Let's think

Evidence for Efficacy (CASE)

Study & Aim	***Context & Sample***	***Nature of CASE Intervention***	***Measures***	***Main Outcomes***	***Link to evidence***
Adey, Shayer & Yates (CASE II: 1984-1989) Study of effectiveness of programme on student's cognitive development and examination performance Followed CASE I (exploratory project)	London, UK Implemented in 10 classes (Year 7; 11+ years & Year 8; 12+ years) in 7 different types of schools (N=190 pupils) Also control classes identified in same schools (N=208 pupils)	30 CASE lessons over two years (one every two weeks approx.)	Cognitive level – SRTs (pre-test, post-test, delayed post-test) Academic achievement – End of year science exam (delayed post-test) – GCSE (2 years after completion)	Highly significant gains in science reasoning for 12+ boys (although results bimodal) Experimental group made a gain of 34 percentile points (in delayed post-test) Significant gains on science achievement GCSE results show experimental group averages one grade higher than control group (12+ group, 1σ; 11+ group, 0.6σ) Significant gains also in GCSE maths and English for 11+ girls and 12+ boys	Adey & Shayer (1990), Shayer & Adey (1992a), Shayer & Adey (1992b), Shayer & Adey (1993), Adey & Shayer (1993)

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Jones & Gott (1998) To report on the implementation of CASE in a naturalistic setting.	Sunderland, UK Five comprehensive schools (4 co-ed, 1 all boys).	Followed CASE in 1 UK local education authority from its implementation in 1992 to 1995 SATs.	Achievement – Key Stage 3 SATs results Teacher view – Teacher Opinion questionnaire	Overall SAT performance for all students showed an increase of 0.5* of a SAT level for those involved in CASE *(Variation among schools)	Cognitive acceleration through science education: alternative perspectives. International Journal of Science Education, 20(7) pp.755–768
Maume (1998) CASE intervention implemented in one academic year	Republic of Ireland 12+ year old males (First year of secondary school)	30 CASE lessons taught within and outside of normal class time	Cognitive level – SRT (pre-test & post-test) Mathematical ability – Richmond test Achievement – End of year science exam	Increased cognitive ability of exp group (1σ) No sig difference for tests of mathematical ability or achievement	An examination of the feasibility of running the CASE intervention programme in one academic year. Master's thesis (Trinity College)
Shayer (1999)	Sunderland, UK Refutation to Jones & Gott study (1998)		Cognitive level – SRT (pre-test & post-test)	Increased cognitive ability (Large σ for most groups) Mean gains in order of 30 percentile points Long-term gains (GCSE results in Science, Maths & English)	Cognitive acceleration through science education II: its effects and scope. International Journal of Science Education, 21(8) pp.883-902
Shayer (1999)	UK 11 schools (trained by King's College)	30 CASE lessons over two years (one every two weeks approx.)	Cognitive level – SRTs (pre-test) Academic achievement – GCSE (2 years after completion)	Added- values grades: Science: 1.02 (0.6σ), Maths: 0.95 (0.5σ) English: 0.90 (0.57σ)	GCSE 1999: Added-value from schools adopting the CASE intervention

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Iqbal & Shayer (2000) CASE implemented in an effort to increase cognitive level and school achievement of students (prior research showed demands of curriculum was in excess of student abilities)	Pakistan Implemented in 3 schools (2 private, fee-paying and 1 public) over a two year period with students aged between 11.5- 13 years	CASE implemented at secondary level Ambitious training programme (2 days intensive training, teachers witnessed CASE lessons been taught at University of Punjab, the teachers teach the lesson in their school). This was dropped after 8 lessons and replaced with after-school discussion on lessons. This was further replaced by visit from the lead author.	Cognitive level – SRT II (pre-test) & III (post-test)	Post-test means of experimental group were higher than control (who had higher pre-test scores) RGS showed that boys made greater gains than girls	Accelerating the Development of Formal Thinking in Pakistan Secondary School Students: Achievement Effects and Professional Development Issues. Journal of Research in Science Teaching, 37, pp. 259-274
Endler & Bond (2001) To examine the influence of CASE on cognitive development and academic achievement	North Queensland, Australia 141 students in one private, co-ed school. 29 students followed over 5 years, 112 Students form a comparison	CASE intervention delivered to all three science classes in the year group	Cognitive level – Bond's Logical Operations Test Achievement – Australian Schools Science Competition results 1993 (Y8) and 1995 (Y10).	CASE group showed higher cognitive levels than those joining school after program delivery. Statistically significant relationship between BLOT and achievement in science (r=0.8)	Cognitive Development in a secondary science setting. Research in Science Education, 30(4) pp.403-416

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Hautamäki, Kuusela & Wikström (2002)	Vihti, Finland All Year 6 (12+ years) pupils in town randomly assigned to CASE (N=92), CAME (N=92), control (N=92)	True randomised control experiment Intervention over 1 year (1 CASE/ CAME lesson per week)	Cognitive level – Test of higher cognitive functions & mental arithmetic (pre- and post test) 2 SRTs (post-tests)	CASE, CAME & control groups made significant gains in cognitive development. Immediate post-test showed gain of 1 σ against national norms	CASE and CAME in Finland: "The second wave". Harrogate: 10th International Conference on Thinking.
Choi, Han, Kang, Lee, Kang, Park & Nam (2002) Study of effectiveness of CASE in Korea, with an interest in gender	Korea CASE implemented in 6 middle schools (7th grade, aged 12+) N= 841 Non-intervention group also identified (no CASE intervention)	CASE intervention delivered	Cognitive level – SRT II (pre-test) & VII (post-test)	Statistically significant gains in CASE group compared to non-intervention. Cognitive level of CASE group significantly increased compared with non-intervention group (regardless of gender). Effects were shown greater for the concrete op- students, than for transitional/ early formal	Synopsis on p.167 of this document

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Mbano (2003) To investigate if older students could benefit from CASE	Malawi 425 pupils (148 girls & 277 boys, mean age 16.5) from seven schools	In experimental school pupils participated in 1 CASE lesson per fortnight instead of their normal science lesson	Cognitive level – SRT II (pre-test)& III (post-test) Academic achievement – Malawi School Certificate of Education results in biology, physical science, maths and English Teacher and pupil views – semi-structured interviews.	Significant gains in cognitive level in experimental school students over control school students ($p<0.01$) Experimental boys outperformed control boys in all four subject areas. Experimental girls outperformed control girls in physical science only	The effects of a Cognitive Acceleration Intervention Programme on the performance of secondary school pupils in Malawi. International Journal of Science Education, (25) pp.71-87
Endler & Bond (2008) To assess the impact of an American version of CASE on student's ability to employ higher order thinking using different measurement instruments than earlier studies. To investigate if CASE can work in a suboptimal setting	Oregon, USA All students in grades 6-10 in one rural school district (approx 650 students) followed over 32 months Students split into 3 cohorts according to age. Cohort A were age 11 (6^{th} grade) at the beginning, Cohort B were 12 (7^{th} grade) and Cohort C were 13 (8^{th} grade).	Delivered CASE materials (renamed as STEP (Scientific Thinking Enrichment Project) without ongoing staff training and in-class support Initially delivered 1 lesson every 3 weeks to grades 6-10 (ages 11-16) but restricted to grades 7-9 (ages 12-15) after 1 year progress review. CASE lessons taught ranged from 13-21 depending on teacher	Cognitive level – Bond's Logical Operations Test Achievement – Oregon State Scores for science, maths, reading and literature. Teacher view – Teacher Satisfaction survey	Only cohort B showed a significant gain in cognitive level over the cross-sectional control. Cohorts A & B showed significantly higher results in maths than expected by the cross-sectional control. Significant correlations found between scholastic achievement and cognitive level for science, maths, reading and literature	Changing Science Outcomes: Cognitive Acceleration in a US Setting. Research in Science Education, 38(2) pp.149-166

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McCormack (2009) To investigate the effectiveness of CASE implemented across the primary-second level transition	Republic of Ireland Pupils aged 12- 13 years (Final year of primary school and first year of secondary school) (Primary school, N = 304; Secondary school, N=120; Across two years, N=32)	Delivered between 14-18 lessons at primary level and 14-16 lessons at second level. Some thought by researcher, teacher (training provided) and combination. Effects measured against non-intervention group (no CASE in either year)	Cognitive level – SRTs I (pre-test), II (post-test), III (pre-test)& IV (post-test) Teacher view – Teacher interview	Significant effect on science reasoning (Primary school, 0.5σ; Secondary school,0.52σ; Across two years, 1σ)	Cognitive Acceleration across the primary-second level transition PhD thesis (Dublin City University)
Babai & Levit-Dori (2009) To investigate if using a small section of the CASE programme raises student's performance in science	Central Israel Four Grade 9 (age 14-15, UK year 10) classes (N=120) in one school. Classes were randomly allocated to two teachers so that each teacher had one experimental and one control class.	Delivered the first four lessons from the CASE program (control of variables reasoning scheme) in accordance with CASE guidelines	Achievement – post-intervention exam on enzymes. Cognitive level – SRT II (pre-test)	Significant effect on post-intervention exam performance Significant effect of cognitive level on exam performance was reported with students working at higher cognitive levels achieving higher scores on the exam.	Several CASE Lessons Can Improve Students' Control of Variables Reasoning Scheme Ability. Journal of Science Education and Technology vol. 18 issue 5 October 2009. pp. 439 - 446
Moore, O'Donnell&Poirier (2012) Effectiveness of CASE when implemented at third level	Winona, USA Elementary education students (@university)	11 CASE lessons delivered in one of the two science classes Students given one lesson to work on over the weekend, and this was followed by a discussion on the Monday (30 min)	Cognitive level – Lawson's Classroom Test of Scientific Reasoning	Post-pre gains of ~2.2 points (on the paired 13 point scale). Normal gains for a one-semester are ~0.8-1.0 points.	Using Cognitive Acceleration Materials to Develop Pre-service Teachers' Reasoning and Pedagogical Expertise

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Oliver, Venville & Adey (2012) Effects of a Cognitive Acceleration Programme in a Low Socioeconomic High School in Regional Australia	Western Australia Year 8 & 9 (first and second year of junior high school, age 12-14) (N= 71)	CASE lessons delivered over two years in one school with six case study science teachers (15 in Year 8 and 15 in Year 9) Six days of PD for teachers over 2 years (away from school)	Cognitive level – SRT II (pre-test)& IV (post-test) Achievement – NAPLAN tests (literacy and numeracy) & WAMSE test (science knowledge, skills & understanding) Student view – questionnaire Teacher view – interview	Significant cognitive gains Improvement in state-wide testing in science when participating students were in Year 9 Teachers reported changes in the ways they teach and described challenges in implementing the programme	Effects of a Cognitive Acceleration Programme in a Low Socioeconomic High School in Regional Australia. International Journal of Science Education, 34:9, 1393-1410