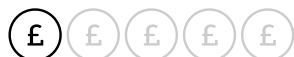


Metacognition and self-regulation

Very high impact for very low cost based on extensive evidence

Metacognition and self-regulation approaches to teaching support pupils to think about their own learning more explicitly.

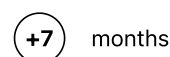
Implementation cost



Evidence strength



Impact (months)



Subject breakdown

maths: 57
reading: 117
science: 22
toolkit: 245

School phase breakdown

primary: 135
secondary: 107
toolkit: 245

Technical Appendix

The criteria used to judge the inclusion of studies in the Toolkit are:

- The population sampled involved early years and school age learners from 3-18 learning in their first language.
- The intervention or approach being tested was educational in nature, including named or clearly defined programmes and recognisable approaches classifiable according to the Toolkit strand definitions (e.g. peer tutoring or small group teaching). The intervention or approach is undertaken in a normal educational setting or environment for the learners involved, such as a nursery or school or a typical setting (e.g. an outdoor field centre or museum).
- A valid comparison was made between those receiving the educational intervention or approach and those not receiving it.
- Outcomes include the assessment of educational or cognitive achievement which reports quantitative results from testing of attainment or learning outcomes, such as by standardised tests or other appropriate curriculum assessments or school examinations or appropriate cognitive measures.
- The study design provided a quantitative estimate of the impact of the intervention or approach on the educational attainment of the sample, calculated or estimated in the form of an effect size (standardised mean difference) based on a counterfactual comparison.

Standardised mean differences and confidence intervals for the most appropriate estimates of the impact of the intervention or approach for the Toolkit were extracted from each included study, along with other study variables. These effect sizes were further synthesised into a single pooled effect using a random effects meta-analysis adopting a restricted maximum likelihood (REML) estimation methods. For the full details of the methodology see the [Protocol and Analysis Plan](https://educationendowmentfoundation.org.uk/public/files/Toolkit/EEF_Evidence_Database_Protocol_and_Analysis_Plan_June2019.pdf) (https://educationendowmentfoundation.org.uk/public/files/Toolkit/EEF_Evidence_Database_Protocol_and_Analysis_Plan_June2019.pdf).

References (244)

The forest plot below is a graphical representation of the results of all included studies in this Toolkit strand. It shows the effect size and confidence interval of each study, and whether the particular intervention in that study was more or less effective than standard practice or other alternative interventions that the study looked at.

Studies that show an effect size result on the right-hand side of the red vertical red indicate that the particular intervention studied was more effective than standard practice. Studies that show an effect size on the left-hand side of the red vertical indicate that the particular intervention studied was less effective than standard practice.

Author	Title	Effect Size	Effect Size (Graph)
Cardelle-Elawar (1992) 1_1	Effects of teaching metacognitive skills to students with low mathematics ability (<i>Teaching and Teacher Education</i>)	Effect Size: 3.95 LCI: 3.225 UCI: 4.675 Weight: 0.346 Standard error: 0.37	
Cardelle-Elawar (1992) 1_2	Effects of teaching metacognitive skills to students with low mathematics ability (<i>Teaching and Teacher Education</i>)	Effect Size: 3.88 LCI: 3.037 UCI: 4.723 Weight: 0.312 Standard error: 0.43	
Torrance (2007)	The teachability and effectiveness of cognitive self-regulation in sixth-grade writers (<i>Learning and Instruction</i>)	Effect Size: 3.665 LCI: 3.066 UCI: 4.263 Weight: 0.384 Standard error: 0.305	
Fuchs (2003)	Enhancing third-grade student' mathematical problem solving with self-regulated learning strategies. (<i>Journal of Educational Psychology</i>)	Effect Size: 2.808 LCI: 2.462 UCI: 3.155 Weight: 0.456 Standard error: 0.177	
Muñiz-Swicegood (1994)	The Effects of Metacognitive Reading Strategy Training on the Reading Performance and Student Reading Analysis Strategies of Third Grade Bilingual Students (<i>Bilingual Research Journal</i>)	Effect Size: 2.686 LCI: 2.126 UCI: 3.246 Weight: 0.396 Standard error: 0.286	
Aleven (2002) 1_1	An effective metacognitive strategy: learning by doing and explaining with a computer-based Cognitive Tutor (<i>Cognitive Science</i>)	Effect Size: 2.6 LCI: 1.816 UCI: 3.384 Weight: 0.329 Standard error: 0.4	

Author	Title	Effect Size	Effect Size (Graph)
Teong (2003)	The effect of metacognitive training on mathematical word-problem solving (<i>Journal of Computer Assisted Learning</i>)	Effect Size: 2.476 LCI: 1.633 UCI: 3.32 Weight: 0.312 Standard error: 0.43	
Bornas (1992) 1_1	Cognitive training programs to reduce impulsivity-related achievement problems: The need of in-classroom interventions (<i>Learning and Instruction</i>)	Effect Size: 2.045 LCI: 0.668 UCI: 3.422 Weight: 0.191 Standard error: 0.703	
Molenaar (2012)	Dynamic scaffolding of socially regulated learning in a computer-based learning environment (<i>Computers & Education</i>)	Effect Size: 2.01 LCI: 0.011 UCI: 4.009 Weight: 0.113 Standard error: 1.02	
Hudgins (1988)	Children's Self-Directed Critical Thinking (<i>The Journal of Educational Research</i>)	Effect Size: 1.877 LCI: 1.11 UCI: 2.643 Weight: 0.334 Standard error: 0.391	
Patching (1983)	Direct Instruction in Critical Reading Skills. (<i>Reading Research Quarterly</i>)	Effect Size: 1.754 LCI: 0.827 UCI: 2.681 Weight: 0.289 Standard error: 0.473	
Salomon (1989) MSR	The Computer as a Zone of Proximal Development: Internalizing Reading-Related Metacognitions from a Reading Partner (<i>Journal of Educational Psychology</i>)	Effect Size: 1.73 LCI: 1.066 UCI: 2.394 Weight: 0.365 Standard error: 0.339	
Bimmel (2001)	Effects of strategy training on reading comprehension in first and foreign language (<i>European Journal of Psychology of Education</i>)	Effect Size: 1.695 LCI: 1.066 UCI: 2.324 Weight: 0.375 Standard error: 0.321	
Kramarski (2008)	Using Errors as Springboards for Enhancing Mathematical Reasoning With Three Metacognitive Approaches (<i>The Journal of Educational Research</i>)	Effect Size: 1.569 LCI: 0.972 UCI: 2.167 Weight: 0.385 Standard error: 0.305	
Klauer (1992)	Teaching inductive thinking to highly able children (<i>European Journal of High Ability</i>)	Effect Size: 1.538 LCI: 0.382 UCI: 2.694 Weight: 0.234 Standard error: 0.59	

Author	Title	Effect Size	Effect Size (Graph)
Kramarski (2002)	The effects of metacognition and email interactions on learning graphing (<i>Journal of Computer Assisted Learning</i>)	Effect Size: 1.478 LCI: 0.847 UCI: 2.109 Weight: 0.375 Standard error: 0.322	
Pennequin (2010)	Metacognition and low achievement in mathematics: The effect of training in the use of metacognitive skills to solve mathematical word problems (<i>Thinking & Reasoning</i>)	Effect Size: 1.46 LCI: 0.813 UCI: 2.107 Weight: 0.37 Standard error: 0.33	
Esser (2001) MSR	The effects of metacognitive strategy training and attribution retraining on reading comprehension in African - American students with learning disabilities (<i>NA</i>)	Effect Size: 1.459 LCI: 0.754 UCI: 2.164 Weight: 0.352 Standard error: 0.36	
Michalsky (2009) 1_3	Elementary School Children Reading Scientific Texts: Effects of Metacognitive Instruction (<i>The Journal of Educational Research</i>)	Effect Size: 1.435 LCI: 0.832 UCI: 2.038 Weight: 0.383 Standard error: 0.308	
Hansen (1981)	The effects of inference training and practice on young children's reading comprehension (<i>Reading Research Quarterly</i>)	Effect Size: 1.432 LCI: 0.212 UCI: 2.652 Weight: 0.22 Standard error: 0.623	
Miller (1985) 1_2	The Effects of General and Specific Self-Instruction Training on Children's Comprehension Monitoring Performances during Reading (<i>Reading Research Quarterly</i>)	Effect Size: 1.408 LCI: 0.455 UCI: 2.362 Weight: 0.282 Standard error: 0.486	
Kramarski (2006) 1_1	Online Discussion and Self-Regulated Learning: Effects of Instructional Methods on Mathematical Literacy (<i>The Journal of Educational Research</i>)	Effect Size: 1.36 LCI: 0.689 UCI: 2.031 Weight: 0.363 Standard error: 0.342	
Miranda (1997)	Is Attribution Retraining Necessary? Use of Self-Regulation Procedures for Enhancing the Reading Comprehension Strategies of Children with Learning Disabilities (<i>Journal of Learning Disabilities</i>)	Effect Size: 1.345 LCI: 0.652 UCI: 2.039 Weight: 0.356 Standard error: 0.354	
Nolan (1991) 1_1	Self-Questioning and Prediction: Combining Metacognitive Strategies (<i>Journal of Reading</i>)	Effect Size: 1.322 LCI: 0.492 UCI: 2.152 Weight: 0.316 Standard error: 0.423	

Author	Title	Effect Size	Effect Size (Graph)
Manlove (2007)	Software scaffolds to promote regulation during scientific inquiry learning (<i>Metacognition and Learning</i>)	Effect Size: 1.322 LCI: 0.576 UCI: 2.067 Weight: 0.34 Standard error: 0.38	
García-Sánchez (2006) 1_2	Effects of two Types of Self-Regulatory Instruction Programs on Students with Learning Disabilities in Writing Products, Processes, and Self-Efficacy (<i>Learning Disability Quarterly</i>)	Effect Size: 1.31 LCI: 0.799 UCI: 1.822 Weight: 0.411 Standard error: 0.261	
Payne (1992)	Basal reader instruction: Effects of comprehension monitoring training on reading comprehension, strategy use and attitude (<i>Reading Research and Instruction</i>)	Effect Size: 1.29 LCI: 0.478 UCI: 2.102 Weight: 0.321 Standard error: 0.414	
Berkeley (2007) MSR	Reading comprehension strategy instruction and attribution retraining for secondary students with disabilities (<i>NA</i>)	Effect Size: 1.276 LCI: 0.614 UCI: 1.937 Weight: 0.365 Standard error: 0.338	
Oladunni (1998)	An experimental study on the effectiveness of metacognitive and heuristic problem solving techniques on computational performance of students in mathematics (<i>International Journal of Mathematical Education in Science and Technology</i>)	Effect Size: 1.254 LCI: 0.924 UCI: 1.584 Weight: 0.46 Standard error: 0.168	
De Koning (1999)	Teaching inductive reasoning: theoretical background and educational implications (<i>Teaching and Learning Thinking Skills</i>)	Effect Size: 1.243 LCI: 0.345 UCI: 2.141 Weight: 0.297 Standard error: 0.458	
Collings (1994)	Some Fundamental Questions about Scientific Thinking (<i>Research in Science & Technological Education</i>)	Effect Size: 1.219 LCI: 0.842 UCI: 1.596 Weight: 0.448 Standard error: 0.192	
Bornas (1992) 1_2	Cognitive training programs to reduce impulsivity-related achievement problems: The need of in-classroom interventions (<i>Learning and Instruction</i>)	Effect Size: 1.206 LCI: 0.033 UCI: 2.379 Weight: 0.23 Standard error: 0.598	
Kinnunen (1995)	Comprehension monitoring and the level of comprehension in high- and low-achieving primary school children's reading (<i>Learning and Instruction</i>)	Effect Size: 1.201 LCI: 0.192 UCI: 2.209 Weight: 0.268 Standard error: 0.514	

Author	Title	Effect Size	Effect Size (Graph)
Kramarski (2003) 1_2	Effects of Computer Algebra System (CAS) with Metacognitive Training on Mathematical Reasoning (<i>Educational Media International</i>)	Effect Size: 1.196 LCI: 0.517 UCI: 1.874 Weight: 0.36 Standard error: 0.346	
Hohn (2002) 1_1	Heuristic Training and Performance in Elementary Mathematical Problem Solving (<i>The Journal of Educational Research</i>)	Effect Size: 1.186 LCI: 0.716 UCI: 1.657 Weight: 0.423 Standard error: 0.24	
Graham (2005) MSR	Improving the writing performance, knowledge, and self-efficacy of struggling young writers: The effects of self-regulated strategy development (<i>Contemporary Educational Psychology</i>)	Effect Size: 1.166 LCI: 0.658 UCI: 1.673 Weight: 0.412 Standard error: 0.259	
Tajika (2007)	Effects of self-explanation as a metacognitive strategy for solving mathematical word problems (<i>Japanese Psychological Research</i>)	Effect Size: 1.151 LCI: 0.567 UCI: 1.736 Weight: 0.389 Standard error: 0.298	
Lane (2011)	Self-Regulated Strategy Development at Tier 2 for Second-Grade Students With Writing and Behavioral Difficulties: A Randomized Controlled Trial (<i>Journal of Research on Educational Effectiveness</i>)	Effect Size: 1.144 LCI: 0.501 UCI: 1.786 Weight: 0.371 Standard error: 0.328	
Stevens (1986)	The Effects of Strategy Training on the Identification of the Main Idea of Expository Passages. Report No. 4. (NA)	Effect Size: 1.138 LCI: 0.243 UCI: 2.032 Weight: 0.298 Standard error: 0.456	
Zhang (2015)	Exploring the Impacts of Cognitive and Metacognitive Prompting on Students' Scientific Inquiry Practices Within an E-Learning Environment (<i>International Journal of Science Education</i>)	Effect Size: 1.136 LCI: 0.541 UCI: 1.731 Weight: 0.386 Standard error: 0.304	
Lucangeli (1995) 1_2	Specific and general transfer effects following metamemory training (<i>Learning Disabilities Research & Practice</i>)	Effect Size: 1.123 LCI: 0.72 UCI: 1.526 Weight: 0.442 Standard error: 0.206	
Kramarski (2001)	Effects of Multilevel Versus Unilevel Metacognitive Training on Mathematical Reasoning (<i>The Journal of Educational Research</i>)	Effect Size: 1.123 LCI: 0.74 UCI: 1.506 Weight: 0.447 Standard error: 0.195	

Author	Title	Effect Size	Effect Size (Graph)
Strang (1993)	Enhancing high school students' achievement in chemistry through a thinking skills approach (<i>International Journal of Science Education</i>)	Effect Size: 1.098 LCI: 0.165 UCI: 2.03 Weight: 0.288 Standard error: 0.476	
O'Hara (2007) MSR	The influence of supplemental instructional approaches upon the comprehension, metacognitive awareness, and motivation of struggling third-and fourth-grade readers (<i>NA</i>)	Effect Size: 1.097 LCI: 0.499 UCI: 1.695 Weight: 0.385 Standard error: 0.305	
Miller (1985) 1_1	The Effects of General and Specific Self-Instruction Training on Children's Comprehension Monitoring Performances during Reading (<i>Reading Research Quarterly</i>)	Effect Size: 1.092 LCI: 0.184 UCI: 2.001 Weight: 0.294 Standard error: 0.464	
Gordon (1995) MSR	Strategic reading instruction and reattribution training for students who are "at-risk" or learning disabled (<i>NA</i>)	Effect Size: 1.075 LCI: 0.374 UCI: 1.776 Weight: 0.353 Standard error: 0.358	
Lundsteen (1963)	Teaching Abilities in Critical Listening in the Fifth and Sixth Grades (<i>NA</i>)	Effect Size: 1.074 LCI: 0.817 UCI: 1.331 Weight: 0.476 Standard error: 0.131	
Lizarraga (2010)	Stimulation of thinking skills in high school students (<i>Educational Studies</i>)	Effect Size: 1.04 LCI: 0.424 UCI: 1.656 Weight: 0.379 Standard error: 0.314	
Camahalan (2006)	Effects of Self-Regulated Learning on Mathematics Achievement of Selected Southeast Asian Children (<i>Journal of Instructional Psychology</i>)	Effect Size: 1.02 LCI: 0.491 UCI: 1.549 Weight: 0.405 Standard error: 0.27	
Muttart (1984)	Assessment of Effects of Instrumental Enrichment Cognitive Training. (<i>Special Education in Canada</i>)	Effect Size: 0.999 LCI: -0.028 UCI: 2.025 Weight: 0.264 Standard error: 0.524	
Franklin (1993)	Overcoming the Reading Comprehension Barriers of Expository Texts (<i>Educational Research Quarterly</i>)	Effect Size: 0.988 LCI: 0.373 UCI: 1.604 Weight: 0.379 Standard error: 0.314	

Author	Title	Effect Size	Effect Size (Graph)
Kramarski (2006) 1_2	Online Discussion and Self-Regulated Learning: Effects of Instructional Methods on Mathematical Literacy (<i>The Journal of Educational Research</i>)	Effect Size: 0.984 LCI: 0.348 UCI: 1.621 Weight: 0.373 Standard error: 0.325	
Bean (1984)	The Effect of Three Forms of Summarization Instruction on Sixth Graders' Summary Writing and Comprehension (<i>Journal of Reading Behavior</i>)	Effect Size: 0.97 LCI: 0.402 UCI: 1.538 Weight: 0.394 Standard error: 0.29	
King (1999)	Constructing meaning via reciprocal teaching (<i>Reading Research and Instruction</i>)	Effect Size: 0.962 LCI: 0.669 UCI: 1.255 Weight: 0.469 Standard error: 0.15	
Palincsar (1984) 1_1	Reciprocal Teaching of Comprehension-Fostering and Comprehension-Monitoring Activities (<i>Cognition and Instruction</i>)	Effect Size: 0.957 LCI: -0.267 UCI: 2.182 Weight: 0.219 Standard error: 0.625	
Kernaghan (1995)	Providing grade one students with multiple spelling strategies: Comparisons between strategy instruction, strategy instruction with metacognitive information, and traditional language arts (<i>Applied Cognitive Psychology</i>)	Effect Size: 0.957 LCI: 0.065 UCI: 1.849 Weight: 0.298 Standard error: 0.455	
Kramarski (2002)	The effects of metacognitive instruction on solving mathematical authentic tasks (<i>Educational Studies in Mathematics</i>)	Effect Size: 0.948 LCI: 0.316 UCI: 1.58 Weight: 0.374 Standard error: 0.322	
Reynolds (2009)	A Comparison of Text Structure and Self-Regulated Writing Strategies for Composing From Sources by Middle School Students (<i>Reading Psychology</i>)	Effect Size: 0.936 LCI: 0.478 UCI: 1.393 Weight: 0.426 Standard error: 0.233	
Cardelle-Elawar (1995)	Effects of metacognitive instruction on low achievers in mathematics problems (<i>Teaching and Teacher Education</i>)	Effect Size: 0.92 LCI: 0.724 UCI: 1.116 Weight: 0.487 Standard error: 0.1	
Erkin (2004)	Teaching thinking for mathematics through the enhancement of metacognitive skills (<i>Research in the Schools</i>)	Effect Size: 0.916 LCI: 0.486 UCI: 1.347 Weight: 0.434 Standard error: 0.22	

Author	Title	Effect Size	Effect Size (Graph)
Hansen (1983) 1_2	An instructional study: Improving the inferential comprehension of good and poor fourth-grade readers (<i>Journal of Educational Psychology</i>)	Effect Size: 0.91 LCI: -0.011 UCI: 1.831 Weight: 0.291 Standard error: 0.47	
Hamers (1998) 1_2	Inductive Reasoning in Third Grade: Intervention Promises and Constraints (<i>Contemporary Educational Psychology</i>)	Effect Size: 0.902 LCI: 0.656 UCI: 1.147 Weight: 0.479 Standard error: 0.125	
Ward (1993)	Application of a metacognitive strategy to assessment, intervention, and consultation: A think-aloud technique (<i>Journal of School Psychology</i>)	Effect Size: 0.89 LCI: 0.024 UCI: 1.756 Weight: 0.306 Standard error: 0.442	
Tomic (1996) 1_2	On the effects of training inductive reasoning: How far does it transfer and how long do the effects persist? (<i>European Journal of Psychology of Education</i>)	Effect Size: 0.864 LCI: -0.017 UCI: 1.745 Weight: 0.301 Standard error: 0.45	
Maqsd (1998)	Effects of metacognitive instruction on mathematics achievement and attitude towards mathematics of low mathematics achievers (<i>Educational Research</i>)	Effect Size: 0.863 LCI: 0.212 UCI: 1.514 Weight: 0.369 Standard error: 0.332	
Kapa (2001)	A Metacognitive Support during the Process of Problem Solving in a Computerized Environment (<i>Educational Studies in Mathematics</i>)	Effect Size: 0.86 LCI: 0.599 UCI: 1.12 Weight: 0.476 Standard error: 0.133	
Bossert (1995)	Children's comprehension monitoring: Training children to use rereading to aid comprehension (<i>Reading Research and Instruction</i>)	Effect Size: 0.851 LCI: 0.123 UCI: 1.579 Weight: 0.345 Standard error: 0.371	
Carr (1989) MSR	Attributional training and the generalization of reading strategies with underachieving children (<i>Learning and Individual Differences</i>)	Effect Size: 0.845 LCI: 0.068 UCI: 1.622 Weight: 0.331 Standard error: 0.396	
Desoete (2003)	Can offline metacognition enhance mathematical problem solving? (<i>Journal of Educational Psychology</i>)	Effect Size: 0.843 LCI: 0.446 UCI: 1.24 Weight: 0.443 Standard error: 0.203	

Author	Title	Effect Size	Effect Size (Graph)
Nolte (1985)	Active comprehension: Teaching a process of reading comprehension and its effects on reading achievement (<i>Reading Teacher</i>)	Effect Size: 0.842 LCI: 0.191 UCI: 1.492 Weight: 0.369 Standard error: 0.332	
Ehlinger (1988) MSR	The relative merits of characteristics of teacher verbal modeling in influencing comprehension and comprehension monitoring of eighth-grade readers (<i>NA</i>)	Effect Size: 0.842 LCI: 0.256 UCI: 1.429 Weight: 0.388 Standard error: 0.299	
Brunstein (2011)	Testing a path-analytic mediation model of how self-regulated writing strategies improve fourth graders' composition skills: A randomized controlled trial (<i>Journal of Educational Psychology</i>)	Effect Size: 0.842 LCI: 0.463 UCI: 1.22 Weight: 0.448 Standard error: 0.193	
Riding (1987)	The Effect on Reasoning, Reading and Number Performance of Computer-presented Critical Thinking Activities in Five-year-old Children (<i>Educational Psychology</i>)	Effect Size: 0.836 LCI: 0.324 UCI: 1.349 Weight: 0.41 Standard error: 0.261	
Chamberlain (1993) MSR	Philosophy for Children program and the development of critical thinking of gifted elementary students (<i>NA</i>)	Effect Size: 0.809 LCI: 0.353 UCI: 1.266 Weight: 0.427 Standard error: 0.233	
Benito (1993)	The effect of instruction in question-answer relationships and metacognition on social studies comprehension (<i>Journal of Research in Reading</i>)	Effect Size: 0.8 LCI: 0.036 UCI: 1.564 Weight: 0.335 Standard error: 0.39	
Jacobse (2009)	Student-controlled metacognitive training for solving word problems in primary school mathematics (<i>Educational Research and Evaluation</i>)	Effect Size: 0.785 LCI: 0.188 UCI: 1.382 Weight: 0.385 Standard error: 0.305	
Andre (1978) 1_1	The Development and Evaluation of a Self-Questioning Study Technique (<i>Reading Research Quarterly</i>)	Effect Size: 0.78 LCI: 0.016 UCI: 1.544 Weight: 0.335 Standard error: 0.39	
Hogan (1999)	Thinking Aloud Together: A Test of an Intervention to Foster Students' Collaborative Scientific Reasoning (<i>Journal of Research in Science Teaching</i>)	Effect Size: 0.767 LCI: 0.449 UCI: 1.086 Weight: 0.463 Standard error: 0.162	

Author	Title	Effect Size	Effect Size (Graph)
Philbrick (2002) MSR	The effects of metacognitive reading instruction on students' comprehension of social studies text (NA)	Effect Size: 0.767 LCI: 0.327 UCI: 1.206 Weight: 0.431 Standard error: 0.224	
Kramarski (2004)	Making sense of graphs: does metacognitive instruction make a difference on students' mathematical conceptions and alternative conceptions? (<i>Learning and Instruction</i>)	Effect Size: 0.757 LCI: 0.467 UCI: 1.048 Weight: 0.469 Standard error: 0.148	
Kaniel (2000) 1_1	The Influence of Metacognitive Instruction of Reading and Writing Strategies on Positive Transfer (<i>Gifted Education International</i>)	Effect Size: 0.748 LCI: 0.405 UCI: 1.091 Weight: 0.457 Standard error: 0.175	
Tomic (1995)	Training in Inductive Reasoning and Problem Solving (<i>Contemporary Educational Psychology</i>)	Effect Size: 0.736 LCI: 0.041 UCI: 1.43 Weight: 0.355 Standard error: 0.354	
Harris (2006)	Improving the Writing, Knowledge, and Motivation of Struggling Young Writers: Effects of Self-Regulated Strategy Development With and Without Peer Support (<i>American Educational Research Journal</i>)	Effect Size: 0.732 LCI: 0.081 UCI: 1.383 Weight: 0.369 Standard error: 0.332	
Shortland-Jones (1986) MSR	The development and testing of an instructional strategy for improving reading comprehension based on schema and metacognitive theories (NA)	Effect Size: 0.73 LCI: 0.142 UCI: 1.318 Weight: 0.388 Standard error: 0.3	
Singer (1982)	Active Comprehension: Problem-Solving Schema with Question Generation for Comprehension of Complex Short Stories (<i>Reading Research Quarterly</i>)	Effect Size: 0.728 LCI: -0.015 UCI: 1.47 Weight: 0.341 Standard error: 0.379	
Gordon (1980)	The effects of instruction in metacomprehension and inferencing on children's comprehension abilities (NA)	Effect Size: 0.714 LCI: -0.05 UCI: 1.477 Weight: 0.335 Standard error: 0.39	
Huffman (1997)	Effect of explicit problem solving instruction on high school students' problem-solving performance and conceptual understanding of physics (<i>Journal of Research in Science Teaching</i>)	Effect Size: 0.705 LCI: 0.364 UCI: 1.047 Weight: 0.457 Standard error: 0.174	

Author	Title	Effect Size	Effect Size (Graph)
Dejonckheere (2011) 1_2	Are Fourth and Fifth Grade Children Better Scientists through Metacognitive Learning? (<i>Electronic Journal of Research in Educational Psychology</i>)	Effect Size: 0.699 LCI: -0.042 UCI: 1.439 Weight: 0.342 Standard error: 0.378	
Dejonckheere (2002) 1_1	Are Fourth and Fifth Grade Children Better Scientists through Metacognitive Learning? (<i>Electronic Journal of Research in Educational Psychology</i>)	Effect Size: 0.699 LCI: -0.042 UCI: 1.439 Weight: 0.342 Standard error: 0.378	
Klein (1997)	Structuring Reflection: Teaching Argument Concepts and Strategies Enhances Critical Thinking (<i>Canadian Journal of School Psychology</i>)	Effect Size: 0.695 LCI: -0.071 UCI: 1.461 Weight: 0.334 Standard error: 0.391	
Mason (2004)	Explicit Self-Regulated Strategy Development Versus Reciprocal Questioning: Effects on Expository Reading Comprehension Among Struggling Readers. (<i>Journal of Educational Psychology</i>)	Effect Size: 0.681 LCI: -0.035 UCI: 1.397 Weight: 0.349 Standard error: 0.365	
Kapa (2007)	Transfer from structured to open-ended problem solving in a computerized metacognitive environment (<i>Learning and Instruction</i>)	Effect Size: 0.679 LCI: 0.289 UCI: 1.07 Weight: 0.445 Standard error: 0.199	
Klauer (1996) 1_1	Teaching inductive reasoning: some theory and three experimental studies (<i>Learning and Instruction</i>)	Effect Size: 0.677 LCI: 0.126 UCI: 1.228 Weight: 0.399 Standard error: 0.281	
Schunk (1993) 1_1	Goals and Progress Feedback: Effects on Self-Efficacy and Writing Achievement (<i>Contemporary Educational Psychology</i>)	Effect Size: 0.676 LCI: -0.063 UCI: 1.415 Weight: 0.342 Standard error: 0.377	
Chen (2014)	Facilitating English-Language Reading Performance by a Digital Reading Annotation System with Self-Regulated Learning Mechanisms (<i>Journal of Educational Technology & Society</i>)	Effect Size: 0.667 LCI: 0.163 UCI: 1.172 Weight: 0.413 Standard error: 0.257	
Michalsky (2009) 1_2	Elementary School Children Reading Scientific Texts: Effects of Metacognitive Instruction (<i>The Journal of Educational Research</i>)	Effect Size: 0.666 LCI: 0.117 UCI: 1.215 Weight: 0.399 Standard error: 0.28	

Author	Title	Effect Size	Effect Size (Graph)
Tomic (1998)	Accelerating Intelligence Development through an Inductive Reasoning Training. (<i>Conceptual issues in research on intelligence</i>)	Effect Size: 0.653 LCI: 0.065 UCI: 1.241 Weight: 0.388 Standard error: 0.3	
Yeazell (1982) MSR	Improving reading comprehension through philosophy for children (<i>Reading Psychology</i>)	Effect Size: 0.652 LCI: 0.153 UCI: 1.15 Weight: 0.414 Standard error: 0.254	
León (1995)	Intervention in comprehension and memory strategies: Knowledge and use of text structure (<i>Learning and Instruction</i>)	Effect Size: 0.65 LCI: 0.14 UCI: 1.16 Weight: 0.411 Standard error: 0.26	
Nelson (2003) MSR	The effect of metacognitive strategy instruction on fifth-grade comprehension of expository text (<i>NA</i>)	Effect Size: 0.645 LCI: -0.01 UCI: 1.3 Weight: 0.367 Standard error: 0.334	
Mourad (2009)	The Effectiveness of a Program Based on Self-Regulated Strategy Development on the Writing Skills of Writing-Disabled Secondary School Students (<i>Electronic Journal of Research in Educational Psychology</i>)	Effect Size: 0.641 LCI: 0.149 UCI: 1.133 Weight: 0.417 Standard error: 0.251	
Paris (1984)	The Benefits of Informed Instruction for Children's Reading Awareness and Comprehension Skills (<i>Child Development</i>)	Effect Size: 0.636 LCI: 0.324 UCI: 0.949 Weight: 0.464 Standard error: 0.16	
Hahn (1983) MSR	Training sixth graders to use general comprehension monitoring strategies for expository text processing (<i>NA</i>)	Effect Size: 0.628 LCI: 0.207 UCI: 1.05 Weight: 0.436 Standard error: 0.215	
Kramarski (2003) 1_1	Enhancing Mathematical Reasoning in the Classroom: The Effects of Cooperative Learning and Metacognitive Training (<i>American Educational Research Journal</i>)	Effect Size: 0.612 LCI: 0.324 UCI: 0.899 Weight: 0.47 Standard error: 0.147	
Chen (2014)	Web-based reading annotation system with an attention-based self-regulated learning mechanism for promoting reading performance (<i>British Journal of Educational Technology</i>)	Effect Size: 0.599 LCI: 0.242 UCI: 0.956 Weight: 0.454 Standard error: 0.182	

Author	Title	Effect Size	Effect Size (Graph)
Zion (2005)	The effects of metacognitive instruction embedded within an asynchronous learning network on scientific inquiry skills (<i>International Journal of Science Education</i>)	Effect Size: 0.594 LCI: 0.316 UCI: 0.872 Weight: 0.472 Standard error: 0.142	
Hamers (1998) 1_1	Inductive Reasoning in Third Grade: Intervention Promises and Constraints (<i>Contemporary Educational Psychology</i>)	Effect Size: 0.59 LCI: -0.194 UCI: 1.374 Weight: 0.329 Standard error: 0.4	
Glaser (2007)	Improving fourth-grade students' composition skills: Effects of strategy instruction and self-regulation procedures (<i>Journal of Educational Psychology</i>)	Effect Size: 0.589 LCI: 0.137 UCI: 1.04 Weight: 0.428 Standard error: 0.23	
Peters (2010)	The Effect of Nature of Science Metacognitive Prompts on Science Students' Content and Nature of Science Knowledge, Metacognition, and Self-Regulatory Efficacy (<i>School Science and Mathematics</i>)	Effect Size: 0.574 LCI: 0.134 UCI: 1.013 Weight: 0.432 Standard error: 0.224	
Unrau (1991)	The Effects of Explicit Instruction on Critical Reading and Argumentative Writing: The TASK of Reading and Writing (<i>Annual Meeting of the American Educational Research Association</i>)	Effect Size: 0.564 LCI: 0.132 UCI: 0.995 Weight: 0.434 Standard error: 0.22	
Klauer (1996) 1_2	Teaching inductive reasoning: some theory and three experimental studies (<i>Learning and Instruction</i>)	Effect Size: 0.561 LCI: -0.017 UCI: 1.139 Weight: 0.391 Standard error: 0.295	
Adey (2002)	Effects of a cognitive acceleration programme on Year I pupils (<i>British Journal of Educational Psychology</i>)	Effect Size: 0.54 LCI: 0.344 UCI: 0.736 Weight: 0.487 Standard error: 0.1	
Meloth (1992)	Effects of two cooperative conditions on peer-group discussions, reading comprehension, and metacognition (<i>Contemporary Educational Psychology</i>)	Effect Size: 0.539 LCI: 0.269 UCI: 0.809 Weight: 0.474 Standard error: 0.138	
Allen (2008)	Reading Comprehension Improvement with Individualized Cognitive Profiles and Metacognition (<i>Literacy Research and Instruction</i>)	Effect Size: 0.538 LCI: 0.181 UCI: 0.896 Weight: 0.454 Standard error: 0.182	

Author	Title	Effect Size	Effect Size (Graph)
Miller (1987)	Fostering Comprehension Monitoring in below Average Readers through Self-Instruction Training (<i>Journal of Reading Behavior</i>)	Effect Size: 0.537 LCI: -0.039 UCI: 1.114 Weight: 0.391 Standard error: 0.294	
Palincsar (1987)	Collaborating for Collaborative Learning of Text Comprehension (<i>NA</i>)	Effect Size: 0.527 LCI: 0.526 UCI: 0.529 Weight: 0.504 Standard error: 0.001	
Roth-van (2002)	Task Similarity and Transfer of an Inductive Reasoning Training (<i>Contemporary Educational Psychology</i>)	Effect Size: 0.521 LCI: 0.072 UCI: 0.97 Weight: 0.429 Standard error: 0.229	
Ashman (1993)	Teaching students to use process-based learning and problem solving strategies in mainstream classes (<i>Learning and Instruction</i>)	Effect Size: 0.518 LCI: 0.129 UCI: 0.907 Weight: 0.445 Standard error: 0.198	
Torgerson (2014)	Improving Writing Quality: Evaluation report and executive summary (<i>NA</i>)	Effect Size: 0.515 LCI: 0.268 UCI: 0.763 Weight: 0.478 Standard error: 0.126	
Hauptman (2011) 1_1	The synergetic effect of learning styles on the interaction between virtual environments and the enhancement of spatial thinking (<i>Computers & Education</i>)	Effect Size: 0.509 LCI: 0.089 UCI: 0.93 Weight: 0.437 Standard error: 0.214	
Schunk (1993) 1_2	Goals and Progress Feedback: Effects on Self-Efficacy and Writing Achievement (<i>Contemporary Educational Psychology</i>)	Effect Size: 0.504 LCI: -0.389 UCI: 1.398 Weight: 0.298 Standard error: 0.456	
Tomic (1996) 1_1	On the effects of training inductive reasoning: How far does it transfer and how long do the effects persist? (<i>European Journal of Psychology of Education</i>)	Effect Size: 0.503 LCI: -0.181 UCI: 1.188 Weight: 0.359 Standard error: 0.349	
Kaniel (2000) 1_2	The Influence of Metacognitive Instruction of Reading and Writing Strategies on Positive Transfer (<i>Gifted Education International</i>)	Effect Size: 0.502 LCI: 0.16 UCI: 0.844 Weight: 0.457 Standard error: 0.174	

Author	Title	Effect Size	Effect Size (Graph)
Kramarski (2006)	How can self-regulated learning be supported in mathematical E-learning environments? (<i>Journal of Computer Assisted Learning</i>)	Effect Size: 0.502 LCI: 0.007 UCI: 0.998 Weight: 0.415 Standard error: 0.253	
Perels (2009)	Is it possible to improve mathematical achievement by means of self-regulation strategies? Evaluation of an intervention in regular math classes (<i>European Journal of Psychology of Education</i>)	Effect Size: 0.5 LCI: -0.049 UCI: 1.049 Weight: 0.4 Standard error: 0.28	
Paris (1986) MSR	Children's reading strategies, metacognition, and motivation (<i>Developmental Review</i>)	Effect Size: 0.499 LCI: 0.497 UCI: 0.501 Weight: 0.504 Standard error: 0.001	
Vauras (1999)	The role of metacognition in the context of integrated strategy intervention (<i>European Journal of Psychology of Education</i>)	Effect Size: 0.498 LCI: -0.103 UCI: 1.099 Weight: 0.384 Standard error: 0.307	
Tregaskes (1989) MSR	Effects of metacognitive strategies on reading comprehension (<i>Reading Research and Instruction</i>)	Effect Size: 0.49 LCI: 0.176 UCI: 0.804 Weight: 0.464 Standard error: 0.16	
Bruce (2001) 1_1	The Clever Kid's Reading Program: Metacognition and Reciprocal Teaching (<i>Annual European Conference on Reading</i>)	Effect Size: 0.49 LCI: -0.059 UCI: 1.039 Weight: 0.4 Standard error: 0.28	
Kramarski (2003) 1_1	Effects of Computer Algebra System (CAS) with Metacognitive Training on Mathematical Reasoning (<i>Educational Media International</i>)	Effect Size: 0.489 LCI: -0.141 UCI: 1.119 Weight: 0.375 Standard error: 0.321	
Lucangeli (1995) 1_1	Specific and general transfer effects following metamemory training (<i>Learning Disabilities Research & Practice</i>)	Effect Size: 0.483 LCI: 0.061 UCI: 0.905 Weight: 0.436 Standard error: 0.216	
Stoeger (2010)	Do Pupils with Differing Cognitive Abilities Benefit Similarly from a Self-Regulated Learning Training Program? (<i>Gifted Education International</i>)	Effect Size: 0.48 LCI: 0.284 UCI: 0.676 Weight: 0.487 Standard error: 0.1	

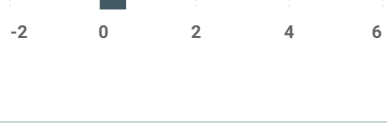
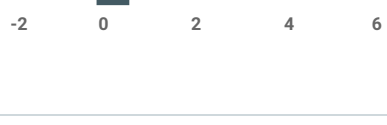
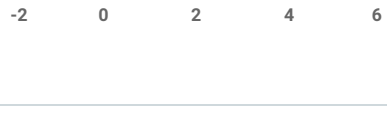
Author	Title	Effect Size	Effect Size (Graph)
Brill (1984)	Effects of two metacognitive programs on comprehension transfer and maintenance of time-order sequencing in text (Causality, reading) (ETD Collection for Fordham University)	Effect Size: 0.476 LCI: -0.25 UCI: 1.202 Weight: 0.346 Standard error: 0.37	
Csapó (1992)	Improving Operational Abilities in Children (Neo-Piagetian Theories of Cognitive Development: Implications and Applications For Education)	Effect Size: 0.474 LCI: -0.068 UCI: 1.015 Weight: 0.402 Standard error: 0.276	
Riesenmy (1991)	Retention and Transfer of Children's Self-Directed Critical Thinking Skills (The Journal of Educational Research)	Effect Size: 0.47 LCI: -0.408 UCI: 1.349 Weight: 0.302 Standard error: 0.448	
Michalsky (2009) 1_1	Elementary School Children Reading Scientific Texts: Effects of Metacognitive Instruction (The Journal of Educational Research)	Effect Size: 0.462 LCI: -0.079 UCI: 1.003 Weight: 0.402 Standard error: 0.276	
Peters (2010)	Self-regulation of student epistemic thinking in science: the role of metacognitive prompts (Educational Psychology)	Effect Size: 0.456 LCI: 0.144 UCI: 0.769 Weight: 0.464 Standard error: 0.159	
Nolan (1991) 1_2	Self-Questioning and Prediction: Combining Metacognitive Strategies (Journal of Reading)	Effect Size: 0.448 LCI: -0.304 UCI: 1.199 Weight: 0.338 Standard error: 0.383	
Houtveen (2007) MSR	Effects of metacognitive strategy instruction and instruction time on reading comprehension (School Effectiveness and School Improvement)	Effect Size: 0.446 LCI: 0.275 UCI: 0.616 Weight: 0.491 Standard error: 0.087	
Hoek (1997)	Effects of Training in the Use of Social and Cognitive Strategies: An Intervention Study in Secondary Mathematics in Co-Operative Groups (Educational Research and Evaluation)	Effect Size: 0.443 LCI: 0.235 UCI: 0.651 Weight: 0.485 Standard error: 0.106	
Mevarech (1999)	Effects of Metacognitive Training Embedded in Cooperative Settings on Mathematical Problem Solving (The Journal of Educational Research)	Effect Size: 0.434 LCI: 0.101 UCI: 0.767 Weight: 0.46 Standard error: 0.17	

Author	Title	Effect Size	Effect Size (Graph)
Klingner (1998)	Collaborative Strategic Reading during Social Studies in Heterogeneous Fourth-Grade Classrooms (<i>The Elementary School Journal</i>)	Effect Size: 0.43 LCI: 0.088 UCI: 0.771 Weight: 0.458 Standard error: 0.174	
Anderson (2001)	Peer interaction and the learning of critical thinking skills in further education students (<i>Instructional Science</i>)	Effect Size: 0.424 LCI: -0.101 UCI: 0.949 Weight: 0.407 Standard error: 0.268	
Williams (2002)	Practical Intelligence for School: Developing Metacognitive Sources of Achievement in Adolescence (<i>Developmental Review</i>)	Effect Size: 0.421 LCI: -0.004 UCI: 0.846 Weight: 0.436 Standard error: 0.217	
de Koning (2002)	Teaching Inductive Reasoning in Primary Education (<i>Developmental Review</i>)	Effect Size: 0.404 LCI: 0.107 UCI: 0.701 Weight: 0.468 Standard error: 0.152	
Kim (2011)	Advancing young adolescents' hypothesis-development performance in a computer-supported and problem-based learning environment (<i>Computers & Education</i>)	Effect Size: 0.404 LCI: 0.096 UCI: 0.713 Weight: 0.465 Standard error: 0.157	
Lysynchuk (1990)	Reciprocal Teaching Improves Standardized Reading-Comprehension Performance in Poor Comprehenders (<i>The Elementary School Journal</i>)	Effect Size: 0.401 LCI: -0.26 UCI: 1.062 Weight: 0.366 Standard error: 0.337	
Alvermann (1988)	Effects of Spontaneous and Induced Lookbacks on Self-Perceived High- and Low-Ability Comprehenders (<i>The Journal of Educational Research</i>)	Effect Size: 0.4 LCI: -0.09 UCI: 0.89 Weight: 0.417 Standard error: 0.25	
Tsai (2002) MSR 1_2	Do Male Students Often Perform Better Than Female Students When Learning Computers?: A Study of Taiwanese Eighth Graders' Computer Education through Strategic and Cooperative Learning (<i>Journal of Educational Computing Research</i>)	Effect Size: 0.392 LCI: -0.051 UCI: 0.835 Weight: 0.431 Standard error: 0.226	
Verschaffel (1999)	Learning to Solve Mathematical Application Problems: A Design Experiment With Fifth Graders (<i>Mathematical Thinking and Learning</i>)	Effect Size: 0.39 LCI: 0.116 UCI: 0.664 Weight: 0.473 Standard error: 0.14	

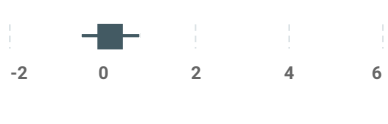
Author	Title	Effect Size	Effect Size (Graph)
Kramarski (1997)	Cognitive-metacognitive training within a problem-solving based Logo environment (<i>British Journal of Educational Psychology</i>)	Effect Size: 0.388 LCI: -0.092 UCI: 0.869 Weight: 0.42 Standard error: 0.245	
Burke (1992) MSR	The effects of an intervention program for improving reading comprehension and motivational attitudes with eighth-grade social studies students (<i>NA</i>)	Effect Size: 0.382 LCI: -0.009 UCI: 0.774 Weight: 0.445 Standard error: 0.2	
Boulware-Gooden (2007)	Instruction of Metacognitive Strategies Enhances Reading Comprehension and Vocabulary Achievement of Third-Grade Students (<i>The Reading Teacher</i>)	Effect Size: 0.38 LCI: 0.017 UCI: 0.743 Weight: 0.452 Standard error: 0.185	
Loranger (1997)	Comprehension strategies instruction: Does it make a difference? (<i>Reading Psychology</i>)	Effect Size: 0.378 LCI: 0.376 UCI: 0.379 Weight: 0.504 Standard error: 0.001	
Iqbal (2000)	Accelerating the Development of Formal Thinking in Pakistan Secondary School Students: Achievement Effects and Professional Development Issues (<i>Journal of Research in Science Teaching</i>)	Effect Size: 0.375 LCI: 0.089 UCI: 0.661 Weight: 0.47 Standard error: 0.146	
Lonberger (1989)	The effects of training in a self generated learning strategy on the prose processing abilities of fourth and sixth graders (<i>NA</i>)	Effect Size: 0.373 LCI: -0.287 UCI: 1.032 Weight: 0.366 Standard error: 0.337	
Curtis (1980)	Developing Critical Thinking Skills in Nonacademic Social Studies Classes. (<i>Alberta Journal of Educational Research</i>)	Effect Size: 0.364 LCI: 0.021 UCI: 0.708 Weight: 0.457 Standard error: 0.175	
Tracy (2009)	Teaching Young Students Strategies for Planning and Drafting Stories: The Impact of Self-Regulated Strategy Development (<i>The Journal of Educational Research</i>)	Effect Size: 0.352 LCI: 0.001 UCI: 0.703 Weight: 0.455 Standard error: 0.179	
Lederer (2000)	Reciprocal Teaching of Social Studies in Inclusive Elementary Classrooms (<i>Journal of Learning Disabilities</i>)	Effect Size: 0.349 LCI: -0.001 UCI: 0.7 Weight: 0.455 Standard error: 0.179	

Author	Title	Effect Size	Effect Size (Graph)
Kramarski (2003) 1_2	Enhancing Mathematical Reasoning in the Classroom: The Effects of Cooperative Learning and Metacognitive Training (<i>American Educational Research Journal</i>)	Effect Size: 0.339 LCI: 0.051 UCI: 0.627 Weight: 0.47 Standard error: 0.147	
Mevarech (2003)	The effects of metacognitive training versus worked-out examples on students' mathematical reasoning (<i>British Journal of Educational Psychology</i>)	Effect Size: 0.334 LCI: -0.028 UCI: 0.695 Weight: 0.452 Standard error: 0.184	
Harty (1986)	Academic Challenge Program: Evaluation Report (NA)	Effect Size: 0.325 LCI: -0.104 UCI: 0.755 Weight: 0.434 Standard error: 0.219	
Kramarski (2009) MSR	Group-Metacognitive Support for Online Inquiry in Mathematics with Differential Self-Questioning (<i>Journal of Educational Computing Research</i>)	Effect Size: 0.323 LCI: -0.156 UCI: 0.803 Weight: 0.42 Standard error: 0.245	
Mercer (1999)	Children's Talk and the Development of Reasoning in the Classroom (<i>British Educational Research Journal</i>)	Effect Size: 0.318 LCI: 0.317 UCI: 0.32 Weight: 0.504 Standard error: 0.001	
Kelly (1984) MSR	Reading comprehension enhancement: a metacognitive generative strategies approach (NA)	Effect Size: 0.306 LCI: -0.04 UCI: 0.652 Weight: 0.456 Standard error: 0.176	
Hauptman (2011) 1_2	The synergetic effect of learning styles on the interaction between virtual environments and the enhancement of spatial thinking (<i>Computers & Education</i>)	Effect Size: 0.306 LCI: -0.081 UCI: 0.692 Weight: 0.446 Standard error: 0.197	
Chang (1999)	The use of a problem-solving-based instructional model in initiating change in students' achievement and alternative frameworks (<i>International Journal of Science Education</i>)	Effect Size: 0.305 LCI: 0.008 UCI: 0.602 Weight: 0.468 Standard error: 0.152	
Zohar (1994)	The effect of the biology critical thinking project on the development of critical thinking (<i>Journal of Research in Science Teaching</i>)	Effect Size: 0.302 LCI: 0.122 UCI: 0.483 Weight: 0.49 Standard error: 0.092	

Author	Title	Effect Size	Effect Size (Graph)
Motteram (2016)	ReflectED: Evaluation report and executive summary (NA)	Effect Size: 0.3 LCI: -0.033 UCI: 0.633 Weight: 0.459 Standard error: 0.17	
Souvignier (2006)	Using self-regulation as a framework for implementing strategy instruction to foster reading comprehension (Learning and Instruction)	Effect Size: 0.27 LCI: -0.025 UCI: 0.565 Weight: 0.468 Standard error: 0.15	
Hartman-Haas (1984)	An Evaluation of the Holistic Approach to Improving Thinking (Annual Meeting of the American Educational Research Association)	Effect Size: 0.265 LCI: -0.144 UCI: 0.674 Weight: 0.44 Standard error: 0.209	
Rienzo (2015) 1_1	Changing Mindsets: Evaluation report and executive summary (NA)	Effect Size: 0.264 LCI: -0.028 UCI: 0.557 Weight: 0.469 Standard error: 0.149	
Chan (1991)	Promoting Strategy Generalization through Self-Instructional Training in Students with Reading Disabilities (Journal of Learning Disabilities)	Effect Size: 0.26 LCI: -0.253 UCI: 0.772 Weight: 0.411 Standard error: 0.261	
Duffy (1987)	Effects of Explaining the Reasoning Associated with Using Reading Strategies (Reading Research Quarterly)	Effect Size: 0.246 LCI: -0.078 UCI: 0.57 Weight: 0.462 Standard error: 0.165	
Peskin (2004) MSR	The Effects of Adding Metacognitive Language to Story Texts (Cognitive Development)	Effect Size: 0.24 LCI: -0.328 UCI: 0.808 Weight: 0.394 Standard error: 0.29	
Tzuriel (1994)	Cognitive and Motivational Modifiability as a Function of the Instrumental Enrichment (IE) Program (Special Services in the Schools)	Effect Size: 0.233 LCI: 0.231 UCI: 0.235 Weight: 0.504 Standard error: 0.001	
Perels (2005) 1_3	Training of self-regulatory and problem-solving competence (Learning and Instruction)	Effect Size: 0.232 LCI: -0.127 UCI: 0.591 Weight: 0.453 Standard error: 0.183	

Author	Title	Effect Size	Effect Size (Graph)
Carriedo (1996)	Main idea comprehension: training teachers and effects on students (<i>Journal of Research in Reading</i>)	Effect Size: 0.23 LCI: 0.073 UCI: 0.387 Weight: 0.493 Standard error: 0.08	
Carr (1983)	The Effect of Inference Training on Children's Comprehension of Expository Text (<i>Journal of Reading Behavior</i>)	Effect Size: 0.227 LCI: -0.329 UCI: 0.784 Weight: 0.397 Standard error: 0.284	
Marzano (1989)	Evaluations of the 'Tactics for Thinking' Program: Summary Report (NA)	Effect Size: 0.225 LCI: -0.035 UCI: 0.485 Weight: 0.476 Standard error: 0.133	
Andre (1978) 1_2	The Development and Evaluation of a Self-Questioning Study Technique (<i>Reading Research Quarterly</i>)	Effect Size: 0.222 LCI: -0.35 UCI: 0.794 Weight: 0.393 Standard error: 0.292	
Baumann (1984)	The Effectiveness of a Direct Instruction Paradigm for Teaching Main Idea Comprehension (<i>Reading Research Quarterly</i>)	Effect Size: 0.22 LCI: -0.373 UCI: 0.813 Weight: 0.386 Standard error: 0.302	
Cantrell (2010) 1_1	The impact of a strategy-based intervention on the comprehension and strategy use of struggling adolescent readers. (<i>Journal of Educational Psychology</i>)	Effect Size: 0.218 LCI: 0.017 UCI: 0.419 Weight: 0.486 Standard error: 0.103	
Hansen (1983) 1_1	An instructional study: Improving the inferential comprehension of good and poor fourth-grade readers. (<i>Journal of Educational Psychology</i>)	Effect Size: 0.206 LCI: -0.674 UCI: 1.085 Weight: 0.302 Standard error: 0.449	
Adey (1990)	Accelerating the development of formal thinking in middle and high school students (<i>Journal of Research in Science Teaching</i>)	Effect Size: 0.202 LCI: 0.005 UCI: 0.4 Weight: 0.487 Standard error: 0.101	
Hoek (1999)	The effects of integrated social and cognitive strategy instruction on the mathematics achievement in secondary education (<i>Learning and Instruction</i>)	Effect Size: 0.202 LCI: 0.016 UCI: 0.389 Weight: 0.489 Standard error: 0.095	

Author	Title	Effect Size	Effect Size (Graph)
Kemp (1991)	The effects of instruction in forming generalizations on high school students' critical thinking in world history (<i>Reading Research and Instruction</i>)	Effect Size: 0.196 LCI: -0.33 UCI: 0.721 Weight: 0.407 Standard error: 0.268	
Ritchie (1996)	Creative thinking instruction for aboriginal children (<i>Learning and Instruction</i>)	Effect Size: 0.191 LCI: -0.433 UCI: 0.816 Weight: 0.377 Standard error: 0.319	
Brown (1968)	An experimental study of the effectiveness of organizing learning experiences to achieve the objective of critical thinking in certain fifth grade social studies classes (<i>NA</i>)	Effect Size: 0.19 LCI: -0.32 UCI: 0.7 Weight: 0.411 Standard error: 0.26	
Paris (1984)	Informed Strategies for Learning: A program to improve children's reading awareness and comprehension. (<i>Journal of Educational Psychology</i>)	Effect Size: 0.18 LCI: -0.134 UCI: 0.494 Weight: 0.464 Standard error: 0.16	
Blank (2000)	A metacognitive learning cycle: A better warranty for student understanding? (<i>Science Education</i>)	Effect Size: 0.177 LCI: -0.403 UCI: 0.756 Weight: 0.39 Standard error: 0.296	
Sato (1996)	Instructional effects on children's strategy use, metacognition, and subsequent comprehension in reading. (<i>NA</i>)	Effect Size: 0.176 LCI: -0.155 UCI: 0.507 Weight: 0.46 Standard error: 0.169	
Perels (2005) 1_1	Training of self-regulatory and problem-solving competence (<i>Learning and Instruction</i>)	Effect Size: 0.176 LCI: -0.182 UCI: 0.535 Weight: 0.453 Standard error: 0.183	
Golden (1990)	Effectiveness of Guided Practice during Remedial Reading Instruction: An Application of Computer-Managed Instruction (<i>The Elementary School Journal</i>)	Effect Size: 0.165 LCI: -0.554 UCI: 0.884 Weight: 0.348 Standard error: 0.367	
Kaniel (1992)	Instrumental Enrichment—Effects of Generalimtion and Durability with Talented Adolescents (<i>Gifted Education International</i>)	Effect Size: 0.16 LCI: -0.173 UCI: 0.493 Weight: 0.459 Standard error: 0.17	

Author	Title	Effect Size	Effect Size (Graph)
Chen (2009)	Personalized E-learning system with self-regulated learning assisted mechanisms for promoting learning performance (<i>Expert Systems with Applications</i>)	Effect Size: 0.16 LCI: -0.178 UCI: 0.498 Weight: 0.458 Standard error: 0.172	
Dresel (2008)	A Computer-Based Approach to Fostering Motivation and Self-Regulated Learning (<i>The Journal of Experimental Education</i>)	Effect Size: 0.154 LCI: -0.225 UCI: 0.532 Weight: 0.448 Standard error: 0.193	
Slavin (2009) 1_1	The Reading Edge: a randomized evaluation of a middle school cooperative reading program (<i>Effective Education</i>)	Effect Size: 0.152 LCI: -0.043 UCI: 0.347 Weight: 0.488 Standard error: 0.1	
Gallini (1993)	The Influence of Macro and Micro-Level Cognitive Strategies Training on Text Learning (<i>Journal of Research and Development in Education</i>)	Effect Size: 0.152 LCI: -0.485 UCI: 0.789 Weight: 0.373 Standard error: 0.325	
Klauer (2002)	Inducing Inductive Reasoning: Does It Transfer to Fluid Intelligence? (<i>Contemporary Educational Psychology</i>)	Effect Size: 0.15 LCI: -0.124 UCI: 0.424 Weight: 0.473 Standard error: 0.14	
García-Sánchez (2006) 1_1	Effects of two Types of Self-Regulatory Instruction Programs on Students with Learning Disabilities in Writing Products, Processes, and Self-Efficacy (<i>Learning Disability Quarterly</i>)	Effect Size: 0.137 LCI: -0.311 UCI: 0.585 Weight: 0.429 Standard error: 0.228	
Chamberlain (2007)	A randomized evaluation of the Success for All Middle School reading program (<i>Middle Grades Research Journal</i>)	Effect Size: 0.134 LCI: -0.061 UCI: 0.329 Weight: 0.488 Standard error: 0.1	
Tsai (2002) MSR 1_1	Do Male Students Often Perform Better Than Female Students When Learning Computers?: A Study of Taiwanese Eighth Graders' Computer Education through Strategic and Cooperative Learning (<i>Journal of Educational Computing Research</i>)	Effect Size: 0.129 LCI: -0.31 UCI: 0.567 Weight: 0.432 Standard error: 0.224	
Vaughn (2011)	Efficacy of Collaborative Strategic Reading With Middle School Students (<i>American Educational Research Journal</i>)	Effect Size: 0.122 LCI: -0.018 UCI: 0.262 Weight: 0.495 Standard error: 0.072	

Author	Title	Effect Size	Effect Size (Graph)
Allsopp (1997)	Using Classwide Peer Tutoring to Teach Beginning Algebra Problem-Solving Skills in Heterogeneous Classrooms (<i>Remedial and Special Education</i>)	Effect Size: 0.113 LCI: -0.132 UCI: 0.358 Weight: 0.479 Standard error: 0.125	
Crawford (2014)	LIT Programme: Evaluation report and executive summary (<i>NA</i>)	Effect Size: 0.09 LCI: -0.039 UCI: 0.219 Weight: 0.496 Standard error: 0.066	
Cantrell (2010) 1_2	The impact of a strategy-based intervention on the comprehension and strategy use of struggling adolescent readers (<i>Journal of Educational Psychology</i>)	Effect Size: 0.076 LCI: -0.119 UCI: 0.271 Weight: 0.488 Standard error: 0.099	
Aleven (2002) 1_2	An effective metacognitive strategy: learning by doing and explaining with a computer-based Cognitive Tutor (<i>Cognitive Science</i>)	Effect Size: 0.076 LCI: -0.538 UCI: 0.69 Weight: 0.38 Standard error: 0.313	
Molenaar (2011)	Metacognitive scaffolding in an innovative learning arrangement (<i>Instructional Science</i>)	Effect Size: 0.073 LCI: -0.267 UCI: 0.413 Weight: 0.458 Standard error: 0.174	
Lewanski (1998)	The effect of computer-assisted library research on critical thinking skills acquisition of ninth-grade students (<i>NA</i>)	Effect Size: 0.061 LCI: -0.241 UCI: 0.363 Weight: 0.467 Standard error: 0.154	
Bruce (2001) 1_2	The Clever Kid's Reading Program: Metacognition and Reciprocal Teaching (<i>Annual European Conference on Reading</i>)	Effect Size: 0.06 LCI: -0.508 UCI: 0.628 Weight: 0.394 Standard error: 0.29	
McCarthy-Tucker (1998)	Teaching logic to adolescents to improve thinking skills (<i>Korean Journal of Thinking and Problem Solving</i>)	Effect Size: 0.037 LCI: -0.305 UCI: 0.379 Weight: 0.457 Standard error: 0.174	
Slavin (2009) 1_2	The Reading Edge: a randomized evaluation of a middle school cooperative reading program (<i>Effective Education</i>)	Effect Size: 0.028 LCI: -0.173 UCI: 0.228 Weight: 0.487 Standard error: 0.102	

Author	Title	Effect Size	Effect Size (Graph)
Thomas (1975)	The Effects of Instruction on the Critical Thinking Abilities of Middle-School-Age Children (<i>Annual Meeting of the American Educational Research Association</i>)	Effect Size: 0.026 LCI: -0.114 UCI: 0.166 Weight: 0.495 Standard error: 0.071	
Perels (2005) 1_2	Training of self-regulatory and problem-solving competence (<i>Learning and Instruction</i>)	Effect Size: 0.007 LCI: -0.351 UCI: 0.365 Weight: 0.453 Standard error: 0.183	
Hanley (2016)	Let's Think Secondary Science (NA)	Effect Size: -0.003 LCI: -0.054 UCI: 0.048 Weight: 0.502 Standard error: 0.026	
Davey (1986)	Effects of question-generation training on reading comprehension (<i>Journal of Educational Psychology</i>)	Effect Size: -0.018 LCI: -0.578 UCI: 0.543 Weight: 0.396 Standard error: 0.286	
Kitmitto (2018)	Thinking, Doing, Talking Science - Effectiveness trial-Evaluation report and executive summary (NA)	Effect Size: -0.022 LCI: -0.066 UCI: 0.021 Weight: 0.503 Standard error: 0.022	
Gorard (2015)	Philosophy for Children: Evaluation report and executive summary (NA)	Effect Size: -0.026 LCI: -0.1 UCI: 0.048 Weight: 0.501 Standard error: 0.038	
Zohar (1993)	Incorporating Critical Thinking Into a Regular High School Biology Curriculum (<i>School Science and Mathematics</i>)	Effect Size: -0.033 LCI: -0.48 UCI: 0.414 Weight: 0.429 Standard error: 0.228	
Gambrell (1986)	Mental Imagery and the Comprehension-Monitoring Performance of Fourth- and Fifth-Grade Poor Readers. (<i>Reading Research Quarterly</i>)	Effect Size: -0.036 LCI: -0.388 UCI: 0.316 Weight: 0.455 Standard error: 0.18	
Hanley (2015)	Thinking Doing Talking Science: Evaluation report and executive summary (NA)	Effect Size: -0.043 LCI: -0.143 UCI: 0.058 Weight: 0.499 Standard error: 0.051	

Author	Title	Effect Size	Effect Size (Graph)
Torgerson (2018)	Calderdale Excellence Partnership: IPEELL (Effectiveness Trial)- Evaluation report and executive summary (NA)	Effect Size: -0.067 LCI: -0.146 UCI: 0.012 Weight: 0.501 Standard error: 0.04	
Guthrie (1998)	Does concept-oriented reading instruction increase strategy use and conceptual learning from text? (Journal of Educational Psychology)	Effect Size: -0.079 LCI: -0.494 UCI: 0.335 Weight: 0.438 Standard error: 0.211	
Guthrie (2004) 1_1	Increasing Reading Comprehension and Engagement Through Concept-Oriented Reading Instruction. (Journal of Educational Psychology)	Effect Size: -0.083 LCI: -0.317 UCI: 0.151 Weight: 0.481 Standard error: 0.119	
Germann (1989)	Directed-inquiry approach to learning science process skills: treatment effects and aptitude-treatment interactions (Journal of Research in Science Teaching)	Effect Size: -0.11 LCI: -0.59 UCI: 0.369 Weight: 0.42 Standard error: 0.245	
Ennis (1969)	Conditional Logic and Children. (Cornell Critical Thinking Readiness Project, Phase IIC). (NA)	Effect Size: -0.132 LCI: -0.426 UCI: 0.163 Weight: 0.468 Standard error: 0.15	
Dorsett (2014)	Mind the Gap: Evaluation report and executive summary (NA)	Effect Size: -0.141 LCI: -0.696 UCI: 0.414 Weight: 0.398 Standard error: 0.283	
Meyer (2010)	Improving literacy and metacognition with electronic portfolios: Teaching and learning with ePEARL (Computers & Education)	Effect Size: -0.172 LCI: -0.404 UCI: 0.06 Weight: 0.481 Standard error: 0.118	
Rienzo (2015) 1_2	Changing Mindsets: Evaluation report and executive summary (NA)	Effect Size: -0.204 LCI: -0.335 UCI: -0.072 Weight: 0.496 Standard error: 0.067	
Guterman (2003)	Integrating written metacognitive awareness guidance as a 'psychological tool' to improve student performance (Learning and Instruction)	Effect Size: -0.219 LCI: -0.487 UCI: 0.05 Weight: 0.474 Standard error: 0.137	

Author	Title	Effect Size	Effect Size (Graph)
Carr (1995)	Brief Metacognitive Intervention and Interest as Predictors of Memory for Text. Reading Research Report No. 35. (NA)	Effect Size: -0.226 LCI: -0.693 UCI: 0.241 Weight: 0.424 Standard error: 0.238	
MacDonald (1986)	Self-generated questions and reading recall: Does training help? (Contemporary Educational Psychology)	Effect Size: -0.227 LCI: -0.797 UCI: 0.343 Weight: 0.393 Standard error: 0.291	
Alfassi (1998)	Reading for Meaning: The Efficacy of Reciprocal Teaching in Fostering Reading Comprehension in High School Students in Remedial Reading Classes (American Educational Research Journal)	Effect Size: -0.232 LCI: -0.73 UCI: 0.267 Weight: 0.414 Standard error: 0.254	
Westbrook (1991)	An Analysis of the Relationship between Student-Invented Hypotheses and the Development of Reflective Thinking Strategies (Annual Meeting of the National Association for Research in Science Teaching)	Effect Size: -0.261 LCI: -0.714 UCI: 0.192 Weight: 0.428 Standard error: 0.231	
Hedin (2008)	The effects of thinking aloud on the comprehension and monitoring of sixth graders (NA)	Effect Size: -0.284 LCI: -0.93 UCI: 0.362 Weight: 0.37 Standard error: 0.33	
Gudbrandsen (2005) MSR	The effect of tutoring and metacognition on 5th- and 6th-grade students' reading strategies, reading comprehension, and attitude toward reading (NA)	Effect Size: -0.309 LCI: -0.915 UCI: 0.297 Weight: 0.382 Standard error: 0.309	
Lubliner (2005)	The Effects of Comprehensive Vocabulary Instruction on Title I Students' Metacognitive Word-Learning Skills and Reading Comprehension (Journal of Literacy Research)	Effect Size: -0.313 LCI: -0.737 UCI: 0.111 Weight: 0.436 Standard error: 0.216	
Shayer (1987)	Does Instrumental Enrichment Work? (British Educational Research Journal)	Effect Size: -0.384 LCI: -1.531 UCI: 0.763 Weight: 0.236 Standard error: 0.585	
Stoeger (2008)	Evaluation of a classroom based training to improve self-regulation in time management tasks during homework activities with fourth graders (Metacognition and Learning)	Effect Size: -0.406 LCI: -0.674 UCI: -0.138 Weight: 0.474 Standard error: 0.137	

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Huff (2009)	Using strategy instruction and confidence judgments to improve metacognitive monitoring (<i>Metacognition and Learning</i>)	Effect Size: -0.424 LCI: -0.921 UCI: 0.073 Weight: 0.415 Standard error: 0.254	
Wright (2003) MSR	Teaching Phonological Awareness and Metacognitive Strategies to Children with Reading Difficulties: A comparison of two instructional methods (<i>Educational Psychology</i>)	Effect Size: -0.618 LCI: -1.293 UCI: 0.057 Weight: 0.361 Standard error: 0.344	
Langdon (1984)	Teaching High School Students to Identify Main Ideas in Expository Text (<i>The Journal of Educational Research</i>)	Effect Size: -0.683 LCI: -1.616 UCI: 0.25 Weight: 0.287 Standard error: 0.476	
Cohen (1983)	Self-generated questions as an aid to reading comprehension (<i>Reading Teacher</i> ,)	Effect Size: -0.711 LCI: -1.302 UCI: -0.119 Weight: 0.387 Standard error: 0.302	