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Learning about Learning enhances performance

The purpose of this paper is to review evidence which connects learning about learning with higher levels of performance, and to consider current explanations of such a connection. It is based on a reading of approximately 100 research studies, not all of which are cited for reasons of space.

Background/Context

In the last few decades, understandings of learning have advanced significantly. In the 1960s and 1970s it was fashionable to model learning on computing processes, and to consider learners as "intelligent systems". Since then other features of learning have been re-discovered. Studies of social aspects of learning have re-emphasised that understanding is a shared phenomenon, that learning can be usefully viewed as joining a knowledge community, and that much learning remains very specific to the social situation in which it was originally learned.[1]

In parallel and sometimes in connection with these developments, increasing attention has been given to "higher order" processes of understanding. The term "metacognition" has become more commonly used, following its coining in 1976[2].

In the world of education, practices reflecting these ideas have been taken up in various ways. The following terms can be found in regular use by educators:

- Thinking about Thinking[3]
- Learning to Think[4]
- Learning to Study[5]
- Learning How to Learn[6]
- Learning to Learn[7]
- Learning about Learning[8]

The term metacognition (awareness of thinking processes, and "executive control" of such processes) denotes the first in the list, whereas the term meta-learning (making sense of one's experience of learning) denotes the last. Meta-learning covers a much wider range of issues than metacognition, including goals, feelings, social relations and context of learning. The meanings of the terms in this list and the practices associated with them vary in important ways: some adopt a highly instrumental approach to learning while others do not: some imply that successful learning strategies may be defined in advance, while others do not.

Notwithstanding the differences between these terms, their broad focus is of great importance for learning. Indeed, an earlier review in this series, "*Effective Learning*"[9], highlighted such higher-order processes as a key ingredient in the definition of effective learning. "Effective learners have gained understanding of the processes necessary to become effective learners", and effective learning "is that which actively involves the student in metacognitive processes of planning, monitoring and reflecting"[10]. Writers who use the term "expert learner" accentuate this point:

> "Reflection on the process of learning is believed to be an essential ingredient in the development of expert learners. By employing reflective thinking skills to evaluate the results of one's own learning efforts, awareness of effective learning strategies can be increased and ways to use these strategies in other learning situations can be understood."[11]

While the range of understandings of learning in the formal literature has developed, the range of understandings of learning held by learners themselves is also now a key focus. People variously view learning as:[12]

- increasing one's knowledge
- memorising and reproducing
- applying, general rules to particulars
- understanding, making sense
- seeing something in a different way
- changing as a person

and the links between conception of learning and how a learner goes about their learning are now clearer. The above conceptions have been described in polarised ways - quantitative versus qualitative, or surface versus deep. Such descriptions risk confusing a conception of learning with approach, strategies or outcomes. To appreciate them as descriptions rather than acts or outcomes, we prefer to view them as varying from *thin* conceptions to *rich* conceptions of learning.

Similarly, conceptions of teaching are identifiable. Bruner[13] writes of four, which simplified are:

- showing
- telling
- making meaning
- creating knowledge

While teaching is not the core focus of this paper, it is mentioned here because approaches to teaching influence approaches to learning.

This review includes both illuminative studies and intervention studies, but such a distinction is imperfect. Illuminative studies show an association between those learners who hold a rich conception of learning and those who perform well in various learning tasks. But the context has its effect, sometimes because it promotes the association, and other times because it does not (e.g. when rich conceptions of learning are not encouraged in schools). Intervention studies show impact of a new strategy for promoting learning, but here again the context is important, not only for supporting the new strategies being tried, but also for embedding them into the complexity of the classroom. There is no single simple intervention with powerful results, so various interventions may be seen as contributions to building a rich learning environment (and in the process grappling with all the contextual pressures which can work against this goal).

Learning, and its relationship with performance

We first consider the relationship between learning and performance with the learner as the focus. Three decades of major studies in a number of countries[14] have shown that different learners approach achievement-related tasks with different goals, orientations or motivations, and that the distinction between learning and performance is key. It relates to different beliefs about success, motivations in learning, and responses to difficult tasks.

"learning orientation" concern for *improving* one's competence	*"performance orientation"* concern for *proving* one's competence
• belief that effort leads to success • belief in one's ability to improve and learn • preference for challenging tasks • derives satisfaction from personal success at difficult tasks • uses self-instructions when engaged in task	• belief that ability leads to success • concern to be judged as able, concern to perform • satisfaction from doing better than others • emphasis on normative standards, competition and public evaluation • helplessness: evaluate self negatively when task is difficult

So learners with a learning orientation do not focus on performance as a goal - a paradox in some people's minds. Their success is partly achieved by talking themselves through the task in hand. By contrast, performance orientation is associated with helplessness - "I'm no good at Maths" and the like. This difference may relate to the finding that giving learners feedback of a person-oriented kind leads to lower levels of performance than giving task-related comments. Similarly, giving grades as feedback can undermine motivation: pre-occupation with grade attainment can lower the quality of performance[15]. Indeed, performance feedback can have a negative effect on performance on about 40% of occasions[16]. But schools are subject to increasing pressure for "results", and performance is confused with learning.

Learning orientation, rich strategies and meta-learning

Learners who adopt a learning orientation may also be those who have a richer conception of learning, which engages more elements and more complex relationships. At the same time, they may have a richer range of learning strategies, but here a further connection emerges. Learners may "possess" learning strategies, but not employ them, or employ them ineffectively. So it is the process of selection and use which comes to the fore. This is where the meta-cognitive strategies of monitoring and reviewing are vital: indeed one review concluded that direct teaching of "study skills" to students without attention to reflective, metacognitive development may well be pointless[17]. Since the development we seek refers to learning (i.e. more than just thinking) we consider the term meta-learning more accurate.

So learning about learning aims to:

1. focus on learning as opposed to performance
2. promote a rich conception of learning, and a rich range of strategies
3. develop meta-learning to monitor and review

In what ways can classrooms foster this? Is there any evidence that such learning leads to high levels of performance, and if so under what conditions? The choice of performance measures and whether they assess high-level learning will be critical.

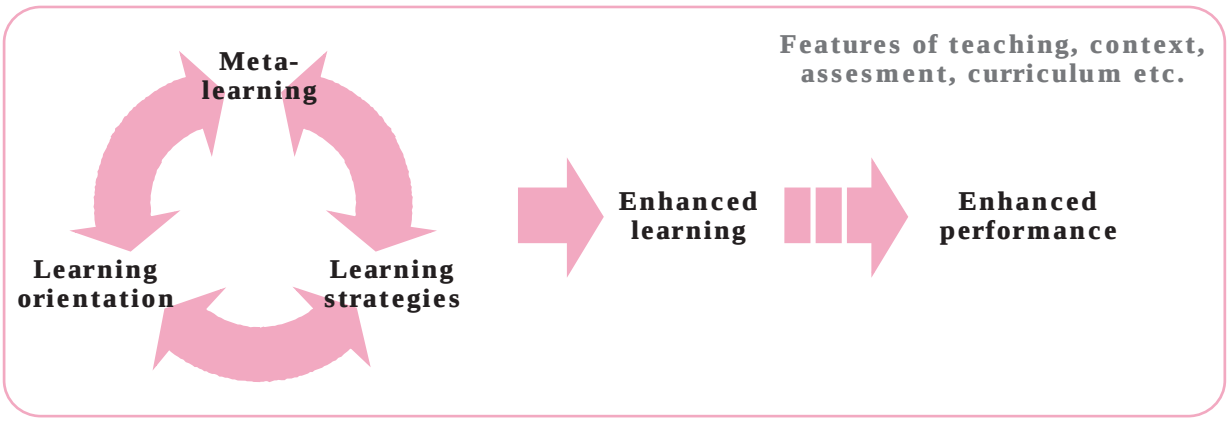


Figure 1. Relations between the major elements connecting learning and performance

Learning about Learning in Pre-School

Young children's learning is often under-estimated. Yet young 3 to 5 year-olds can transfer learning from a single example of a problem, on the basis of principle, not surface features[18]. This learning can be accelerated by a key practice: asking them to explain. 3-year olds then perform as well as 4-year olds (twice as well as the 3-year olds who did not reflect). By 4 years children's own explanations promote transfer better than those provided by an adult.

Young children's conceptions of learning develop over time. With 3 to 8 year-olds, conceptions of *what* they learn developed from (a) to do something, (b) to know something, to (c) to understand something; conceptions of *how* they learn developed from (a) learning as doing (b) learning as growing older, to (c) learning through experience, either passive with the passing of time or active with practice[19].

This development was accelerated with teaching practices designed to promote children's greater awareness of their own learning[20] . Through what were called "metacognitive dialogues" (i.e. meta-learning dialogues) the children were asked to reflect and ponder about what they were doing and why they were doing certain things which are normally taken for granted, for example:

"How come that we [did X] yesterday?"
"Did you find out anything that you didn't know before?"
"How did you go about finding out?"
"Can you find out some more on that by tomorrow?"
"How would you go about teaching other people all you have learnt about this?"

Finally it was shown that "children who have been involved in this form of educational activity (including meta-learning) are better prepared for learning (understanding new content)". Six year olds showed greater understanding in three real-life learning experiments than did their peers in parallel groups[21] .

Children also showed a richer conception of learning: when asked *"If you were the one who had to decide what the children will have to learn next, what would you suggest?"*, their answers were more about learning to know than about learning to do. When asked *"Imagine you are as old as your teacher, and have to teach children in another pre-school all that you have learned (about X), how would you go about that?"*, their answers were more about teaching by planning experience, rather than teaching by telling.

These studies have indicated the significant impact of two important classroom practices:

1. *making learning an object of attention*
2. *making learning an object of conversation*

Projects pairing 4-year olds and 8 year olds show that the older children can plan and evaluate learning for the younger ones, who are also able to lead the direction of learning. The adults concluded "children learn many things at school, but they very rarely have a chance to learn about the process of teaching and learning"[22] .

Learning about Learning in Primary School

By 4 years, children begin to show the differences associated with learning orientation (talking oneself through difficult tasks) and with performance orientation (learned helplessness), and by age 11 their different beliefs about ability (fixed versus malleable) and explanations of success (product versus process) have also developed[23]. These orientations inform pupils' behaviour in learning situations, and those situations in turn may encourage more of one orientation than the other.

In a survey of 30 classes of 10-year-olds, classes had significantly different orientations, as did the learners. For both, learning orientation was associated with beliefs that interest and effort cause success, whereas performance orientation was associated with beliefs that competitiveness causes success[24]. When learning orientation was high, work avoidance and alienation from school were both low. Pupils' orientations were not simply defined by their classroom: for example, some perceived teachers' expectations as predominantly competitive, yet maintained a learning orientation for themselves.

Learned helplessness can be reversed. Those pupils whose performance deteriorates after a failure experience because of attributing to themselves a lack of ability (as opposed to those who merely reduce engagement) can be helped by practising less fixed internal attributions, such as attributing success and failure to effort or strategy rather than to ability. Then their performance (18 pupils of age 10 completing arithmetic tasks) after subsequent failure experiences did not deteriorate[25].

Promoting pupils as learners has been captured in a programme known as "Fostering Communities of Learners" with inner-city pupils aged 6 to 12 years. The programme enhances children's emergent strategies and metacognition, and helps them advance each others' understanding in small groups. In these classrooms, pupils are (i) encouraged to engage in self-reflective learning, and (ii) act as researchers who are responsible to some extent for defining their own knowledge and expertise. The programme is successful at improving both literacy skills and subject knowledge. Rates of comprehension doubled, and ways of explaining became more connected. Children developed flexible learning and inquiry strategies of wide applicability. This approach contrasts significantly with those which aimed to train pupils in learning strategies: when left to their own devices there was little evidence of them using strategies. As the investigator put it "Gradually it became apparent that the children's failure to make use of their strategic repertoire was a problem of understanding: *they had little insight into their own ability to learn intentionally; they lacked reflection.* Children do not use a whole variety of learning strategies because they do not know much about the art of learning".[26]

Promoting high-level learners is helped by having them pose various meaning-oriented questions to promote understanding. Most effective questions are those posed by the learners themselves.10 year-olds trained in this performed better in later learning tasks. Questions for linking with the learner's prior knowledge and experience and promoting connections to the lesson are more effective than questions simply designed to promote connections among ideas in a lesson: 10 and 11 year-olds' performance on comprehension tests was greater[27]. Thought-provoking questions (such as ''Why is . . . important?'' and ''What would happen if . . . ?'') asked in small pupil groups, elicit more explanations and, in turn, mediate learning: Year 6 pupils offered better explanations[28]. Asking questions in advance of teaching elicits higher order questions than those produced after classroom activity: they include "wonderment" questions aimed at explanation or at resolving discrepancies in knowledge[29].

Promoting engaged learners brings attention to the style of tasks, especially in light of the disengage-ment of the later primary years. A longitudinal study with 431 US pupils showed that they become less learning-oriented and more work avoidant[30], culminating in a "fourth grade slump" probably associated with teaching isolated skills for state tests. Tasks which are challenging, collaborative, and multi-day lead to pupils being less performance-oriented, and less work avoidant especially the low-achieving pupils. A key feature is that tasks demand planning and dialogue. 9 year olds prefer high challenge tasks (requiring longer writing, collaboration and extending over more than one school day, e.g. essays on own choice of topic, letters to politicians, research papers, letters to next year's class) over low challenge tasks (short, completed alone, lasting a single lesson, e.g. worksheets on vowels, pronouns, and vocabulary, spelling and handwriting exercises). They view the latter as boring and requiring minimal thought[31]. High-challenge tasks were preferred because of aspects of the learning process: pupils felt creative, experienced positive emotions, and worked hard.

Developing meta-learning requires open task structures, with choice and self-control. Such tasks in the literacy activities in 12 classrooms also helped 6-year olds develop intrinsic motivation, metacognition and strategic behaviour[32]. Similarly, writing activities in classrooms supporting self-regulated learning helped 7- and 8-year olds monitor and evaluate their writing in productive ways, use peers effectively, and see teachers as collaborators[33]

A focus on meta-learning can enhance engagement. While devising ways of building children's metacognitive knowledge, leading experimenters frequently found children becoming actively interested in what the activity allowed them to discover about their mental processes. "Involvement and enthusiasm have generally been high. Students who have not liked writing have nonetheless seemed to like analysing the task and the process"[34].

Active metacognition helps learners regulate their own learning and be able to plan. 10 and 11 year-olds who took part in monitoring exercises, described by the authors as metacognitive training, while they learned to use problem-solving software performed better. They were more successful with the more complex problems, they succeeded more quickly, and overall they employed more effective strategies, not because they used particular strategies more effectively, but because they started by reflecting on a problem and considering the possibilities before proceeding[35]. Similarly, 10 year-old pupils who learned about goals and strategies in learning sometimes improved their performance, but they also needed meta-learning in order to use the learning strategies[36]. Learning about strategies and learning about learning go best hand-in-hand.

The third element in the classroom practices which promote learning about learning is clear - reflection. Writing reflections in a notebook dedicated to experience of learning, often called "learning logs" has proved successful with 10 year-olds[37].

> *"Dear Mrs Sanford*
> *I see that as I write log entries I tend to read them. I find in some places where words are misspelled or where I got an answer to a question or I something [sic]*
> *Last year my teacher gave us so much homework I would just memorise it and not care what it was or if I understood it and you take a test and have nothing to show for it. Except for the grade, but it doesn't matter the grade. Understanding is what counts for you.*
> *These log entries help me a lot.*
> *As I write I notice and understand more too.*
> *Your student, Lynne"*

So beyond
- making learning an object of attention an
- making learning an object of conversation, we now include
- making learning an object of reflection.

The act of writing about one's learning requires attention and demands verbalisation: it also makes one's ideas available for consideration.

Current practice in English and Irish classrooms suggests there is some way to go in meta-learning. Only a minority of teachers provided opportunities for students to develop metacognitive awareness and strategies about the task of reading in 12 classrooms of 9 year olds in Leeds and Dublin. These teachers helped learners become more aware of how they learn and acquire or refine strategies for the learning of reading, for example, thinking out loud, and suggesting ways of tackling a task. They elicited children' s prior knowledge and helped them verbalise their experiences, offered guidance on strategies, etc. The other teachers placed great emphasis on the task to be completed, the end product of the activity, pupil compliance with teacher directives, and so on. The promotion of learning strategies and learning about learning was not a prominent feature of classroom life.[38]

Learning about Learning in Secondary School

For nearly 20 years it has been known that students with more elaborated conceptions of learning perform better in public examinations at age 16[39]. Lower attainment at that age is correlated with perceived pressure from adults, while higher attainment is positively related to independence, competence and a meaning-oriented approach to learning. Recent data confirms the connection: students with qualitative and experiential conceptions of learning were likely to use meaning-oriented approaches, whereas students with quantitative conceptions of learning tended to use surface approaches[40]. Similar findings appear in 14-year olds in Hong Kong. Learning orientation is significantly associated with adaptive learning strategies, and performance orientation with maladaptive learning strategies (229 12 year-olds). Learning orientation is also associated positively with students' beliefs that they are able to regulate themselves and their learning. The more students are supported as autonomous learners, the higher their school performance, as demonstrated by the grades in French, Maths, Biology and Geography (263 15 year-old students in Canada)[41].

The classroom environment is again a contributor: meaning-oriented approaches to learning relate to classrooms which are personalised, encourage active participation and the use of investigative skills (484 students in two Australian schools)[42]. When students view classrooms as having a learning orientation they have positive coping strategies and positive feeling; by contrast, when they view classrooms as having a performance orientation there is defensive coping and negative feeling (880 US students at transfer from primary to secondary school)[43].

Better academic performance relates to a learning orientation and a malleable view of ability: these also link with positive motivational beliefs, higher use of learning strategies, and self-regulation (434 12 and 13 year-olds in USA)[44]. These findings held across three subjects: English, maths, and social studies. Classrooms have different impacts, but this is not simply about subject differences. Where differences occurred between subjects (in thinking and motivation), they were less pervasive than similarities (545 12 to 14 year-olds)[45]. Student self-regulation did not differ by subject area, and links with performance were very similar across the three subjects. So from the learner's perspective, differences between subjects may not be as great as teachers may feel.

Learning is often researched in a single subject, especially science. Learners' different beliefs prove salient. Students who believe that science is about constructing ideas engage more actively and use more meaningful strategies: those who believe understanding is the best strategy for learning science scored highest in examinations.

Students with a rich conception of learning are also more active metacognitively. They engage in "on-line theorising", ask questions which focus on explanations or discrepancies, venture ideas, use personal experiences, and give more elaborate explanations[46]. Their comments in class included:

- self-evaluating their ideas: "I've figured out what I want to say",
- recognising blocks "No, I don't get it",
- maintaining commentary "I didn't draw that right: I'm getting confused", and
- self-questioning when problems arose "What am I going to do?" "Have I come across this before?" and "What do I know about this?"

Reflecting on learning is necessary for conceptual change: without it students regress to their original conceptions. When learning collaboratively students need to reflect on and reconstruct their conceptions[47].

Students can be helped towards a richer conception. Asking them to reveal their science ideas and discuss with each other the status of their conceptions, has led to more permanent restructuring of their understanding[48]. Through the Metacognitive Learning Cycle the teacher found "It definitely changed the climate of the classroom: the metacognitive class definitely had livelier discussions, even volatile at times, and became more involved in the class - especially some students that would not normally have been involved. Especially some of the girls became more involved".

Again, asking oneself a sequence of meaningful and thought-provoking questions improves engagement and understanding: when this practice is incorporated into peer tutoring, one asks and the other explains. The ability to construct knowledge in science improved, both during the tutorial and on written measures[49]. Through this 12 year-olds enhanced each others higher order thinking and learning, and effects were not restricted to situations in which one partner was more knowledgeable or competent (as other stances on peer-tutoring suggest). Understanding and metacognition were shared, and new knowledge was constructed. Student-generated questions are more effective than provided ones. They can also help the learner be active in learning situations typically viewed as passive: in a world history course 15 year-olds trained in the strategy during classroom lectures showed greater comprehension than those involved in discussion or self-review. Students maintained the strategy when external prompts were removed. Self-questioning improves performance raising the mean from 50% to 64% on standardised tests and to 81% on task-related comprehension tests[50].

Similarly, learners trained to generate explanations to oneself (self-explaining) perform better. Students asked to self-explain after reading each line of a passage had a greater knowledge gain than those who read the text twice. Incorporated into peer tutoring, a tutor's prompts to self-explain are the most beneficial in producing deeper meaning and co-construction[51].

A programme in science classrooms set its aim as "Increased learner awareness of the nature and process of learning"[52]. Materials were devised to increase students' awareness and control of their own learning, including a Question-Asking Checklist, an Evaluation Notebook , and a Techniques Workbook. Lessons often included discussions of the purposes of learning, questionnaires about learning, and discussions about the relative roles of teacher and student in learning. After 6 months, 15- and 16-year-olds showed greater understanding of content and more purposeful learning, while the teacher had changed to allow more learner control. A project to generalise the strategies[53] showed the need to pay attention to context, purpose, support and assessment methods. These influenced whether students accepted the meta-learning strategies and saw them as fruitful. Old orientations sometimes die hard: for example, after 8 months two students came to their science teacher:

> One said: "We see what all this is about. You are trying to get us to think and learn for ourselves"
> "Yes, yes" replied the teacher, heartened by this long-delayed breakthrough, "That's it exactly"
> "Well", said the student, "We don't want to do that".

Meta-learning is also the key to effective use of learning strategies. Data from nearly five thousand 14 and 16 year-olds and college / university students showed that students with higher meta-learning selected appropriate strategies and deployed them effectively, with enhanced performance: those students with low meta-learning appeared to use strategies without metacognitive involvement and their use did not correlate well with performance. "They appear to be functioning in the same way as 'techniques' or 'tactics', i.e. as short-term props to learning that do not involve any metacognitive insight on the part of the learner"[54]. A lack of development through school was suggested: "Even at the upper end of the secondary school, however, many students do not appear to have the meta-learning capability to use learning strategies appropriately".

As a focus for courses or programmes, learning about learning has more impact than study skills. One programme used material from the history curriculum making it the object of reflection: another used generic learning skills materials. The students in the first group developed more advanced conceptions of learning, and got better grades on essays and achieved better examination results[55].

In the UK a project identified the thinking required in physics[56] and then tried "cognitive acceleration". In separate lessons, specially designed problems engineer cognitive conflict, to accelerate students into formal operational thinking. The intervention seems to have large effects for some and near-zero for others, and effects are not stable across years or gender. Improved patterns of school results at GCSE, in science and maths and English are claimed. Yet some students did not show gains in thinking. Recent explanations align with this review: "These results were attributed to aspects of the intervention methodology intended to enhance metacognition"[57]

Making a difference to classrooms does not require major reorganisation. When teachers "coach" students in learning strategies (e.g. describing thinking processes, suggesting strategy use) a significant difference in use occurs[58]. Yet on average coaching occurred in only 9% of observed segments, and in only 2% of the total did they suggest use of a learning strategy. Here, teachers most frequently urged use of learning aids ("Use your calculator" "check your answers with the map") and, less frequently, metacognitive monitoring ("look back and see how you've done"). Teachers varied in suggestion-making, ranging from 0 to 7.2% of lesson segments. Differences in this range had significant effect in promoting learners' use of strategies: when the average is so low, this suggests that learners are more responsive to coaching in these domains than a transmission view of teaching them might suggest.

The above studies illustrate the fourth element in classroom practices:
- *making learning an object of learning*

For such learning, starting ideas such as previous knowledge, organisation, metacognition, and dialogue may be needed, but students can then investigate their own learning and experiment with learning strategies[59]. There is a need to build a vocabulary of learning and highlight learning discourse. In a UK secondary school, low-achieving 13 year olds could all focus on learning as a topic of conversation and participate in reflective discussion about their own and peers' learning[60]. This challenges the prevalent idea that low attainers need simplification. Investigation of 14-15 year-olds' ideas about learning suggests they are varied, with no clear understanding of how they learn[61].

The most recent analysis of patterns in examination performance in UK secondary schools over the last decade[62] shows that the schools which improve more than the national norm have gone through three approaches:

(i) new tactics to maximise their showing in the performance tables (enter more pupils, mentor the borderlines etc.),

(ii) internal strategies to improve their schools (more responsibility to pupils, departmental improvement strategies, pastoral and academic links),

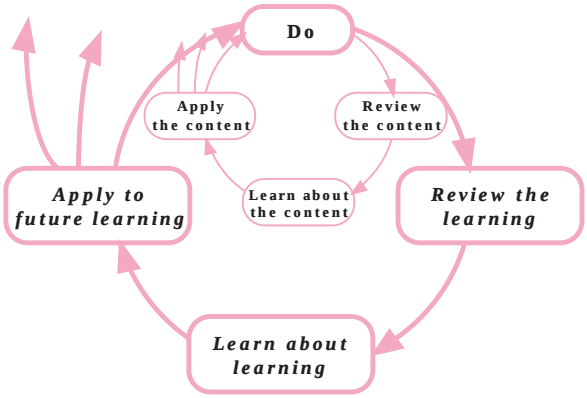
(iii) the small group of the highest improving schools has shifted beyond these two into an area which builds its capacity to improve, through an overarching focus on learning.

Currently schools differ greatly in their focus on learning. These differences relate to students' learning in a systematic way. Schools with emphasis on autonomy and moderate stress on achievement are associated with learning for understanding. Those with strong emphasis on formal academic achievement have counter-productive effects on learners[63].

When teachers learn more about learning, the effectiveness of a school improves and increased performance follows, especially for many of the underachieving students[64] .

Explanations of meta-learning and its impact

We may think of meta-learning as an additional cycle in the learning process, through which metacognitive knowledge about learning is constructed just like any other knowledge, pieced together on the basis of fragmentary data from a range of experiences.



Meta-learning can bring attention to goals, strategies, effects, feelings and context of learning, each of which has significant personal and social dimensions.

Meta-learning capability mediates the quality of learning outcome, and may also impact on what counts as learning. Those who are advanced in meta-learning realise that what is learned (the outcome or the result) and how it is learned (the act or the process) are two inseparable aspects of learning.

Greater understanding of one's own learning can include seeing how it varies across contexts. This is a crucial element in what is often taken-for-granted by educators - the transfer of learning. As seen above, learners may sometimes have a rich range of strategies but not use them in other learning situations. Effective transfer requires: (a) requisite skills (b) choosing to use the skills (c) recognising when a particular skill is appropriate in new situations, and (d) metacognitive awareness, monitoring and checking progress. People with metacognitive awareness, are more likely to recognise the applicability of a strategy in a different-looking context.

Meta-learning plays a key role in a learner's self-regulation of learning, building the autonomy upon which even collaborative work thrives.

Meta-learning promotes the versatile learner.

It is for these reasons that meta-learning has substantial effect on performance. Reviews of studies in the area of reading show that the teaching of metacognitive awareness, monitoring, and regulating has effects on performance "among the larger ones that have been uncovered in educational research"[65].

Metacognition is a defining characteristic of our species: meta-learning is its dynamic epitome.

Concluding remarks

Although this review has been structured by periods of schooling which may imply a developmental trend in learning about learning, the evidence is not supportive. Rather, an explicit focus on learning is an infrequent experience at any stage of education, and many learners show signs that they have little understanding of their own learning processes.

In a context where the dominant discourse is of performance and transmission, a focus on learning and construction will seem "against the grain", and many of the pressures and practices of current-day schooling work against the themes of this review. Nevertheless, the findings are clear: when teachers and co-workers "work against the grain" improved results are within reach, both in terms of authentic goals for education and in terms of the performance sought by current demands.

The major messages are:

- a focus on learning can enhance performance, whereas a focus on performance can depress performance;
- promoting learners as active and collaborative constructors of meaning with autonomy and self-direction can enhance performance;
- learning about learning is a necessary element for learners to select and use appropriate strategies and to be effective learners in a range of situations.

A recent meta-analysis of research on teaching, combining studies on over a million learners, concluded "Metacognition is the engine of learning"[66]. An eye to the future gives added emphasis and urgency to this theme. In a context where the knowledge base doubles every 300 days and the ability to learn in a wider landscape of learning is increasingly important, the focus on learning about learning stands in its own right as a key goal for schooling. This review has confirmed the practices needed for schools of all sorts to make a more vibrant, transferable and long-lasting contribution to 21st-century living.

Reflections

Building a focus on learning about learning requires:

(a) a process view on learning
(b) recognition of the need for explicit talk about learning
(c) everyday practices in the classroom
(d) supportive school vision and management
(e) resilience to keep at bay the pressures and simplifications.

Choose the best of your experience of the above five elements. How was it possible to achieve this? How could more be achieved?

In what ways has your own learning about learning been enhanced? What further ways could you plan?

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