Thinking, interthinking, and technological tools

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Introduction: the development of individual and collective thinking

The pictures here (see Figure 38.1) will be familiar to most who have had any contact with educational settings in the last 20 or so years. Indeed, one of our most recent books (Littleton & Mercer, 2013) reflected on one of the first pieces of research into school-classroom based dialogue from that time. There, it was noted that in many cases group work around computers was conducted not due to any underlying pedagogic strategy, but because of a lack of resources. For many this will be a familiar story, but along with colleagues, we have spent considerable effort in investigating what constitutes effective learning in group activity particularly that mediated by technological devices. Of course, many educators - as was the case in that original research - will have had the experience of frustration in some such situations, finding occasions when group work seemed to be ineffective and suspecting that a better use of resources would be to set students on individual tasks. Indeed, what is so potent about many new technologies is their ability to open up new worlds of learning for individuals. Yet, in this chapter we will argue that to see technology as primarily an individual pursuit is to miss out on two important considerations: firstly, many modern technologies vastly expand the potential for inter-textual and inter-active elements (Wegner, 2013) through our interaction with which we are exposed to the thoughts and arguments of others and, secondly, technology can be an invaluable aid in rescoring and supporting both co-located and remote small group activity.

Throughout this chapter we aim to highlight the ways in which shared use of technology can be seen as both an individual and collective resource, and foreground the importance of dialogue as being of fundamental importance in such contexts.

Language and thinking

The Russian psychologist, Lev Vygotsky, highlighted the importance of language for thinking, emphasizing that:
Simon Knight and Karen Littleton

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Figure 38.1 Diverse contexts for the potential of technology for thinking and interthinking.

What children gain from their ‘intermental’ experience (communication between minds through social interaction) shapes their ‘intra mental’ activity (the ways they think as individuals). What is more, he suggested that some of the most important influences on the development of thinking will come from the interaction between a learner and more knowledgeable, supportive members of their community. (Moser, 2003)

Building on this premise, one of us (Simon Knight) in earlier work on the importance of dialogue in the effective use of interactive white boards (IWB) noted that:

With respect to direct pedagogical functions (as opposed to social functions such as behaviour management), dialogue seems to serve several purposes:

1 supporting individuals’ subject learning
2 supporting psychological development – the development of oral language and reasoning skills
3 promoting whole class and small group understanding or commonality
4 enabling sharing of ideas that can be improved together (both whole class and small group) – a purpose the IWB is particularly well placed to serve. (Knight, 2013b)

Traditionally educational researchers have been particularly interested in the first two of these concerns, regarding the effectiveness of group work for individual learning. Similarly, psychological research has tended to focus on the individual impact of social interaction on thinking and learning. The focus, then, has been on how collaboration changes individuals, as opposed to how collaboration might be an object of inquiry in its own right. The implication is that there are clear individual benefits to high quality dialogue; that taking individuals as the focus is not such a poor strategy in the analysis of classroom dialogue. Of course this will be of little surprise. When in conversation a person informs you of some fact, which you then use, some learning has taken place. Moreover, when they demonstrate some linguistic method such as a particular argumentation structure, you may use that format to resource your own subsequent thinking. It is for this reason that in both

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philosophy and psychology there is an increasing interest in ‘testimonial knowledge’ – the knowledge we gain from other’s testimony, largely through speech – and as Harris (2012) has noted, the trusting of what you are told is at least some of the tune fundamental to the learning experience.

There is a parallel to this focus on learning directly from others, in the use of technology in the classroom. When teachers stand at the front of classrooms and provide students with information, or warn them of dangers in science experiments and so on we expect students to trust that information. Similarly, when we ask students to engage in research, using books and increasingly the internet, we hope that they will use their critical skills to engage with some of the information that they find. High quality dialogue, then, could simply be an enhanced version of this type of exchange; the appropriation of claims from reliable informants.

Much group work takes this individualistic level of analysis as its focus. For example, this section of information exchange has sometimes been termed ‘transactivity’ which has in some circumstances been operationalised as an individualistic level, with individuals placed into situations in which they have information required by other group members for the completion of some task. Indeed, much group work research takes this level of analysis as its focus – the individual, as opposed to the collaborative unit. This focus on individual activity in collaborative contexts in contrast to collaborative units is common to much group work research, for example Asmuss and Montgomery’s (1993) analysis of information transmission via individual’s explicit statements (rather than on the language used to co-construct). It is to this perspective on dialogue, as a co-constructive tool to interthink, that we turn in the next section.

Interthinking

We began the preceding section by noting the significance of Vygotsky in our understanding of learning. However, as we note in the previous section, this view of the transmission of knowledge from experts to novices provides only one – albeit important – facet of the potential of dialogue for learning. There is now strong consensus that high quality educational dialogue among peers is associated with positive learning outcomes (see the collection edited by Littleton and Howe (2010)). Engaging children in extended talk which encourages them to ‘interthink’ and reason together in talk, impacts both their subject learning, and general reasoning skills (Dawes, Mercer, & Wegerif, 2004; Mercer, Dawes, Wegerif, & Sans, 2004; Mercer & Littleton, 2007; Mercer, Wegerif & Dawes, 1999; Mercer &Sans, 2006; Ruge-Drummond, Littleton, Hernández, & Zálaga, 2010) as well as their social and language skills (Wegerif, Littleton, Dawes, Mercer, & Rowe, 2004).

However, a common concern in computer-based tasks, is that the shared nature of the resource may reduce the need for children to talk and articulate their knowledge explicitly. This suggests the need for task-based studies which explore the ways that discourse is used (Clark & Brennan, 1991; Pickering & Garrod, 2004). Indeed:

some problems that learners may encounter in Computer Supported Collaborative Learning (CSCL) environments seem to be enhanced in these contexts, for example, due to a lack of social presence or limited nonverbal cues such as gestures and facial expressions (Daft & Lengel, 1986; Krejns, Kirschner, & Jochems, 2003; Short, Williams, & Christie, 1976).

(Jansson & Bølme, 2013, p. 40)

Partly in response to such concerns, Mercer and colleagues have extensively researched what constitutes effective educational dialogue, including in CSCL contexts. They have developed an intervention strategy called ‘Thinking Together’ designed to explicitly teach children how to engage
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Table 38.1 Mercer and colleagues’ typology of talk

<table>
<thead>
<tr>
<th>Type of talk</th>
<th>Characteristics</th>
<th>Analysis</th>
</tr>
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<tbody>
<tr>
<td>Disputational</td>
<td>‘Characterised by disagreement and individualised decision making. There are few attempts to pool resources, to offer constructive criticism or make suggestions.’</td>
<td>‘Short exchanges, consisting of assertions and challenges or counter-assertions (“Yes it is.” “No it’s not.”’</td>
</tr>
<tr>
<td>Cumulative</td>
<td>‘Speakers build positively but uncontentiously on what the others have said. Partners use talk to construct “common knowledge” by accumulation.’</td>
<td>‘Cumulative discourse is characterised by repetitions, confirmations and elaborations.’</td>
</tr>
<tr>
<td>Exploratory</td>
<td>‘Partners engage critically but constructively with each other’s ideas. Statements and suggestions are offered for joint consideration. These may be challenged and counter-challenged, but challenges are justified and alternative hypotheses are offered. Partners actively participate, and opinions are sought and considered before decisions are jointly made. Compared with the other two types, exploratory talk knowledge is made more publicly accountable and reasoning is more visible in the talk.’</td>
<td>Explanatory terms and phrases more common – for example, ‘I think’ because’ ‘cause’ ‘it’, ‘for example’, ‘also’.</td>
</tr>
</tbody>
</table>


in constructive dialogue in classroom contexts through the teaching of particular types of talk, and the use of pedagogic strategies such as generating and establishing ‘ground rules’ for talk designed to foster effective group work.1 The team have highlighted a particular form of productive dialogue which, adapting the term from Douglas Barnes’ (Barnes & Todd, 1977) original broadly individualistic description, they have termed ‘exploratory’. They contrast this with two other types of, typically less productive, talk – disputational, and cumulative, as in Table 38.1.

Other researchers have offered similar characterisations of educationally productive dialogue. For example, ‘Accountable Talk’ (see Michaels, O’Connor, Hall, & Resnick, 2002; Resnick, 2001) has been described as encompassing three broad characteristics:

1 accountability to the learning community – in which participants listen to and build their contributions in response to those of others;
2 accountability to accepted standards of reasoning, talk that emphasises logical connections and the drawing of reasonable conclusions; and,
3 accountability to knowledge, talk that is based explicitly on facts, written texts, or other public information.

(Michaels, O’Connor, & Resnick, 2008, p. 283)

As with the typology of talk developed by Mercer and colleagues, the emphasis of Accountable Talk is on learning to engage constructively, yet critically, with others’ ideas, and in so doing develop and use the skills of explanation and reasoning – learning to use language as a tool for thinking together rather than focusing solely on learning a particular subject or topic. Knowledge. Thus, while the individualistic focus of much psychology research may initially have appeared reasonable, it seems less appropriate given closer scrutiny. In many cases problem solving and learning more generally involves deploying the resources around you – including the minds of other people. Indeed, learning and teaching are fundamentally communicative acts as we noted, this claim is receiving renewed focus in both philosophy and psychology (see, for example, Fricker, 2012; Haddock, Millar, & Pritchard, 2010; Lackey & Soss, 2006; Lackey, 2008) and their analysis of ‘testimonial knowledge’, the role of, as Harris puts it, ‘trusting what you’re told’ (Harris, 2012), but simple appropriation of claims will not do. This highlights the significance of dialogue in learning. Wherever education is taking place, commonality – a shared perspective – is imperative, and dialogue is the tool used to co-create and constitute such a perspective (Edwards & Mercer, 1987). Furthermore, the dialogue used to create ‘common knowledge’ is related to the educational development of children.

Recently Littleton and Mercer (2013) considered the complexity of common knowledge context as both historical and dynamic:

Successful interthinking requires partners to have, and to develop, a foundation of common knowledge to underpin their discussions. We have distinguished two types of common knowledge, both of which can be important. The first of these is accumulated through the activities of a group, as members develop a shared history. They have knowledge in common because it has been generated by their joint activities and associated conversations. It is the kind of common knowledge which allows a teacher to refer only briefly to the content of a previous lesson and expect students to have some recollection what it had been about.

We have called this dynamic common knowledge, because it is produced by the dynamics of the group’s own extended activity. The second type, which we call background common knowledge, is that which any established member of a community of practice can take for granted as being shared with other members and does not therefore need to be explained from first principles.

Language is thus an important cultural tool. Even if we disagree with particular claims, our shared language allows us to draw upon our common knowledge as a resource for interthinking. Technologies, including books, afford grounding for this resourcing of our dialogue. Thus, through the use of technology, we are able to draw on the voices of others across time and space (Wegerif, 2013). It is for this reason that the transmissive view of language and technology use described above offers only a partial perspective on the potential of language: our capacity to interthink is fundamental to our capacity to engage with the ideas of others.

Technological tools

We invite the reader to return to the images presented at the beginning of this chapter, or indeed to consider any number of other scenarios: children sat next to each other but not working together; squabbling over control of the keyboard; children communicating via text remotely; the posting of comments on blogs and status updates, and so on.

Our reason for raising these examples is not to highlight the randomness with which technological use will be of success. Rather, it is to foreground that many technologies fit seamlessly into our everyday practices, technologies afford opportunities for particular types of interaction, but the contexts in which they are used (including classroom task) are of fundamental importance. In all cases, it is interesting to think about the individual and collective benefits of
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development. However, a second interpretation is motivated by our understanding of interthinking. This interpretation implicates the role of effective collaborative dialogue in the co-construction of shared knowledge. Indeed, one of us (Knight, 2011e) has noted that the possible associations between more advanced epistemic working and exploratory or dialogic dialogue (Reentskaya & Gregory, 2013) has direct implications for information seeking contexts in which our evaluation skills (fundamentally epistemic in nature) are utilized. Indeed, in earlier work (Knight & Mercer, forthcoming; Knight, 2012) one of us (SK) has explored precisely this relationship between collaborative classroom dialogue and search based tasks. In that work, despite generally similar academic attainment, the success of the small number of groups appeared to be directly related to their ability to use the kind of exploratory dialogue described above. In that work we noted that the least successful group also engaged in the least exploratory talk, as well as reflecting very little on the relationship between the information they found and the purpose for which they were seeking it. Indeed, that group appeared to be primarily concerned with the quantity, ease of access, and aesthetic value of information. In contrast, the other two groups focused on the ‘importance’ of information and particularly that information was ‘explained’; and the detail and novelty of information, respectively. The point here is not to suggest that individual learning does not take place in information seeking tasks. Rather, it is to highlight that such tasks can involve a range of levels of work—and that at times it might be appropriate to set information seeking tasks that involve interthinking. To draw an analogy, just as whole class questioning can involve a range of question types (including open and closed, and those aligned at a stage on the popular Bloom’s Taxonomy (1956)) so too can search tasks.

In search tasks, then, there is potential in thinking about open questions, and considering the ways in which questions should be broken down into components to understand how one question might lead to another (‘What is the name today of the town where the founder of the British Empire was born?’). Indeed, the seeking of information can be seen as part of the promotion of dialogue to explore misconceptions, discuss evaluation of results, and sharing of strategies. Of course, searching for information also involves identification with other points of view—representations of knowledge which are ‘given’, and served up through the search engine—and we turn to this now.

Background common knowledge: co-constructed representations
Orientation to other’s points of view, as we search the internet, talk to peers, read books, and so on is an important part of the learning process. In engaging in such activity we work with ‘given’ knowledge, representations that can be shared, and form a part of our common knowledge. With such resources we can engage in a rich history of ideas, and use ‘co-constructed representations’ to engage in the ‘co-construction’ of representations. The field of CSCL has a particular interest in this kind of ‘knowledge building’ (Scardamalia & Bereiter, 2003, 2006), the ways in which background common knowledge can effectively resource the co-construction of dynamic common knowledge through the use of representational tools. Thus, much work in CSCL has focused on developing environments that support particular types of efficacious dialogue. As we discuss below, there is evidence that suggests that CSCL representations used to resource collaborative group work, and mediate interactions with common knowledge, have a significant role to play in mediating effective group dialogue. However, we note that although such environments play an important role, types of productive dialogue which bear striking resemblance to those in our own work are not ‘automatically’ produced in the use of structured environments (see, for example, Yies, Lund and Baker 2002). Moreover, Dillenbourg (2002) notes that some CSCL environments risk ‘over structuring’ with

dynamic common knowledge: co-construction of representations
The seeking of information is a classic example in which the benefits of the activity appear to be entirely conferred on the individual. We seek information because we (as individuals) wish to use it (as individuals). Indeed, this is the notion of information as a functional (and often possessive) entity. This view ignores the fact that information can flow in both directions in such exchanges. Secondly, when we seek information, particularly on the web, we engage with a network of linked documents with a rich set of intertextual ties; in a very real sense, reading much of the web involves an interaction with the thoughts of many people, through blogs and micro-blogs, posts, videos, and images, all of which ‘readers’ may comment on.

This example is in fact particularly interesting because, unfortunately children in particular are rather poor at the use of search engines, and this paucity appears to be only marginally related to their lack of technological skill. This lack of skill has led one researcher who explored collaborative information seeking in educational settings to suggest that teenagers may be ‘largely unable to select appropriate search strategies (planning), check their progress (monitoring) and assess the relevance of search outcomes (evaluating)’ (Lazonder, 2008, p. 466). In that research, on line pairs of teens searched for information together, Lazonder was interested in the extent of collaboration on this ‘inert knowledge problem’ (Lazonder, 2005, p. 462). Lazonder’s suggestion was that through the use of verbalisation learners might improve their self-regulatory processes, prompting users into better negotiating the search process. Indeed, in this example from a sample of 20 students with a mean age of 20, Lazonder found that pairs did perform better, and faster, than individuals. They also used more varied search strategies and evaluated websites more critically than the individuals. This example can be read in two ways: the first (suggested by Lazonder) implicates the second of the dialogue purposes noted above—that language can facilitate individual psychological
the consequence being that they restrict the use of educationally productive types of dialogue. So whilst design may reduce some difficulties (for example, by introducing threading to discussions) context is fundamental to understanding the dynamic features of dialogue through which learning is co-constructed. Computer environments may be seen as complementary to such dialogue, in particular where they embody some of the systems through which exploratory and accountable talk are more likely to occur – the ‘ground rules’ of each.

Work has thus focused on the ways in which the provision of a shared set of representations may support the development of productive dialogue, and the co-construction of further representations. Building on earlier work (Suthers & Hundhausen, 2003; Suthers, 2006), Suthers (2008) reports on three possible influences of CSCL representations on collaborative processes:

1 Negotiation potentials – because the representation is shared, participants feel obliged to negotiate over changes to it.

2 Referential resource – because the representation has shared history, it becomes imbued with meanings.

3 Mutual awareness – Because the representation is external, it is a shared resource which creates a shared frame for activity.

With respect to the third point above, in a review of the literature on awareness in CSCL, Jansen and Bodemer (2013) note the importance of both content and social (or relational) group awareness – with the former relating to aspects such as awareness of knowledge states, while the latter relates to the quality of collaborative processes. This is of particular interest given the concern raised that too much CSCL research has focused on information sharing (between learners exchanging ‘facts’), at the cost of analyzing the interactional conditions for learning, despite the fact that informational sharing is not a good predictor of collaborative performance (Suthers, Medina, Vartapu, & Dwyer, 2007; Suthers, Vartapu, Medina, & Dwyer, 2007; Suthers, Vartapu, Medina, Joseph, & Dwyer, 2007).

In these studies, Suthers et al. note that despite one group outperforming another on knowledge construction involving the integration of multiple sources, those groups appeared not to share any more information (as indicated by individual referencing in an essay) and that their performance was best associated with ‘interaction’, as characterized by ‘round trips’ of information. These ‘round trips’ describe the reuse of information previously stated, the building of ideas between collaborators – perhaps the interthinking of collaborators using and developing shared artefacts. Building on work by Wells (1999), Twine (Twine, Littleton, Collin, & Whinlock, 2014; Twine, 2011) has suggested that such artefacts can function as ‘digital improvables’ – providing a cumulative basis of common knowledge upon which future discussions and other activities can draw and progressively build. Thus, the ways in which existing representations – the ‘co-constructed’ of our section heading – are used in the resourcing of co-construction is an important consideration.

Conclusion

We have shown that the use of various kinds of digital tools, whether a shared display such as an interactive whiteboard, an asynchronous chat tool, or the various kinds of social media and their facilities for commenting and sharing, can provide some valuable support for productive discussion. The ways in which technologies support access to representations, and the co-construction of representations, provides important support for not only thinking, but interthinking. Such representations and technologies can resource what Wegner (2010) has called a ‘dialogic space’

in which different ideas, perspectives and understandings can be collectively explored, and material can be modified to record the development of a discussion and capture emerging ideas. Wegner’s (2010) claim is that, for a dialogic use of technology, we should consider:

1 Opening dialogic spaces (e.g. by adding comments to blogs), but also teaching to do this (e.g. through the use of ground rules for talk, and philosophy for children).

2 Widening dialogic spaces – understanding more points of view, and the background behind them, for example through WebQuest activities in which different perspectives and their assumptions are explored.

3 Deepening dialogic spaces – increasing reflection on assumptions made in arguments by students and others, shared awareness tools to make explicit the arguments being made (and their structures) can support such deepening.

4 Teaching content through induction into fields of dialogue – Wegner notes ‘interactivity makes it easy for software to simulate multiple points of view in a dialogue, thus allowing learners to be inducted into a field of dialogue rather than into fixed “truths”’ (Wegner, 2010, p. 359) noting that, the internet can be a cacophony of voices, rather than a dialogue, but through designed spaces – such as WebQuests, and the enabling of links between geographically distant groups – presence and dialogue can be mediated to encourage reflection and learning.

This final point is not only a claim about collaborative dialogue, but one about the very nature – the unstructured, messy nature – of the internet, and its use for developing space to explore multiple viewpoints. Crucially, if our targets are higher level reflection and conceptual understanding, such space must be created in contrast to many current educational systems, reiterating the point that collaborative task context is as important as collaborative tool design (Rick & Gault, 2006). Importantly, this highlights the need to consider the use of technology in context, and not just the design of technology itself.

The ‘interpretative flexibility’ of technologies is important. When we observe or deploy technologies we should consider the particular social setting, and be mindful of not falling into the trap of technological determinism (Hamlet & Freenberg, 2008). Expectations for the transformative power of technologies should be mitigated by an understanding of the place of technology in the wider social system (Crook & Lewthwaite, 2010), which dialogue plays a fundamental role in and consideration of the kinds of interaction we are aiming for (Oliver, 2011).

Thus digital technologies offer opportunities for students to interthink online, and to do so without the constraints of time and location that arise in more conventional educational settings. However, we have also noted that any technology has its own limitations, and new tools do not necessarily lead to improved learning outside of the context of high quality dialogue.

The conclusion we draw from research on technology and dialogue is that consideration should be given to the ways in which task, representation, and collaborative dialogue are brought to bear on learning. Working alone, and together, with or without technologies can confer benefits on individual thinking. However, the benefits of interthinking – and the facilitative role of technology in such activity – extend beyond this, offering opportunity for building new ideas together in ways that can be transformative.

Notes

1 See the Thinking Together materials hosted at the University of Cambridge: http://thinkingtogether.educ.cam.ac.uk/.
References


Knight, S., & Mercer, N. (Forthcoming). The role of exploratory talk in classroom search engine tasks. Technology, Pedagogy and Education.


The Routledge International Handbook of Research on Teaching Thinking is a comprehensive guide to research on teaching thinking. Teaching thinking is key to growing a more successful economy. It is needed for increased democratic engagement and is vital for the well-being of individuals faced with the complexity of a globalised world. However, there are questions about what we mean by “thinking”, how best to teach it and how best to assess it, and it is these questions that this handbook explores and addresses.

Containing surveys and summaries of international, cutting-edge research on every aspect of teaching thinking in a range of contexts, the handbook is thorough in its delivery, examining many different approaches and methods to help readers understand what teaching thinking is and how we can best take this movement forward. Key topics include:

- Theoretical perspectives on teaching thinking
- Approaches for teaching thinking
- Developing creative thinking
- Developing critical thinking and metacognition
- The assessment of thinking
- Teaching thinking in the context of STEM
- Collaborative thinking and new technology
- Neuro-educational research on teaching thinking

This book is an essential guide for policy-makers, teachers and researchers who are interested in teaching thinking.

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The Routledge International Handbook of Research on Teaching Thinking

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Dedicated to the memory of Robert Burden (1940–2014) and Anna Craft (1961–2014), contributors to this volume who died while it was being prepared. Their wisdom will be sadly missed.
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how teacher and student creativity is sometimes (unintentionally) suppressed and how it can be incorporated in the everyday classroom. He has published widely on this topic. His newest book *Killing Ideas Safely? The Promise and Perils of Creativity in the Classroom* is published by Information Age Publishing. Dr. Beghetto is the editor-in-chief for the *Journal of Creative Behavior* and serves as an associate editor for the *International Journal of Creativity and Problem Solving*. He is a fellow of the American Psychological Association and the Society for the Psychology of Aesthetics, Creativity and the Arts (Div. 10, APA). Dr. Beghetto has received numerous awards for excellence in teaching and research.

Robert Burden (1940–2014), conducted research in educational psychology which covered a wide range of topics but shared a concern with improving the quality of children’s experience of school. His influential ‘Myself as a Learner Scale’ revealed the importance of how children think about and respond to education. In 2005, when he became a professor emeritus, he established the Cognitive Education Centre at Exeter, which later became the Cognitive Education Development Unit. This promoted his whole school approach to teaching thinking and has had an impact not only in the UK, where there are now many ‘Thinking Schools’ accredited by Bob and his team, but also in countries around the world.

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Introduction

Rupert Wegerif, Li Li, James C. Kaufman

Introduction

Teaching thinking is important. Policy reports from around the world stress that education for higher level skills, such as problem solving, creativity and learning to learn, is crucial for future economic growths (e.g., World Bank, 2011). This policy push is influenced by social science research that strongly suggests a causal relationship between the level of cognitive skills in a nation and the level of economic development (Rindermann and Thompson, 2011; Hanushek and Woessmann, 2008). Beyond these familiar economic arguments there is also widespread recognition that dispositions required for good thinking such as resilience, tolerance, creativity and reasonableness are all also essential to personal and collective well-being in an increasingly globalized world (OECD, 2014).

In China the curriculum has been changed in recent years to focus more on promoting critical and creative thinking. In the USA and UK many colleges include Critical Thinking as part of their general core curriculum. In Malaysia the government has declared that every school will engage in teaching thinking training in order to become a 'thinking school' within three years. Similar initiatives can be found in other developing economies including Thailand, Mexico, Russia and Brazil. Teaching thinking is very much on the agenda for education in the twenty-first century, but how good is the research base for all these practical initiatives?

This book offers the background theory and summaries of research evidence required by policy makers and teachers who have to make decisions about teaching thinking.

The interest in teaching for thinking and creativity around the world has led to a great many publications of practical recipes. However, given that anyone can publish a book and claim whatever they want to, much of this practice is not informed in a rigorous way by research. Teaching thinking as a field of research has been damaged by the commercial success of teaching thinking packages. Each package claims to be based on research but these claims are almost always based on cherry picking the research findings that seem to fit the approach adopted rather than on building an approach that comes out of a serious review of the research findings.

Commercial packages in the field of teaching thinking have a real vested interest in not learning from research. Research implies constant reflection, refinement, and development, whereas
packages need to stay the same to establish and expand their brand penetration of the market. Edward de Bono’s well known ‘six thinking hats’ approach is a good example of this problem.

This approach has many positive virtues, but it is important to note that it has not changed in the last thirty years. There have been a few small evaluations designed to demonstrate that the hats approach is effective but there has been no serious research to help us find out why these are exactly the hats that we need and what would happen if we had different hats or if we used seven hats or five instead of the given six.

Just pulling packages, like the six hats approach, off the shelf and applying them without questioning why they work is the opposite of thinking. Yet it is exactly such a poor choice of action that many misguided policy makers and teachers believe is all that is needed in order to ‘teach thinking.’ At world conferences on teaching thinking the voices of gurus with commercial solutions drown out the more modest voices of serious educational researchers. This is why we need this volume. All the contributors to this volume are university researchers or based in research laboratories. The chapters are not promoting packages or any commercial product but are instead exploring the principles that underlie the success or failure of different approaches to teaching thinking.

Another reason why we need this volume is to report on the changes and developments in the field of research into teaching thinking. Our choice of the term ‘teaching thinking’ to describe this research field already says something significant about how we think that the field has developed.

What is ‘teaching thinking’?

Some people might find that the term ‘teaching thinking’ sounds a little vague. They might prefer something that sounds more precise like ‘cognitive skills’ or ‘Higher-Order Thinking’ or ‘critical thinking’. However, we find that the practice of teaching thinking takes many forms, from electric car simulation (Snowball et al., 2013) to group drama (Anderson, 2004). All of these approaches are united by the desire of practitioners and policy makers to improve the quality of thinking of students. In conducting research in support of this practice we need to question and develop notions of what counts as good thinking but we are not yet in a position to define the field through our theories. If we claim that we are teaching ‘cognitive skills’ for example then we exclude approaches with good results that are not obviously cognitive or obviously skills such as working on emotions (Newton, this volume) or working on the self image of students (Burden, this volume). There is a long tradition of separating the teaching of critical thinking from the teaching of creativity, but most research indicates that creativity is crucial to all types of effective real-world thinking. Now teaching for creative thinking tends to be seen as a key part of teaching good thinking in any context (Tan; Cropley, both this volume). The separation of ‘Higher Order’ thinking skills such as ‘evaluating’ from supposedly ‘Lower Order’ skills such as ‘remembering’ is not grounded on good neurocognitive research evidence. The use of phrases such as ‘Higher-Order Thinking Skills’ sounds technical and precise but in practice means simply ‘the kind of thinking that is highly valued in this culture at this time and that we think students do not do enough of and really ought to do more’ (Wegerif, 2002). So by using the inclusive phrase ‘teaching thinking’ we avoid the potential trap of prematurely claiming a settled consensus as to what good thinking is and how it can be taught. On the other hand we are clearly delineating a field of research: this is research into the underlying structures and causal processes behind the widespread cultural practice of teaching thinking.

Resnick’s insight into the field of teaching thinking, expressed nearly thirty years ago, remains true today (Resnick, 1987). Although we might not be able to explain what we mean by good thinking in advance, we recognise it when we see it. It cannot be completely defined in advance because it is not algorithmic but always surprising. This is another way of saying that the field of teaching thinking is founded on the intuitive and practical expertise of educationalists who want to teach for more than repetition and exam success and who know from experience that this is possible.

Developments in the field

Resnick’s definition of good thinking as always surprising implies that creativity is an essential component of good thinking. Creativity was once marginal in the field of teaching thinking, yet now it has become central. The scholarship on creativity is a rapidly increasing juggernaut that has brought academic rigour to a field that is often thought to be ‘off’. There are more academic journals devoted specifically to creativity research than ever before, and the impact factors of these journals have uniformly increased (sometimes more than doubling) over the last decade (Long et al., 2014). The question of how creative thinking can be improved has been studied by a multitude of fields, from education (Beghetto & Kaufman, 2010) to neuroscience (Vartanian et al., 2013) to business (Paulus & Nijstad, 2003). This shift is reflected in the Handbook not only with a section of six chapters on research on teaching for creative thinking but also through the fact that creativity features as a significant theme in most of the chapters. Beghetto considers challenges and new opportunities in teaching creative thinking in K-12 schools in the USA, whereas Li and Johnston explore what it means to teach creativity for teachers in China. Craft discusses possibility thinking for creativity to suggest that it helps us to understand how children inhabit the world of imagination that allows them to pose ‘what if’ questions as well as engaging in ‘as if’ behaviours. Creative thinking is not a stand-alone concept but something that everyone needs to have and it can be embedded in various learning environments (Yeh, this volume) and can be nurtured across the lifespan with various methods appropriate to the developmental needs of individuals (Hui, He, Liu-Au, and Ching, this volume). Creative thinking can be and should be linked to other aspects of learning, such as motivation and goals (Kaufman, Reiter-Palmon & Royston, this volume). The shift of teaching thinking towards fostering creative thinking also is evidenced by the approaches of assessing creative thinking (Long & Plucker; West & Stamos, both this volume).

When David Perkins surveyed developments in the field of teaching thinking in his valedictory address at Harvard (in 2011, available on YouTube) he stressed a particular shift from a focus on teaching skills to teaching for the development of enduring dispositions. Research suggests that cognitive skills often do not transfer from the context in which they are taught. A focus on teaching for positive thinking dispositions is an answer to this challenge. Dispositions are tendencies to act in certain ways that people carry with them across different situations. Dweck’s work (2012) has been particularly influential in demonstrating a) the importance of having a positive disposition towards learning new skills and b) that this disposition can be taught. This shift from understanding teaching thinking as teaching skills or abilities to understanding teaching thinking also in terms of teaching for positive thinking dispositions is implicit behind many of the chapters in the Handbook, particularly the two chapters on research into cognitive styles (Zhang; Evans and Waring, Doug Newton’s exploration of the significance of emotional responses and Robert Burden’s chapter on assessment (all this volume).

The increasing roles given to creativity and to dispositions are perhaps part of a broader movement away from a focus on discrete cognitive skills of the kind that can be measured in a laboratory and towards an understanding of thinking as always embedded in world contexts and so needing to be taught in a way that takes context into account. In the theory section of the Handbook for example, Robert Sternberg argues for the importance of
ethical thinking as part of effective thinking in social contexts, Yezan Harpaz draws out some of the implications of understanding approaches to teaching thinking as ideologies, supported by Steve Higgins who looks at the factors and motives that have influenced the history of teaching thinking. In the STEM (Science, Technology, Engineering, and Mathematics) section, we look at teaching thinking embedded within particular curriculum contexts, in relation to cognitive acceleration (Oliver & Venville), developing science teachers’ epistemic practices and thinking (Erduran & Garcia-Mila), teaching and learning of probabilistic thinking (Cherntof & Sitzman), and problem-based learning (Adel El Sayary, Forzali, & Mansour).

In real life, thinking is something we usually do using tools and together with others, so to many people it makes sense to also teach it that way. The use of tools such as argument maps or concept maps and other visual scaffolds is widespread in teaching thinking practice (e.g., Fytle, 2000) and it is perhaps weakness of this volume that we do not have more research into how such tools work. However, Johnston-Laird (this volume) offers a fascinating study of the impact of using diagrams of possibilities to support thinking.

Traditionally teaching thinking has focused on individuals. It is only quite recently that there has been clear research demonstrations that collective or group thinking is a real separate phenomenon with its own unique features that can be measured and can be taught (Wooldley, 2010). Group thinking depends upon communication and research on group thinking is often linked to research on tools that support group thinking (e.g., Suh, 2006). This very new approach to teaching thinking is brought out in the final section of the Handbook, ‘Collaboration and New Technology’ where several chapters explore how we can teach thinking together mediated by tools. This new development follows the logic of the general shift towards more situated approaches to thinking and teaching thinking.

While the developments outlined above all fit with the overarching theme of moving from discrete skills to studies of thinking in context, there is one very exciting development that cannot always appear to be just moving in the opposite direction. This is the recent expansion in neuropsychological research relying on brain-scanning techniques. Vartanian and Beatty (this volume) review the impact of training on the working memory and so on more general thinking ability. Many other chapters in the book refer to this new and expanding line of research, the findings of which will have growing significance in the field of research on teaching thinking.

Finally, there is another prominent development in the field of teaching thinking which we take account of in this Handbook: globalisation. Previous handbooks, such as Baroo and Steen's (1987) excellent volume Teaching Thinking Skills, have been largely limited to researchers in North America. The three editors of this volume are citizens of three continents (North America, Europe, and Asia) and their geographical spread is reflected in the contributions. For example in the theory section, Li explores the cultural issues that arise around the meeting of Western ideas of teaching thinking and Confucian traditions of education. The rise of interest in education in the Asia-Pacific region is particularly reflected in this Handbook with chapters from Hui, Li and Johnston; and Cheng (all this volume) surveying developments there in teaching thinking and in the assessment of thinking, as well as several other chapters reporting on studies of teaching thinking conducted in Asia.

These are just a few highlights of developments in a complex and multi-faceted field. In focusing on new and emerging themes we do not mean to obscure other, more established areas that continue to develop. The Handbook also has a section on research developments in metacognition and critical thinking research for example. Metacognition is closely examined in specific subject areas, such as second language learning and science education. Zohar and Barzilai point out the central role of metacognition in teaching higher order thinking skills in science, and argue that metacognitive skills should be taught explicitly more often. Liu and Li review the research in metacognition in second language reading and consider think-aloud protocols in tapping into second language learners' metacognition. They also offer practical guidance for developing metacognitive awareness in second language classrooms.

Although we have done our best to include all relevant strands of research inevitably some important and exciting research in the area of teaching thinking has been left out. This Handbook is not intending to be either exhaustive or final. The dynamic field of teaching thinking research cannot be contained in one book or summed up in one narrative.

Some tensions that help to define the field

Ideology or science?

Harpaz (this volume) lays down the challenge that teaching thinking is based upon ideology although it often presents itself as if it was science. The very idea of teaching thinking seems to depend upon a notion of good thinking that is culturally specific and so inevitably disputed. Li (this volume) brings out that ideas of good thinking and of good ways to teach thinking are different in China than in the West and this has implications for pedagogical interventions. Wegerif (this volume) refers to evidence that how we think and also how we value thinking, varies across cultures and across time. Many of the chapters in this Handbook actively advocate a particular approach to teaching thinking which implies a particular view of what good thinking is. Just to give three examples, Sternberg advocates teaching ethical thinking. Baumfield advocates teaching thinking as a way to engage teachers in reflecting on their practice; whereas Hogan advocates the value of teaching a particular kind of systems thinking. Other chapters, such as Veenman and Topping and Trickey, limit themselves to the more neutral voice common in natural science research, reporting the results of research.

A major tension between styles of writing in the field, some articles reading like political advocacy while others read like neutral scientific research reports, indicates a tension at the heart of all educational research. Education inevitably involves decisions about what to teach and how to teach it and these decisions imply values. From its inception, the field of teaching thinking research has been about political advocacy for the need to teach for more than transmission of knowledge (Higgins, this volume). That advocacy might be grounded on 'ideology' according to Harpaz’s definition of this term, but that does not mean that it is incompatible with good science. Good science is needed to tell us the effects of different approaches to teaching and to help us understand the learning and teaching processes that lie behind those effects. Education is always an arena for political debate and no more so than the field of teaching thinking. Researchers in the field of teaching thinking propose or imply so many different models of good thinking, and so many different ways to teach good thinking, that they cannot all be right. It is best to be honest about this. However, that is precisely why we need good scientific research. Research might be motivated by social concerns (or 'ideologies') but in pursuing these it needs to provide persuasive evidence based on reliable methods. In the process research helps us to understand what lies behind the different approaches to teaching thinking not only so that we can choose between them but more importantly, so that we can better understand what good thinking is and how best to teach for it.

Can we teach good thinking in general or should we teach thinking in a way that is specific to different subject areas?

Moore (this volume) raises the long-standing debate between those who claim that good thinking has general features that can be taught and those who claim that good thinking is specific
to context, especially disciplinary context. He looks at what is meant by 'critical thinking' in different areas of the university curriculum and concludes that it takes different forms and requires subject knowledge. This is not an argument against teaching thinking but in favour of teaching thinking skills within curriculum areas in ways that are specific to those areas. Higgins (this volume) looks at what the evidence of research studies tells us about the debate between teaching thinking skills as extra ‘enrichment’ outside the curriculum and teaching thinking in a way that is ‘infused’ within each area of the curriculum. He concludes that the evidence points clearly to the need to do both. Teaching thinking skills outside contexts can leave students unclear as to how to apply them whereas teaching skills only within contexts can lead to a limited awareness of how to apply the same skills in new contexts.

This debate will continue because it depends not just on research evidence but on what we mean by thinking and on our purpose in teaching thinking. Thinking as metacognitive awareness of the kind advocated by Larkin (this volume) is not obviously the same as the critical thinking activities that Moore considers. It might be that the demands of teaching thinking in the primary school context looked at by Larkin are less constrained by disciplinary boundaries than the thinking in college subject areas explored by Moore. Butler (this volume), appears to take the opposite point of view to Moore, claiming that generic critical thinking can be successfully taught and successfully assessed. It is noticeable that the beginning chapter with a reference to the need to teach twenty-first century real-world skills, referring to a kind of thinking perhaps different from the thinking in the context of college teaching of History, Philosophy and Cultural Studies referred to by Moore.

Is thinking individual or social?

The mainstream tradition in the teaching thinking movement has always been to focus on improving the thinking of individuals. Even when practical approaches use the language of ‘thinking schools’ (Burdens, this volume), ‘thinking classrooms’ (McGinnisnes, 1999) and thinking communities (Harpaz & Lefstein, 2008), it is not obvious that they are assuming that thinking is really located in the internal processes of individual brains. However, as we mentioned above there has recently been much interest in research on collective thinking suggesting that this has unique features (Woolley et al., 2010). Knight and Littleton (this volume) and Wegerif (this volume) both refer to the direct teaching of better collective thinking through interventions that address the shared culture of communication and the means of communication including communication technology. Schwartz and Shlemon (this volume) illustrate how teaching can change the culture of a classroom in the direction of improving collective thinking. Of course, focusing on teaching thinking at the individual level and at the social level are not incompatible. It is likely that better group thinking will transfer to individuals within that group (Wegerif et al., 1999) which is perhaps one reason why the community of inquiry approach is a popular way to teach thinking (Topping & Triaey, this volume). However, whether the focus is on thinking understood as a property of a shared culture or thinking understood only as the property of individuals is another tension that can be seen in the field of research on teaching thinking.

Towards the future of teaching thinking research

Teaching thinking is driven by the desire for a kind of education that goes beyond the transmission of existing culture towards providing students with the skills and dispositions that they need to face new challenges in the future. Understood in this way the drive to teach thinking is as old as education itself but this drive takes different forms in different contexts (Higgins, this volume). The contemporary teaching thinking movement has already seen waves of enthusiasm followed by periods of controversy and retreat (Harpaz, this volume). We are at the beginning of a new wave of interest in teaching thinking fueled partly by the challenge of new technologies and partly by developing countries interested in education that will lead to more economic innovation. Key to this new wave is the kind of rigorous research into teaching thinking that this Handbook exemplifies. Teaching thinking has lost some academic respect in the past because of the influence of champions who were long on prescriptive rhetoric and short on the kind of convincing argument that can be backed by research evidence. This Handbook is part of a movement to overcome that weakness. Although there are many approaches and many methods represented in this Handbook they all participate in a serious attempt to understand what teaching thinking is and how we can best take this movement forward.

References

Thinking, interthinking, and technological tools

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Introduction: the development of individual and collective thinking

The pictures here (see Figure 38.1) will be familiar to most who have had any contact with educational settings in the last 20 or so years. Indeed, one of our most recent books (Littleton & Mercer, 2013) reflected on one of the first pieces of research into school-classroom based dialogue from that time. There, it was noted that in many cases group work around computers was conducted not due to any underlying pedagogic strategy, but because of a lack of resources. For many this will be a familiar story, but along with colleagues, we have spent considerable effort in investigating what constitutes effective learning in group activity particularly that mediated by technological devices. Of course, many educators – as was the case in that original research – will have had the experience of frustration in some such situations, finding occasions when group work seemed to be ineffective and suspecting that a better use of resources would be to set students on individual tasks. Indeed, what is so potent about many new technologies is their ability to open up new worlds of learning for individuals. Yet, in this chapter we will argue that to see technology as primarily an individual pursuit is to miss out on two important considerations: firstly, many modern technologies vastly expand the potential for inter-textual and inter-active elements (Wenger, 2013) through our interaction with which we are exposed to the thoughts and arguments of others and, secondly, technology can be an invaluable aid in resourcing and supporting both co-located and remote small group activity.

Throughout this chapter we aim to highlight the ways in which shared use of technology can be seen as both an individual and collective resource, and foreground the importance of dialogue as being of fundamental importance in such contexts.

Language and thinking

The Russian psychologist, Lev Vygotsky, highlighted the importance of language for thinking, emphasizing that: