, as we have seen, continued to evolve into varied iterations.

Teachers should be proficient and effective in SRL so that they can support pupils becoming self-regulated learners as pointed out by Dignath & Karlen, (2023). They go on to discuss the distinction between Pedagogical Content Knowledge (PCK) and Content Knowledge (CK) in the context of SRL, showing that PCK-SRL might be of greater significance for teachers' promotion of SRL. From this the argument is strengthened that teachers often lack sufficient knowledge about metacognitive strategies, with some holding misconceptions about strategies and neglecting their functional value. Delving deeper into their research they describe deficit or fragmented knowledge relating to both content knowledge about pedagogical content knowledge about SRL (PCK-SRL) and SRL (CK-SRL). Teachers' beliefs about SRL may not consistently align with their observed SRL practice, leading to inconsistencies between beliefs and actions in the classroom. However, the research base in the area of teachers' support for pupils' metacognition is tenuous, suggesting a need for further examination to understand differences in teachers' SRL practice.

It has been suggested that metacognitive awareness is underutilized in teacher training centres (Jafarzadeh, 2014). Whilst this study had 131 participants, this is still a small sample size, in a small area in Northern Iran, meaning it may not be possible to transfer findings. In a more robust study, Halamish (2018) argues that trainees’ metacognitive knowledge is often inaccurate and does not improve just with experience in a classroom. It is recommended to include detailed coaching about the advantages of supported metacognitive strategies in teacher training programs. The study involved 83 pre-service teachers and 82 in-service primary, middle, and secondary teachers and suggests that many teachers lack understanding of effective learning strategies (Halamish, 2018).

Let’s consider trainee confidence in understanding pupil progress - using metacognitive questioning. This will be tackled in four parts – pupil progress; the construct of trainee confidence and why it matters; trainee confidence in understanding pupil progress; and metacognitive questioning.

Black & Wiliam (1998) argued pupil progress is most effectively understood through using continuous formative feedback which then allows adjustments in teaching strategies, as well as pupils to better understand their own learning. We can see the possible influence of metacognition in this process. There are other contrasting points of view in what characterises pupil progress e.g., from taking a more quantitative approach measuring the effect sizes of intervention outcomes (Hattie, 2008); to the importance of motivation to engage in learning as well as specific measurable outcomes (Dweck, 2007). In this paper I will adopt the definition applied by Black & Wiliam (2009) which explores progress through a number of lenses which will form useful constructs in the planning of the intervention. Here trainee progress can be measured by employing questioning, eliciting detailed answers as evidence of where individuals are on their learning journey, and adapting teaching accordingly in a dynamic environment of formative assessment, which can include peer work and self-questioning and monitoring.

It could be argued that all any teacher must do to understand the progress made by a pupil, is to look at their regular test scores. The assumption being, that all assessments are perfect measurements, and that all pupils are equally adept at responding to such assessments to check their understanding of any topic. Trainee teachers are expected to learn to understand how their pupils are learning and absorbing information (Burn et al., 2015). I would argue that understanding progress and engagement ‘in the moment’ is more powerful to the trainee making them a more responsive practitioner. In my own practice, I found, again anecdotally, that trainees struggled to engage pupils in extended questioning. The majority of questions were ‘what’ with the very occasional ‘how’ or ‘why’ and trainees did not capitalise on taking pupil answers any further. Trainee confidence was not high in terms of knowing how well pupils were progressing in a lesson. In terms of discussion support - a DL seminar does touch on dialogic teaching, but is limited to minimal signposting, and does not give secondary trainees a mechanism to use for deeper exploration of pupil knowledge and thinking processes.

Metacognition helps teacher development by enhancing confidence, self-efficacy, and motivation, and Personal Construct Psychology (PCP) can facilitate teacher metacognition by bringing unconscious beliefs to consciousness (Larkin, 2023). Larkin (2023) argues teacher training programmes programs should focus on metacognitive strategies by addressing negative implicit beliefs. Larkin goes on to argue bringing unconscious beliefs to consciousness is essential for metacognition, and that consciousness hub of processing anything metacognitively. I would agree to a point, certainly in SRL which is consciously planned. Indeed it could be argued, that these iterations of metacognition involve the verbal, conscious mind (Mevarech & Kramarski, 2014). On the other hand, there is an alternative argument that suggests that not all aspects of metacognition are articulated or available to consciousness (Sangster-Jokić & Whitebread, 2011). Indeed, I would suggest that the subconscious ‘experiences’ influencing the conscious is at the core of Flavell’s (1979) original model. Flavell (1979) clearly states that metacognitive knowledge can be conscious or sub-conscious and can influence cognitive processes without entering consciousness or can lead to conscious experiences known as metacognitive experiences. Indeed, Nelson, (1990) in a study on meta-memory, discusses a Feeling of Knowing (FOK) as a metacognitive judgment that individuals make about their ability to retrieve or recognize information from memory, even when they are unable to recall or recognize it at the present moment. FOK judgments are subjective assessments

of one's own knowledge or familiarity with a particular item or concept and can be conscious or sub-conscious. Returning to Larkin (2023) – I disagree with metacognition requiring consciousness, however her premise of addressing negative implicit beliefs via PCP may be a way of tackling negative beliefs about metacognition itself amongst teacher trainers.

Teacher professionalism and confidence can be thought of as interlinked (Nolan & Molla, 2017) and there are many studies that look at the building blocks that one could argue build confidence. Yıldız & Akdağ (2017) argue that metacognitive strategies increase trainee teachers' *self-efficacy* belief. Avila & Baetiong (2012) suggested that teacher training in metacognitive strategies improved teachers' *attitudes* towards these strategies and enhanced their teaching performance. However, the study may be limited to 16 participants in the Philippines. Geetha et al., (2023) published a study that purported to show an increase in *resilience* when trainees used metacognition, however the scope of 20 participants in one area of India with a lack of randomization means this is of limited value in my organisation.

I would argue there is a need for trainee teachers to be taught how to use questioning as a strategy to support students in constructing meaning, and developing the critical thinking skills that metacognition delivers. Newton, (2017) suggests that trainee teachers need guidance in formulating higher-level questions and tailoring their questions to the needs of the situation. Developing trainee teachers' questioning skills to enhance their effectiveness in promoting productive thought and facilitating meaningful learning experiences, developing follow-up questioning, acknowledging, re-voicing, and building upon pupils' ideas, can significantly enhance classroom dialogue and student engagement (Demszky et al., 2023). Surely then, this would develop trainees' confidence in different types of prospective judgments, such as judgments of learning and Feeling of Knowing discussed earlier.

Can one specifically argue that incorporating metacognitive questioning in teacher training can boost trainee teachers' confidence levels and improve their confidence in understanding of pupil progress? There is limited precise evidence, and more research is required to discover if correlation, or with Randomised Control Trials (RCT), causation, exists. In a landmark EEF study[4] Motteram et al., (2016) sought exactly this using RCT. Goldacre (2013), argued RCTs would make the evidence more reliable with a control group. This claim warrants sustained critical evaluation. It could be argued that the way the RCTs were administered, by school, rather than within schools, could limit the validity of the findings. Motteram et al., (2016) found that schools feared 'missing out' if some classes were control groups, and to obtain the number of schools taking part, it was found to be easier to divide the RCT test and control groups on a school-by-school basis. I would argue this removes 'Randomised' from the equation. Further, it creates various variables between schools that could not be separated in the trial, not least of which, some schools were already teaching metacognitive strategies, and therefore would have had an advantage over schools that did not. One could argue that this makes the RCT element redundant.

[4] ReflectED

Within the literature, is it then possible to say that judgements in confidence of knowing pupil progress, in connection with metacognition can ever really be known? How can we ever get inside the minds of trainees or pupils and see for sure? Effective estimation of uncertainty and confidence crucial for adaptive behaviour (Pieschl et al., 2023), and mis-calibrated confidence can lead to errors in judgements (Larkin, 2023). There are studies relating to perceptual reality monitoring, decision making and memory that date back several decades, however, recent studies in the last decade using functional magnetic resonance imaging (fMRI) have revealed positive results. Miyoshi et al., (2024) published a study identifying a neural basis for confidence judgments in decision-making processes, highlighting the role of brain regions like the prefrontal cortex, in the role of confidence in guiding adaptive behaviour, effectively bridging metacognition to consciousness research. This has implications for not only trainees gaining confidence to unpack their understanding of how well their pupils are learning, but also, of course, pupils gaining confidence in understanding how they learn, in other words, becoming more proficient in metacognition – that proposed silver bullet to close the attainment gap discussed earlier. Perhaps future research will bridge the gap further to measure confidence in decision making as improvements in technology and artificial intelligence continue, although there is an inherent risk of missing the crucial element of perception and constructivism if we try to capture metacognition as a positivist reality. For now, in the classroom, I will use surveys results and coded interviews to measure self-reported perceptions.

To what extent teacher trainers may have fixed beliefs or misunderstandings into the nature of metacognition is relevant in the literature as we have seen. Will it be as relevant in my organisation? At the beginning of this review of literature, I defined metacognition, temporarily, as thinking about thinking, following the description by Flavell, (1979). Mannion (2018, pp 2) defines metacognition as:

> *“….monitoring and controlling your thought processes….”;*

self-regulation as:

> *“….monitoring and controlling your emotions and behaviours….”;*

and self-regulated learning as:

> *“….the application of metacognition and self-regulation to learning….”*

This leans heavily on a definitions by Schunk (2006). I believe he has a point, as self-regulation did not develop from metacognitive theory, it developed separately as a social cognitive theory (Schunk, 2006). Of, course, as Dinsmore et al. (2008) pointed out – the language of self-regulation is similar to metacognition, in terms of monitoring and controlling, and so perhaps comparisons were inevitable. I will move forward, for now, with these definitions, from a review of the literature.

The existing body of research on metacognition as we have seen, is varied and as a learning theory, it has undergone many iterations, which have approached learning, and outcomes, differently. However, terms that have meant different things when coined have been used interchangeably amongst nearly half of all academic peer-reviewed articles. It is inevitable that teachers will have different ideas of what metacognition is, and as national support was only in the form of domain-general, rather than domain-specific, is its efficacy blurred by teacher misconceptions of the latest research? A more comprehensive understanding of factors that contribute to a lack of formal practical use in my own organisation, and the current status quo, provided a grounding to create an intervention. My own research faced challenges as trainees were dispersed across different schools. As Menter & Thompson (2018) point out, there can be difficulties due to differing policies, cultures and practices. The hope was that metacognition's usefulness to trainees, and by extension their pupils, could be tested in the field, within the parameters of how my organisation works at a national level. I have the opportunity to uncover stimulating educational possibilities (Claxton, 2021). Considering both the review of literature and the context in which I am working, I believe my study should be guided by:

A deeper understanding of my own organisation by discovering:

A. What are the personal views of the DLs regarding metacognition in questioning?
B. How well is it understood?
C. Is metacognitive learning as questioning occurring in our schools?
D. Are there any potential barriers to the success of the intervention?

Using that information, and the review of literature, I hope to be able to explore the following core questions with the intervention:

1. Do trainee teachers feel more confident in their understanding of pupil progress using the metacognitive questioning in the intervention?

   Additionally:

2. Do trainees feel more confident generally, as Year 1 teachers, as a result of using metacognitive questioning?
3. Do trainees perceive a better understanding of difficulties faced by pupils, in using metacognition?
4. Do trainees feel that their pupils are becoming metacognitive learners?

Methodology

I knew that the intervention would not be straight forward and involve a number of ethical and logistical problems. Having studied the varying disagreements in the ‘methodology wars’ of quantitative or qualitative (Meyer et al., 2010), I did not want to approach the task primarily from an ontological or epistemological point of view, and then use the best fit methodology, quantitative or qualitative (Mason, 1996; Gorard & Cook, 2007; Creswell & Plano-Clark, 2018). I wanted to capture data at scale, and I wanted to have a descriptive window of narration on that data. Mixed methods seemed the most appropriate method for both purposes. Indeed, Smith et al., (2016) point out that mixed-methods can produce rich explanations that neither method can produce on their own.

I wanted to capture the practices of my colleagues quickly using a quantitative survey, and then use a smaller number of qualitative semi-structured interviews to understand nuances and meaning – clues to what the data held. I would then plan an intervention taking this first phase of data into account. I felt that my first focus was finding the best instruments and questions to obtain those results, rather than being led by philosophical arguments. Ontology could come second to the importance of getting the right intervention that would have impact for the trainees and their pupils, as well as my colleagues and wider organisation. As Gorard & Taylor, (2004) put it, I did not want to put the cart before the horse with a fixation on either Ontology or Epistemology before the instruments of data collection.

Ontology and epistemology

With methods decided, a constructivist ontology and interpretivist epistemology using mixed methods with explanatory sequential design was used. It acknowledges the subjective nature of confidence, and explores the complex, interpretive processes trainee teachers engage in. By focusing on the personal experiences and perceptions of trainee teachers, this approach facilitates a deeper understanding of the intervention's impact on their confidence levels of understanding pupil progress. The importance of well-designed research was vital as design is ethically obligated to show quality (Cohen et al., 2018). I felt that it was critically important to measure or attempt to understand the subjective meanings that are linked to actual experiences of the trainees (Schwandt, 1994). This meant that a positivist, fact-based investigation was not suitable – as it was perceptions rather than facts that were the focus. I chose Likert scale to measure perceptions (Fink, 2017) with qualitative semi-structured interviews (Seidman, 2013; Creswell & Plano Clark, 2017), capturing the ‘why’ elements within an interpretivist epistemology. Here knowledge can be gained by understanding the subjective meanings and experiences within trainees’ individual contexts. The methodology to be employed was cross-sectional over one week for DLs, with a longitudinal intervention over three months for the trainees, culminating in a final week of fact-gathering with the trainees.

I would argue that the philosophical perspective of social constructivism is particularly suitable for investigating and understanding trainee confidence in their perceptions of both pupil progress and engagement as it is well aligned to the dynamic and interactive nature of a classroom. Constructivists argue that knowledge is mediated by human perceptions and social contexts, making it inherently subjective and constructed. Approaching any data collected through the lens of interpretivist epistemology would naturally focus on understanding the subjective meanings and experiences of trainees within their specific contexts. The hope is that I can understand the interactions and personal experiences of trainees, and how they interpret their pupils' progress and engagement, allowing for nuanced understanding of the complexities of interactions within a classroom.

Ethics

Ethical research must be original, significant, and rigorous, guiding research that creates positive effects for both individuals and society (ESRC, 2021; Gearon & Parsons, 2019). Ethical considerations punctuate the fabric of the fieldwork from beginning to end as we will see.

As a Development Lead with new teachers and students at a university, I have the privilege to not only impact teacher development, but young people's learning too. I hoped that I had a significant opportunity to contribute to my organisations', and partner school's society (Walford, 2001) and trainees by choosing this project to examine metacognition..

The University ascribes to the Research Excellence Framework (Hobbs & Roberts, 2016) as do all HE institutions. Functioning alongside this is the Department of Education Research Ethics Committee (DREC) and with significance to my intervention, the Central University Research Ethics Committee (CUREC).

At each step of the design, a situational approach to integrating ethical consideration was required. There are significant deontic safeguarding considerations to consider in both schools and teacher training. I ensured that my research was ethically carried out by gathering informed consent from participants ensuring transparency and confidentiality with respect to the scope and purpose of my research (Guillemin & Gillam, 2004) issued to participants online, before participation. DLs and trainees needed to navigate several pages of information, before they could agree to participate. These were taken directly from templates, pre-approved by CUREC and guided by my supervisor, relating to the research title, survey and interventions, avoiding harm arising from participation incentives, the right to participant withdrawal, protection of privacy, disclosure and the storage of data.

CUREC consent was applied and obtained before any fieldwork began, reference: EDUC-C1A-23-336.

First Collaborations

The dissertation requires a collaboration. I felt it was necessary to carry out two ‘sets’ of collaborations with a third to be carried out some time after the end of the dissertation, following write-up to share findings and explore possible changes to practice within my organisation. I have viewed each set of collaborations as either operational – with staff to facilitate the event to happen, or strategic – with senior staff to agree on the scope and frame of reference and ethics of the intervention. At no point did I receive assistance in terms of ideas for the content, suggestions for improvement, or analysis of results. Arguably the information gathering with the DLs was also a collaboration, but as no conversation directly relating to an intervention occurred, I have not highlighted DL survey and interviews prior to the intervention as a collaboration, per se.

The first collaborations effectively began after my interview for the role of DL, before I accepted it. On July 3rd 2023 I began discussions with the Programme Support Manager, Programme Support, (now Leadership Delivery) South East and South Coast. I received an ‘in principle’ acceptance. The initial idea was to onboard a number of schools, so that both Headteacher and mentor support would be in place to monitor a gradual roll out of the intervention in one area. The next step was a conversation with the CEO in early September, advice on the best steps forward in terms of approvals from Support Manager - Programme Delivery London Hub, before a series of meetings with the Research and Knowledge Manager - Strategy & Impact Division, on September 11th and September 14th. This was the first of two slight changes of course, required to meet ethical requirements, the needs of my organisation, and the ordinances of the MLT course at the University.

My supervisor at Oxford had already discussed the need to have a separation between research subjects, and my own portfolio. Part of my role is to recommend QTS if standards are met by trainees, and this recommendation then goes directly from me to my organisation and on to the DfE. Not only could it impact results, but there would be a potential conflict of interest if trainees felt obliged to give certain answers to the ‘gatekeeper’ of their QTS. Ethically, I could not just use my own portfolio of trainees as my research sample.

My meeting at my organisation also brought up an additional ethics consideration. It was felt that there should be a hands-off approach to trainees. After discussing the best methods of communication, it was decided that trainees could be recruited via a message in the fortnightly trainee bulletin. Concerns were raised about focussing on a small group of trainees with extra observations – it was felt that trainees should not feel ‘overburdened’ with ‘extra work’. Additionally, it should be stated clearly in the bulletin that there was no obligation for trainees to take part, and that they could withdraw at any time, the latter of which was stated in the CUREC documentation for trainees online. As Cohen et al., (2018) point out – being accepted as a researcher in the research setting was an ethical milestone. Whilst I had a ‘yes’ in principle, there was clearly some way to go. It was at this point that the Research and Knowledge Manager, Strategy & Impact

Division warned of a potential pitfall in the intervention. Surveys were issued regularly to trainees, offering the opportunity to win gift vouchers, but uptake was usually very low.

The following weeks saw a re-imagining of the project on my part based on the first collaborations with my organisation. The first change was that there would be discreet cycles. In the phase 1, I would gather opinions, practices and insight from my colleagues as to what is happening currently. The intervention would require an exceptional 'carrot' for the trainees to take part, and ethically, it had to be delivered in such a way as they did not feel overburdened, and that it was highly actionable – without me being directly involved, again due to ethics considerations in phase 2. From timings, the phase 2 methodology would be a longitudinal quasi-experiment over three months. I hoped that for trainee teachers, this approach would facilitate capturing the rich, contextualised experiences of their teaching practices and pupils' interactions, allowing a deeper exploration of how, or if, confidence in understanding progress could be afforded.

The different phases of the fieldwork

Figure 5 - Fieldwork

Finally, in phase 3 the trainees would be reviewed for confidence in their understanding of pupil progress and engagement using metacognitive strategies – but it would have to be a large group to offset a forewarned low response. Measurement might well be aggravated by the reliance of not only trainees completing, at the very least, the phase 3 surveys, but in the complete reliance on self-reporting. In the next part of the 'first collaboration,' on October 3rd, a nationwide research and intervention project was signed off by my organisation.

Phase 1 Understanding the practice of DLs Nationally

For the intervention to be as successful as possible, information from DLs regarding current practice was essential. I know the precise references to metacognition that is in training materials, but in observations and feedback, DLs have

autonomy to use their own expertise, without a survey and sample interviews, I had no idea what was actually happening in schools nationally. Additionally, whilst the third set of collaborations would be outside the timespan of this thesis, I knew that initial DL involvement would ignite interest amongst my colleagues, and if the intervention was to add real value to my organisation after it was complete – I would need the DLs on-board in any future roll out across the organisation.

Ethically, I wasn't restricted to contacting my colleagues via the DL fortnightly bulletin, so I was able to email all DLs, and word of mouth spread across the MS Teams network meaning that 51% of DLs took part in the initial survey, and 14 signalled a willingness to be interviewed.

Data gathering with DLs

Data was captured online. DLs were first presented with information as per the CUREC process and agreed electronically to take part. They were then asked to complete a four-part Likert scale with 'Strongly Disagree' 'Disagree' 'Agree' and 'Strongly Agree' options. Finally, they were asked if they consented to a follow-up Teams call interview. The survey questions are listed in Table 2.

Table 2 - DL Survey Questions

Q1. I think classroom questioning techniques are crucial as part of overall pedagogical practice.
Q2. I believe that metacognitive feedback in classroom questioning enhances pupil learning.
Q3. I believe that metacognitive techniques can enhance pupil motivation.
Q4. I believe that self-regulation plays a crucial role in facilitating metacognitive practices in both classroom learning and homework.
Q5. I explore metacognition in visits and discussions with my trainee teachers.
Q6. I encourage my trainee teachers to engage in reflection about their own teaching practices and classroom management.

In questions 1-4, DLs were asked to express their personal views, in an ideal world. In questions 5-6, DLs were asked to reflect on what they did in schools. I wanted to examine Dignath & Karlen's (2023) view that teacher self-efficacy is positively associated with metacognitive practice, but the correlation between beliefs and practice is inconsistent. Questions were posed in this way to examine belief systems separately from practice. The key question as to what is happening in schools is Q5. Q6 is designed to cross reference if DLs are employing any form of metacognition with

trainees, here in the form of reflective discussion, even if metacognition is not happening between their trainees and pupils.

Quantitative Methods

My Likert scale avoided neutral choice possibilities - with an even number of options - participants had no ‘sit-on-the-fence’ choice, and therefore made binary choices, and degrees feeling.

More nuanced results could be explored by a six-point scale, with three degrees for both positive and negative, however, I decided to choose a 4-point scale to reduce risks of cognitive overload and survey fatigue (Nemoto & Beglar, 2014). I created six questions which allowed for statistical triangulations of participants answering similar questions in a similar manner, with correlation tests to examine if pairs of correlation existed. The questions did not seek to incorporate falsifiability (Popper, 1959). I was not attempting to prove scientific theory but explore perceptions using descriptive statistics.

I used description and inferential non-Bayesian statistics to seek patterns from ordinal data, and used the University IBM SPSS statistics programme to test relationship correlations between pairs of variables (Field, 2013). For visual representations of data, I used a mixture of SPSS, and Datawrapper, to experiment with using charts and data representations to tell the story of the data in an entirely anonymised format. I used a non-parametric measure, using Spearman's rank correlation coefficient,

The equation used was:

$$\rho = 1 - (6 * \Sigma d^2) / (n * (n^2 - 1))$$

Where:

ρ = Spearman's rank correlation coefficient

Σd^2 = sum of the squared differences between the ranks of each pair of observations

n = number of pairs of observations

The value of Spearman's correlation coefficient ranges from -1 to 1:

I used the following for interpreting the magnitude of rho – a small correlation between variables as 0.2 and 0.35; medium from 0.35 and 0.65; and large above 0.65 (Cohen et al., 2018).

Qualitative Methods

To explore the findings further I followed the survey with semi-structured interviews (Walford, 2005; Patton, 1990). I would start the conversation with prompts and probes based around the original questions from the survey, to help with fluency of discussion, without being suggestive of content in any way (Cohen et al., 2018 pp513-514).

I used the University NVIVO software in the qualitative analysis to process coding and keep interview data within the University's software systems. MAXQDA24, ATLAS, and Visme were later used to process anonymous percentages to help tell the story in the data.

Phase 2 National intervention with Year 1 trainees

The results from the DL surveys and interviews gave me a picture of what was happening within my organisation – that will be discussed in the findings and discussion section. Suffice to say at this point, I wanted to investigate the full range of questioning that was likely to be possible through a downloadable document.

Questioning and feedback toolkit

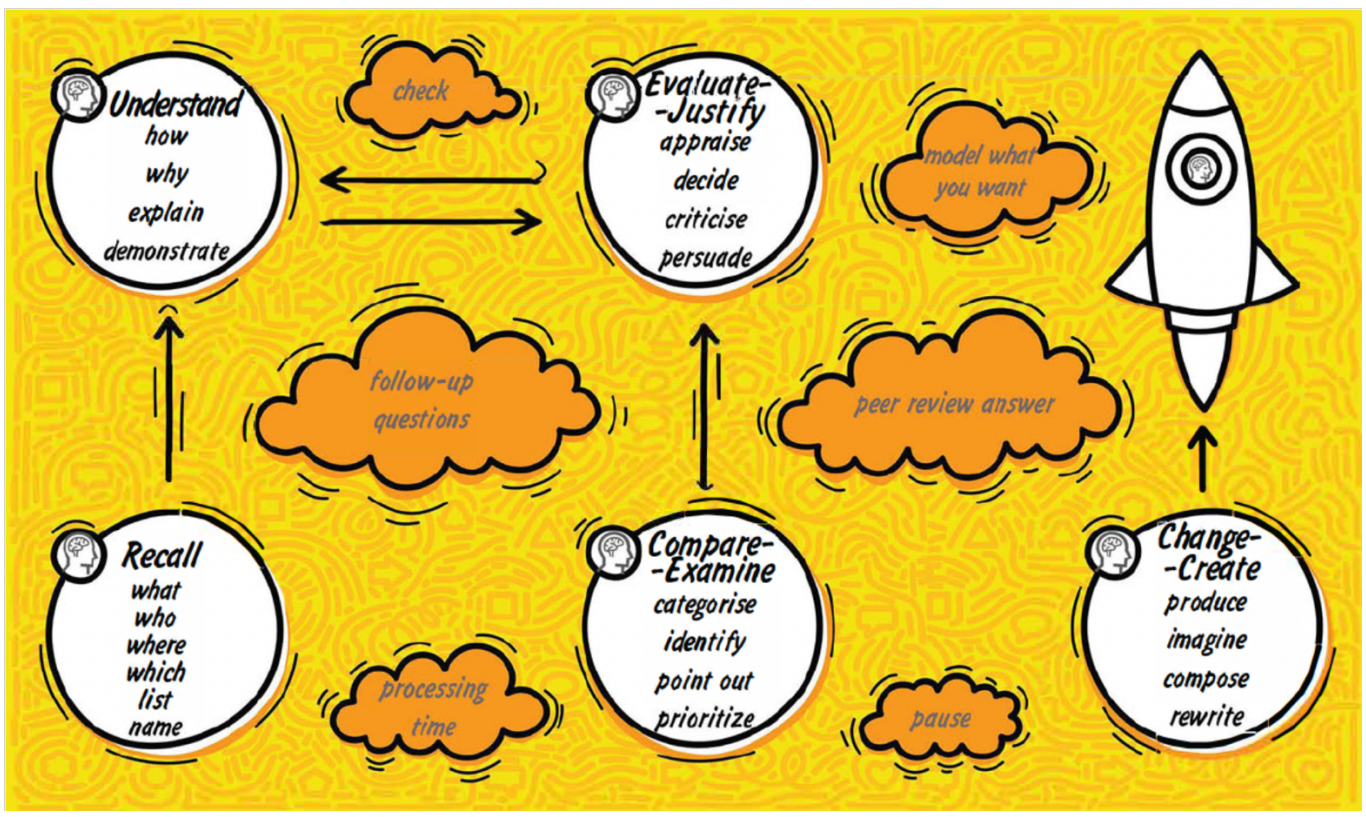
Trainees were often asked to reflect in organisational surveys, and I did not want them to associate the toolkit with those, in case it reduced downloads. To that extent, a range of metacognitive questioning from Flavell's (1979) model which included metacognition experienced as conscious or sub-conscious; to prepared reflective metacognitive questioning; and through to SRL influenced strategies, were used. I did not want to get trainees fixating on what metacognition was in depth, and instead concentrated on the methods and domain-specific exemplars in the toolkit. Two verbal questioning strategies were created for the toolkit. The first is very much teacher-led, the second is pupil-led in pairs as a lead-in to contributing to class discussion. One written feedback strategy was created for the toolkit, targeting pupil written reflective metacognitive and self-questioning in 'Get them to Reflect'. The latter employ elements of the deliberative acts of planning and reflection in SRL (Zimmerman, 1989), whereas the former is more attuned to Flavell's (1979) original model with scaffolding from Bloom's taxonomy (Anderson & Krathwohl, 2001).

Class questioning

The first element of the intervention is based entirely on class questioning, with the emphasis of moving trainees from cognitive closed questions to open questions that gradually require more metacognitive elements. Here pupils would be asked to answer deeper questions, justify their answers, and use the interactions of metacognitive experience (Flavell, 1979) with other aspects of Flavell's model, whether conscious or subconscious to develop their answers, and understanding. The trainees are already familiar with using a mini whiteboard (MWB) to capture snapshots of understanding and progress. The aim of the deeper questioning is to capture a rolling assessment. Trainees could investigate understanding in more depth, scaffold questions based on individual pupil development and needs – in short – with practice, improve their confidence in understanding pupil progress.

Based on feedback from DLs in Phase 1, additional support in questioning was created using a simple structure – see Appendix 1 which was based on Bloom's taxonomy (Anderson & Krathwohl, 2001). Trainees would start with *recall* questions such as what or where; before follow-up questions on *understanding* questions such as how and why. Questions could then flow between understanding and evaluating or justifying such as appraise or persuade to augment the metacognitive elements. Other starting points were introduced such as compare and examine or change and create which would be adaptable to all subjects, or which the latter is intended to show some level of mastery such as composing a final line of poetry or rewriting an equation after the questioning or indeed during it. Familiar language that trainees were already aware of was baked-in such as 'processing time' or 'pause' in lower visual clouds with higher clouds presenting new concepts such as 'peer review answer' in the Toolkit – see Figure 7 – questioning template.

Figure 7 - questioning template



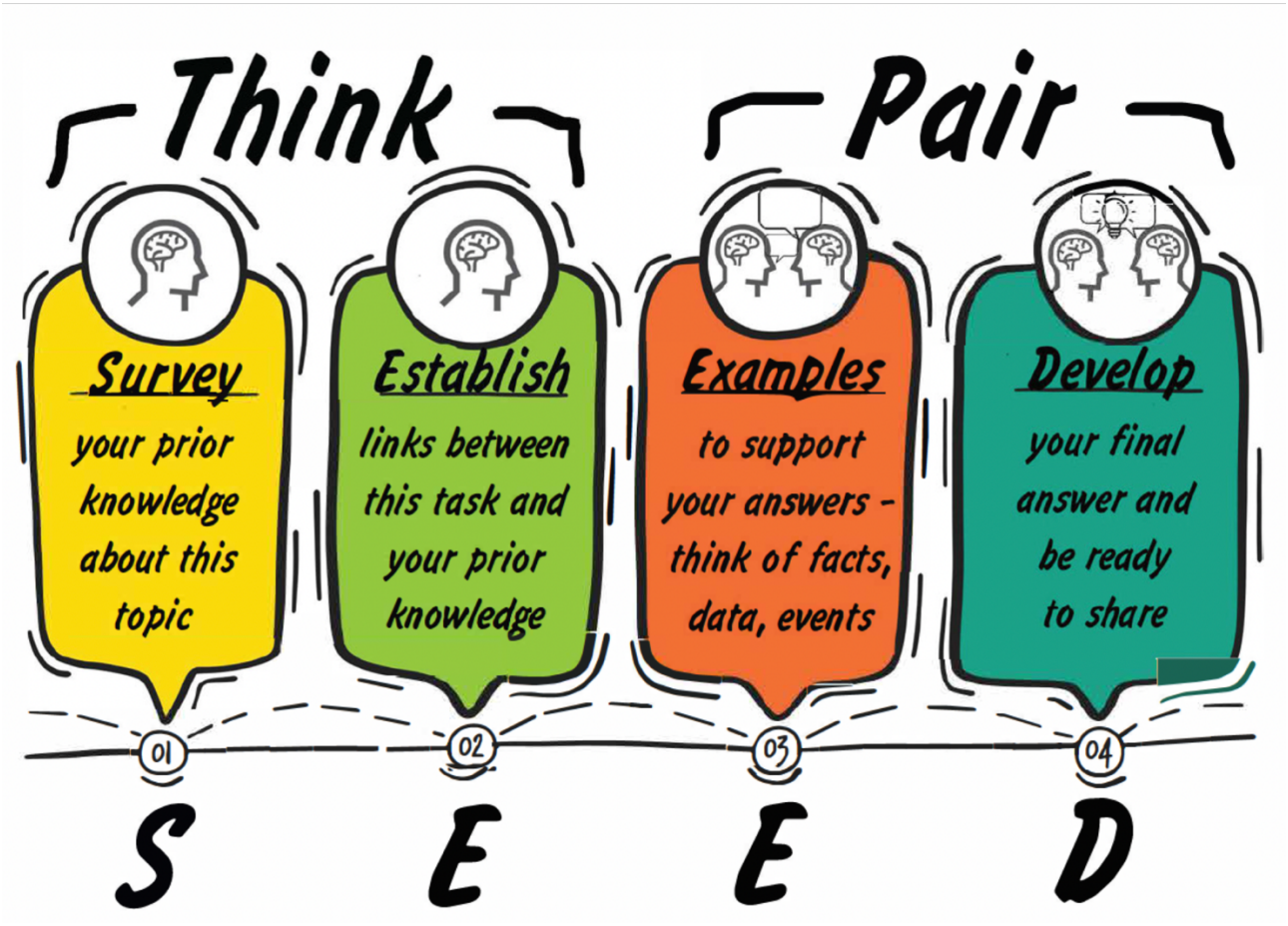
Bloom's taxonomy has been criticised as being used as a hierarchy (Booker, 2007). There is a criticism that upper levels more valuable than lower levels. However, I would argue that this isn't entirely fair as the original taxonomy (Bloom,

1956) did not argue in favour of a linear progression in learning. Certainly, the recall questions are just as important as any other in building knowledge. My plan was modelled on the revised taxonomy of (Anderson & Krathwohl, 2001) to include the ‘create’ grouping, and I made the plan more geared towards an upward trend in grouping complexity to activate metacognitive questioning as to how certain answers were arrived at and how different interpretations could be made, rather than a linear hierarchy from ‘recall’ to ‘create’. Nevertheless, a linear progression is possible, and indeed an example script of this in practice was also provided as well as further instructions for use – see Appendix 1 and Appendix 2.

SEED

This was conceived again following beliefs from DLs regarding trainee metacognitive use. SEED uses a collaborative structure, to provide a scaffold for trainees to have some observational time, rather than the ‘in the moment thinking’ of teacher questioning. Beech (2023) pointed out the importance of classroom dialogue and has cited ‘think-pair-share’ as a useful strategy to allow pupils to think about a question, discuss it in pairs, and then share their findings. I created the concept of SEED to merge think-pair-share into the dialectical constructivism of SRL. This exploratory talk and dialogue in pairs can improve learning outcomes and reasoning skills (Mercer, 2016) and I wanted to add reflecting on past learning experiences and adapting strategies (Quigley & Stringer, 2018) as a key metacognitive strategy here.
Pupils would relate a new situation to their prior knowledge with problem-solving, actively engaging with the new information, contrasting it with what they know, and developing it to form a fresh understanding in four stages – see Figure 8.

Figure 8 - SEED



After pair-work pupils feed back to the class, led by the teacher, which would then be completed as a highly scaffolded whole class questioning exercise, but with prepared discussion to support the trainee and pupils alike. I was interested to discover pupil reactions to SEED in this regard, and if this type of whole-class metacognitive questioning works.

See Appendix 3 -9 for some of the SEED pages in the Toolkit. There are subject specific pages with precise examples to give trainees more support, following research that suggests higher efficacy in domain-specific baked-in deployment (Kramarski & Heaysman, 2021).

Get them to reflect

This element of the intervention was again devised following the results of Phase 1. Pupils will self-question and reflect on how they have used metacognition, and how they can improve – See Appendix 9. This sits firmly within SRL, and trainees were advised the strategy was designed to empower their pupils to think about how they are doing in a cycle of planning, monitoring and evaluation, which could occur regularly.

Second Collaborations

With the toolkit written, I met with the Head of Evaluation and Impact, Strategy & Impact, shortly after the beginning of term 2b to discuss and seek final approval for materials going to trainees and what I was asking them to do. As I had to use a bulletin– a newsletter – to reach and attract trainees due to ethical considerations, I negotiated top billing for the invitation to trainees with the Programme Support Manager – Delivery, in the last week of March to maximize its impact. This was then published and sent to all trainees following arranging the format of the copy with a Delivery Officer. Trainees began downloading the intervention from the beginning of April, and I arranged to collect survey results, and an invitation to interview, via the Marketing and Communications with the first results arriving in mid-June, and the survey closing at the end of the second week in July, with trainees implementing the intervention in a three month window.

Phase 3 Data gathering with Year 1 trainees

Phase 3 Quantitative Methods

The same methodology was applied as with the DLs. See table 3 for the questions.

Table 3 - Trainee Survey Questions

Q1. The resource pack has helped my confidence as a Year 1 teacher.
Q2. I feel more confident in understanding pupil progress using metacognitive written feedback interventions.
Q3. The resource pack has enhanced my understanding of the difficulties pupils face in learning to use metacognition.
Q4. I believe my pupils have become better at using metacognitive strategies as a result of my use of the resource pack.
Q5. The resource pack has helped me to better identify and correct misconceptions.
Q6. I feel more confident in understanding pupil progress using metacognitive whole class questioning interventions.
Q7. The resource pack has improved my confidence in understanding pupil progress.

Phase 3 Qualitative Methods

Again, the same format of qualitative methods was used in the interviews with the trainees, as with the DLs. I did wonder, despite the steps taken as described in the first set of collaborations, if the inherent dynamic between a teacher trainer and trainee teacher – the person interviewing and the person being interviewed – could impact responses (Walford, 2005) as there is always the risk of trainees wanting to impress, that could re-colour natural responses. Kitwood (1977) argued that an array of motivational elements could also impact results in such interviews. As Bruner (1999 pp19) said:

> *"knowledge is dependent upon perspective and that we share and negotiate our perspectives in the knowledge-seeking process".*

The survey questions would be the basis of the interview, with the following semi-structured questions to guide interviews as appropriate.

Third Collaborations

The third collaborations, as with the number in the first and second, is not necessary for the dissertation, and in fact the third lives beyond it, insofar as it will not take place before the end of 2024. This will be a feedback session online to DLs as part of the charity's 'Lunch and Learn' PD spots that I will host. As Cohen et al., (2018) point out – reciprocity is key to ethical research. The hope is that this dissertation, and the research and fieldwork within it, will benefit the organisation that has permitted the research to take place across its framework.

Findings and discussion

The phase 1 quantitative survey was taken by 37 DLs, from a population size of 72 nationally, representing 51% of the population. From this, a follow up qualitative individual interview was undertaken by 14 DLs amounting to 19% of the population size.

At the beginning of the intervention 127 trainees downloaded the phase 2 intervention toolkit, with 108 completing the phase 3 survey three months later, representing 9% of a population of 1159. This suggested a drop-off of 15%. I was assured by research staff in my organisation, that this was common, in fact, surveys direct from the organisation achieved a slightly lower rate of uptake, despite offering the possibility of winning gift vouchers. I imagined that as the toolkit included ‘easy to use’ materials to boost confidence in understanding pupil progress, uptake was better than routine company surveys requesting feedback on seminars that had already taken place.

This meant as an estimate based the on number of schools and number of trainees, the intervention was carried out in 70 – 100 schools nationally. From this, the follow-up qualitative series of interviews was carried out with 12 trainees, representing 1% of the sample population.

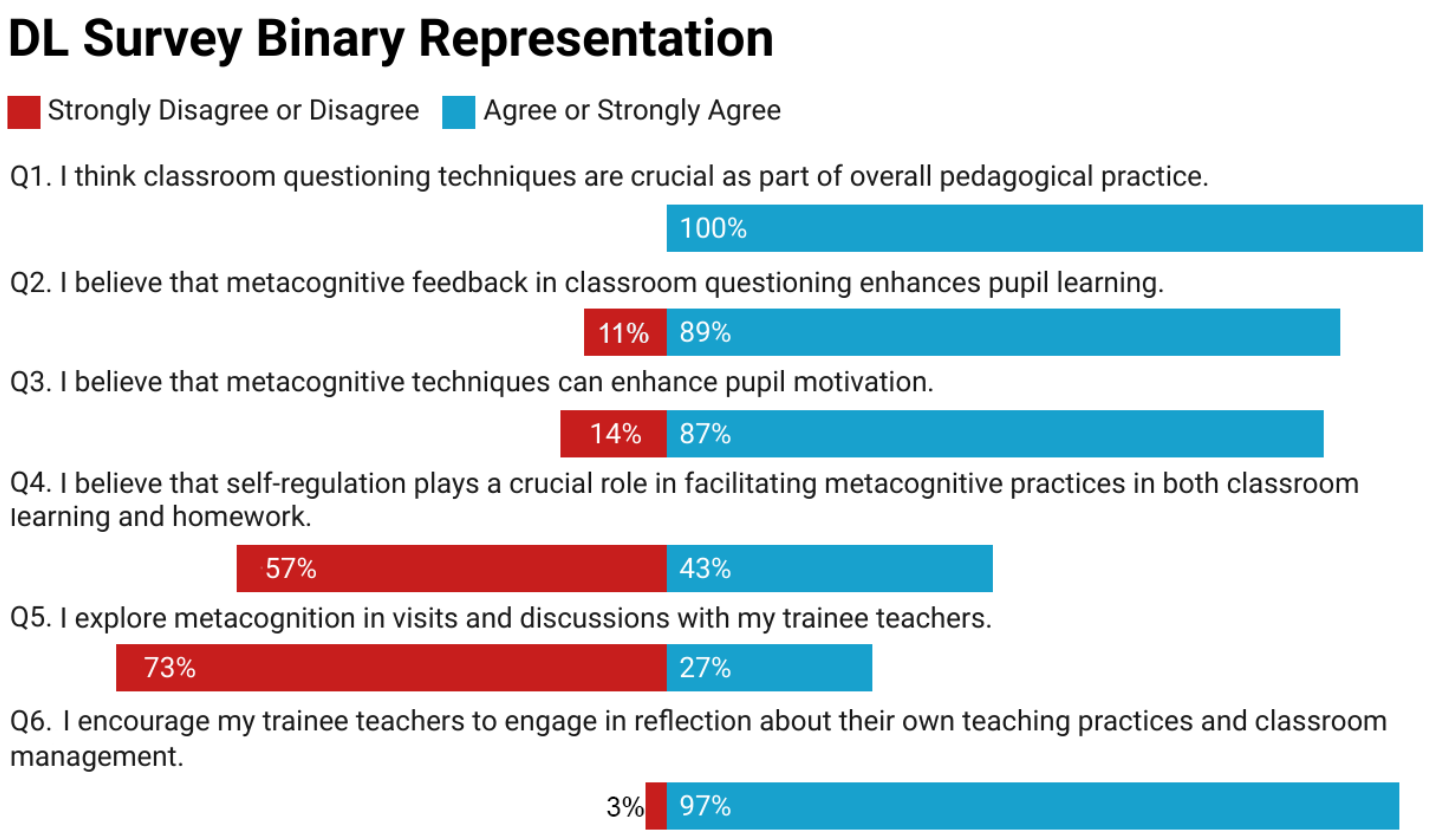
Both quantitative surveys were regarded as highly targeted, direct to teacher trainers in my organisation, and direct to trainees trained within my organisation’s school network. Cohen et al., (2018 pp 207) recommended resources to calculate target sample sizes, which in I also used to calculate confidence intervals, and therefore margins of error to check the statistical rigour of the results. Applying a confidence Level of 95%, a sample of 37 DLs from a population produced a confidence level of 11.3%, and therefore a margin of error of 5.65% which is within the boundaries of academic rigour (Creswell & Plano-Clark, 2018). The trainee sample produced a confidence level of 9% and margin of error of 4.5%.

I will use descriptive statistics to analyse the quantitative results.

Phase 1 Data Gathering with the DLs – Quantitative Binary Analysis

Questions 1-4 relate to DLs own opinions and 5-6 to their activities in their role – see Figure 7. 100% of DLs believed that classroom questioning techniques are a crucial part of overall pedagogical practice Q1, yet only 27% guide their trainees to use questioning with metacognitive elements Q5, – see Figure 9.

Figure 9 - Binary Analysis

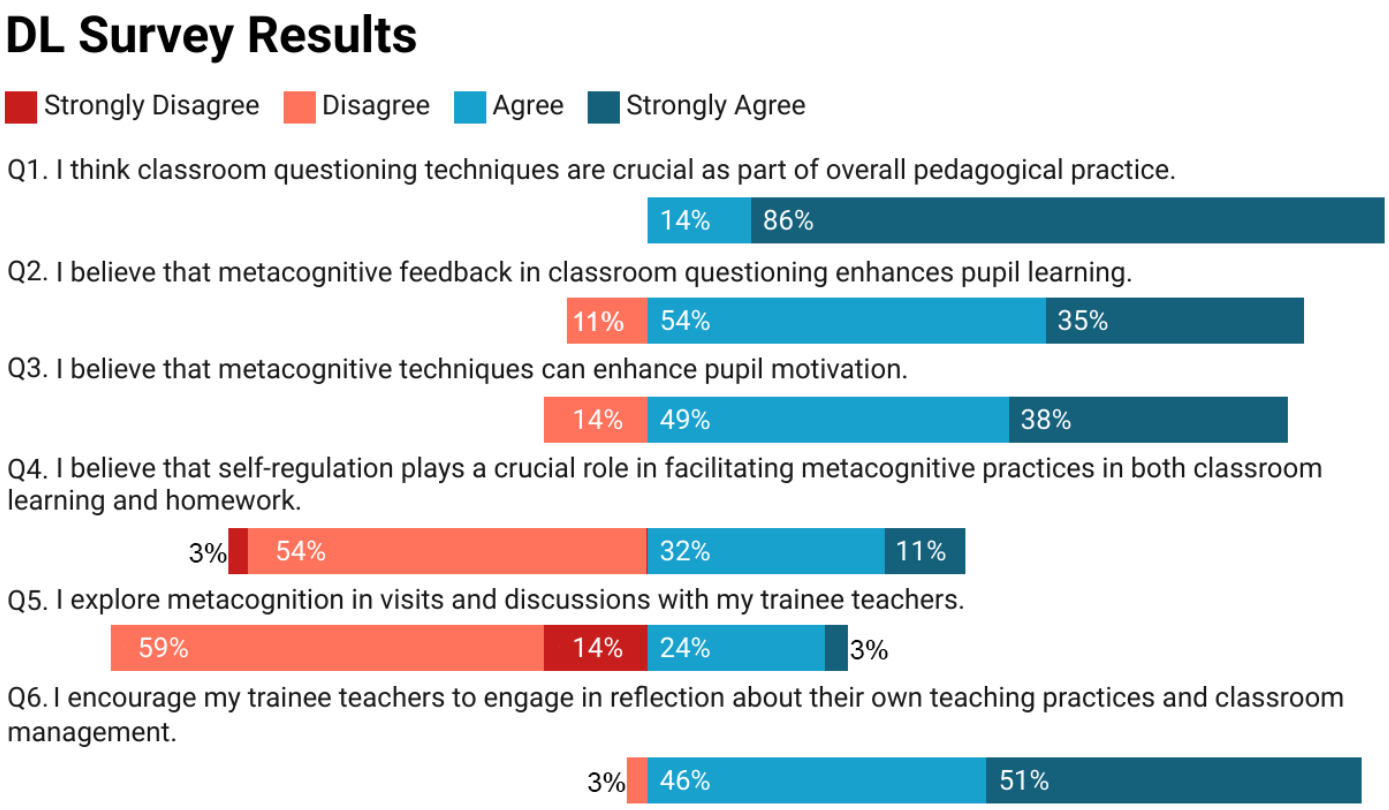


The figure is much higher at 97% for DLs that engage in reflection, and it could well be, DLs are actually engaging in metacognition with the trainee at least, without actually realising it as metacognition per se is potentially, misunderstandings of terms due to belief systems of the DL (Lawson et al., 2019). The negative 57% Q4 may well be connected with beliefs relating to the efficacy of homework or some other cause, as personal beliefs in Q2 and Q3 show a high belief in the value of metacognition in both pupil learning and motivation at 89% and 87% respectively. Compared with the action of training trainees in the classroom Q5 at minus 73%, there is inconsistencies between beliefs and actions in the classroom, supporting literature from Dignath & Karlen, (2023).

Phase 1 Data Gathering with the DLs – Quantitative Survey Results

Looking within the detailed break-down in Figure 10, the results are slightly less polarised in metacognitive feedback in classroom questioning relating to enhancing pupil progress, motivation, and the use of reflection with trainees, fairly evenly split between Agree and Strongly Agree.

Figure 10 - Quantitative Trainee Results



Phase 1 DL Quantitative Statistical Frequency findings

Across the questions asked, only one pair of replies showed a strong two-tailed correlation, at 0.712 – this could suggest that their answers given by DLs were potentially inconsistent, or there was a problem with the test – see Table 4.

Table 4 - DL Quantitative Statistical Frequency findings

Nonparametric Correlations

Correlations

			I believe that metacognitive feedback in classroom questioning enhances pupil learning.	I believe that metacognitive techniques can enhance pupil motivation.
Spearman's rho	I believe that metacognitive feedback in classroom questioning enhances pupil learning.	Correlation Coefficient	1.000	.712**
		Sig. (2-tailed)	.	<.001
		N	37	37
	I believe that metacognitive techniques can enhance pupil motivation.	Correlation Coefficient	.712**	1.000
		Sig. (2-tailed)	<.001	.
		N	37	37

**. Correlation is significant at the 0.01 level (2-tailed).

All recipients worked for the same organisation, and followed the CCF, despite a level of autonomy within their day-to-day work. It is possible the inconsistency was derived from metacognition meaning different things to different DLs.

Phase 1 Data Gathering with the DLs – Qualitative Interview Results

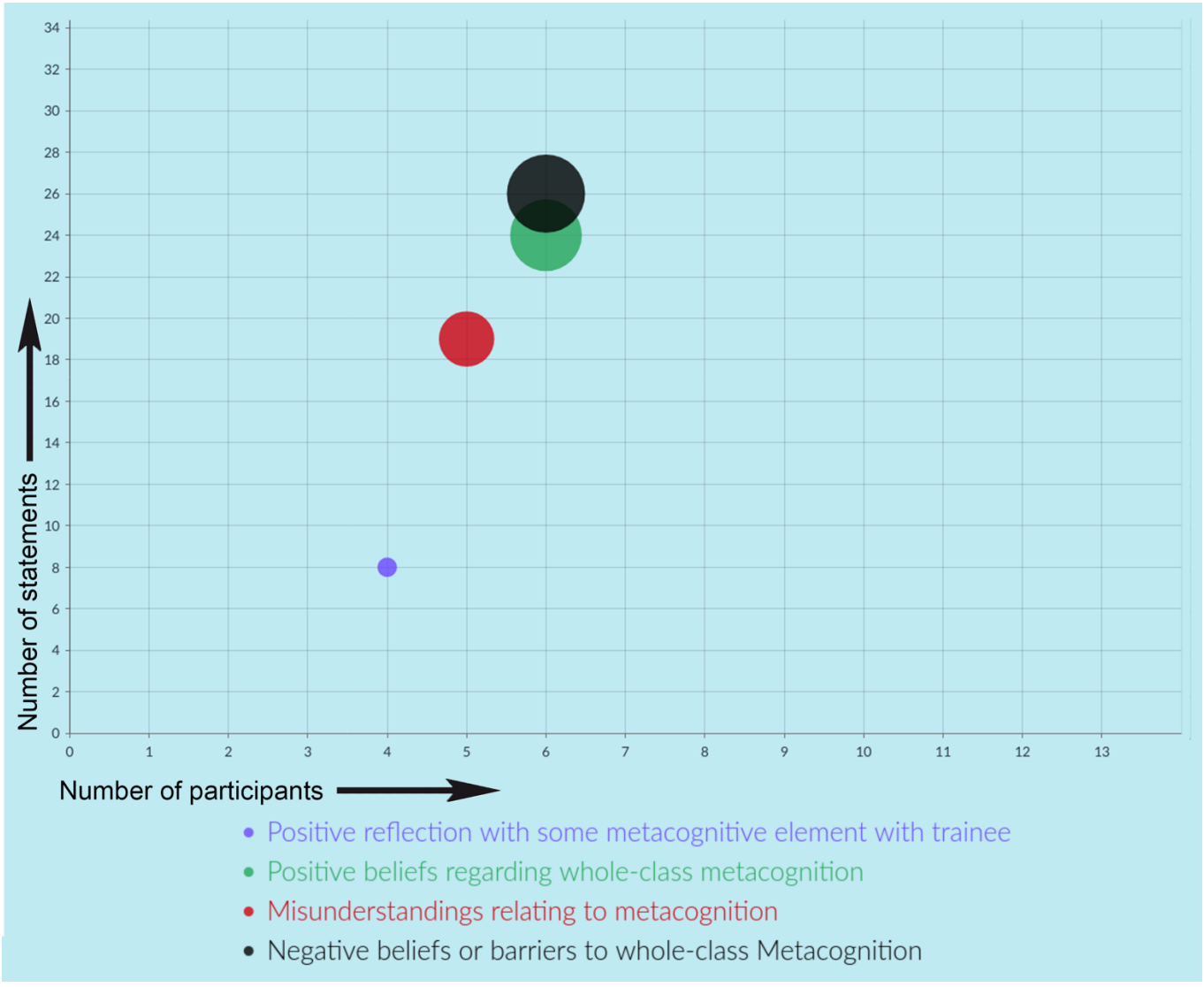
DLs who expressed that they were happy to be interviewed were contacted within days of the survey closing. If DLs ticked that they were happy to be interviewed, the option of leaving a contact email address was set up to appear in Qualtrix, followed by an MS Teams meeting. Whilst it was possible for me to identify most of the DLs by their email, the interviews were conducted formally. 14 DLs were interviewed representing 19% of the population size.

Once interviews had been coded, clear themes emerged in NVivo based on similarity of responses from participants. They were:

1. Positive reflection with some metacognitive element with trainee
2. Positive beliefs regarding whole-class metacognition
3. Misunderstandings relating to metacognition
4. Negative beliefs or barriers to whole class metacognition

Figure 11 is a representation of these themes. The X-axis shows the number of participants, and which themes all participants contributed to. Not every participant made a comment on every theme. Some participants felt that their views were the result of experience, or a gut-feeling. To explain the graph, six participants expressed negative beliefs or barriers to whole class metacognition. The Y-axis represents the number of separate statements made about each key theme, after the codes had been analysed, this matches the bubble on the graph - the greater the number of points raised by participants, the bigger the bubble. Taking the same example, 26 separate comments about negative beliefs or barriers to whole class metacognition were expressed by 6 participants. Conversely, 12 participants made 17 statements relating to their current reflections with their trainees that included some metacognitive element.

Figure 11 - DL qualitative frequency / magnitude



1. Positive reflection with some metacognitive element with trainee
2. Positive beliefs regarding whole-class metacognition
3. Misunderstandings relating to metacognition
4. Negative beliefs or barriers to whole class metacognition

<u>1. Positive reflection with some metacognitive element with trainee</u>

Four in the sample DLs expressed that there was some kind of metacognitive element to the work they were doing with their trainee, e.g., as a representative example:

- *"….she'll ask the students to really just explain how they came to that answer. She, challenges them to think about it…."*
- *"….the best way to give that feedback is to get them to see why things didn't work, um, and to get them to recognize things. So using that metacognition again, what was your thinking here? What were you doing there? Why what's the process? Um, what are the steps? Can you talk me through your thinking at this point? That's probably the where I use it the most…."*
- *"….So it's getting them to kind of question each step and why they would do the next part…."*

Thinking about getting trainees to develop questioning skills:

- *"….getting them to understand that just telling a child that they've got it right or wrong doesn't get them to understand why it was incorrect, or even more importantly, why it was correct and how they can then repeat that for the next question that comes up in an exam or the next essay that they're going to write…."*

Recognising the motivational aspects of metacognitive techniques:

- *"….metacognitive techniques can enhance motivation…."*

Curiosity and openness to team discussions on metacognition:

- *"….I'm kind of fascinated, actually, that, you know, this could be something that I should be doing more of or could be doing more of. And, you know, whether we can maybe talk about it as a team…."*

2. Positive beliefs regarding whole-class metacognition

Six DLs held positive beliefs regarding whole-class metacognition – some expressed the importance of shifting responsibility to the students:

- *"….It moves them away from the teacher being font of all knowledge, and always being the one to lead, if students understand their thinking, how to guide their own thinking, how to direct it, how their thinking works, then they're able to do it themselves. It's like that that adage about, you know, teach them how to fish rather than just giving them a fish…."*

Recognizing the importance of trainee metacognition to be able to support pupils:

- *"….they have to understand their own metacognition so that they can actually support the child in doing it…."*

Recognising the need for some form of metacognitive questioning in classrooms:

- *"….trainees need to start asking some form of metacognition question, because otherwise it's all very yes and no answers. And the children are, you know, becoming quite disengaged by the fact that they're not being made to think…."*

Desire for deeper engagement with metacognition within the training programme:

- *"….I think in principle, yeah, absolutely. I'd like to go into it with them in year one. And arguably if we had enough time, if we had more time with them, then perhaps…."*

Supportive belief that metacognition enhances learning:

- *"….metacognitive feedback in the classroom questioning enhances pupil learning…."*

Other comments were vocalised as their beliefs or 'gut' feelings, without specifics.

3. Misunderstandings relating to metacognition

Five DLs demonstrated misunderstandings relating to metacognition. A very common thread was confusion between the cognitive and metacognitive:

- *"….I encourage spaced practice questions with all trainees…."*

Confusion relating to teaching methods rather than metacognitive pedagogy, which can be very much teacher led:

- *"….self-exploration with the teacher being a guide has died out…."*

Misunderstandings in the form of thinking that all metacognition needs to be planned, and evaluated:

- *"….a lot of work doesn't need to be planned and reviewed, we encourage to follow the I do, We do, You do method….*

Confusion that metacognition is best as non-domain specific:

- *"….it is done best at form time and Year 1 trainees don't have a form…."*

Some had incomplete ideas about metacognition:

- *"….if they're marking an extended piece of writing in science or history I'll model how I would mark it I don't just tell them how to mark I and show them how I would consider what was the learning process the children should have gone through…."*

4. Negative beliefs or barriers to whole class metacognition

DLs had negative beliefs or reasons why it was not appropriate for Year 1 trainees. They were also the most vocal in terms of the number of comments see Figure 11. Some examples are below, for example, metacognition being in the realm of the best trainees only:

- *"….for those trainee teachers who are really taking a real strong, passionate view of teaching and improving…."*
- *"….I would say that this depends on the trainee. I think this is more for like those trainees that are already there. I would never introduce it with the majority of trainees…."*
- *"….it depends on what the needs of the trainee are…."*
- *"….in previous iteration of this role, I was working with both first and second years and I would be looking at metacognitive strategies with year 2, not year 1…."*
- *"….some of our weaker trainees, maybe we don't want to overload them with things that appear to be too complicated…."*
- *"….we only accept, don't we, trainees with really good degrees. And sometimes they're so naturally able in that subject that they can't unpick some of the misconceptions themselves to be able to allow the child to understand the thinking process…."*

- *"….I think that disconnect between me not necessarily going into depth with the metacognitive strategies with them, but thinking they're a good idea you know, I don't as it's more about the stage of student teacher…."*
- *"….we pick the highest leverage action to talk to them about in the main and that, you know, could be something to do with behaviour, could be something to do with assessment…."*
- *"….I'd say with all bar, perhaps the strongest trainees, it's maybe not something that I do explore with them in the first year…."*

Some DLs thought that metacognition is valuable to some subjects, more than others:

- *"….particularly powerful in subjects like maths…."*

Department expectations of what should be in a lesson was seen as a barrier to metacognition:

- *"….often it's about how can they make the best of the policy that they have in front of them…."*

This it is no longer fashionable:

- *"….metacognition was kind of bandied around as a kind of in-vogue phrase for a while, but it's not really in-vogue now…."*

One DL had similar opinions to Norman (2020):

- *"….it's like cognitive load on their pupils…."*
- *"….it's hard to get it right in a coherent sequence so that the questioning comes at the right time and that they don't overload the information too quickly…."*

Insufficient training and exposure to metacognitive practices - that it was not in seminars, and just in a brief portion of online training, NB a tab is equal to one page:

- *"….it's very sort of outskirts though, isn't it, of what they do, I think it's only a couple of tabs or something online, or maybe just one tab…."*

One DL noted that it was part of the programme several years ago:

- *"….I'm sure we used to go it back in the day. Maybe if you have a look around some of the older sharepoint files, you might find something in there…."*

All DLs whose responses included negative views or barriers, included a belief that many trainees were incapable of metacognition in class in Year 1:

The DLs from this group felt that deeper questioning was risky with classroom management :

- *“….they feel less confident when the questions that they're asking provides them with terms to explore discussion, because that's harder to manage classroom management wise….”*
- *“….if it's the difference between helping them be effective in their classroom and feel like they're meeting the expectations and keeping them out of trouble, I want them to stay in the classroom….”*
- *“….generally your stronger trainees can get to that point. Now, if a trainee is still struggling to get children quiet, then it it's not it's not the focus….”*

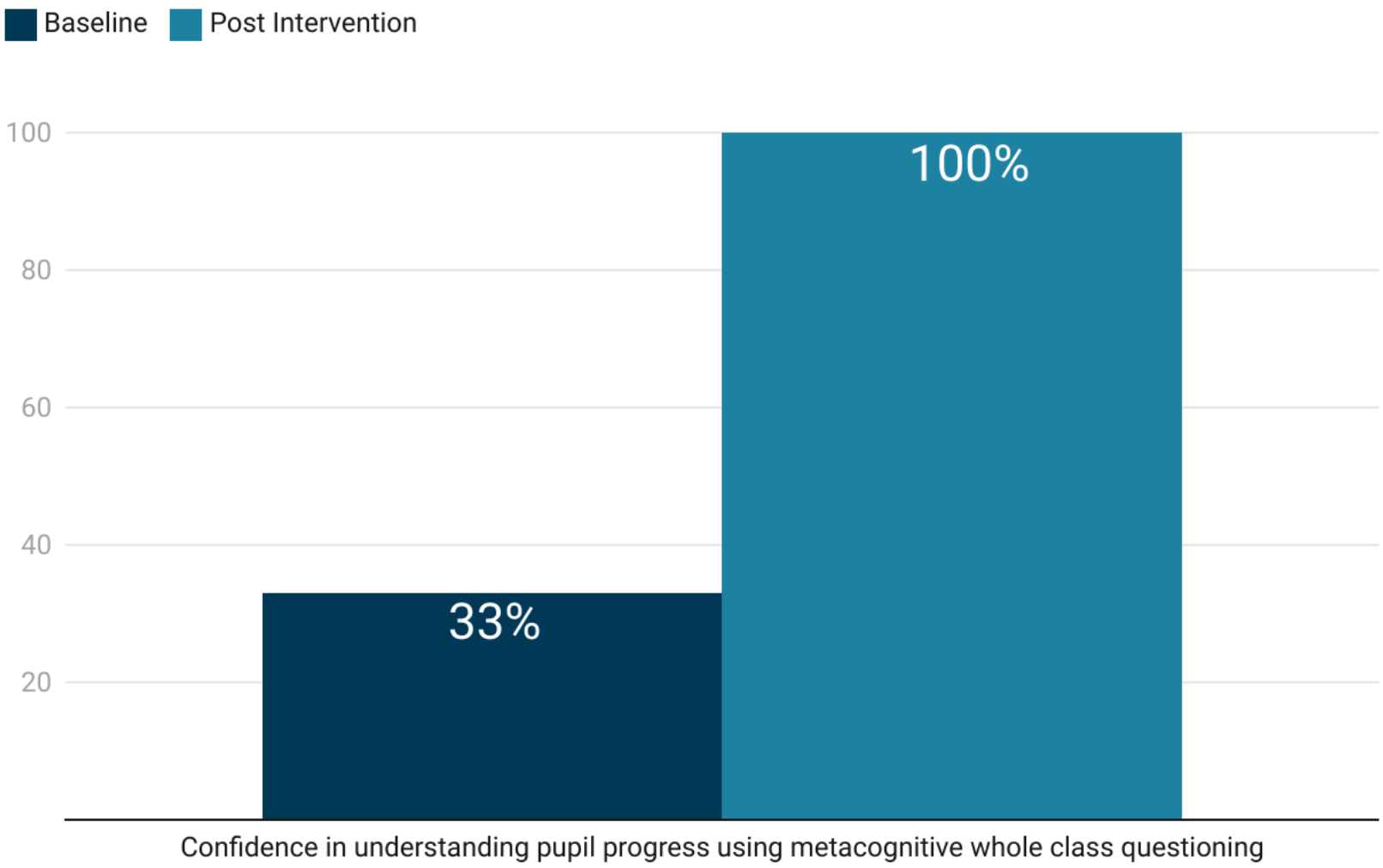
Structural and systematic barriers within the training programme:

- *“….the system's a bit broken because I know that in the long term, it's really helpful for them to see a range of things and for them to choose what is the right thing for their pupils, but only have an hour with them every six weeks….”*
- *“….My personal philosophy has to get put to one side….”*
- *“….I think it's I was quite surprised in the self-study that we were even thinking about introducing metacognition. Yet in that self-study session, being given like one page, I don't know, it's just strange. It’s big and we've just kind of given them a piecemeal thing in that self-study….”*

Phase 3 Trainee Quantitative Survey Results

Trainees self-rated their knowledge of metacognition as part of their initial interaction online, agreeing to the survey and its ethical considerations, and providing a contact email before downloading the intervention and it’s supporting documents. The original self-reporting of trainees immediately prior to downloading the intervention toolkit can be seen below in Figure 12. I felt that the 33% initial baseline could be explained by their DLs who may have independently worked on metacognition with trainees, or that some schools may have metacognitive systems in place. In hindsight I wish I had added a freeform text reply for a justification of answer at the point on download.

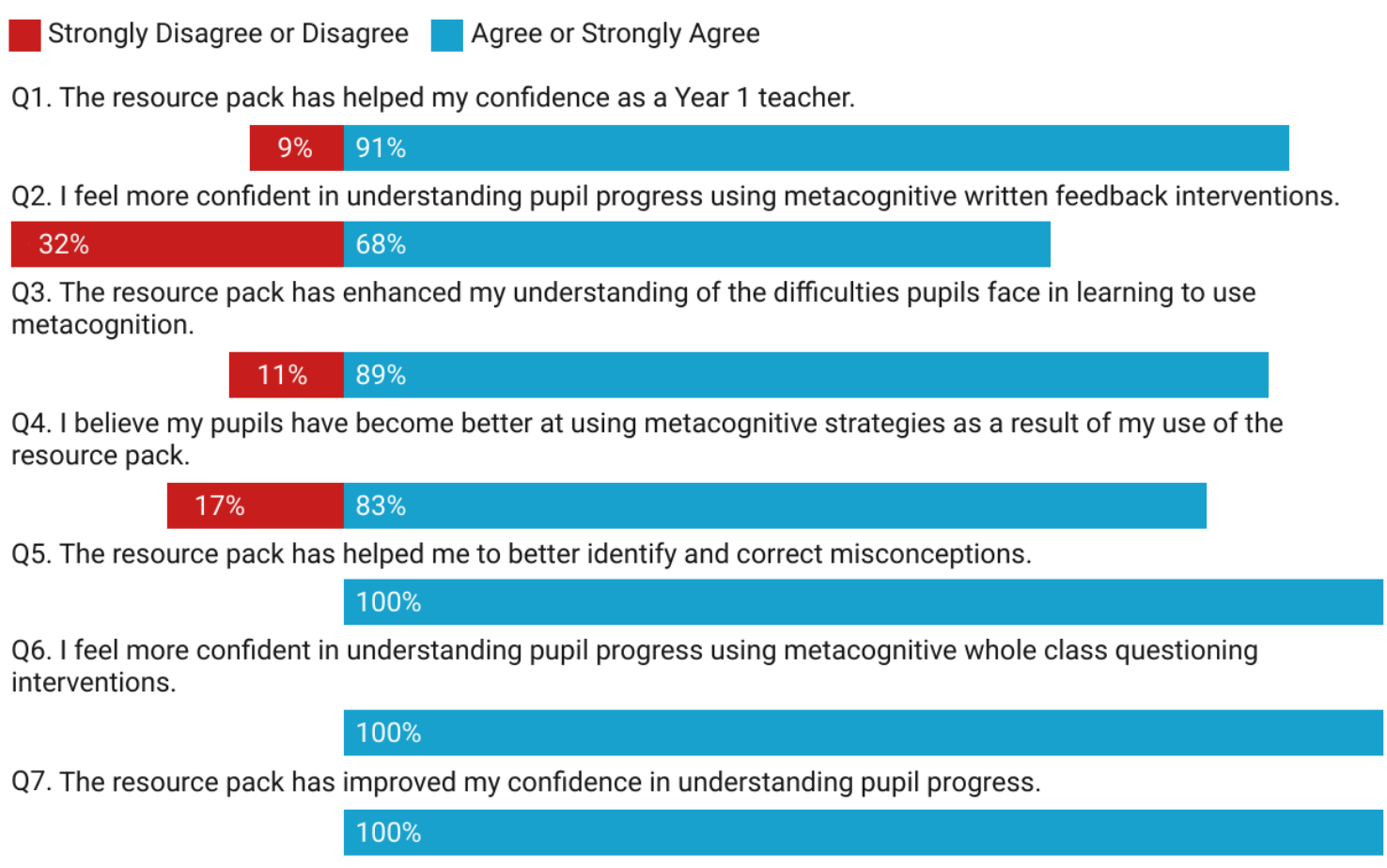
Figure 12 - Baseline v Post Intervention data



Phase 3 Trainee Quantitative Survey Binary Analysis

91% of trainees felt that it had helped their confidence as a Year 1 teacher. Given that the intervention focused on increasing confidence in understanding pupil progress, it was a wider, and very positive result. I felt this was a statement of greater magnitude in terms of confidence, than the 100% relating to metacognition across their entire practice see Figure 13.

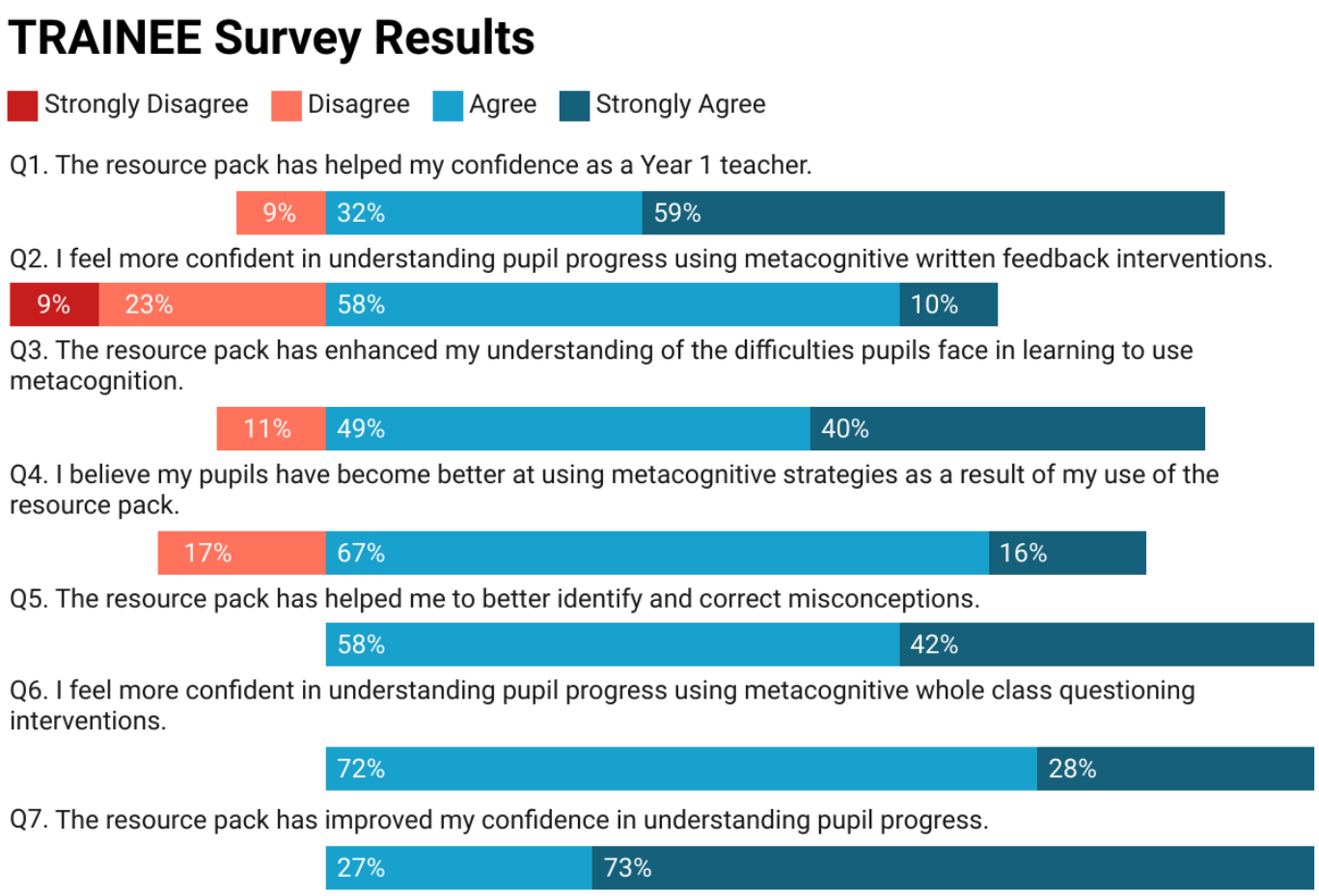
Figure 13 - Trainee Survey Binary Representation



Very high percentages were reported in trainees empathising with the difficulties pupils face with metacognition as opposed to cognition, and that pupils were better at using metacognition. The 100% score in trainees surveyed feeling more confident understanding pupil progress, as well as identifying misconceptions was again, unexpected. I did not expect such a positive figure, and that there would be more light and shade in the results. Within the trainee's constructs, they all felt that they understood how their students were progressing in their lessons. It will be interesting to see in the qualitative interviews, what adjustments trainees may have made to their teaching in those circumstances. The noticeable figure that bucks the trend is a lower figure of 68% of trainees felt more confident understanding progress in relation to written elements of metacognition – in 'get them to reflect'.

The detailed breakdown in Figure 14 reveals the strength of feeling that trainees had regarding the central question in this dissertation: the effect of whole-class metacognitive questioning on trainee teachers' confidence in understanding pupil progress.

Figure 14 - Trainee Survey Results



Analysing the survey across all 4 choices, it is possible to see the depth of feeling.

Phase 3 Trainee Quantitative Statistical Frequency Findings

There were four weak correlations identified between pairs of questions in Phase 3. A belief that pupils had become better at metacognition, and trainee belief that they understood pupil progress better as a result of using the toolkit was 0.29 – see Table 5.

Table 5 - Trainee Quantitative Statistical Frequency Findings trainee more confident understanding pupil progress, belief that pupils better at metacognition

Nonparametric Correlations

Correlations

			I believe my pupils have become better at using metacognitive strategies as a result of my use of the resource pack.	The resource pack has improved my confidence in understanding pupil progress.
Spearman's rho	I believe my pupils have become better at using metacognitive strategies as a result of my use of the resource pack.	Correlation Coefficient	1.000	.289**
		Sig. (2-tailed)	.	.002
		N	108	108
	The resource pack has improved my confidence in understanding pupil progress.	Correlation Coefficient	.289**	1.000
		Sig. (2-tailed)	.002	.
		N	108	108

**. Correlation is significant at the 0.01 level (2-tailed).

Trainee confidence in understanding pupil progress using metacognitive whole class questioning interventions, and trainees confirming that the resource pack had helped them to better identify and correct misconceptions was 0.23 – again a weak correlation – see Table 6.

Table 6 - Trainee Quantitative Statistical Frequency Findings more confident understanding pupil progress using metacognitive questions, and identifying misconceptions

Nonparametric Correlations

Correlations

			I feel more confident in understanding pupil progress using metacognitive whole class questioning interventions.	The resource pack has helped me to better identify and correct misconceptions.
Spearman's rho	I feel more confident in understanding pupil progress using metacognitive whole class questioning interventions.	Correlation Coefficient	1.000	.231*
		Sig. (2-tailed)	.	.016
		N	108	108
	The resource pack has helped me to better identify and correct misconceptions.	Correlation Coefficient	.231*	1.000
		Sig. (2-tailed)	.016	.
		N	108	108

*. Correlation is significant at the 0.05 level (2-tailed).

The correlation between trainees confirming that the resource pack had helped them to better identify and correct misconceptions, and understanding the difficulties pupil face using metacognition was moderate at 0.30 – see Table 7.

Table 7 - Trainee Quantitative Statistical Frequency Findings identify and correct pupil misconceptions and understanding pupil metacognitive difficulties

Nonparametric Correlations

Correlations

			The resource pack has helped me to better identify and correct misconceptions.	The resource pack has enhanced my understanding of the difficulties pupils face in learning to use metacognition.
Spearman's rho	The resource pack has helped me to better identify and correct misconceptions.	Correlation Coefficient	1.000	.303**
		Sig. (2-tailed)	.	.001
		N	108	108
	The resource pack has enhanced my understanding of the difficulties pupils face in learning to use metacognition.	Correlation Coefficient	.303**	1.000
		Sig. (2-tailed)	.001	.
		N	108	108

**. Correlation is significant at the 0.01 level (2-tailed).

Trainee confidence improving as a result of the Toolkit, and trainees confirming that the resource pack had helped them to better identify and correct misconceptions was just under moderate at 0.28 – see Table 8.

Table 8 - Trainee Quantitative Statistical Frequency Findings identify and correct pupil misconceptions, and confidence as a Year 1 teacher

Nonparametric Correlations

Correlations

			The resource pack has helped me to better identify and correct misconceptions.	The resource pack has helped my confidence as a Year 1 teacher.
Spearman's rho	The resource pack has helped me to better identify and correct misconceptions.	Correlation Coefficient	1.000	.278**
		Sig. (2-tailed)	.	.004
		N	108	108
	The resource pack has helped my confidence as a Year 1 teacher.	Correlation Coefficient	.278**	1.000
		Sig. (2-tailed)	.004	.
		N	108	108

**. Correlation is significant at the 0.01 level (2-tailed).

Phase 3 Trainee Qualitative Analysis of the Interviews

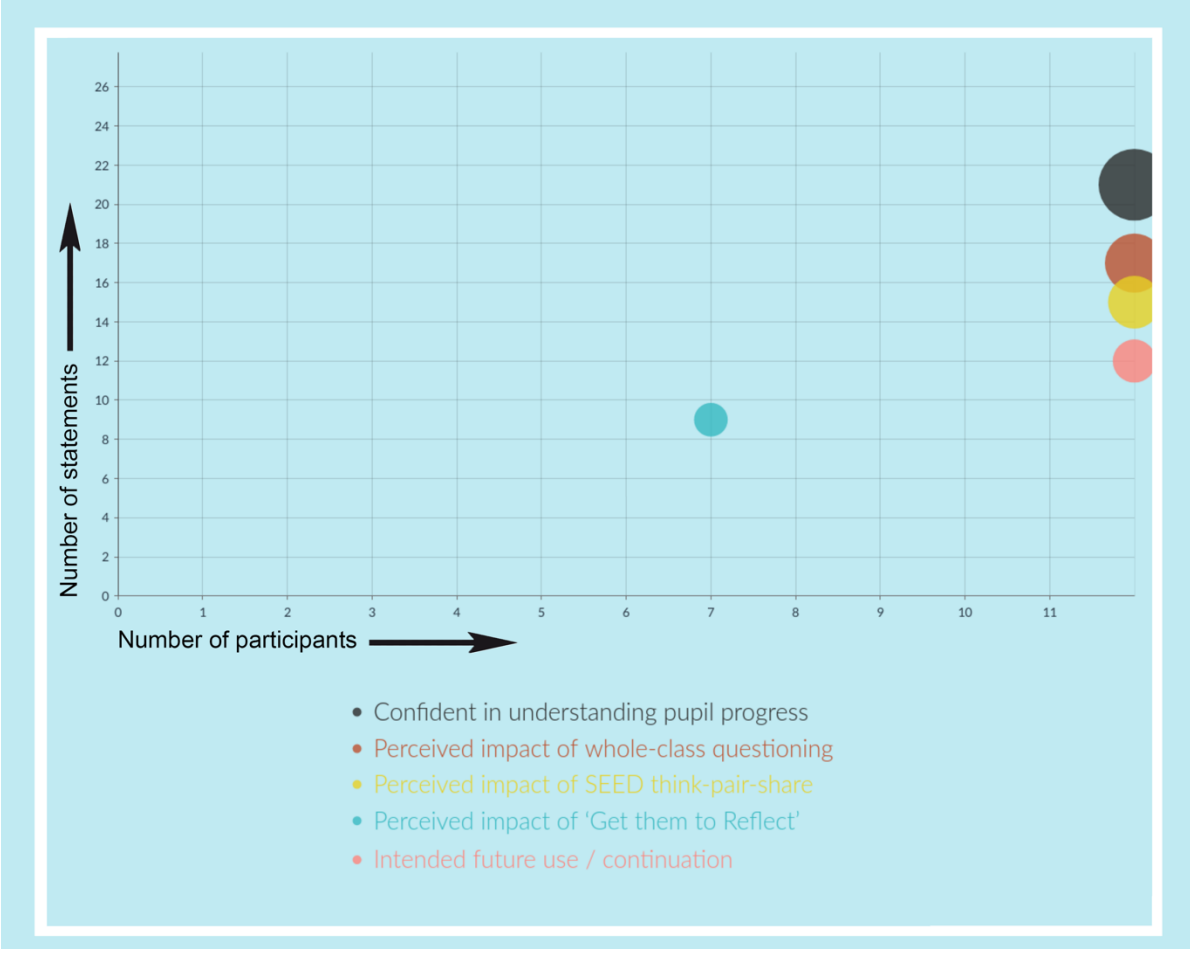
Trainees who expressed that they were happy to be interviewed were contacted shortly after the one-week survey window had closed. If trainees ticked that they were happy to be interviewed, the option of leaving a contact email address was set up to appear in Qualtrix, followed by an MS Teams meeting. 12 trainees were interviewed representing 1% of the population size.

Five core themes emerged in the interviews when coded in NVivo:

1. Confidence in understanding pupil progress
2. Impact of whole-class questioning
3. Impact of SEED think-pair-share
4. Impact of ‘Get them to Reflect’
5. Future Use and Continuation

Figure 15 is a representation of these themes. The X-axis shows the number of participants, and also which themes all participants contributed to. If every participant made a comment on every key theme, it will be represented on the ‘12’ marker for example. The Y-axis represents the number of separate statements made about each key theme, after the codes had been analysed. The larger the bubble, the more comments made.

Figure 15 - Trainee qualitative frequency / magnitude



1. Confidence in understanding pupil progress.

All trainees felt more confident in understanding pupil progress using the toolkit, expressing in different ways that they were more confident in understanding progress in the moment across the whole class. This category attracted the most, and most enthusiastic responses e.g., Growing confidence in real-time assessment:

- *“….it’s really helped me be more confident with understanding how they are unpacking the lesson, and helped the students too….”*

All trainees were surprised that in deeper level questioning, pupils were not able to make connections that trainees thought they would be able to and perhaps the learning was not as secure as they had imagined it to be. This information, through metacognitive questioning informed follow-up teaching e.g.:

- *"…And also sometimes it's revealing when you kind of get a blank response, it's kind of, OK, maybe they don't understand as much as I thought they did ….."*

All trainees discussed their growing confidence in the toolkit, that gave them confidence in understanding progress, e.g.:

- *"…it becomes easier, the more I do it ….."*

2. Impact of whole-class questioning

All trainees felt that the questioning techniques provided a clear framework for assessing individual pupil progress. A framework for individual pupil assessment:

- *"…because it's layered and it increases in complexity, it gives you an idea of where students are at on an individual basis ….."*
- *"….to what extent they've understood it and to what extent they're able to apply it. So it's very helpful…."*

Enhanced lesson planning and questioning techniques:

- *"….I actually have the template in front of me. I find it very helpful because I've highlighted the keywords…."*
- *"….I would say it's helped a lot in terms of pre-planning my questions that I'm going to put on the slide…."*
- *"….What I have started to do is to add those questions in like delayed on the slide so that I remember. So I'll have my initial ones and then I'll dig deeper in, like in an animation so that they come up on the slide…."*
- *"….I would say it's helped a lot in terms of pre-planning my questions that I'm going to put on the slide…."*
- *"….I'll focus on the main takeaway and I'll do the questioning surrounding that. That's kind of my strategy…."*
- *"….if a student is unable to answer it, in some cases scaffold and in some cases bounce [to another student], but either way then you're aware of the progress of the student and where they're at. So it's very helpful…."*

Trainees were able to foster better connections between different topic areas, aiding student understanding:

- *"….make the links between the topic areas, because I know that's a key issue as well, showing students the interrelated nature of the topics, because they like to think of everything in isolation…."*
- *"….So it has really helped and another thing I've embedded, is these link chains that we do anyway together as a class. But using the questioning to actually create the link chains for a*

learning objective, has made it a much, I want to say effective process, where there's more thought on my part as the teacher, instead of just creating these chains. I'm asking the meaningful questions and then building up the intensity as well…."

The biggest surprise to the trainees was the increased motivations of pupils:

- *"….in the questioning I would say motivation, because students that previously didn't raise their hands, for example, are now actively raising their hands, eager to give a contribution…."*

3. Impact of SEED think-pair-share

Some trainees were often surprised by the increased engagement from students who were previously less active:

- *"…I found it effective, a lot of them will just sit there. And then when you ask them, when it's SEED pair time, that's when they start thinking….."*

Most trainees identified an increase in confidence from their pupils:

- *"….I think definitely in terms of the participation from students that I wouldn't normally expect to participate and to then have the confidence to answer…. with the SEED think-pair-share….kind of gives them that confidence that, OK, I think this is a good answer. Or like, oh, I've cracked something. Or like 'this feels like an important thing for me to say'….."*

Some found it easier to identify areas where pupils needed additional support in questioning and SEED.

- *"….And of course, time is limited, so they don't maximise, you know, the time and learning. So using the SEED think-pair-share to make sure they have something tangible to start with, to begin with, and then they explore that with their partner….."*

Some trainees made an adaption to the SEED think-pair-share strategy to improve engagement by either getting pupils to write out the first section, or write everything so they had prompts for the whole-class Discuss stage in the sharing / questioning final stage of the strategy, tailoring SEED for better pupil engagement:

- *"….I found it easier if the Survey first stage in SEED was a written stage, that way I could see exactly what earlier learning they were drawing on, I could see if they were engaged too, rather than sitting in the class thinking for a couple of minutes…."*
- *"….for some classes I did SEED as a written activity with the discussion in the middle in pairs, then back to writing. I think they found it easier to contain the information if it was written down…."*

4. Impact of ‘Get them to Reflect’

In contrast only 7 trainees made comments about the written element ‘get them to reflect’. Some recognized the need to foster deeper understanding and reflection among pupils to improve the effectiveness of these techniques.

- *“…they'll often come across different strategies that will work in different ways, and it's, it's about building up that kind of resource cupboard, if you like, in their, in their minds about, you know, what strategy will work in different, different scenarios, which can be really, really good…..”*

Challenges in facilitating and assessing reflection:

- *“….I do admit that that's something that I struggle a little bit more to gauge if the students are actually reflecting. So, for example, if I do an exam feedback lesson or an assessment feedback and I include those reflective metacognitive questions, I haven't incorporated it in a way that makes me actually tell whether or not they are successfully being reflected, if that makes sense…..”*
- *“….It would have been good to have more help on the written feedback, I wasn’t really confident using that….”*

Some trainees discussed barriers if trying to use the reflection as homework:

- *“….our homework is set by the department, so I didn’t get to use that….”*
- *“….we have online homework or based on class examples so I used it in class….”*
- *“….it doesn’t fit with our homework policy….”*

5. Future Use and Continuation

All trainees in the sample plan to continue using these techniques and seek to apply them more broadly within their curriculum. There was a unanimous desire for ongoing refinement and support to maximize the effectiveness of these methods. It should be noted that there was more enthusiasm, as well as examples, for metacognitive questioning and SEED; compared with ‘get them to reflect’.

This enthusiasm and reported success of 100% contrasts with reasons given by only 27% of DLs who believe it is a good idea to roll out metacognition across all Year 1 trainees. There was no choosing which trainees signed up to the intervention, it was, in effect, a blind test. What is certain is that 100% of trainees felt that they had confidence using metacognitive whole class questioning, as compared with 33% who felt confident they could use metacognitive questioning to understand pupil progress as a baseline figure before the intervention. Of course, I have no way of knowing what level of accuracy there is in either measurement, and such self-declarations tend to be overestimated as we have seen in the literature (Larkin, 2023; Pieschl et al., 2023).

However, one valid element of the comparison remains. There is a three-fold rise to 100% of the same trainees reporting more confidence, or new confidence in understanding pupil progress via metacognitive questioning from the baseline question.

Figure 16 - Increased teacher confidence Venn Diagram

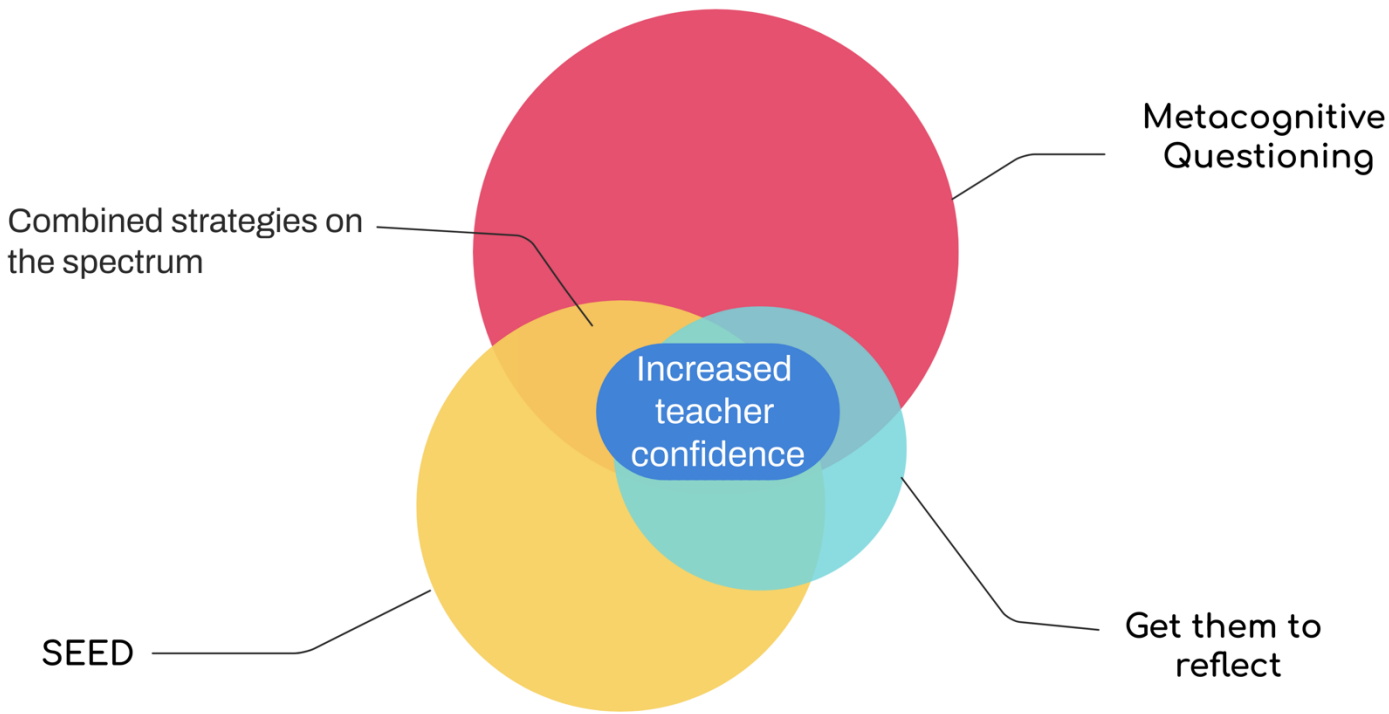


Figure 16 represents how the three metacognitive questioning strategies in the Toolkit have impacted teacher confidence in understanding pupil progress. Each circle in the Venn diagram represents the number of trainees who responded positively to the individual strategies, based on qualitative, detailed responses.

To re-examine the research questions set in the review of literature, some answers are immediately clear - see Table 9. These are broad stroke answers, they are the ‘what’ and ‘who’ answers constructed mainly from quantitative research, supported slightly by quantitative research. In the same way I have asked trainees to become familiar with detail using the higher order metacognitive questioning, it’s essential that we turn to the detail in the qualitative interviews to explore further.

Table 9 - initial answers to research questions

From Review of Literature	Question	Question	Project Findings / Research Findings	Quantitative	Qualitative
Organization	A	What are the personal views of the DLs regarding metacognition in questioning?	Range of DL views, which could be clouded by misunderstandings of what metacognition is	Ranges from 43% to 89%	43% positive*
	B	How well is it understood?	The question wasn't measured quantitively, but 36% of qualitative interviewees had misconceptions	n/a	36% misunderstandings
	C	Is metacognitive learning as questioning occurring in our schools?	Yes as the result of independent DLs – disconnect between belief and practice (Dignath & Karlen, 2023)	27% yes	29% yes
	D	Are there any potential barriers to the success of the intervention?	Yes – based on belief systems of value, trainee capabilities and perceived systemic barriers / lack of support materials (Lawson et al., 2019; Dignath & Karlen, 2023)	Negative beliefs ranging 11% to 73%	43% Negative belief systems
Trainees	1	Do trainee teachers feel more confident in their understanding of pupil progress using the metacognitive questioning in the intervention?	Yes	100% yes	100% yes
	2	Do trainees feel more confident generally, as Year 1 teachers, as a result of using metacognitive questioning?	The remaining questions were not measured in interview. In the survey, across their entire practice, the response was high	91% yes	n/a
	3	Do trainees perceive a better understanding of difficulties faced by pupils, in using metacognition?	The majority, yes	89% yes	n/a
	4	Do trainees feel that their pupils are becoming metacognitive learners?	The majority, yes	83% yes	n/a

There was undoubtedly confusion as to what metacognition was between the three constructs of metacognition, self-regulation and SRL from the qualitative interviews with staff. These constructs revolve around the idea of people overseeing their thoughts and behaviours to gain self-control (Dinsmore et al., 2008). Metacognition and self-regulation have different historical routes but have become increasingly entangled over time, as evidence earlier by the EEF's (Muijs & Bokhove, 2020) misuse of terms.

Five of the fourteen DLs interviewed demonstrated misunderstandings relating to metacognition. Dignath & Karlen (2023) state, as we saw in the review of literature, that some teachers may have fragmented or deficit knowledge about metacognitive knowledge. They point out that it is essential to be competent in self-regulation in order to facilitate pupils developing SRL skills. If teacher trainers hold negative illusions on the potential role of metacognition in teaching (Dunlosky et al., 2009), then belief systems significantly constrain the advocacy and implementation of metacognitive strategies within my organisation (Lawson et al., 2019).

A belief system that only the very best trainees are capable of using metacognition in their first year dominated the responses of the 6 out of 14 DLs. This presents barriers to integration of the pedagogy confirming Lawson et al.'s (2019) finding that belief systems significantly constrain the advocacy and implementation of metacognitive strategies within educational settings. It was interesting to examine such beliefs in my own organisation, and it supports the theory that teachers need to make conscious and deliberate decisions when planning and working with students in order to engage in metacognitive thought (Duffy et al., 2009).

Lawson et al.'s (2019) answer is that belief systems must undergo a conceptual shift, which would be a significant undertaking, unless this, or future research is compelling, and misunderstandings are overcome. Clear and unambiguous messages with respect to metacognitive benefits in teacher training to prevent a continuation of the status quo: trainees' metacognitive knowledge is often inaccurate and does not increase with teaching experience (Halamish, 2018).

Although some DLs expressed a desire for deeper engagement with metacognition within the training programme, the majority of the 43% who held positive beliefs regarding metacognition in the interviews, felt either that they had to put their views aside, or that insufficient trainee training and exposure to metacognitive practices. Just a brief portion of online training, led some DLs to suggest structural and systematic barriers within the training programme preventing use. The feeling was also that there wasn't time, in the time they had allocated to each trainee, for metacognition. Given that metacognitive strategies have a significant role to play to reduce the achievement gap (McGuire, 2021), this is significant for my organisation, and suggested that metacognition should be incorporated into our training programme (Piret et al., 2020). But this was only part of the problem expressed by a small minority of DLs, the bigger issues in terms of the number of coded remarks, relate to misunderstandings and belief systems that present barriers to including the pedagogy at all.

The trainees have reported as strongly as they can that this metacognitive intervention has had an impact. I was especially pleased with this result as there was always the risk of variable impact as trainees were dispersed across different schools, with differing policies, cultures and practices (Menter & Thompson, 2018). Developing trainee teachers' questioning skills to enhance their effectiveness in meaningful learning experiences, developing follow-up questioning, and building upon pupils' ideas, clearly enhanced classroom dialogue and student engagement (Demszky et al., 2023), and I was especially pleased with the increased engagement and motivation reported by many trainees.

I would argue strongly against continuing on a case-by-case basis, so that some are never coached in metacognitive practices. The findings suggest all trainees should be participating. Whilst some trainees fear problems with classroom management, we have seen that students who are stretched at their level, with more opportunities for success are more engaged and this leads to less disruption (Pressley et al., 1992).

If my organisation views this dissertation as a compelling reason to initiate further research, or a small scale roll out, then redefining belief systems would be key, and evidence suggests that there is every opportunity that it would be popular and successful with trainees, and the link between improved outcomes amongst socioeconomically disadvantaged pupils and metacognition is very strong.

Limitations

The perception construct within the ontology acknowledges that there is self-reporting, and that views are personal, and subjective. It is possible that trainees simply felt more psychologically empowered in using the intervention toolkit, or that the positivity was partially due to gaining more teaching hours and experience naturally, when reflecting on their perceptions before, and after using the intervention toolkit.

The benchmarking data serves to factor in the confounding variable surrounding the potentiality of the intervention occurring in multiple schools - some schools that may have metacognitive CPD or practices which will mean that the trainees have knowledge beyond that of the intervention toolkit.

As we have seen in the review of literature, participants have been shown to be overly generous with their own self-reporting judgement of their own success with metacognition. The intervention is also taking place in an environment of progression in training. Trainees expect to improve month by month, and whilst the vast majority do, I know from personal experience that occasionally trainees need additional support, or support plans, and it can sometimes come as a surprise when they are not doing so well as they perceived to be doing.

Another confounding variable is that a small percentage of trainees have previously either been a teaching assistant or science technician and may have had access to metacognition training in a different institution to the one they are placed in for the entirety of their training.

There is a confounding variable that was not accounted for in the design of the intervention. The intervention did not take account of ages. In some respects, this was due to trying to cast a wide net, and concern of a low uptake given the limited promotion available. There is no separation of pupil ages within KS3-4 (or KS5 in the case of Business trainees) within this study, or regional uptake, or type of secondary school. Further study with these variables in mind is likely to increase data richness.

In the baseline first survey, there would inevitably be confounding variables at play. Firstly, would trainees understand what was meant by metacognition? How accurate were their self-assessments? Were the answers well considered, or simply quick clicks to get to the download? Equally, in the phase 3 survey, there is little account of the impact of mentors on the self-assessments. It is inevitable that some kind of discussion must have taken place with at least some of the trainees. What help did they receive from mentors that may have impacted their progress? Was progress hindered by inaccurate belief systems? Baseline data may have errors, as it is not known if trainees may have misunderstood terms in this field when answering questions, given misunderstandings and misusage with both teacher trainers and also academia. Extended questioning should have been easily understood, metacognition on the other hand may not have been.

Conclusions and Implications

My hope at the beginning of this dissertation, stated in the introduction, was that if trainees were able to use the answers they received from deep live metacognitive questioning, or, prepared metacognitive answers to questioning, then they will better understand how much their individual pupils understand – their progress from one lesson to another – and adapt teaching accordingly, creating in effect, better and more engaging lessons.

All trainees reported strongly that they perceived that they had benefitted by engaging with the toolkit. There was complete positivity that trainees were more confident understanding pupil progress using metacognitive questioning.

Embedding ‘baked-in’ examples of how to use the toolkit in a domain-specific manner made it accessible to the trainees. There were examples in most school subjects, and I believe this contributed to its success. The toolkit lacked lengthy theoretical explanations, and was more of a ‘do this’ template, adjustable to individual teachers’ developing style of delivery. Some felt comfortable using a clip board approach, especially with metacognitive questioning, and some found their own variations, such as introducing writing, rather than just thinking, as the Survey section in SEED.

A boost in Year 1 confidence in understanding progress and engagement boosts feelings of self-efficacy. This could support retention of trainees. As we have seen, the learning about metacognition is part of the CCF, but there is no requirement to demonstrate it for QTS, as it does not appear on the TS, despite the intention that the CCF was modelled on the TS. Omission, deliberate or otherwise, there are compelling reasons why my organisation could conduct further research and a pilot scheme across several schools, with mentor and Headteacher involvement.

A bi-product of both whole-class metacognitive based questioning and SEED was a noticeable increase in pupil motivation and engagement. Whilst a welcome bi-product and one that merits further study, it is difficult to speculate on this additional outcome. Perhaps pupils became used to the structure of questions? Perhaps they were being stretched more and therefore more engaged? Perhaps their teacher was more confident? More study would be required to understand why. If we view metacognition as existing on a spectrum from the sub-conscious to the highly planned, structured, and reflective, then it is surely far more useful, and easier to understand and adopt, as we will see shortly.

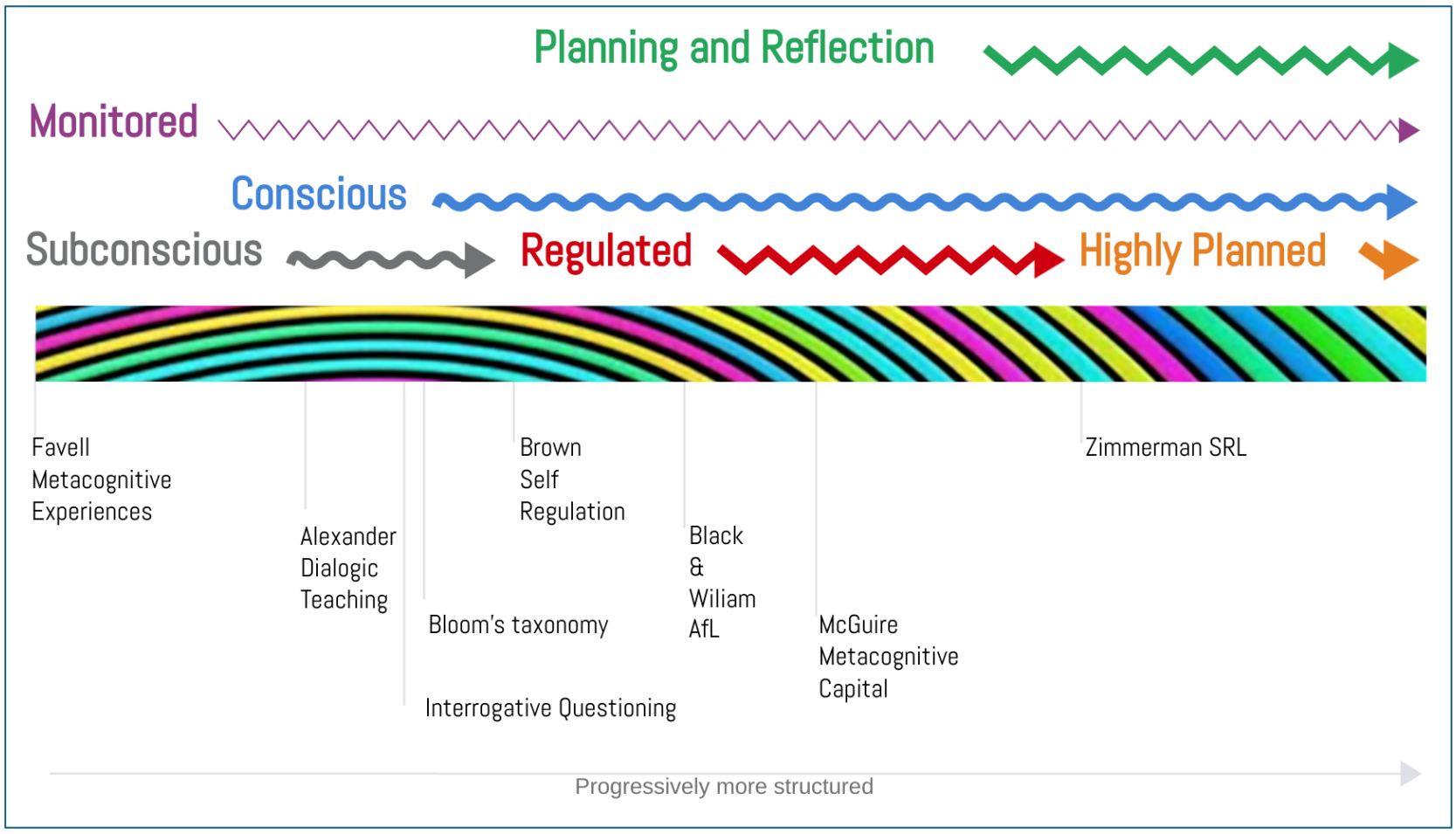
Introducing metacognition in a practical situation was successful with Year 1 trainees. Most teacher trainers at my organisation had belief systems that suggested metacognition should only be introduced to high flying trainees, or not at all – that it had been a “fad” in the past. Many had some level of misunderstanding of what metacognition was. As an evolving pedagogy, there is disagreement as to what metacognition is, and many still think it is a non-domain specific activity that can be taught separately and applied everywhere.

I think there are elements of ‘all of the above’. Metacognition was a fad if only viewed through the lens of non-domain specific Government initiatives such as ‘learning to learn’ or ‘thinking skills’. Perhaps the nomenclature of multiple groups of ‘things’ to describe metacognition is just too overly complicated to be used at scale in schools. Those that have a great interest will embrace the theory, will love it, those who must choose carefully with limited time allocations, may not. What matters is embedding metacognition in subject based domain-specific cognition – with examples. Removing confusion as to what metacognition is, would certainly help.

This is no fault of the DLs, some of whom have picked up misconceptions and deficit belief systems. Ethically, the report back to my organisation must frame this point so that no harm is done. The fieldwork suggests metacognition could be invaluable, but it must be presented in such a way that that it does not undermine DLs. It is an enormous role with far more than metacognition to think about. It may be impossible, as many have said, unless it appeared in the practical curriculum. Equally, there is no fault in the part of my organisation for not embedding metacognition into the practical framework of the programme. After all, it is not part of QTS derived from TS.

It might be helpful to DLs to think about redefining metacognition as *any thought process where learning is potentially confirmed or modified by the learner*. This can, and was originally intended to be either conscious or sub-conscious. The history of metacognition shows a move to more purposeful planning, monitoring, or reflection, as conflation with self-regulation transformed into SRL, and sometimes as a platform for discovery learning, or formally taught as non-domain specific thinking skills. I believe metacognition, where learning is modified by the learner, exists on a *spectrum*. At one end, the sub-conscious Feeling of Knowing, or changing perspectives to rethink a problem in the moment, to the more specific recalling of previous learning to help navigate new tasks, right to the other end of the *metacognitive spectrum* to SRL – for example planned revision, reflecting of specifics of a battleplan, and reflecting on the modifications as to how the learning best occurred. I would argue that metacognition is fluid and adaptable to circumstances. It doesn’t have to lead to confusion. I have not found references in educational teaching literature to a *metacognitive spectrum* see Figure 17. In essence, the Toolkit comprised strategies moving across it.

Figure 17 - Proposed Metacognitive Spectrum



It is accepted that learning is a change in knowledge, so then it should be easy to accept metacognition as a confirmation or change in learning by the learner. If we use this lens then perhaps, we can see that so many of the activities that occur in a classroom are metacognitive: the modelled thinking out loud explanation by a teacher; the we-do section of the gradual release model, interrogative interrogation, and even dialogic discussion. The difference in the toolkit was clarity and templates. If supported by DLs then there is the potential to exponentially grow the results using the expertise of the staff involved.

Implications

There is scope for further research here. It is possibly the first type of intervention of its kind, and as such various strands that can be investigated in more depth, especially involving mentors to track the accuracy of trainee estimations of increased confidence in understanding pupil progress. I am sure confidence grew given the survey and interview answers, but we are always facing over-estimations, and 100% may well be too high in light of this. Improvements could be made by including the involvement of Headteachers and mentors across varied schools. With support in each school, more precise measurements of confidence could be included such as accuracy by adding mentor views of changes in trainee confidence, which could then be compared with trainee views. If there is indeed a gap for a definitive study, where terms and best practice are clarified, more DLs could feel confident enough to train new teachers in how to use metacognition in the classroom. It is perhaps a case of knowledge disseminators, being confused by the message of knowledge generators. It would be to everyone's advantage to have a clear set of guidelines, so that there are not camps

of teachers using personal experience rather than best practice from research informed sources to make decisions, distilled into a table that could be used in busy classrooms.

As stated, my organisation operates in schools in deprived socio-economic areas. Barriers discussed that create and sustain attainment gaps need to be addressed. The outcome of greater pupil participation, and more enthusiastic participation of pupils in not just answering questions, but in answering more difficult questions – questions that are inherently building metacognitive capital, is ripe for future exploration and development.

It would be exciting to imagine the organisation embedding metacognitive capital through the strategies explored in the intervention to help reduce the attainment gap in schools, which so closely aligns to its vision.

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Appendices

See next page. All artwork by the author.

Appendix 1 - Class Questioning

Class questioning

Ever seen a teacher going into great detail with questions, bouncing ideas across the room, and controlling responses like the conductor of an orchestra?

It takes practice. You can only build these skills in a live classroom environment, but this scaffold will help you spread your wings.

There are two ground rules for your pupils:

1. Everyone listens respectfully to everyone else (no butting in or shouting out). Be prepared to issue "stop/eyes on me/no talking" commands then wait, with a stern look for your pupils to stop, but never keep the 'act' of being cross going past the stop.
2. No hands-up.

There are more ground rules for you.....

- --» This lives in the WE DO part of your lesson. Try and avoid asking too many questions in the I DO part. That first part is for your pupils to watch you elaboratively explaining how to do something. It can break concentration if you ask them to guess what happens next.
- --» You want to move your students from RECALL to UNDERSTANDING, in other words, you want them to think harder, and not just recall facts.
- --» When students can COMPARE/ANALYSE, move them on to EVALUTE/JUSTIFY so they can form their own view. You still want to cross reference UNDERSTANDING at this point. If they have formed a view, how did they reach that point of view? Why do they think that? Information lands in long-term memory more securely if students elaborate on their explanations and reasoning.
- --» CHANGE/CREATE is going to depend on your subject, in some subjects it is the end goal, in others, less so.
- --» Praise effort and attempts as much as correct answers. The more low-stakes and less judgemental you make it, the higher the number of your pupils will participate.
- --» Avoid a teacher 'praise and repeat' e.g. a pupil tells you an answer is 5. Don't say 'well done' and repeat the answer is '5'. That's 10% of your job as a teacher, to say if the answer is right or wrong, or shades in-between. The other 90% is to get them to think harder and remember. So, choose either to elaborate the answer explaining to everyone why it was 5; ask the student why they thought that, or how they came to that answer; or ask one of their peers in the room an UNDERSTANDING question.
- --» Never praise ability – praise effort instead.
- --» Don't just ask RECALL questions to LPA and harder questions to HPA. All children can think and need the opportunity to be guided.
- --» Give students time to think. Ask the question, then wait 5 seconds (at least) before asking someone for the answer.
- --» Ask for respectful opinions about an answer.
- --» Don't say 'is Jamal right', ask 'why might Jamal be right, why might he be wrong?'
- --» It sounds obvious, but give model answers to start, so your pupils understand what you want.

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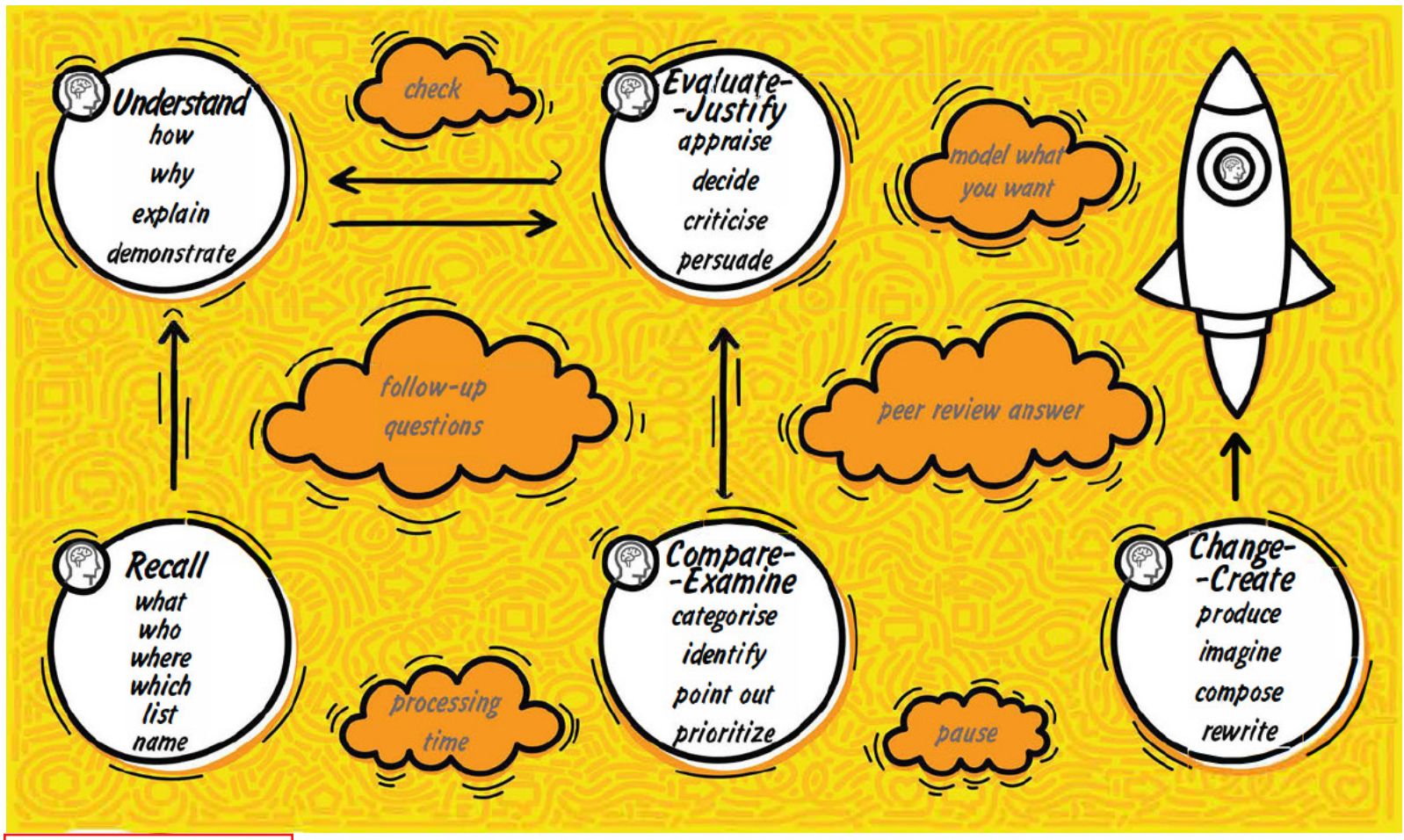
Appendix 2 - extract of model script to trainees



The figure originally presented here cannot be made freely available via ORA because of copyright.

Here's a short, scripted dialogue that follows the demonstration and explanation of photosynthesis in a Year 9 classroom. Real conversations ebb and flow of course, this is just to give you an idea of practice:

Teacher: "Now that we've explored how plants produce their own food through photosynthesis, tell me Alex, what are the main substances that plants need for photosynthesis?"

Student (Alex): "They need water, carbon dioxide, and sunlight, Miss."

Teacher: "Excellent, Alex. And why do plants need sunlight?"

Student (Alex): "Because it provides the energy for the reaction, right?"

Teacher: "That's right. Now, I'm curious, Jamie, can you explain why carbon dioxide is important, Jamie?"

Student (Jamie): "It's... um, it's used to make glucose?"

Teacher: "Why does the plant need glucose, Jamie?"

Student (Jamie): "Um.....the plant uses it for energy?"

Teacher: "Well done, Jamie. Glucose is indeed the energy source. Now, let's consider this further. If we compared a plant in the dark and a plant in the light, compare the differences in their photosynthesis process.... Imran?"

Student (Imran): "The plant in the dark wouldn't be able to photosynthesize because it needs light to kickstart the reaction."

Teacher: "Precisely, Imran. Now, how could we use this understanding to justify why plants are so important to the environment? Any thoughts, Layla?"

Student (Layla): "Well, since they produce oxygen through photosynthesis, and we need oxygen to breathe, they're essential for our survival."

Teacher: "Indeed, Layla. And evaluating this further, the implications of deforestation on our planet's oxygen levels? Sam, what do you think?"

Student (Sam): "I'm not sure miss"

Teacher: "Kendra, help Sam here."

Student (Kendra): "Less oxygen?"

Teacher: "That's it, Kendra. Sam, put that in a sentence and tell me why."

Student (Sam): "Erm ..... less oxygen in the atmosphere since there are fewer trees to produce it."

Teacher: "That's a great evaluation, Sam. Now, let's shift our thinking. How could we use our knowledge of photosynthesis to create solutions for increasing oxygen production in urban areas? Tina?"

Student (Tina): "Maybe we could design buildings with plants that have more surface area for photosynthesis, like vertical gardens!"

Teacher: "What a creative idea, Tina! You're thinking like a true scientist. Remember, it's not just about the right answer, but about the process you use to get there. I want you all to take a moment, think about everything we've discussed, and complete page 3 in your booklets. 5 minutes, no talking, we'll share answers in 5 minutes."

Each student is encouraged to engage with the content at a deeper level, moving beyond just recalling facts to synthesizing and applying knowledge. The teacher also models the desired response and emphasizes the importance of process and effort over

Appendix 3- SEED example A

SEED

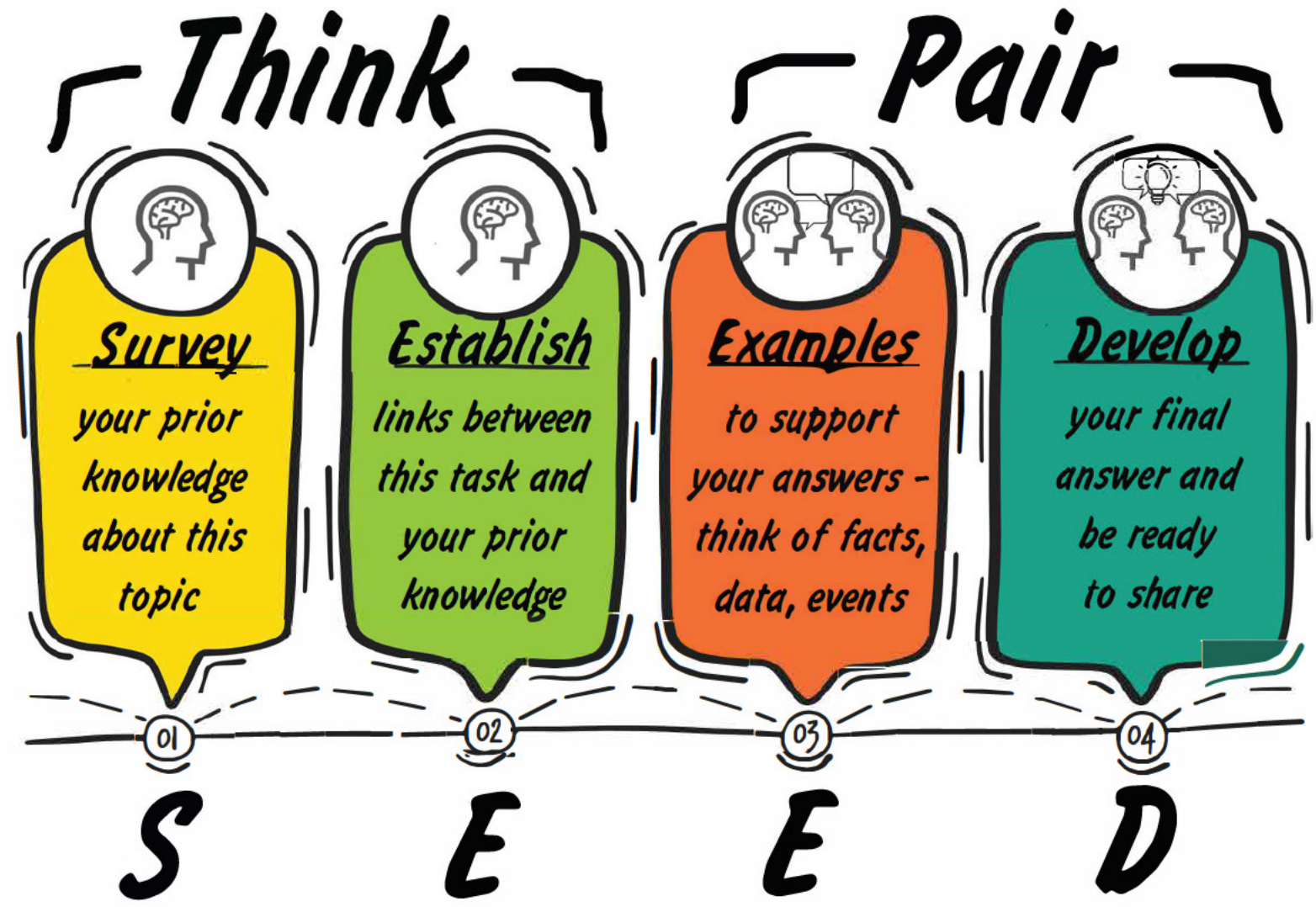
Survey, Establish, Example, Develop – presents a scaffold for metacognitive thinking in guiding pupils through the process of answering questions within the think-pair-share framework, especially when connecting older learning to new situations.

Explain it with the PowerPoint slide insert in Appendix + and give a subject-based concrete example. See Appendix + and feel free to adapt.

- **Survey:** This initial step involves surveying what is already known or understood about the topic in question. It's about recalling prior knowledge, which is crucial for building connections with new information.
- **Establish:** Here, pupils are encouraged to establish clear links between the new question and their existing knowledge. This step involves pinpointing specific concepts, theories, or information from previous learning that are directly relevant to the new situation or question.
- **Example:** The step ensures that pupils are reminded to provide concrete examples to support their answers. This could involve citing historical events, scientific data, literary quotes, mathematical problems, or real-life scenarios, depending on the subject matter. The use of examples makes the response more grounded and understandable.
- **Develop:** The final step, 'Develop', involves elaborating on the answer, integrating the established connections and examples into a coherent and comprehensive response. This is where pupils synthesise their thoughts and present them in a structured manner.

The SEED strategy is intended to provide a clear and structured approach to answering questions, ensuring that pupils' responses are not only well-informed but also well-organized and substantiated with examples. By following these steps, pupils can improve their critical thinking and reasoning skills, making them more adept at applying their learning to new and diverse situations.

Appendix 4 - SEED example B



In this example - pupils have been asked to use the Survey element of SEED as a route to making comparisons between previous, and current learning. Conversly, you can also use SEED for a reflection of previous learning techniques, and then from Establish onwards ask pupils to only focus on new content in their answers. There are examples in different secondary subjects in Appendix +

Survey: In silence, Joe recalls the themes of forbidden knowledge and the consequences of surpassing boundaries in "Frankenstein," paralleling this with the theme of challenging societal norms in "Romeo and Juliet." Iqbal reflects on the complexity of characters in both texts, noting how ambition and love drive characters to make fateful decisions.

Establish: Silently, Iqbal establishes a link between the motivations of Victor Frankenstein in pursuing knowledge beyond societal limits and the actions of Romeo and Juliet, who defy their families for love. Joe identifies the theme of tragedy resulting from the characters' actions in both texts, considering how these consequences stem from challenging established norms.

Example: Discussing together, they cite Victor's creation of the monster as an example of ambition leading to unforeseen tragedy, similar to the secret marriage of Romeo and Juliet. They draw parallels between the isolation of Frankenstein's monster and the alienation of Romeo and Juliet from their families, using these examples to highlight the themes of isolation and societal consequences.

Develop: In their pair discussion, Joe and Iqbal elaborate on how the characters' defiance against societal and natural boundaries leads to their downfall. They discuss how Frankenstein's ambition to create life mirrors Romeo and Juliet's determination to be together against all odds, developing a comprehensive answer that connects the thematic elements of ambition, love, societal defiance, and tragedy across both texts.

Appendix 5 - SEED Example Science

Science

For a Year 9 science class transitioning from a topic on the digestive system to one on diet and exercise, the application of the SEED strategy within a think-pair-share framework can be a powerful tool for enhancing understanding and linking previous knowledge to new concepts. Here is a concise example of how two students, Shariq and Victoria, might engage with this process in answering the question, "How are diet and exercise connected?"

Survey

- **Shariq** thinks about the digestive system, remembering how nutrients are absorbed and the role of metabolism.
- **Victoria** recalls the types of nutrients and their purposes, such as carbohydrates for energy and proteins for muscle repair.

Establish

- **Shariq** establishes that diet provides the nutrients necessary for energy and recovery, which are essential for physical activity.
- **Victoria** notes the metabolism's role in converting nutrients such as proteins into usable energy forms.

Example

- **Shariq** mentions how a balanced diet rich in carbohydrates can enhance energy levels for better performance in physical activities.
- **Victoria** adds an example of how proteins are crucial for muscle repair after exercise, illustrating the link with a scenario where a person recovers faster with adequate protein intake.

Develop

- They develop their answer by integrating their thoughts: A healthy diet ensures the body has the right nutrients for energy and recovery, while regular exercise optimizes the body's use of these nutrients, improving overall health and fitness. They conclude that diet and exercise are interconnected in maintaining and enhancing bodily functions and health.

This discussion facilitates a metacognitive process, leveraging their understanding of the digestive system to frame and enrich their responses to new concepts about diet and exercise.

Appendix 6 - SEED example Art and Design

Art and Design

Two Year 8 art and design students, Ivan and Jordan, approach the question: "What kind of image do you think of for this new topic of war and conflict?" Their process, reflecting on their previous work on identity through art perspective and brushwork, unfolds as follows:

Survey

- **Ivan**: Remembers studying portraits that conveyed personal identity through specific brush strokes and colours.
- **Jordan**: Recalls the use of perspective in art to express an individual's place in society.

Establish

- **Ivan**: Connects the concept of identity to war by considering how conflict affects personal and group identities.
- **Jordan**: Thinks about how perspective in art can represent the different viewpoints and experiences within a war setting.

Example (Discussed in Pairs)

- **Ivan**: Suggests depicting a soldier's portrait with a background split into two contrasting colours, symbolizing the internal conflict and the impact of war on personal identity.
- **Jordan**: Proposes a painting showing civilians on one side and soldiers on the other, using perspective to highlight the different experiences of war.

Develop (Discussed in Pairs)

- **Ivan and Jordan**: Decide to merge their ideas into a single painting that uses split composition to show the contrast between the war front and home life. The piece will incorporate varied brushwork to reflect the chaotic nature of conflict and the personal identities of those affected by it. This approach allows them to synthesize their thoughts on identity and perspective with the new topic of war and conflict, presenting a comprehensive and insightful response to the question.

Through the SEED strategy, Ivan and Jordan effectively connect their prior learning on identity with the new topic of war and conflict, demonstrating a metacognitive process that deepens their understanding and application of art concepts.

Appendix 7 - SEED Example French

French

Here is how two invented Year 7 pupils, Alex and Jamie, might engage with the SEED framework in a French class, transitioning from discussing adjectives and their agreements to using 'avoir' for describing possessions.

1. **Survey**: Alex silently recalls the lesson on adjectives, focusing on how they change to match the gender and number of nouns they describe. Jamie thinks about the list of adjectives they learned, such as 'grand' (big), 'petit' (small), 'ancien' (old), and 'nouveau' (new), and how each adjective was used in sentences to describe people or objects.
2. **Establish**: In silence, Alex establishes a connection between the use of adjectives and the new topic of using 'avoir'. He thinks, "To describe what someone has, I must not only state the item but also describe it, which involves using adjectives correctly." Jamie ponders how 'avoir' can be used to say what people have, realizing that describing possessions would also need the adjectives to agree with the nouns they are describing, in terms of gender and number.
3. **Example** (Discussion starts): Discussing together, Alex says, "For example, if we want to describe a friend who has a big, new car, we could say, 'Il a une grande voiture nouvelle'." Jamie nods and adds, "And if we're describing a sister who has small, old books, we'd say, 'Elle a de petits livres anciens'."
4. **Develop**: Building on their examples, they elaborate on how to describe multiple possessions with varying adjectives. Alex proposes, "If we're talking about a brother who has a big, new car and a small, old bike, we could say, 'Mon frère a une grande voiture nouvelle et un petit vélo ancien'." Jamie concludes, "So, it's about using 'avoir' to state what someone has and then describing those items with adjectives that agree in gender and number, just like we did with describing people before."

Appendix 8 - SEED Example History

History

Ali and Taylor, might navigate each stage of the SEED process in silence and through discussion, focusing on the question: "What influences our view of Elizabeth I?"

1. **Survey**:
    - **Ali** silently recalls a previous lesson where they learned about Elizabeth I's stringent control over her image, reflecting on the methods she used, such as portraits and public appearances.
    - **Taylor** thinks about the historical context of Elizabeth's reign, remembering the political and religious challenges she faced and how these might have influenced the way she wanted to be seen by her subjects and foreign powers.
2. **Establish**:
    - **Ali** mentally connects the control Elizabeth had over her depiction with the idea that our current view of her might be influenced by the images and narratives she promoted.
    - **Taylor** establishes a link between the historical context they remembered and the current perceptions of Elizabeth, considering how the challenges she navigated could contribute to her portrayal as a strong and wise ruler.
3. **Example** (Discussion begins):
    - **Ali** shares with Taylor an example of Elizabeth's Rainbow Portrait, discussing how it symbolizes her power and divine right, which could influence modern interpretations of her as a powerful female monarch.
    - **Taylor** counters with the example of Elizabeth's speeches, like the Tilbury speech, suggesting that her words also play a role in shaping our perception, emphasizing her leadership and oratory skills.
4. **Develop**:
    - Together, Ali and Taylor develop their argument, synthesizing the idea that our view of Elizabeth I is influenced by a combination of her controlled self-image and her historical context. They conclude that interpretations of Elizabeth change over time as new information comes to light and as societal values evolve, affecting how historical figures are perceived.

Appendix 9 - SEED Example Maths

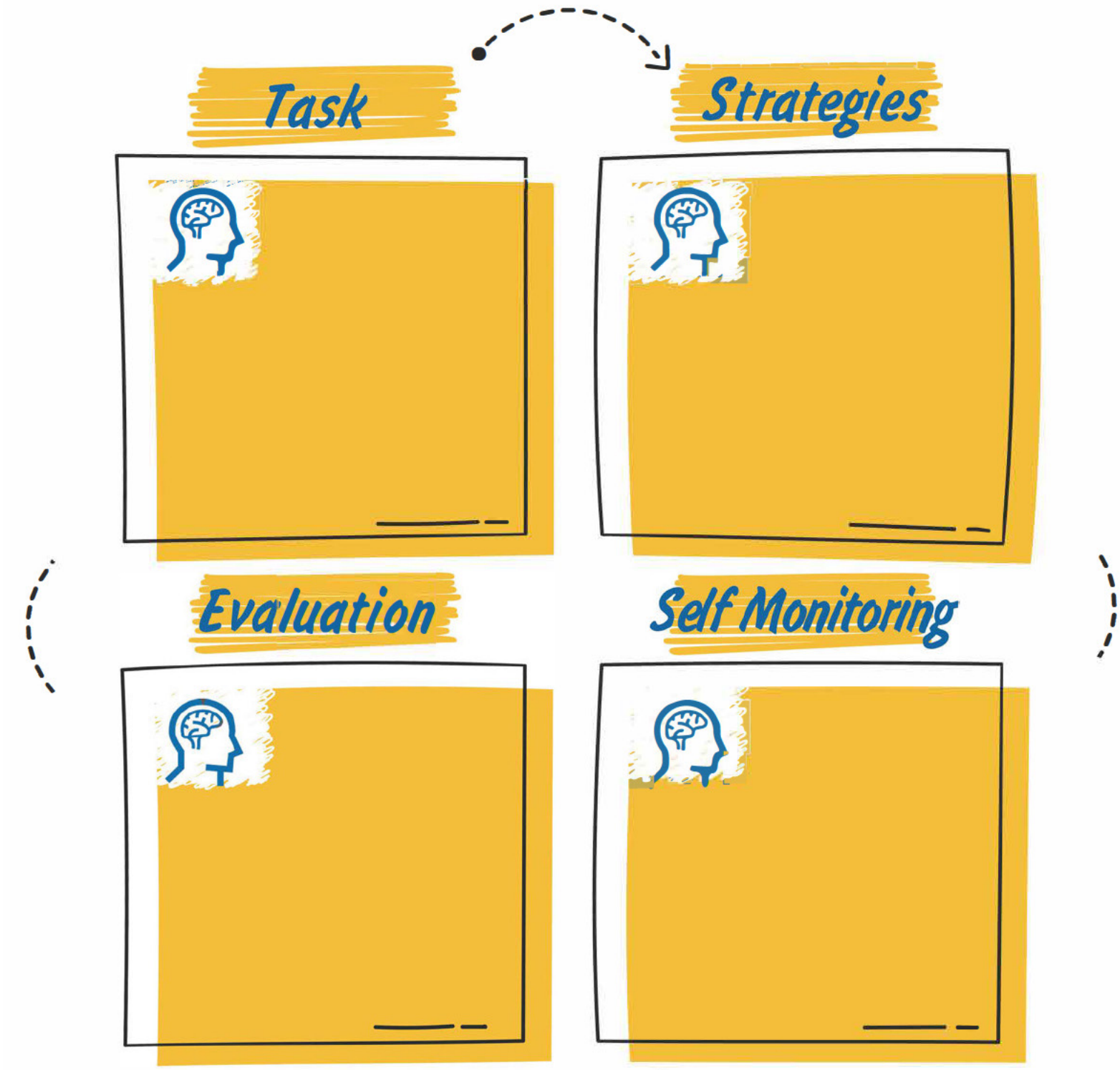
Maths

Year 9 maths pupils are studying constructions, particularly focusing on the properties of a rhombus to construct angle and perpendicular bisectors, let's apply the SEED strategy within a think-pair-share framework. The task is: "How can you use the properties of a rhombus to construct a perpendicular bisector of a given line segment?"

1. **Survey (Individual Thought Process)**: Muhammad recalls learning about the properties of a rhombus, such as its equal sides and angles, and how those properties were applied in constructing an angle bisector. Imani remembers the steps taken to draw an angle bisector and the tools used, such as a compass and straight edge.
2. **Establish (Individual Thought Process)**: Muhammad establishes a link between the previous lesson on angle bisectors and the current question by thinking about the symmetry and properties of a rhombus that could be relevant for constructing a perpendicular bisector. Imani considers the geometric principles learned earlier, like the midpoint and equal angles, as foundational concepts that could apply to the construction of a perpendicular bisector.
3. **Example (Pair Discussion)**: Together, Muhammad and Imani discuss providing an example by first drawing a line segment, then using a compass to mark equal distances from the midpoint on the line segment, similar to the steps they learned in constructing an angle bisector but adjusted for the new task. They talk through using the properties of a rhombus to ensure the bisector is perpendicular by ensuring it meets at right angles to the line segment at its midpoint.
4. **Develop (Pair Discussion)**: The pair elaborates on their answer by integrating the discussed example with the established links. They plan out a step-by-step explanation on how to use the compass and straightedge to draw the perpendicular bisector, ensuring it divides the line segment into two equal parts at a right angle, leveraging their understanding of the rhombus's symmetry and geometric principles from previous lessons.

This process not only helps Pupil A and B to apply their prior knowledge to a new situation but also to articulate their understanding clearly and coherently, demonstrating the effectiveness of the SEED strategy in enhancing metacognitive thinking in maths.

Appendix 10 - Get them to reflect extract - pupil sheet



Task

Is this task difficult?
What parts of this task are the hardest?
How long should I spend on this?
What easy parts can I do first?

Strategies

Are my notes helping me understand this task?
Can I explain it to myself?
What methods can I use when I get stuck?
How can I be sure I remember what I've learned?

Evaluation

Did my plan work?
Did I use the right strategies?
Are there any other points of view, techniques, or ideas I should try next?
What are the positives I encountered?
What are the negatives I encountered?
What was interesting about this task?

Self Monitoring

Does this task require me to remember something?
Do I understand the task? Am I motivated to complete this?
How can I stay focused? Am I doing well?
Do I need to use a different method?
Do the things I said make sense?
Am I finding this hard?
Do I need to change something in order to get better?