Cognitive Acceleration Through Science Education (CASE) in the Irish Primary School

Susan Ryan

Dr. Odilla E. Finlayson
Dr. Thomas J.J. McCloughlin
Dr. Eilish McLoughlin

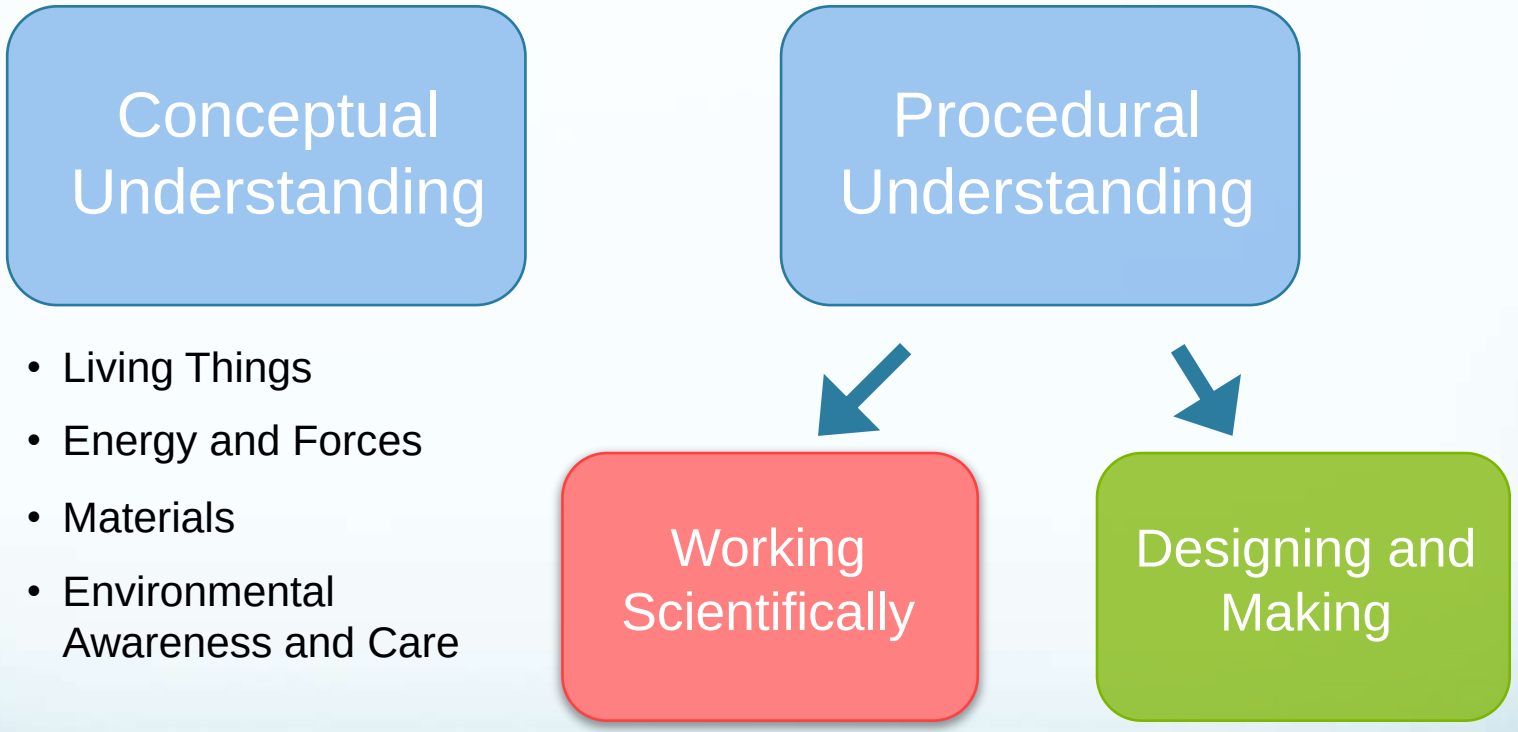
IRC

intel

Aims of Primary Science

- Develop students' knowledge and understanding of scientific concepts
- Foster positive attitudes towards science
- Develop students' scientific literacy
- Develop a scientific approach to problem-solving

Primary Science Curriculum



- Living Things
- Energy and Forces
- Materials
- Environmental Awareness and Care

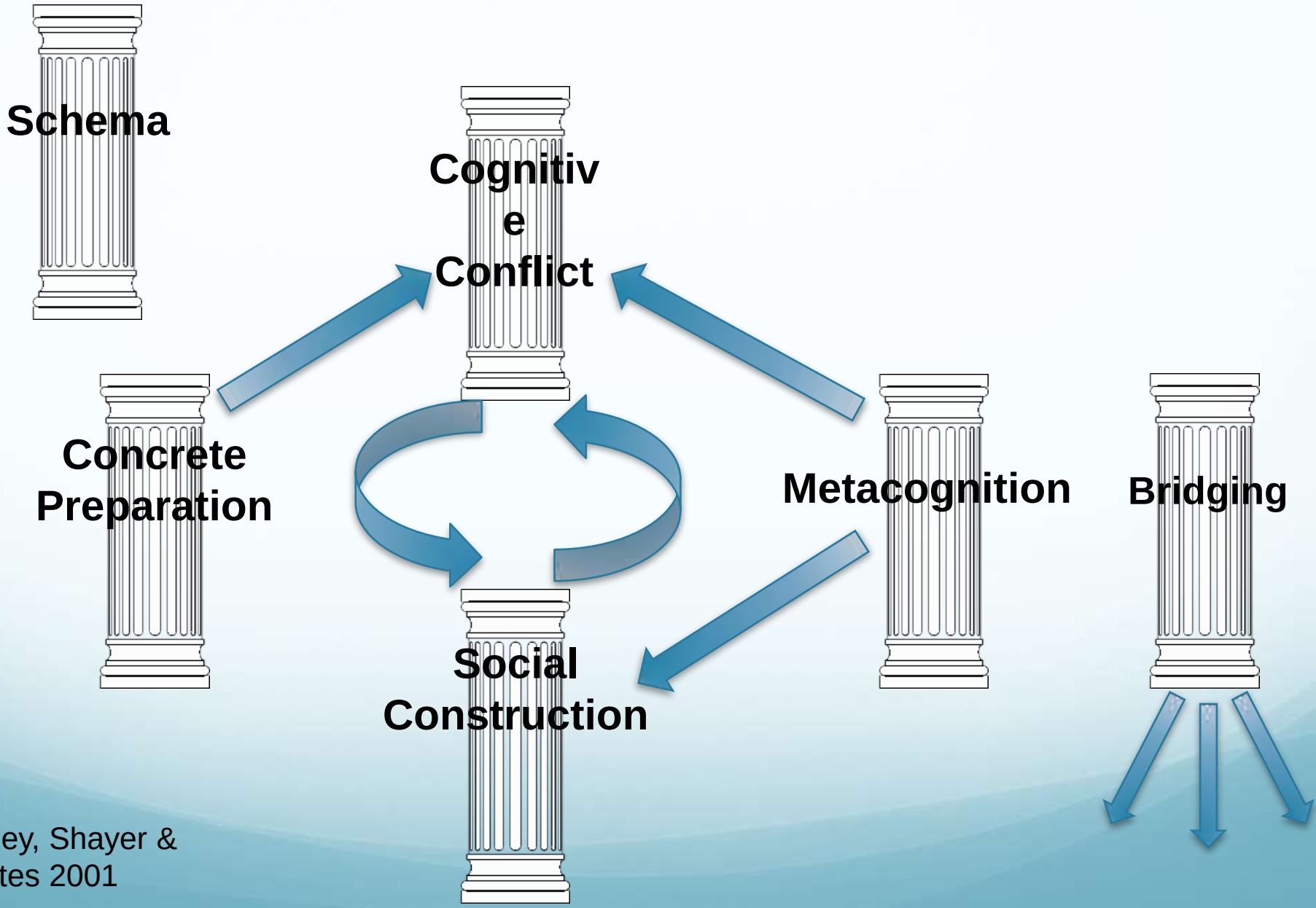
Rational for the study

Varley *et al.*, (2008)	• Lack of student led investigations • Under-development of students' scientific skills
NCCA, (2008)	• Students' HOTS highlighted as area of concern • Recommends a culture of thinking be promoted within the teaching of primary science
TIMSS (2011)	• Poor reasoning skills • 35% of students able to apply their knowledge and to explain everyday scientific phenomena

Aims

- Assess whether the CASE methodology could be integrated into the teaching of science at all levels in an Irish primary school,
- Evaluate the teachers' implementation of the lessons and identify areas of difficulty

Pillars of CASE



Adey, Shayer & Yates 2001

Why CASE?

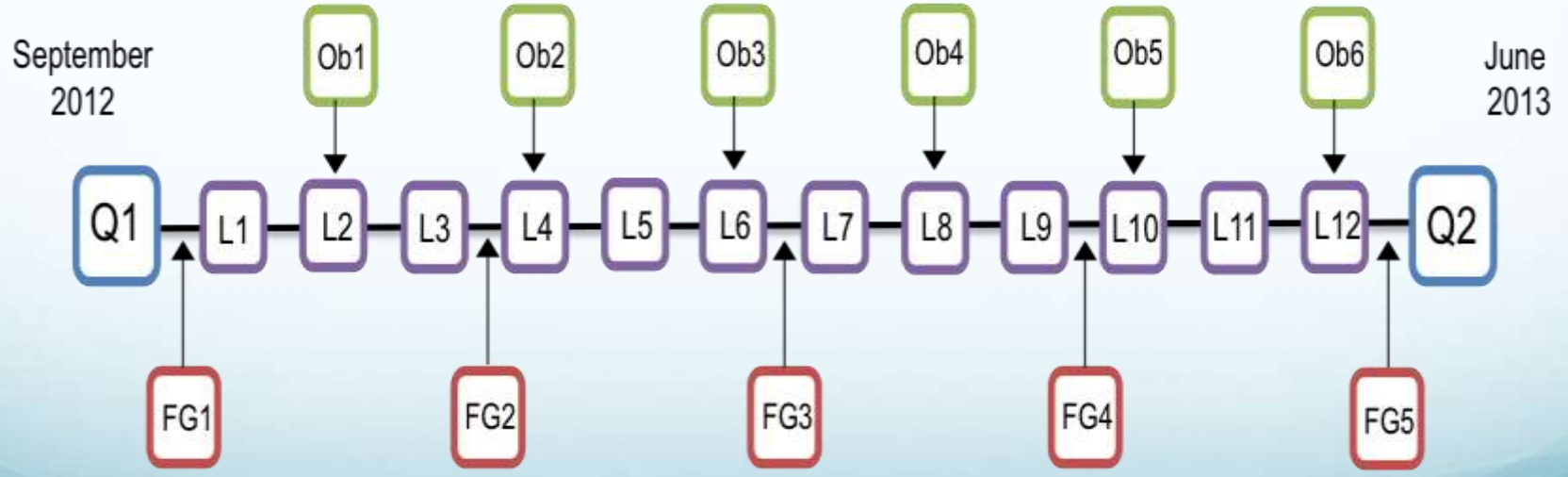
- Embedded within the context of science
- Continuously shown to have positive effects on students thinking skills (Shayer, 1999; Adey *et al*., 2002)
- Has previously shown to have positive effects in promoting Irish students' thinking abilities (Gallagher, 2007; McCormack, 2009)

Mapping the CASE lessons onto the primary science curriculum

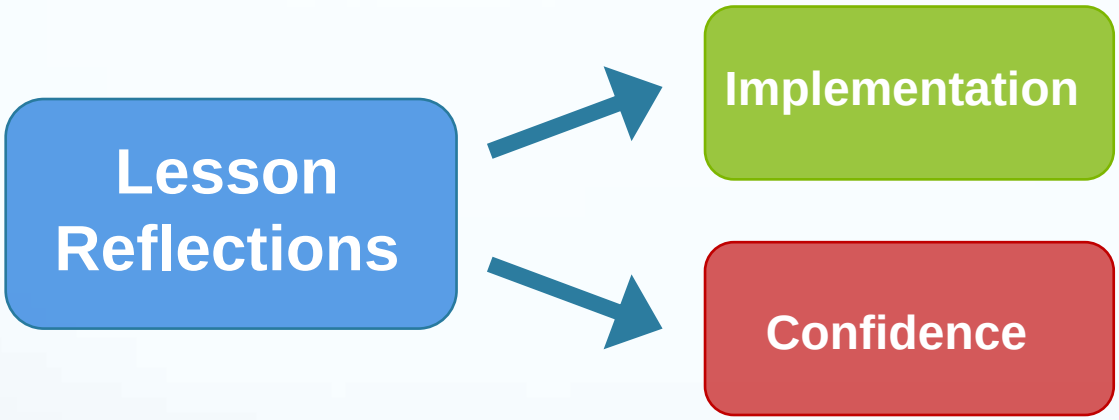
Lesson No.	3rd Class Lesson	Schema	Strand Unit/ Skill	Objective
1	Climb that mountain	Introductory Activity	Working Scientifically	Interpret information and offer explanations
2	Make that Box	Introductory Activity	Design and make	Planning, making, evaluating
3	Who am I?	Classification	Human Life/Plant and animal life	Diversity in human and animal skeletons
4	All these Bones	Classification/ Seriation	Human Life	Identify different human bones and their function
5	What makes me move?	Concrete Modelling	Human Life	Investigate how people move (bones/joints)
6	Where do I live?	Classification	Plant and Animal life	Investigate plants and animals that live in local and wider environments
7	How am I Adapted?	Causality	Plant and Animal life	Observe and explore ways in which plants and animals are adapted to their environments
8	What am I?	Causality	Plant and Animal life	Observe and explore ways in which plants and animals are adapted to their environments
9	How Hot are You?	Classification	Heat	Thinking about the temperatures of ordinary objects
10	Hotter or Colder?	Variables	Heat	Learn that heat can be transferred

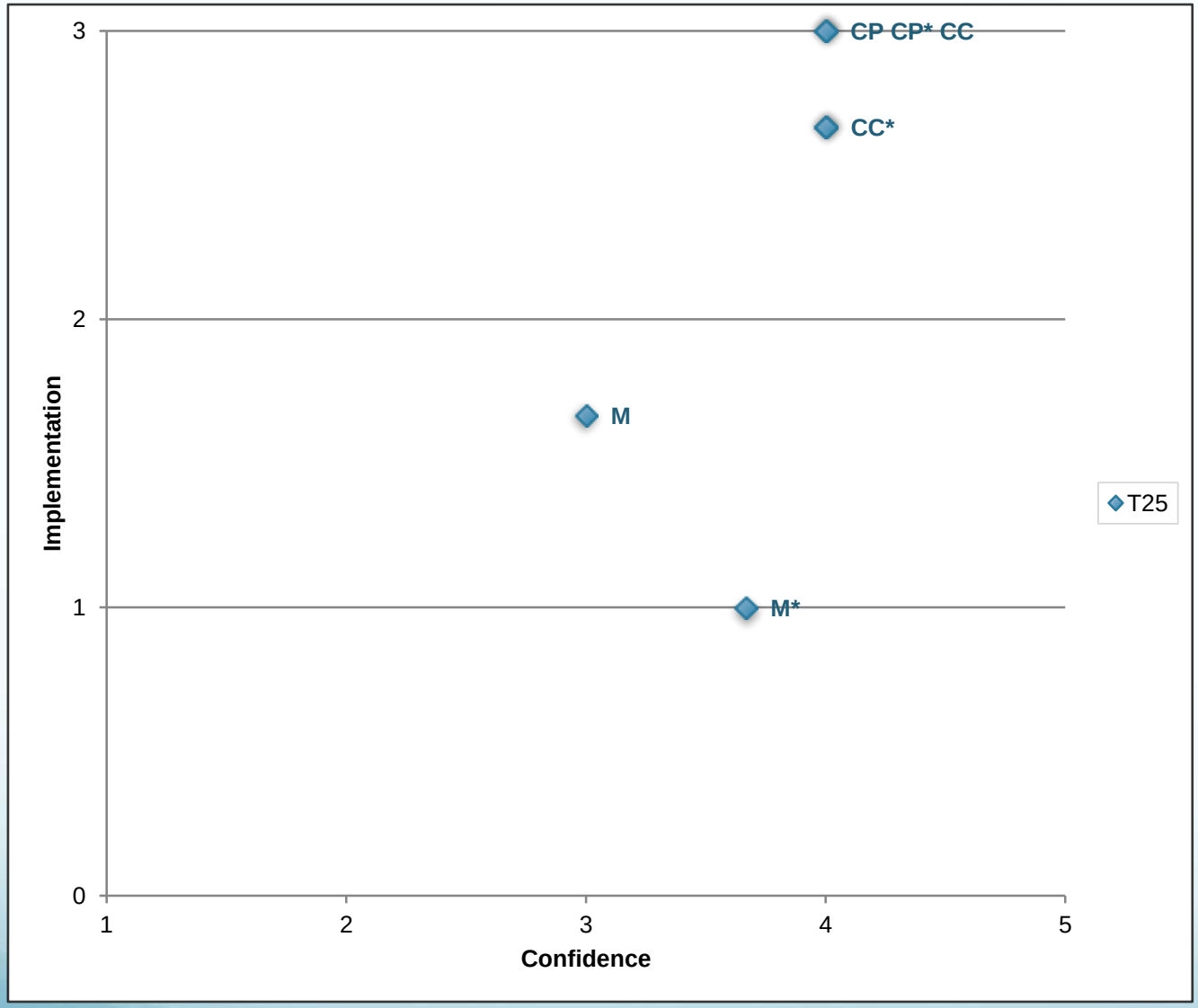
General Programme

- Focus on theory
- In-class coaching
- Encouraged to reflect
- Collective participation
- Co-operation with principal



Whole School Implementation



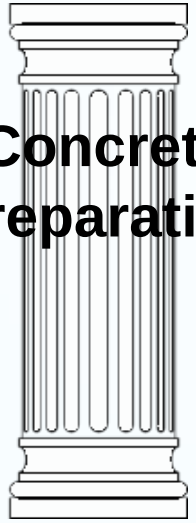


CP = Concrete Preparation

CC = Cognitive Conflict

M = Metacognition

Teachers' Implementation

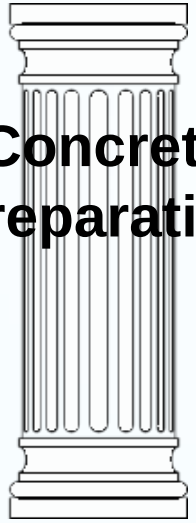


Concrete Preparation

Cognitive Conflict/ Social Construction

Teachers improved in their implementation of the pillars of concrete preparation and cognitive conflict

Teachers' Implementation

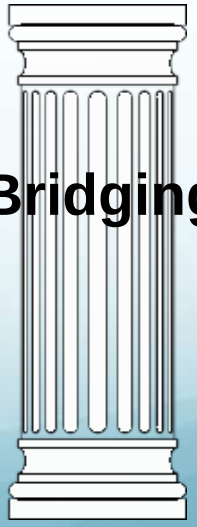


Concrete Preparation

Cognitive Conflict/ Social Construction

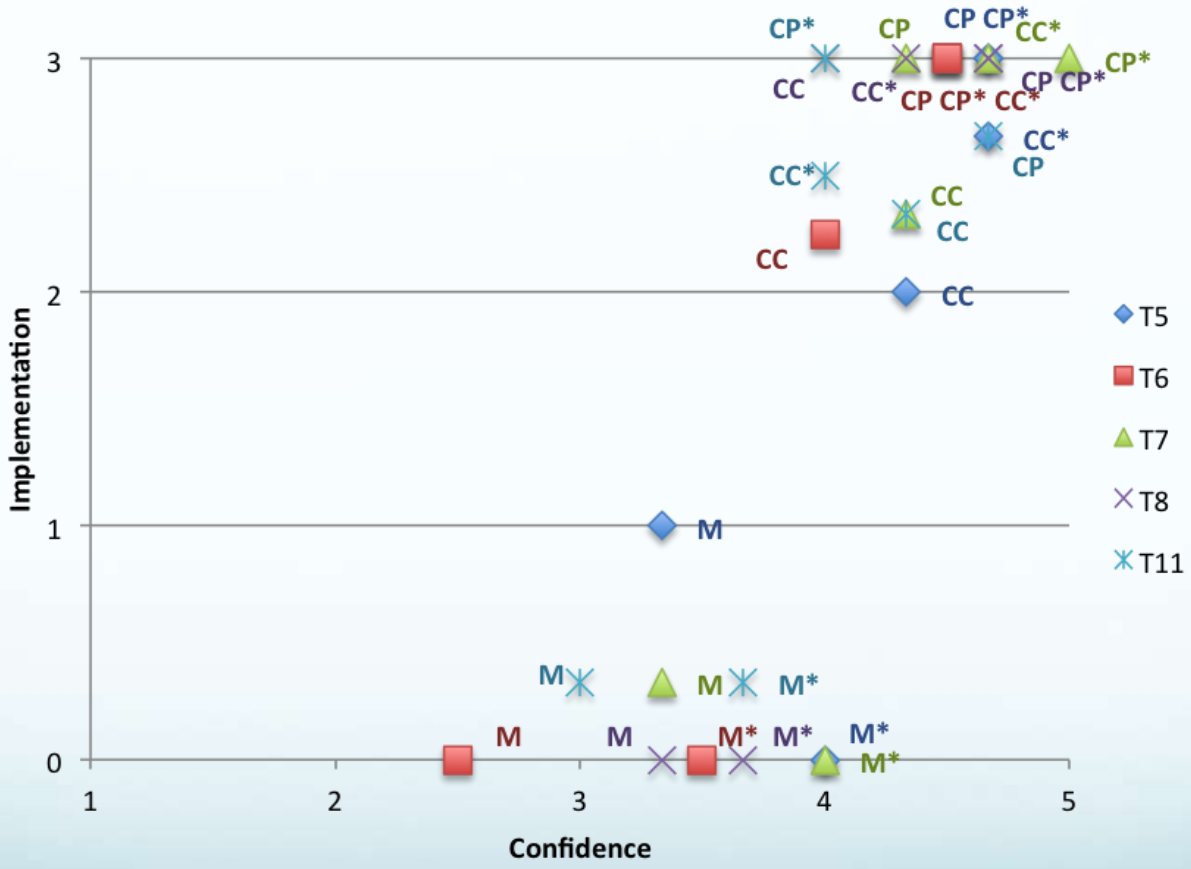
Difficulty in engage their students in metacognitive discussions and relating students' thinking to other areas

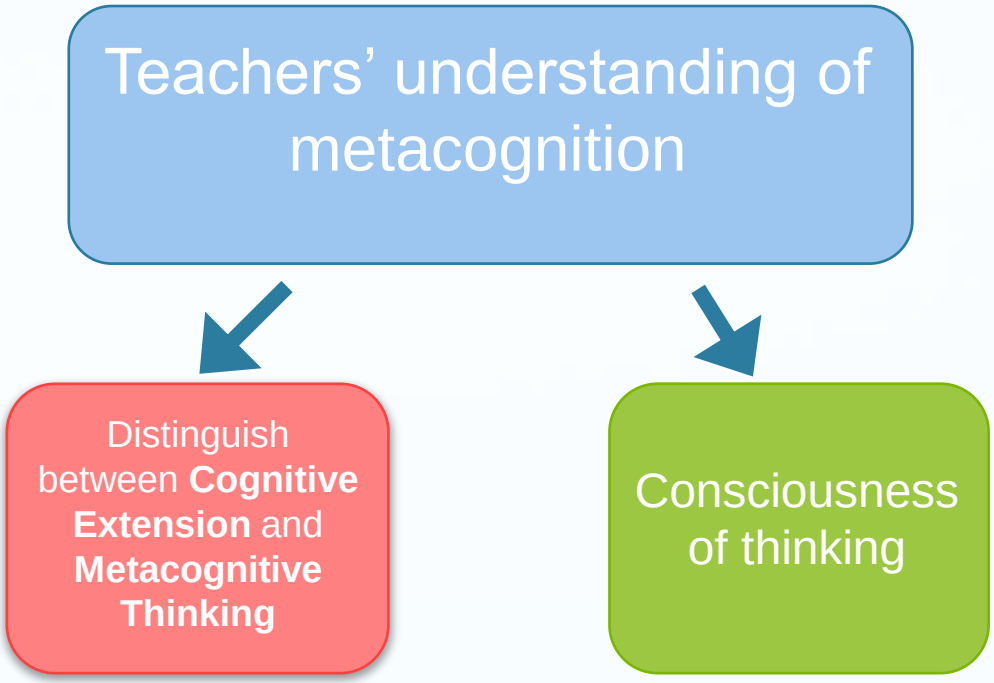
Metacognition



Bridging

Senior Infants/First Class (Group A)





	Distinguish between CE and MT	Refer to consciousness of thinking	Teachers
1	✔	✔	**T14, T17, T21**
2	✗	✔	**T6, T9, T15, T25, T27**
3	✗	✗	**T1, T2, T3, T7, T8, T10, T11, T13, T18, T19, T23, T24, T26, T29**

Key Finding and Recommendations

- CASE can be integrated into the teaching of science in Irish primary schools
- Future Implementation should involve the whole school
- In-class coaching
- Focus on developing teachers knowledge of and pedagogies in metacognition

Junior Cycle Student Award

Managing Myself

Managing Information and Thinking

Communicating

Working with others

Being Creative

Staying Well

“Reflecting on and evaluating my learning”

Teachers

- "*The lessons stop me spoon-feeding them as much because I'm able to see that they can think for themselves*" **(Senior Infants)**
- "*I will be more thorough in future in assessing, monitoring and encouraging their thinking skills*" **(1st Class)**
- "*It has changed my approach to facilitating investigations. I am more conscious about giving the children greater autonomy and time during their discussions and investigations. I am better at asking leading and guiding questions without giving too much information*" **(4th Class)**
- "*It's a very valuable methodology – especially in how it 'transfers' modes of thinking to other subjects – namely geography and maths but surprisingly, history*" **(6th Class)**