Teaching and Learning RESEARCH BRIEFING

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Building thinking skills in thinking classrooms

ACTS (Activating Children's Thinking Skills) in Northern Ireland

In this project, frameworks and classroom strategies were developed with teachers to enhance children's thinking skills across the curriculum. The teaching approach used was called 'infusion'. It involves a curriculum topic and a specific pattern of thinking being taught together. The methods were evaluated in a three-year intervention study with Key Stage 2 pupils in Northern Ireland schools. A particular focus was on the development and analysis of classroom talk that helped children 'to think about their thinking'.

Using the infusion method, teachers were able to design and to teach lessons where a curriculum topic and a specific pattern of thinking were taught together.	→	This approach can be scaled up across the primary curriculum to allow an explicit emphasis on thinking to be integrated with learning curriculum topics.
Video analyses of lessons identified aspects of classroom talk and interactions that helped to develop children's thinking strategies.	→	Thinking lessons must be designed in tandem with the development of teaching methods that engage both the cognitive and the social resources of classrooms.
Teachers involved in the project participated in a Continuing Professional Development (CPD) programme. They reported changes in their class room practices, in their perceptions of children's thinking, and in their images of themselves as teachers.	→	Sustained teacher development needs to focus not only on classroom practices but on teachers' beliefs about, and images of, learners and learning.
Participating in ACTS resulted in positive changes in children's learning, particularly in their use of metacognitive strategies, which were related to effort. These changes took time to build and were not even across all learners.	→	Developing children's capacity to learn and become more skilful thinkers takes time. It needs careful support if children are to become autonomous and self-regulating. When scaling up, particular attention should be paid to children with poorer cognitive and social resources.

T·L·R·P TEACHING & LEARNING RESEARCH PROGRAMME

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

The research

It is generally agreed that children cannot become better thinkers – able to give reasons for their conclusions, to think flexibly and creatively, to solve problems and make good decisions – solely by learning a content-based curriculum. We must make clear what we mean by these different forms of thinking and set out to teach them more explicitly than we normally do in classrooms.

Various models of thinking can be used to guide such teaching. A core distinction is between 'enrichment' and 'infusion' approaches. Enrichment approaches generally draw on a specific cognitive theory. Lessons are pre-designed and are taught in parallel with existing ones. Examples include Cognitive Acceleration programmes and Instrumental Enrichment. In contrast, infusion approaches place thinking in the context of normal curricular topics so that topic understanding and thinking can be taught simultaneously. Infusion can be subject-specific (science, mathematics, history) or may be developed on a wider scale across the curriculum.

It has been argued that infusion across the curriculum is a good strategy for developing 'intelligent' novices who can recognise and use common patterns of thinking, deepen their understanding of curriculum topics, make connections between them, and thus be a position to capitalise on new learning opportunities. ACTS (Activating Children's Thinking Skills) adopted an infusion approach and built on the work of Robert Swartz and David Perkins in the US.

Figure 1 shows the ACTS thinking framework. It includes a range of different types of thinking. They include pattern-making through analysing wholes and parts and similarities and differences, making predictions and justifying conclusions, reasoning about cause and effect, generating ideas and possibilities, seeing multiple perspectives, solving problems and evaluating solutions, weighing up pros and cons, and making decisions. The types of thinking identified in the framework formed the basis for designing infusion lessons.

At the heart of the framework is a different type of thinking – metacognition. Metacognition refers to learners' capacity not only to engage in these explicit forms of thinking but also to use their emergent knowledge about thinking to plan, monitor and adjust their future learning and thinking. Thus metacognition has potential to facilitate the transfer of learning. One of the primary development goals of the ACTS project was to build a metacognitively-rich pedagogy to support children's learning and thinking so that they would be better placed to plan, monitor and appraise their own thinking.

Figure 1: ACTS thinking framework

What happened in the project and what did we find?

Three interrelated strands of investigation were pursued. In the first, a professional development programme was constructed to enable teachers to design infusion lessons and to engage with the classroom practices associated with the ACTS pedagogy. In the second strand, thinking lessons were video recorded to identify features of classroom dialogue which might help the development of metacognition. The third strand tracked the learning progress of 8–11-year-old children who participated in the ACTS project over a three-year period and compared them with a similar group of children who did not participate.

Working with teachers

One of the prime achievements of the research was to test the robustness of infusion for developing children's thinking across the curriculum. In all, 134 teachers of different ages and years of teaching experience participated in five ACTS professional development days throughout each school year. The professional development which they received was based on the notion of teacher collaboration, sharing practice and getting feedback. It included planned classroom activities, and was sustained over a period of a year. Teachers planned, designed and taught infusion thinking lessons to 8–11-year-old children (Key Stage 2 in Northern Ireland) from a variety of social backgrounds. Infusion lessons were taught across all areas of the curriculum and integrated into schemes of work. See Figure 2 for examples of infusion lessons.

Teachers reported substantial shifts in their classroom practices, in the benefits for children, and in their conception of themselves as teachers. The project showed how a primary curriculum that has an explicit emphasis on thinking, and is integrated with learning curriculum topics, can be developed and scaled up.

Classroom dialogue

Video recordings of thinking lessons were conducted with a sub-sample of 21 teachers. Analyses of the videos showed that the ACTS teachers arranged their classrooms in ways that supported opportunities for children's talk and created conditions that helped children to think more about their thinking. For example, they engaged children in cognitively demanding tasks and made thinking more evident in classrooms, by developing a vocabulary for talking about thinking. They modelled thinking in concrete situations and used visual tools such as diagrams and wall charts to aid thinking as well as to help reflection on thinking.

Figure 2: Examples of infusion lessons

In good thinking lessons, learners were given opportunities to talk about thinking, to jointly construct meaning, to evaluate their thinking and to make connections both within and beyond the curriculum. See Figure 3 for an example of a short excerpt of dialogue from a history lesson that supports thinking about decision-making. From the video transcripts a framework for analysing metacognition in classrooms was constructed. It includes a theoretical overview, a set of guidance notes for analysing videos and example excerpts of dialogue to illustrate the process which we have characterised as 'mediating metacognition'.

The evidence from the video recordings was corroborated by teachers' reports about changes in their classroom practices. A sample of 94 teachers who participated in the ACTS professional development programme completed questionnaires. They reported substantial changes in the quantity and quality of group work, increases in children's talking and listening and in the quality of questioning and, overall, more pupil involvement and independence. They also reported significant changes in their images of themselves as teachers, with an increased awareness of the importance and value of teaching thinking, being more open to alternative approaches and allowing children to be more independent in their learning.

Figure 3: Excerpt of dialogue from an infusion lesson on decision-making in a history topic

Children's learning

In the main intervention study, comparisons were made between three groups of children. Two groups of children participated in ACTS for different lengths of time: one group for three years (N=292, 12 classes) and another group for one or two years (N=412, 17 classes). Children from these ACTS classes were compared with a third group of similar children from different schools who were not taught using the ACTS pedagogy (N=548, 25 classes) but whose learning was tracked over the three years of the project.

The main findings were that participating in ACTS had a statistically significant positive effect on how children rated themselves with regard to their use of cognitive and metacognitive strategies, and this change was related to their willingness to work harder and to put in more effort. For example, ACTS children rated themselves higher than control children on items such as:

'I spend some time thinking about how to do my work before I begin it' (planning)

'I ask myself questions when I do my work to make sure I understand' (self-monitoring)

'When I make mistakes I try to figure out why' (evaluating)

'When we have difficult work to do in the class, I try to figure out the hard parts on my own' (independence)

and they rated themselves lower than the control children on items such as

'When I do work I just want to get it done as quickly as possible'.

There are important qualifications to this general conclusion. The effects took time to build and those children who participated in ACTS for three years benefited most. There were few systematic effects for those who participated for one or two years only. In addition, the positive changes were not the same for all children. Children with moderate to high developed abilities (as measured by verbal and non-verbal reasoning tests), and who represented 80 per cent of the sample, benefited most. On the self-rating measures, no positive outcomes were identified for children with poorer developed ability. When poorer children were given problems to solve they did show positive changes in their strategies compared to control children, but these specific achievements did not translate into how the children rated themselves more generally.

Children's self-evaluations of their thinking strategies were positively correlated with measures of attainment in reading and mathematics. But the effects were small compared to the impact of background factors that we know have more powerful effects of attainment, such as social-economic circumstances, gender, previous ability, and age-in-class. This meant that the positive changes in children's self-ratings led to only small statistical improvements in attainment. Nevertheless, this project has shown that thinking skills and strategies are amenable to change. When children become more aware of what they are – and how and when to use them – they can become an important lever for educational improvement.

Major implications

Developing broader learning goals has surfaced as a national priority for many countries including the UK. National curriculum planners across the UK and elsewhere are now engaged in revising and redesigning their curricula and writing guidance materials to help schools give greater emphasis to developing the quality of children's thinking and learning. The findings from this project indicate future directions for these developments.

Becoming and remaining pro-thinking

An important focus for the project was to help build sustainable thinking classrooms.

The potential for sustainability was designed into the project at several levels. The infusion methodology demanded that teachers design and re-design lessons from topics across the curriculum rather than teach from pre-designed thinking lessons. We wanted to allow teachers to consider their own lesson intentions more deeply with regard to higher-order thinking as well as learning to design appropriate tasks and activities.

Evidence from the project showed that teachers were able to design and teach infusion lessons across all areas of the curriculum and that these lessons were integrated into schemes of work. This infusion step was not necessarily straightforward and teachers benefited from sustained CPD that involved collaboration, sharing and feedback. If an explicit and systematic focus on thinking is to be successfully designed into the curriculum, teachers need time for planning, and opportunities for collaborative professional development.

Several strategies were adopted to enhance sustainability, particularly to increase the numbers of teachers from each school who participated in the project. All teachers reported that they were continuing with the methodology, although differences emerged in the teachers' self-reported level of involvement, and in the degree to which schools embraced the ACTS pedagogical practices. A link officer from each of the five Education and Library Boards in Northern Ireland was attached to the project, both to sustain the project for three years and to continue the work with new groups of teachers and schools. The potential for sustainability at a systems level was considerably enhanced by the direction of national curriculum developments in Northern Ireland.

A 'critical mass' of teachers seems important for an innovation on thinking across the curriculum to be sustained. Continuing support is needed within and outside the school. Such innovations are more likely to be sustained if they are consistent with general policy directions.

Metacognition as an organising concept

One of the prime aims of the project was to help teachers develop a metacognitively rich pedagogy with a focus on classroom talk. The findings show that both dialogue and practices were important. ACTS teachers arranged their classrooms in ways that gave children opportunities to talk. They shifted between teacher-led and pupil-led activities, and gave pupils time to talk both to each another in pairs and groups, and to the whole class. This links with findings from the TLRP SPRinG project on groupwork (see www.spring-project.org.uk). In addition, they designed activities that were sufficiently cognitively challenging for children to think about and to reflect on their thinking. To support the development of thinking, teaching methods need to engage both the cognitive and social resources of classrooms.

Children's learning was evaluated by the extent to which they had adopted a more general self-regulatory approach to learning that would permit them to recognise their newly-learned active thinking strategies and to transfer them both within and outside the curriculum. Findings showed it was possible to change children's metacognitive and self-regulatory orientations, although they take time to build in this age group. When scaling up, particular attention needs to be paid to children in the classroom with poorer cognitive and social resources.

Images of learners and learning

In contrast to the passive images of learning that can dominate a content-based curriculum, the image of learners and learning that underpinned this project was one where learners were viewed as potential agents in their own learning, and where expectations were set for high quality thinking and learning. Learners were considered capable of being mindful and resourceful about their learning and were encouraged to participate in joint meaning-making. The project's findings suggest that this image was not fully realised in all the children's experiences, yet it did prove possible to 'turn around' a large number of children to be more proactive about their learning and thinking.

We also found that teachers experienced important changes in their images of themselves as teachers. They described an increased awareness of the importance and value of teaching thinking, of being more open to alternative approaches and allowing children to be more independent in their learning. Images of learners and learning are important factors for changes in curriculum, teachers' professional development, classroom practices and children's conceptions of themselves as learners.

References

Swartz, R. and Parks, S. (1994) *Infusing the Teaching of Critical and Creative Thinking into Content Instruction: A lesson design handbook for the elementary grades. California: Critical Thinking Press and Software.*

Tishman, S., Perkins, D. and Jay, E. (1995) *The Thinking Classroom: Learning and teaching in a culture of thinking*. Boston, MA: Allyn & Bacon.

Further information

Further information about the project and related research can be obtained from the project website www.sustainablethinking-classrooms.ac.uk or from the TLRP website www.tlrp.org.

Related conference presentations include McGuinness, C. et al. (2005) 'Metacognition in primary classrooms: a pro-ACTive learning effect for children'. Paper presented at the TLRP Annual Conference, University of Warwick, November.

Related research publications
McGuinness, C. (2005) 'Teaching thinking: theory and practice'. *British Journal of Educational Psychology, Monograph Series II*, 3, 107–126.

McGuinness, C. (1999) *From Thinking Skills to Thinking Classrooms: A review and evaluation of approaches for developing pupils' thinking*. Norwich: HMSO, DfEE Research Report No 115.

The teachers' handbook from the project is being prepared as part of the TLRP's Improving Practice Series and additional materials will be available shortly through the project website. A book is also under preparation as part of the TLRP's Improving Learning Series.

Sister projects, using the ACTS framework, teaching materials and CPD programme, have been launched in Wales (Ceredigion and Carmarthenshire), England (Surrey), and Scotland (East Ayrshire). These projects have separate evaluation strategies.

At the level of policy, the research is influencing curriculum developments in Northern Ireland through CCEA's Thinking Skills and Personal Capabilities Framework, in Wales through ACCAC's project linking thinking skills approaches with assessment for learning, and through key skills development work with the curriculum council in the Republic of Ireland (NCCA).

The warrant

The evaluation strategy for the main intervention phase of the study was a longitudinal evaluation of the impact of the ACTS pedagogy on children's learning over three years. The design was quasi-experimental and the progress of the ACTS children was compared with a control group matched on a range of measures. Some children participated for one or two years and others for three years, permitting further comparisons to be made. The primary outcome measures for children's learning included both standardised tests of attainment and self-rating questionnaires with good psychometric properties relating to reliability and validity. Additional construct validity work was conducted on the self-rating questionnaires for the age group involved. Extensive multivariate regression analyses permitted the relative influences of the different variables to be assessed.

The theoretical coherence and focus on metacognition is evident throughout the different strands of the project, from the ACTS Thinking Framework, through the pedagogy, to the evaluation of children's learning outcomes. The project builds on a substantial earlier review of the research literature on developing children's thinking through classroom interventions.

User credibility with regard to the pedagogy and the CPD programme is warranted through evaluations and reports from cohorts of teachers who have been involved in the programme, whose feedback have refined it and who have written infusion lessons. Additional endorsement on user credibility came from requests by school principals in Northern Ireland that the CPD programme should continue beyond that which was initially planned within the timescale of the funded project (from one year to three years).

The CPD programme has also been trialled with teachers in England, Scotland and Wales, with separate evaluation strategies.

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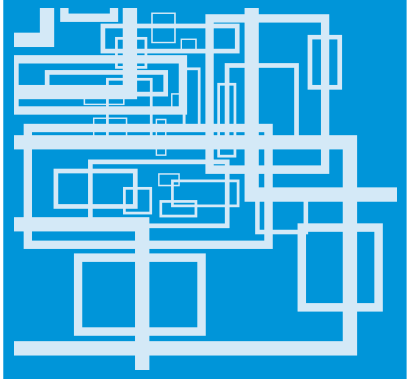
Teaching and Learning Research Programme



TLRP involves over 30 research teams with contributions from England, Northern Ireland, Scotland and Wales. Work began in 2000 and will continue to 2008/9.

Learning: TLRP's overarching aim is to improve outcomes for learners of all ages in teaching and learning contexts across the UK.

Outcomes: TLRP studies a broad range of learning outcomes, including the acquisition of skill, understanding, knowledge and qualifications and the development of attitudes, values and identities relevant to a learning society.

Lifecourse: TLRP supports projects and related activities at many ages and stages in education, training and life-long learning.

Enrichment: TLRP commits to user engagement at all stages of research. It promotes research across disciplines, methodologies and sectors, and supports national and international co-operation.

Expertise: TLRP works to enhance capacity for all forms of research on teaching and learning, and for research informed policy and practice.

Improvement: TLRP develops the knowledge base on teaching and learning and policy and practice in the UK.

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