Metacognition and self-regulation approaches aim to help pupils think about their own learning more explicitly, often by teaching them specific strategies for planning, monitoring and evaluating their learning. Interventions are usually designed to give pupils a repertoire of strategies to choose from and the skills to select the most suitable strategy for a given learning task.

Self-regulated learning can be broken into three essential components:

- cognition - the mental process involved in knowing, understanding, and learning;
- metacognition - often defined as ‘learning to learn’; and
- motivation - willingness to engage our metacognitive and cognitive skills.

How effective is it?
Metacognition and self-regulation approaches have consistently high levels of impact, with pupils making an average of seven months’ additional progress.

These strategies are usually more effective when taught in collaborative groups so that learners can support each other and make their thinking explicit through discussion.

The potential impact of these approaches is high, but can be difficult to achieve in practice as they require pupils to take greater responsibility for their learning and develop their understanding of what is required to succeed.

The evidence indicates that teaching these strategies can be particularly effective for low achieving and older pupils.

How secure is the evidence?
A number of systematic reviews and meta-analyses have consistently found strategies related to metacognition and self-regulation to have large positive impacts. Most studies have looked at the impact on English or mathematics, though there is some evidence from other subject areas like science, suggesting that the approach is likely to be widely applicable.

The approaches that have been tested tend to involve applying self-regulation strategies to specific tasks involving subject knowledge, rather than learning generic ‘thinking skills’.

The EEF has evaluated a number of programmes that seek to improve ‘learning to learn’ skills. The majority have found positive impacts, although smaller in size (around 2 months’ progress on average) than the average seen in the wider evidence base. For three of these programmes there were indications that they were particularly beneficial for pupils from low income families.

A 2014 study, Improving Writing Quality, used a structured programme of writing development based on a self-regulation strategy. The evaluation found gains, on average, of an additional nine months’ progress, suggesting that the high average impact of self-regulation strategies is achievable in English schools.

Guidance report
The EEF has published guidance on applying the evidence on metacognition and self-regulation in the classroom. The guidance report can be found here.

What are the costs?
Overall, costs are estimated as very low. Many studies report the benefits of professional development for teachers, and using an inquiry approach where teachers actively evaluate strategies and approaches as they learn to use them in their teaching. Most projects are estimated as costing under £80 per pupil, including the necessary professional development for teachers.
Metacognition and self-regulation: What should I consider?

Before you implement this strategy in your learning environment, consider the following:

1. Which explicit strategies can you teach your pupils to help them plan, monitor, and evaluate specific aspects of their learning?
2. How can you give them opportunities to use these strategies with support, and then independently?
3. How can you ensure you set an appropriate level of challenge to develop pupils' self-regulation and metacognition in relation to specific learning tasks?
4. In the classroom, how can you promote and develop metacognitive talk related to your lesson objectives?
5. What professional development is needed to develop your knowledge and understanding of these approaches? Have you considered professional development interventions which have been shown to have an impact in other schools?
Technical Appendix

Definition

Metacognition and self-regulation approaches (sometimes known as ‘learning to learn’) aim to improve learning by getting learners to think about their own learning more explicitly so as to take increased responsibility for their own achievement.

Metacognition involves consciously planning, monitoring and evaluating your own learning. It is often considered to have two dimensions: knowledge (or the extent to which a learner is aware of and can articulate metacognitive strategies) and skillfulness (actual capacity in managing learning or capability at putting these strategies into practice). Approaches usually focus on teaching pupils specific strategies to set goals, and monitor and evaluate their own academic development in relation to particular learning tasks and activities, covering all aspects of thinking from basic skills such as recall, to more complex thinking such as evaluation and synthesis. Self-regulation relates to metacognitive skillfulness but also involves managing one’s own motivation towards learning and the development of dispositions such as resilience and perseverance.

In practical terms, the intention is often to provide pupils with a repertoire of strategies to choose from during learning activities, this often involves Feedback on use of different strategies. Approaches also frequently involve Collaborative learning activities and techniques.

Search terms: Metacognition; executive function; self-regulation, learning strategies

Evidence Rating

Overall, the evidence is rated as extensive. There are eleven meta-analyses with seven undertaken in the last 10 years. These are mainly from experimental studies which were often undertaken in schools and which evaluated impact on pupil attainment as well as more general cognitive outcomes, with some exploration of the causes of any identified heterogeneity. The underlying studies, however, vary in quality. Most of the estimates of impact are high. The majority of the pooled effects from the meta-analyses fall in the range 0.44 to 0.71 (a range of less than a third of a standard deviation). However the range of effects from newer meta-analyses is more varied (0.30 to 0.90), and recent single studies have not consistently achieved the gains presented in the meta-analyses.

Additional Cost Information

The main financial cost of implementing a metacognition and self-regulation approach will be the cost of professional development for the teachers. The average cost of professional development in EEF-funded programmes is well under £80 per pupil.

A number of EEF projects have been commissioned in this area. The cost of the Using Self-Regulation to Improve Writing programme, which aimed to improve pupils’ writing by promoting self-regulation, cost £52 per pupil; Thinking Talking Doing Science was estimated at £26 per pupil; Philosophy for Children cost £16 per pupil per year.
References

Instructional Interventions Affecting Critical Thinking Skills and Dispositions: A Stage 1 Meta-Analysis.
Review of Educational Research 78.4 pp 1102-1134.
(2008)

2 Chiu, C.W.T. (Abstract)
Synthesizing Metacognitive Interventions: What Training Characteristics Can Improve Reading Performance?
Paper presented at the Annual Meeting of the American Educational Research Association San Diego, CA
(1998)

3 Crawford, C. & Skipp, A
LIT Programme Evaluation Report and Executive Summary
EEF, London
(2014)

4 de Boer, H., Donker, A. S., & van der Werf, M. P. (Abstract)
Effects of the attributes of educational interventions on students’ academic performance: A meta-analysis.
Review of Educational Research, 84(4), 509-545.
(2014)

5 Dignath, C., Buettner, G. & Langfeldt, H. (Abstract)
How can primary school students learn self-regulated learning strategies most effectively? A meta-analysis on self-regulation training programmes.
(2008)

Effectiveness of learning strategy instruction on academic performance: A meta-analysis.
(2014)

7 Dorsett, R, Rienzo, C., Rolfe, H, Burns, H., Robertson, B., Thorpe, B. & and Wall, K.
Mind the Gap Evaluation Report and Executive Summary
EEF, London
(2014)

8 Fauzan, N. (Abstract)
The effects of metacognitive strategies on reading comprehension: a quantitative synthesis and the empirical investigation
Doctoral dissertation, University of Durham
(2003)

9 Gorard et al.
Philosophy for Children (P4C) Evaluation Report
EEF, London
(2015)

Can Comprehension be taught? A Quantitative Synthesis of “Metacognitive Studies.”
Educational Researcher, 17.9 pp 5-8.
(1988)

Let’s think secondary science: Evaluation report and executive summary
EEF, London
(2016)

12 Higgins, S., Hall, E., Baumfield, V., & Moseley, D. (Abstract)
A meta-analysis of the impact of the implementation of thinking skills approaches on pupils.
Research Evidence in Education Library. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.
(2005)

13 Jacob, R., & Parkinson, J.
The Potential for School-Based Interventions That Target Executive Function to Improve Academic Achievement A Review.
Review of Educational Research
(2015)


## Summary of effects

<table>
<thead>
<tr>
<th>Meta-analyses</th>
<th>Effect size</th>
<th>FSM effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrami, P.C., Bernard, R.M., Borokhovski, E., Wade, A., Surkes, M.A., Tamim, R., &amp; Zhang, D., (2008)</td>
<td>0.34</td>
<td>-</td>
</tr>
<tr>
<td>Chiu, C.W.T., (1998)</td>
<td>0.67</td>
<td>-</td>
</tr>
<tr>
<td>de Boer, H., Donker, A. S., &amp; van der Werf, M. P., (2014)</td>
<td>0.57</td>
<td>-</td>
</tr>
<tr>
<td>Dignath, C., Buettner, G. &amp; Langfeldt, H., (2008)</td>
<td>0.62</td>
<td>-</td>
</tr>
<tr>
<td>Donker, A. S., De Boer, H., Kostons, D., Dignath van Ewijk, C. C., &amp; Van der Werf, M. P. C., (2014)</td>
<td>0.66</td>
<td>0.72</td>
</tr>
<tr>
<td>Fauzan, N., (2003)</td>
<td>0.50</td>
<td>-</td>
</tr>
<tr>
<td>Hailer, E.P., Child, D.A. &amp; Walberg, H.J., (1988)</td>
<td>0.71</td>
<td>-</td>
</tr>
<tr>
<td>Higgins, S., Hall, E., Baumfield, V., &amp; Moseley, D., (2005)</td>
<td>0.62</td>
<td>-</td>
</tr>
<tr>
<td>Klauer, K.J. &amp; Phye, G.D., (2008)</td>
<td>0.69</td>
<td>-</td>
</tr>
<tr>
<td>Losinski, M., Cuenca-Carlin, Y., Zablocki, M., &amp; Teagarden, J., (2014)</td>
<td>0.90</td>
<td>- (pupils with emotional and behavioural needs)</td>
</tr>
<tr>
<td>Zheng, L., (2016)</td>
<td>0.44</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Single Studies</th>
<th>Effect size</th>
<th>FSM effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crawford, C. &amp; Skipp, A (2014)</td>
<td>0.09</td>
<td>-</td>
</tr>
<tr>
<td>Dorsett, R., Rienzo, C., Rolfe, H., Burns, H., Robertson, B., Thorpe, B. &amp; and Wall, K. (2014)</td>
<td>-0.14</td>
<td>-</td>
</tr>
<tr>
<td>Gorard et al. (2015)</td>
<td>0.14</td>
<td>- Reading</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.13</td>
</tr>
<tr>
<td>Hanley, P., Bohnke, J.R., Slavin, B., Elliott, L., &amp; Croudace, T. (2016)</td>
<td>-0.02</td>
<td>-</td>
</tr>
<tr>
<td>Hanley, Slavin &amp; Elliott (2015)</td>
<td>0.22</td>
<td>0.38</td>
</tr>
<tr>
<td>Moteram, G., Choudry, S., Kalambouka, A., Hutcheson, G., &amp; Barton, A. (2016)</td>
<td>0.30</td>
<td>-</td>
</tr>
<tr>
<td>NIESR (2015)</td>
<td>0.18</td>
<td>0.17 English</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.10</td>
</tr>
<tr>
<td>Torgerson, D., Torgerson, C. Ainsworth, H. Buckley, H. M Heaps, C. Hewitt, C. &amp; Mitchell, N. (2014)</td>
<td>0.74</td>
<td>1.60</td>
</tr>
<tr>
<td>Tracy, B., Reid, R., &amp; Graham, S (2009)</td>
<td>0.47</td>
<td>- Writing</td>
</tr>
</tbody>
</table>

| Weighted mean | 0.54 |

The right hand column provides detail on the specific outcome measures or, if in brackets, details of the intervention or control group.

## Meta-analyses abstracts
Abrami, P.C., Bernard, R.M., Borokhovski, E., Wade, A., Sarkes, M.A., Tammim, R., & Zhang, D. (2008) Critical thinking (CT), or the ability to engage in purposeful, self-regulatory judgment, is widely recognized as an important, even essential, skill. This article describes an on-going meta-analysis that summarizes the available empirical evidence on the impact of instruction on the development and enhancement of critical thinking skills and dispositions. We found 117 studies based on 20,698 participants, which yielded 161 effects with an average effect size (g+) of 0.341 and a standard deviation of 0.610. The distribution was highly heterogeneous (QT = 1,767.86, p < .001). There was, however, little variation due to research design, so we neither separated studies according to their methodological quality nor used any statistical adjustment for the corresponding effect sizes. Type of CT intervention and pedagogical grounding were substantially related to fluctuations in CT effects sizes, together accounting for 32% of the variance. These findings make it clear that improvement in students’ CT skills and dispositions cannot be a matter of implicit expectation. As important as the development of CT skills is considered to be, educators must take steps to make CT objectives explicit in courses and also to include them in both pre-service and in-service training and faculty development.

Chiu, C.W.T. (1998) In this paper, meta-analysis is used to identify components that are associated with effective metacognitive training programs in reading research. Forty-three studies, with an average of 81 students per study, were synthesized. It was found that metacognitive training could be more effectively implemented by using small-group instruction, as opposed to large-group instruction or one-to-one instruction. Less intensive programs were more effective than intensive programs. Program intensity was defined as the average number of days in a week that instruction was provided to students. Students in higher grades were more receptive to the intervention. Measurement artifacts, namely teaching to the test and use of non-standardized tests and the quality of the studies synthesized played a significant role in the evaluation of the effectiveness of the metacognitive reading intervention.

de Boer, H., Donker, A. S., & van der Werf, M. P. (2014) This meta-analysis examined the influence of attributes related to the implementation of learning strategy instruction interventions on students’ academic performance, and also examined how the attributes related to the method of testing the intervention effects affected the actual effects measured. Using meta-regression, we analyzed the influence of the subject domain in which the intervention was implemented, the implementer, its duration and intensity, student cooperation, and research method aspects (including measurement instrument). Most attributes moderated the intervention effect. Using forward regression analysis, we only needed four attributes to obtain the best model, however. This analysis showed that the intervention effect was lower when a standardized test was used for evaluation instead of an unstandardized test. Interventions implemented by assistants or researchers were more effective than those implemented by teachers or using computers. Cooperation had a negative, and session duration a positive, contribution. Together, these attributes explained 63.2% of the variance in effect, which stresses the importance of emphasizing not only the instructional focus of an intervention but also its other attributes.

Dignath, C., Buettner, G., & Langfeldt, H. (2008) Recently, research has increasingly focused on fostering self-regulated learning amongst young children. To consider this trend, this article presents the results of a differentiated meta-analysis of 48 treatment comparisons resulting from 30 articles on enhancing self-regulated learning amongst primary school students. Based on recent models of self-regulated learning, which consider motivational, as well as cognitive, and metacognitive aspects (Boekaerts, M. (1999). Self-regulated learning: Where we are today. International Journal of Educational Research, 31(6), 445–457), the effects of self-regulated learning on academic achievement, on cognitive and metacognitive strategy application, as well as on motivation were analyzed. As the results show, self-regulated learning training programmes proved to be effective, even at primary school level. Subsequent analysis tested for the effects of several moderator variables, which consisted of study features and training characteristics. Regarding factors that concern the content of the treatment, the impact of the theoretical background that underlies the intervention was tested, as well as the type of cognitive, metacognitive, or motivational strategy which were instructed, and if group work was used as instruction method. Training context related factors, which were included in the analyses, consisted of students’ grade level, the length of the training, if teachers or researchers directed the intervention, as well as the school subject in which context the training took place. Following the results of these analyses, a list with the most effective training characteristics was provided.

Donker, A. S., De Boer, H., Kostons, D., Dignath van Ewijk, C. C., & Van der Werf, M. P. C. (2014) In this meta-analysis the results of studies on learning strategy instruction focused on improving self-regulated learning were brought together to determine which specific analysis included 58 studies in primary and secondary education on interventions aimed at improving cognitive, metacognitive, and management strategy skills, as well as motivational aspects and metacognitive knowledge. A total of 95 interventions and 180 effect sizes demonstrated substantial effects in the domains of writing (Hedges’ g = 1.25), science (73), mathematics (66) and comprehensive reading (36). These domains differed in terms of which strategies were the most effective in improving academic performance. However, metacognitive knowledge instruction appeared to be valuable in all of them. Furthermore, it was found that the effects were higher when self-developed tests were used than in the case of intervention-independent tests. Finally, no differential effects were observed for students with different ability levels. To conclude, the authors have listed some implications of their analysis for the educational practice and made some suggestions for further research.

Fuzian, N. (2003) The purpose of the study was to investigate the effectiveness of metacognitive strategies on reading comprehension by means of (a) a meta-analysis and (b) an experiment designed following the meta-analysis implemented in Sarawak, Malaysia. Before the meta-analysis, the prevalent theories and issues in the reading literature such as metacognition, models of reading, measurements, motivation and previous meta-analysis were discussed to provide a better understanding of the research area in this study. A meta-analytic procedure conducted to review the primary research studies of metacognitive strategies used effect size as the measure of effectiveness. Searching for the articles and theses in the 1980s until 2001 yielded a record of 473 abstracts and articles from which there were twenty seven studies with a total number of eighty two effect sizes that could be quantitatively synthesized to compare the group performance of the experimental and control groups. The weighted effect size was 0.50 (95% CI = 0.45 to 0.56) when dependent effect sizes were synthesized, and 0.55 (95% CI=0.48 to 0.63) when the extreme ‘outliers’ or deviated effect sizes were excluded and independent effect sizes were created. Overall, the effect size was moderate indicating a positive outcome of the metacognitive strategies. The effect sizes were not homogeneous and further analyses of the qualitative and quantitative features of the studies were made to develop possible reliable estimates.
Two previous reviews have indicated that self-regulated strategy instruction (SRSD) is an evidence-based practice that can improve the writing skills of students with emotional and behavioral disorders. The purpose of this meta-analysis is to extend the findings and analytic methods of previous reviews by examining published studies regarding SRSD, analyzing the findings of both single-case and group designs using a common effect size metric (Hedges' g), and applying methods to address publication bias. In addition, the present meta-analysis examined the difference in treatment effect due to differences in moderating variables. Sixteen of the 20 studies examined met inclusion criteria based on the Council for Exceptional Children’s Standards for Evidence-Based Practices in Special Education. Results indicated that SRSD interventions had large effect sizes across three dependent variables (i.e., essay elements, quality, and word count), and treatment effects were significant for study design and race/ethnicity. Type of intervention, intervention agent, and gender did not significantly predict response to SRSD instruction. Also the results showed limited risk of bias in the tendency of journals to publish only positive findings. Based on these findings, implications for future research and teaching with SRSD are discussed.