The Routledge International Handbook of Research on Teaching Thinking

Rupert Wegerif, Li Li, James C. Kaufman

Metacognitive learning environments

Publication details
Shirley Larkin
Published online on: 03 Jun 2015

How to cite:- Shirley Larkin. 03 Jun 2015, Metacognitive learning environments from: The Routledge International Handbook of Research on Teaching Thinking Routledge Accessed on: 31 Oct 2023
Introduction

There is a long history of research on learning environments and their impact on student outcomes. This is often traced back to ideas circulating in the 1930s around the interaction between individual characteristics and the surrounding environment and the determining effects of this on individual behaviour (Lewin, 1936; Murray, 1938) as Fraser has documented (Fraser, 2012). However, the growth in research into learning environments is most marked during the 1990s and the birth of a journal specific to the field (Learning Environments Research, Springer, 1998). During the twentieth century learning environments research developed from a focus on external factors and what the environment looked like from the outside, to a greater focus on teacher and student perceptions of their learning environment and the extent to which the environment fits with their own needs, values and beliefs. In this chapter I begin with an outline of what is known about the effect of the learning environment on various student and teacher outcomes before arguing for metacognition research to consider taking a learning environment approach. This chapter considers what is meant by a “metacognitive learning environment” and how this might be constructed.

Learning environments

Learning environments research covers both the physical layout of classrooms and learning spaces including how architecture impacts on learning and the psycho-social features of any learning community. It also involves school leadership and management as well as external political and cultural pressures on education systems. Fraser (1998) suggests 12 types of research in the field of classroom environment studies. The most prolific of these being studies which seek associations between student outcomes and the environment. One such study (Walberg, 1981, cited in Fraser, 1998) defines learning as “a function of student age, ability and motivation; of quality and quantity of instruction; and of the psychosocial environments of the home, the classroom, the peer group and the mass media” (p. 20). A deficiency in any one of these factors can result in poor learning outcomes. Thus the focus for remedial action is to work on and
improve the factors which are having a detrimental effect rather than those which are working well. However this is dependent on being able to identify the effects of these different factors when all are working in a complex system. In reviewing a number of large scale and meta-analyses of the association between cognitive and affective learning outcomes and post-test scores, Fraser concludes that “better achievement on a variety of outcome measures was found consistently in classes perceived as having greater Cohesiveness, Satisfaction and Goal Direction and less Disorganisation and Friction” (ibid.).

Many studies of learning environments focus on the classroom environment but more recent studies also take account of the attitudes and behaviour of parents and students and the expectations of teachers. Cavanagh and Waugh (2004), found that both student and parental attitudes and behaviour were related to educational outcomes as were teacher expectations. The model of classroom culture used in this study includes the notion of educational outcomes as not only the result of the learning environment but also as an element of the culture. In this sense educational outcomes are multi-dimensional including short term attainment outcomes but also longer term changes in attitudes towards learning and motivation. A further element of the study was a focus on group attitudes and behaviour in terms of peer interaction. One hypothesis tested was whether learning would be enhanced by a learning environment in which students support and care for their peers. Interestingly this study found no positive relationship between perceived “caring behaviours” of students and academic achievement. It is suggested that caring behaviours could be seen as an outcome of a positive classroom culture rather than as a factor affecting short term academic outcomes. A negative correlation between students’ views of their teachers as caring and students educational values could, the researchers suggest, result from the variability of individual relationships between students and teachers. These individual and complex relationships may impact on collective notions of the classroom environment. Thus there is a tension between competing aims of providing a caring classroom environment and creating successful individual academic outcomes.

Thus in order to change classroom culture and create a positive learning environment, it is necessary to identify what the goal of the environment should be. In a study of mature students on a social care course Prior (2000), explored the possibility of students developing critical thinking skills through changes in the learning environment. Factors such as the students deciding on the content of each session; the group taking responsibility for the direction of the programme and making overt the hierarchical and power structures inherent in further and higher education settings were introduced. The project found that students did change and developed critical thinking, moving from accepting material uncritically to critiquing knowledge and the sources of knowledge; using more and more-varied texts and feeling empowered as learners. Similarly, Matthews and Lowe (2011), highlight the importance of contextual factors for developing criticality. Cultural and external factors can, they argue, constrain or support an individual’s propensity to develop criticality. These factors range from in-class pedagogy such as teacher’s style of teaching, teacher’s attitude towards student questions, types of assessment used, home environment and parenting style. They go further and also include cultural norms and ways of being as possible significant influences on critical thinking. This socio-cultural lens is used by Coyle (2007), to explore learner strategies within a learning community in which students learn not only the content (a foreign language) but also how to learn. Coyle views the learning environment as extending beyond the individual learner to the relationships and interactions within the learning system. This system is co-constructed by the learners. Thus Coyle views learning strategies of individual students as “by-products” of the complex social activity of the learning community. Whilst this study focused on co-construction of knowledge, not all learning environments require a similar epistemological
perspective. The type of learning environment created must be in line with the expressed aim or goals for learning. For instance, we can easily imagine a positive learning environment which focuses on individual development, for example, in terms of remedial/catch up learning or developing expertise in a specific field. However, it is likely that the social relationships in these highly individualised learning environments are still crucial to their success. Thus research into learning environments acknowledges that developing the thinking skills of learners takes place within a community of learners and that such research needs to move beyond the individual learner to take account of classroom interactions.

Educational outcomes can be viewed as both an element of classroom culture (Cavanagh & Dellar, 2001), and as the result of an effective classroom culture. All environments whether in the home, school or university have an impact on learning for good or ill. However, as Cavanagh and Waugh (2004), point out influencing how the learning environment impacts on learning is complex and involves considering the learning attitudes of both teachers and students and developing reflective teachers and school leaders who are concerned with classroom interactions and how they might be improved. This view goes beyond simply changing the curriculum (e.g. into a thinking skills or metacognitive curriculum), or changing the ways in which staff collaborate and co-operate. Indeed such top-down reform to the learning environment does not necessarily have a positive impact on student outcomes and student learning. Thus an argument common to learning environment research is that in order to positively impact on student outcomes, there is a need to understand relationships and interactions between parents, teachers and students and explore how these might influence student beliefs about learning in a positive way. However, not all learning environments are traditional classroom settings which include such variables. Increasingly learning communities are created through on-line and virtual communities which may exist for only a short time for a specific purpose or may become long-term learning communities; some may be formal courses or programmes with contingent design elements such as self-paced learning, led by a facilitator or instructor or involve self-directed learning. Other virtual learning environments are informal communities which have their own internal psycho-social features. The variety and permutations of these non-physical learning environments has been detailed by Moore, Dickson-Deane and Galyen (2011). Their review of literature and survey of international conference delegates found that there was no standard terminology used to describe these learning environments and nomenclature differed across different groups and across different cultures, although characteristics of different types of virtual environment were used by people to distinguish between them. The use of different terminology, the complexity of the learning environments themselves and the methodological difficulties of correlating the features of learning environments with student outcomes makes comparison between studies difficult and the notion of generalising about the affordances of such virtual environments is replete with problems.

Metacognition research

Whilst a good deal of learning environment research investigates links between the learning environment and specific psychological concepts such as affect (Cheng, 1994); motivation (Young, 2005); self concept (Trautwein, Lüdtke, Köller, & Baumert, 2006) few studies consider the connection between features of learning environments and metacognition. (A superficial glance down the index lists of the majority of books on metacognition reveals the relative lack of importance given to learning environments within the metacognition research field.) This may be due to the roots of metacognition research in cognitive and developmental psychology (Brown, 1987; Flavell, 1976; Kluwe, 1987; Nelson & Narens, 1992). Until relatively recently
most research on metacognition has focused on either the cognitive processes involved in metacognition as universal factors or on individual development. Cognitive psychology has provided us with insight into how we can know about our own cognitive processes. Early studies which pre-date metacognition research were often concerned with memory and how it is possible to be aware of knowing something and yet be unable to recall it. These feeling-of-knowing states and tip-of-the-tongue states (Hart, 1965) were the foundations of metacognition research. Since then cognitive psychology research into metacognition has continued to explore phenomenon such as judgements of learning (Koriat, 1997; Nelson, 1984); (which have implications for allocation of study time and therefore for self-regulated learning) and confidence judgements (Costermans, Lories, & Ansay, 1992) (which have implications for decision making). The work of cognitive psychologists has been highly influential in establishing metacognition as a field of research and in demonstrating the application of metacognition for everyday life. However, the majority of studies are based on an experimental paradigm and are concerned foremost with how people (often adults) process information and to what extent they are aware of their own mental states.

Similarly developmental psychology has been concerned with how people at different stages of life are able to reflect on their own thinking processes. Following Flavell (1976), developmental psychologists have often taken a Piagetian view of metacognition as late developing sometimes as late as formal operations, whilst for others metacognition is more explicitly tied to development of a reflective consciousness which enables theory of mind. There is a view that younger children are incapable of metacognition or that early metacognition is not full metacognition. This argument centres around different definitions of what constitutes metacognition, that is, that it requires full epistemic self consciousness associated with passing theory of mind tests which require the attribution of mental states to others or that metacognition is about the regulation of one's own cognition (Esken, 2012). Some studies have shown that pre-school children have a particular metacognitive knowledge deficit in that they are unable to judge their own state of knowledge ignorance, so a new term of meta-ignorance has been introduced into the field (Kloo & Rohwer, 2012) and children are deemed not to exhibit metacognition until around school age. Flavell’s early work on metamemory took the form of field experiments with children of different ages, setting them various tasks and asking them to reflect either on how they had solved the task or on what they thought their memory was like (Flavell & Wellman, 1977). This work was the foundation of his theory of metacognition and cognitive control (Flavell, 1979); the seminal paper in the field of metacognition research. Flavell and Brown’s interest in education and what children could know about their own mental processes led to a blossoming of metacognition research in educational settings which continues today (Brown, 1978; Flavell, Green & Flavell, 1995). However, the majority of studies of metacognition in education are still based on an experimental paradigm which seeks to either test individuals or to test the effects of an educational intervention on individuals. This type of metacognition research has led to a burgeoning of metacognition terminology including: metacomprehension (Glenberg, Wilkinson, & Epstein, 1982); metacognitive strategies (Davidson & Sternberg, 1984); metacognitive skills (Baker & Brown, 1984); meta-knowledge (Kuhn, 2000); meta-theoretic knowledge; meta-questioning knowledge; meta-investigation knowledge; meta-analysis knowledge (White, Frederiksen, & Collins, 2009); meta-affect (Graesser, D’Mello, & Person, 2009) to name but a few. The majority of studies in these areas seek to measure metacognition through one method or another. The most common methods being think-aloud protocols (Kucan, 1997); retrospective judgements (Schraw & Dennison, 1994) using interviews or questionnaires; scales, for example MALS (Burden, 1998); tests such as error detection (Otero & Kintsch, 1992) and sometimes more contextualised observations of
student talk and interaction (Larkin, 2006). However, most of these methods take little account of factors beyond the target student or student group. In metacognition research in education the focus is often on the impact or effect of an educational intervention on an individual or group of students. When contextual factors are taken into account, for example, economic and social demographics; teacher experience; parental educational level and so on, these are most often seen as variables which need to be controlled or which are used to create sub-groups for more sophisticated levels of analysis, rather than as part of the fostering and development of metacognition itself.

However, more recently and possibly as a result of metacognition research being taken up by educationalists and the influence of self-regulated learning theory, metacognition in classrooms is being seen as both socially constructed and part of the socio-cultural learning environment. The work of Thomas (2003b) and Thomas and Mee (2005) has stressed the importance of acknowledging how the development of metacognition is contingent upon and intertwined with the socio-cultural context within which learning takes place, be this in the home, school or in informal learning environments. Thomas has also proposed that the beliefs and practices of the communities within which students learn to learn and reason, strongly influence their metacognitive development. In particular language plays a key role in creating a metacognitive learning environment (Thomas & Mee, 2005).

Creating a metacognitive learning environment

Research has provided evidence of the positive effects of metacognition in improving learning in areas such as literacy (Artelt, Schiefele, & Schneider, 2001), mathematics (Mevarech & Fridkin, 2006) and science (Rickey & Stacy, 2000). It is linked to increased motivation to learn and the development of a positive learner self perception (Borkowski, Carr, Rellinger, & Pressley, 1990). A review of evidence on the impact of metacognition on attainment more generally has shown that metacognition has a high impact for a relatively low cost of implementation (Higgins et al., 2013). Despite a great deal of research to date on metacognition across school curriculum areas there is still little research on metacognition in the domain of religious education (RE), although provision for religious education is mandatory for all UK state schools. In the UK religious education has been heavily criticised by the school inspectorate in terms of standards of attainment and teaching especially in primary schools (Ofsted, 2004, 2007) and for its lack of impact on students’ personal development (Ofsted, 2010). It was against this background that the RE-flect Project (Larkin, Freathy, Walshe, & Doney, 2015) was developed. We suggested that what was missing from RE was children’s ability to reflect on their own knowledge, understanding, beliefs and values before encountering those of others. We argued that there needed to be a move away from research on content in RE (Hayward, 2006; Rymarz, 2007) or the extent to which the representation of religious traditions may be considered truly authentic (Everington, 1996; Greaves, 1998) or representative (Jackson, 2004; Nesbitt, 2004) towards an emphasis on the pupils’ “response, thinking and critical self-awareness” (van der Zee, Hermans, & Aarnoutse, 2006) and we aimed to do this by creating metacognitive learning environments in the primary RE classroom.

The RE-flect project is based on a socio-cultural theory of metacognition which acknowledges the entwined nature of the social, psychological and cultural features of the learning environment and the construction of metacognition. The project also considers the physical environment of the classroom. In order to create a culture of fostering metacognition we collaborated with teachers to manipulate their classroom spaces and create three zones. We agreed on the following zone labels:
1. Meta-thinking – thinking about learning in RE (thinking processes)
2. Worldview – thinking about myself as a learner in RE (self-awareness)
3. Resources – thinking about religious phenomena (encounter with subject knowledge)

Changes to the physical environment of the classroom were complemented by changes to the way teachers planned RE lessons. A planning framework was developed which enabled the teachers to create their own RE-flect activities in addition to activities created for them by an advanced skills RE teacher and education consultant.

**Three zones**

The three physical zones were configured differently for each classroom depending on size, for example a zone could be a corner of the room; a table; a bookshelf; even a window ledge, but all had the following common features:

**Meta-thinking zone (thinking processes)**

This zone was designed to enable pupils to develop knowledge of their own thinking and learning in RE as well as to monitor and control their thinking. It consisted of posters and cue cards including images depicting “thinking”; individual mental state words such as “believe”, “know”, “think”, “imagine” and “guess”; and questions or phrases, such as “How do I know that?”, “Who or what has influenced my beliefs?”, “How well is my group doing?”, “How do I feel about the task?”, and “Could we think about this in a different way?”. The questions and prompt cards were designed to focus on the language of thinking, thus acknowledging the iterative processes at work between using mental state words and developing metacognitive knowledge (Lockl & Schneider, 2006; Wellman & Johnson, 1979). Whether they were engaged in group collaborative tasks or pieces of individual work, pupils were encouraged to visit this zone and teachers would also stop an activity and refer to questions from this zone or encourage a group to visit the zone if they were feeling stuck on a particular problem.

**Worldview Profile zone (self-awareness)**

This zone housed the pupils’ Worldview Profiles. These ranged from exercise books to computer files, in which pupils responded to a series of questions based on Valk’s theory of worldview education. Valk (2009) suggests that by encouraging students to reflect upon and examine the religious and secular worldviews of others (knowing others), they simultaneously come to a greater understanding of themselves (knowing self). Students “come to recognize that worldview neutrality is difficult to achieve – we all embrace beliefs and values of some kind” (Valk 2009, p. 73). We adapted Valk’s framework for exploring beliefs, values and principles (Valk, 2010) and created questions suitable for RE-flect pupils. There are five individual frameworks: (F1) Personal Identity; (F2) Ultimate or Existential Questions; (F3) Worldview Dimensions; (F4) Ontological/Epistemological; and (F5) Primary/Secondary Beliefs, Values and Principles. With their components and questions, these made up the RE-flect “Worldview Questions Framework” (WQF), which was used, during RE-flect lessons throughout the year, to structure pupils’ reflections on their developing worldviews. For example questions around ontology/epistemology included: What is true and false? What is fact and fiction? How do you know? What source(s) do you use to decide? What is knowledge? What is belief? What is opinion? What is faith? Moreover, we encouraged pupils to revisit questions to see how and why their answers may have changed.
Resources zone (thinking about religious phenomena)

The Resources zone included RE-flect activities and materials and also acted like a “nature table” where pupils and teachers displayed resources and artefacts relevant to the current topic. This zone was designed to encourage teachers to create activities based on a metacognitive framework and to acknowledge students’ existing knowledge and experience, drawing on their family and social background to bring artefacts from home to share with the class.

Changing the physical environment of the classroom highlights questions around the “ownership” of classroom space. Some primary schools are very small and RE teachers may be part-time, peripatetic or teaching assistants. The physical zones are a demonstrable manifestation of the desire and motivation to create a metacognitive learning environment and as such the size or complexity of the zone created is less important than the understanding and motivation of the teachers to foster such environments.

In addition to the physical changes to the learning environment we worked with teachers, drawing on metacognition theory to conceptualise a metacognitive learning environment as one in which learners (i.e. both teachers and students):

- Build on prior learning
- Take responsibility for their learning and their thinking
- Engage in social interaction motivated by learning
- Exchange ideas with each other
- Conduct thoughtful and reflective dialogues with others
- Develop a language of thinking
- Make explicit use of metaphors and images for learning
- Promote discussion about learning and the learning process
- Explain their own thinking
- Reflect on their own beliefs and values
- Engage with religious beliefs, practices and values
- Reflect on learning in RE and the challenges this poses
- Reflect on how they might improve their learning (or teaching) in RE.

In addition to creating the physical and psychological learning environment the content of the lessons was given a particular focus. Flavell explicitly described the conditions under which metacognitive experiences are most likely to occur (Flavell, 1979) and the RE-flect tasks were designed to create metacognitive experiences in religious education. Thus teachers were provided with guidance on how to create lessons to foster metacognitive development through RE. For example the following check list was developed collaboratively with teachers to remind them about the salient points of tasks for fostering metacognition:

1. A clear focus. Perhaps a key question, e.g. “Why are images of the Buddha important for Buddhists?”
2. Opportunities for pupils to work collaboratively with others (socially constructed metacognition/importance of developing a language of thinking).
3. What do pupils already know about the question? How do they know this? How might they go about finding out? Why might some strategies be more useful than others? (students should have some impact on the way the lesson develops and the direction it takes – fostering self-regulated learning).
4. An opportunity for pupils to consider how the answer to the question might be important – to them? to others? How does their own worldviews and “starting point” impact on the way in which they view the worldviews and starting points of others? (developing self awareness and theory of mind).
5 Activities that enable pupils to take responsibility for their learning. Ask them to think about how they might find out the answer to the question. Why might some strategies be more useful than others? (Focus on metacognitive skills and strategies.)

6 Occasions for pupils to reflect on their own worldviews and how they might relate to this question (quiet time/time to think and reflect on own beliefs and values).

7 “Time out” spaces within the lesson where pupils are encouraged to think about their thinking and their learning. Use prompt questions to facilitate this, e.g. “How well have I understood ‘X’ and how do I know?”; “How am I feeling about this task and how does that affect my learning?”; “How does it feel to learn?”; “How does it feel when I know I understand something?”; “How does it feel when I don’t understand?”; “How could I improve my learning?”; “How could I change the way I think about this?”; “What difference would that make?” (Time to reflect on learning process and progress towards a goal.)

8 Opportunities for pupils to visit and engage with material/resources in the three zones. (Focus on the learning environment – not only individual learning).

9 Plenty of openings for pupils to demonstrate metacognition. Perhaps provide opportunities for pupils to think about the question or topic in different ways, for example by looking at the same question from different angles or points of view; by using their imaginations to explore other possibilities and take on other roles. (Encourage creative and playful thinking and rumination.)

10 Opportunities to gather evidence that pupils have employed metacognitive skills during the lesson. (Metacognition is not only about process but also about outcome – importance of affect and feelings of success and understanding of impact of metacognitive skills on successful learning.)

Both teachers and pupils reported an increase in motivation for RE after taking part in the RE-flect project and some teachers reported a positive impact on behaviour and tolerance between pupils, whilst others focused on the developing self-regulatory skills of the 9–10-year-old students who took part. In addition the project is continuing to affect the practice of teachers who participated in it, as they transfer the idea of creating a metacognitive learning environment from RE to other areas of the curriculum.

However, research indicates that it is not enough to train teachers to facilitate metacognition (Zohar, 2006). Instead teachers need to develop their own metacognition in order to better facilitate it in others (Duffy, Miller, Parsons, & Meloth, 2009). It is plausible that some of the difficulties encountered in particular by non-specialist teachers in teaching RE are the result of a lack of metacognition in relation to their own learning in RE. Thus it is important in developing metacognitive learning environments that teachers see themselves as learners as well as teachers. It was for this reason that we also included developing adult metacognition in the RE-flect project, as we encouraged teachers to reflect on their own learning and thinking in RE, taking them back to their own childhood experiences of religious education and developing their awareness of the origins of their worldview.

**Different views**

To date much of the metacognition research has been based on the metaphor of the mind as an information processor and knowledge is sought of how the different components of the model work together or develop at different stages. Advances in technology will enable ever more detailed pictures of the interaction of executive processes and metacognitive knowledge (Cornoldi, 1998); whilst cognitive psychologists will continue to develop experiments to
provide knowledge of the role of metacognition and various other cognitive processes and states such as uncertainty (Beck, Robinson, & Rowley, 2012), mindreading (Proust, 2012), or even hypnosis (Dienes, 2012). Similarly, controversies over the age at which metacognition develops and therefore what is or is not considered metacognition and then how this might be measured are likely to continue. But these approaches have also given rise to critiques of metacognition in general, for example Kivinen and Ristelä (2003) argued that the theory of metacognition gives rise to a notion of infinite regress and homunculi driven cognition. However, their critique goes further to suggest that a metacognitive education could damage children’s learning as it restricts their ability to be fully immersed in a task and that it turns learners into psychologists endlessly reflecting and introspecting on their own actions and thinking at the expense of doing and learning unconsciously.

Whilst these criticisms are often directed towards psychological approaches to metacognition research, not all educational metacognition researchers would agree with the approach taken in this chapter, with its emphasis on the socially constructed nature of metacognition and the integration of the learning environment into theories of metacognition not as a set of contextual factors to be controlled but as integral to the development and fostering of metacognition amongst all learners within the environment. The nature of metacognitive learning environment research means that it is not so concerned with the measurement of individual learners’ metacognitive skills or strategy use, although the perceptions of learners about the extent to which their learning environment facilitates metacognition can be measured (see MOLES a scale developed by Thomas (2003a) which was adapted into the REMOS scale for the RE-flect project).

However education is concerned with more than assessment and measurement in particular I would suggest that metacognition in education is about the fostering of flexible and self-aware thinkers who in Flavell’s terms are likely to make “wise and thoughtful life decisions as well as to comprehend and learn better in formal educational settings” (Flavell, 1979, p. 910).

Rogers suggested that:

The only man [sic] who is educated is the man who has learned how to adapt and change; the man who has realized that no knowledge is secure, that only the process of seeking knowledge gives a basis for security. Changingness, reliance on process rather than upon static knowledge, is the only thing that makes any sense as a goal for education in the modern world.

(Rogers, 1983, p. 120)

Above all perhaps, education is dependent on human relationships. Rogers also suggests that what is important in developing such learners equipped for a fast changing society is not the knowledge, planning, resources or skills of the teacher useful though these might be, but on “certain attitudinal qualities which exist in the personal relationship between the facilitator and the learner” (ibid., p. 121).

The attitudes which teachers (or facilitators of learning) require, Rogers states are primarily those of authenticity, trust and care for the learners. He goes on to suggest that it is the job of the learning facilitator to create the learning environment which will enable learners to accept responsibility for their own learning and become more self-regulatory. This humanising concept of learning espoused by Rogers amongst others, is compatible with facilitating metacognition. Rogers believed that learning about the process of learning, being open to new experiences and changing self awareness was the most useful type of learning for the modern world. It may be that creating metacognitive learning environments in classrooms, taking account of the affective
aspects of learning, particularly fostering metacognitive experiences for learners and crucially, if
in the role of educator, continuing to develop metacognitively through adulthood, would go
someway to achieving the type of education that Rogers and others see as of most value in an
ever changing society.

References


P. Mosenthal (Eds.), Handbook of reading research (pp. 353–395). New York: Longman.

In M. J. Beran, J. L. Brandl, J. Perner & J. Proust (Eds.), Foundations of Metacognition (pp. 181–192).
Oxford: Oxford University Press.

of metacognition, attributions, and self-esteem. In B. F. Jones & L. Idol (Eds.), Dimensions of thinking
and cognitive instruction (pp. 53–92). Hillsdale NJ: Erlbaum.

Instructional Psychology, 1, 77–165.

Brown, A. L. (1987). Metacognition, executive control, self-regulation and other more mysterious mecha-
nisms. In F. E. Weinert & R. H. Kluwe (Eds.), Metacognition, motivation and understanding (pp. 65–116).


Cavanagh, R. F., & Dellar, G. B. (2001, December). School improvement: Organisational development or com-
munity building? Paper presented at the Australian Association for Research in Education.

culture on educational outcomes. Learning Environments Research, 7(3), 245–269.


Nelson (Eds.), Metacognition and cognitive neuropsychology (pp. 139–159). Hillsdale, NJ: Erlbaum.

answering: The weight of inferential processes. Journal of Experimental Psychology: Learning, Memory and
Cognition, 18(1), 142–150.


Quarterly, 28, 58–64.

Dienes, Z. (2012). Is hypnotic responding the strategic relinquishment of metacognition? In M. J. Beran,
University Press.

J. Hacker, J. Dunlosky & A. C. Graesser (Eds.), Handbook of metacognition in education (pp. 154–172).
New York: Routledge.


the development of memory and cognition (pp. 3–33). Hillsdale, NJ: Erlbaum.

the Society for Research in Child Development, 60(1), 1–95.
Shirley Larkin


