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Scaling up higher order thinking skills and personal capabilities in primary science: Theory-into-policy-into-practice

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ABSTRACT

This paper builds on and contributes to work on learning and teaching in science, specifically in the area of thinking skills in primary (elementary) and early post-primary science education. It is based on the development and implementation of policy on thinking skills and personal capabilities in Northern Ireland (NI), where they form part of the statutory curriculum. The paper traces the development of a framework for thinking skills and personal capabilities, the adoption of the framework and its translation into policy, and through research on implementing the policy in school science. This critical exploration of theory-into policy-into practice demonstrates ways in which gaps in the process can be addressed, such as the higher-level involvement of teachers as researchers into policy development and implementation, as opposed to being merely 'trained' to implement new science learning and teaching policy. The contribution of pre-service teachers in the process provided an important element of the implementation process, particularly in relation to primary science. The article provides insight into issues such as how might we 'teach' thinking skills in conceptually rich science content, the relationship between thinking skills in science and other subjects, and the links between research and practice in children's science learning.

1. Introduction

Science lessons in primary (elementary[1]) and early post-primary[2] classrooms provide ideal opportunities for developing children's thinking skills and personal capabilities (TSPC). In Northern Ireland (NI), TSPC forms part of the statutory curriculum to be addressed in all curricular areas and subjects. They are presented as a framework (see Fig. 1):

This paper sets out the theory informing policy on TSPC in Northern Ireland and considers its implementation in schools from the standpoint of three primary science research studies.

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[1] Primary 1 children in Northern Ireland are 4 years old – equivalent to Kindergarten children in the US.
[2] Early post-primary includes children up to the age of 14 (grade 9 in the US).

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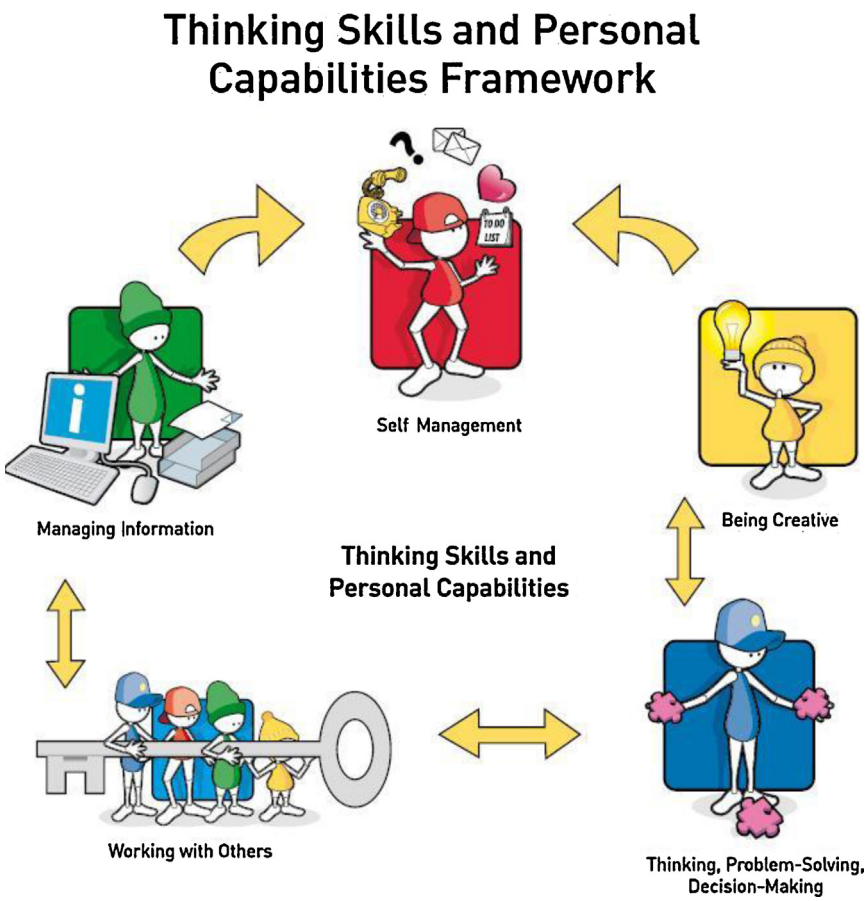

Fig. 1. The thinking skills and personal capabilities framework (NI Curriculum, 2007).

2. Theory into policy

Education systems internationally have sought to define the kinds of skills considered essential for a prosperous economy, and also for personal well-being, which can be reflected through curriculum, assessment and qualifications. There have been many attempts to describe such skills, for example, Lucas and Claxton (2009) who drew out underlying strengths and generalities. Research carried out by McGuinness (2000) on thinking skills and by Bianchi on personal capabilities was used as a basis on which to underpin the construction of the Northern Ireland revised curriculum skills framework (CCEA, 2007a).

The focus of McGuinness's research was the activating children's thinking skills (ACTS) methodology for enhancing thinking skills across the curriculum (McGuinness, 2000) which took place prior to and during the curriculum review. This infusion methodology identified contexts across the curriculum where particular thinking skills could be developed. The methodology contrasted with other attempts to teach thinking in a more generic (Feuerstein, Rand, Hoffman & Miller, 1980) or subject specific way (Adey & Shayer, 1994). Rather, it drew on Swartz and Parks (1994) taxonomy of thinking skills, including:

- searching out order and imposing meaning on information (sequencing, ordering information, analysing etc.)
- critical thinking (making predictions, hypothesising, drawing conclusions, determining bias etc.)
- creative thinking (generating new ideas)
- problem solving (defining problems, thinking up and testing different solutions)
- planning (setting up sub-goals and monitoring progress)
- decision making (generating options, weighing up pros and cons, choosing a course of action)

McGuinness (2000) explored the implications of making thinking explicit using thinking diagrams or graphic organisers, developing thinking vocabulary, giving students time to think and use discussion and reflection on thinking strategies as a way to increase competence, as well as developing teachers' questioning techniques. Findings from her research indicated a pattern of change in the students that was noted as a 'pro-active' learning effect. Children rated themselves with regard