

Linking the Purposes to the Science of Learning and Teaching¹

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Ideally, we would derive the right work of educational leadership from research that describes clear causal links between leadership practices, teaching practices, and students' deep learning. As I explained at the end of the previous chapter, while we have some evidence about this causal chain, it is limited by the use of standardised tests that do not assess the student competencies involved in deep learning, and it is such learning that is central to achievement of the distinctive purposes of educational institutions. In the absence of evidence about the impact of leadership on teaching for deep learning and on the success of such teaching, I adopt an alternative backwards mapping strategy, which starts from educational purpose, then asks how students learn to achieve those purposes, how teachers foster such learning, and how leaders can foster such teaching.

This backwards mapping strategy, in which I derive implications for leadership from the science of learning and teaching, is very different from much of the discourse on educational leadership and management. That discussion is often only loosely connected to the core business of teaching and learning (Bush et al., 2019; Elmore, 2004; Robinson, 2006). As Spillane (2013) claims:

[W]ith some exceptions, many analyses dwell on leading the schoolhouse rather than the core work of the schoolhouse. As a result, descriptions, and prescriptions for leading are only weakly related to the actual work of teaching and leading its improvement. (p. 60)

¹ Portions of Chapters 1 and 2 are a slightly revised version of Robinson, V. (2022). What is distinctive about educational leadership? In R. Tierney, F. Rizvi, E. Kadriye, & G. H. Smith (Eds.), *International encyclopedia of education* (4th ed.). Elsevier.

If leaders are committed to the purposes, understand how those purposes are enshrined in competencies, and understand what they should be doing to support teachers in developing those competencies, then they know . . . what constitutes the right work.

So, even though my backwards mapping strategy is a somewhat indirect way of deriving the “right work” of educational leadership, it reinforces one of the major themes of this book—that pursuit of the distinctive purposes of education should be strongly informed by the science of how students learn and of how teachers foster that learning. If leaders are committed to the purposes, understand how those purposes are enshrined in competencies, and understand what they should be doing to support teachers in developing those competencies, then they know, at least in broad outline, what constitutes the right work.

My initial step in this backwards mapping strategy is to distil some key conclusions from recent cognitive and educational psychology research about how students learn to understand, problem-solve, and transfer their learning. I then discuss some of the implications of these conclusions for teaching, including a brief discussion of social psychological research on the noncognitive aspects of student learning with an emphasis on student choice and autonomy.

How Students Learn

There is now considerable consensus about how students learn (Bransford et al., 2000; Darling-Hammond et al., 2019; Deans for Impact, 2015). Whether or not deeper learning occurs depends in part on the type of academic task in which students are engaged, because different tasks evoke and develop different cognitive operations (Doyle, 1983).

Doyle distinguishes four types of academic tasks:

1. **Memory tasks** in which students recognise or reproduce content they have previously encountered
2. **Procedural tasks** that require correct application of a procedure, formula, or algorithm
3. **Comprehension or understanding tasks** in which students recognise new versions of previously encountered information, apply knowledge to new problems, or draw inferences from or transform existing information
4. **Opinion tasks** that require students to express a preference or position

My focus will be on comprehension tasks, because growth in student comprehension and problem-solving, particularly for students who are struggling, is what is required to achieve deeper learning.

Comprehension and problem-solving tasks require students to actively construct a cognitive representation of the relevant concepts, events, or situations. As students gain experience in a subject domain, they develop more and better-organised representations (schemata) of task-relevant material. Since schemata are stored in long-term memory, they free up limited short-term memory for the processing of new information.

Domain-specific knowledge plays a central role in students' ability to comprehend, explain, and remember. It consists

not only of a well-formed semantic network of valid information in an academic discipline but also of strategies for using this information to represent (comprehend) problems, search for and select algorithms, use resources from the task environment and evaluate the adequacy of answers. (Graesser et al., 2018, p. 168)

In short, competence in a domain requires a deep foundation of factual knowledge that is organised into a network of schemata that aligns with the structure of the discipline or subject. There should be no opposition, therefore, between the learning of facts and deep learning. The challenge for learners and their teachers is to avoid memorising disconnected facts and focus instead on their structure and interrelationships. This requires deepening learners' knowledge of the subject matter while developing their grasp of its conceptual structure (Bransford et al., 2000).

The development of expertise in a subject domain requires accurate encoding of subject matter (Doyle, 1983). Students can develop schemata that encode faulty algorithms and concepts (Nuthall, 2007). When students have little relevant prior knowledge or misunderstand what they have previously encountered, they will be unable to engage with tasks that presume accurate prior knowledge. For these students, comprehension tasks create considerable cognitive overload as they struggle to bring meaning to apparently disconnected bits of information.

Deep learning includes development of the metacognitive skills required to regulate one's own learning. This involves setting goals, planning ahead, activating relevant prior knowledge, and keeping success criteria in mind and using them to monitor and adjust progress towards the goal (Bransford et al., 2000). Because not all learners independently develop the internal talk that self-regulation requires, modern curricula require teachers to scaffold metacognitive strategies by explicit teaching

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and practice so that, over time, students will prompt themselves and monitor their own comprehension and problem-solving.

In addition to the cognitive challenges of deep learning, contextual factors are critical. Academic work is conducted in classrooms in which teachers teach not single students but one or more groups of increasingly diverse students. Furthermore, students complete academic tasks in contexts where they are either recipients of or witnesses to the frequent evaluations of their teacher. For older students, these judgments contribute to a high-stakes accountability system of credits or points that determines report cards, academic pathways, and ultimately the students' qualifications.

These features of classrooms can create teacher-student interactions that profoundly alter students' opportunities to learn the cognitive processes required for deeper learning (Doyle, 1983). Low-achieving students are likely to feel vulnerable in a highly evaluative climate and respond by withdrawal so as to minimise the risk of public exposure and embarrassment (Peeters et al., 2020). Alternatively, they may attempt to increase their chances of success by using a variety of strategies, such as copying, or requesting detailed guides and model answers, that are designed to reduce the cognitive demands of the task. Teachers who give overly detailed instructions, prompts, and advice can unwittingly turn a comprehension task into a procedural one in which students happily follow their teacher's detailed guidance without increasing their expertise in the subject domain (Doyle, 1986).

In summary, academic work, particularly that required to achieve deep learning, is complex. As Graesser et al. (2018, p. 170), write:

Studies of the cognitive processes underlying academic work have revealed the enormously complex character of the operations and decisions that academic competence entails, a complexity that is often overlooked when the goals of schools are discussed.

Leaders should understand and accept this complexity so they can support their teachers in providing opportunities for deep learning. I discuss how this can be done effectively in Chapter 3.

Student Motivation and Autonomy

Students learn better when they are aware of their own learning and have the opportunity to take charge, in small and large ways, of elements of their lessons (National Academies of Sciences, Engineering, and Medicine, 2018). These findings are explained by self-determination theory, which "posits that behavior is strongly influenced by three universal,

innate, psychological needs—autonomy (the urge to control one’s own life), competence (the urge to experience mastery), and psychological relatedness (the urge to interact with, be connected to, and care for others)” (National Academies of Sciences, Engineering, and Medicine, 2018, p. 115).

When these needs are met in school, students are more likely to be motivated by their interest in and enjoyment of the task. If enjoyment and interest are not strong, students will persist nevertheless if they perceive success on the task as linked to achievement of a valued goal. Students’ interest in the task, control over their learning, and belief that they can succeed mean they want to engage in the activity for its own sake—they are intrinsically motivated. When these conditions are not present, students’ engagement and persistence will depend on their compliance with external rewards and sanctions—they are extrinsically motivated. There is a considerable body of evidence suggesting that external rewards can reduce intrinsic motivation, because they focus the student on the rewards rather than on their own learning processes and may undermine the learner’s sense of being in control of their own learning (Deci et al., 2001). Accordingly, to help students learn better and deeper, we want to primarily nurture intrinsic motivation.

In my Chapter 1 discussion of the purposes of education, I suggested that it was the responsibility of educational leaders to ensure the integration of the three purposes—preparation, socialisation, and autonomy. Self-determination theory provides a research-based framework for such integration because it explains how and why students who are in control of their own learning are likely to be more intrinsically motivated and successful than those who have little control over and understanding of what they are learning, why, and of how they can succeed (Patall et al., 2010).

For example, students who are given a choice of homework tasks that are designed with their interests, competence, and goals in mind are more likely to complete their homework, report being more intrinsically motivated to do so, and perform better on a related test than students given no such choice. In addition, students who perceive their teachers as supportive of their autonomy are more intrinsically motivated to persist at difficult tasks than students who perceive their teachers as more controlling.

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Implications for Classroom Teaching

There are several excellent texts available that explain the implications for classroom teaching of how students learn (Bransford et al., 2000; Darling-Hammond et al., 2019; Deans for Impact, 2015).



TEACHING FOR DEEPER LEARNING REQUIRES

1. Aligning tasks to the intended deep learning outcomes
2. Inquiring into students' prior knowledge
3. Managing groups of diverse learners
4. Integrating the teaching of metacognitive skills into subject matter teaching

Here I concentrate on four implications that have particular relevance to teaching for deeper learning before focusing more specifically on enhancing student motivation and autonomy.

First, since what students learn is a function of the type of task they engage in, it is critical that teachers are skilled in the selection, design, and assessment of tasks that are tightly aligned to the cognitive processes they intend students to develop (Tekkumru Kisa & Stein, 2015). If the intended learning outcome is comprehension,

then all task components, including explanations and assessments, should foster that outcome.

For example, if a math teacher wants students to understand why an algebra formula works, then setting students 20 practice examples in which they apply the formula will foster procedural accuracy rather than comprehension. Comprehension is more likely to be fostered by assessing whether students can decompose the formula, apply its various steps to concrete materials, and provide a written or oral explanation of why it works.

Second, since deep learning requires the cumulative integration of prior knowledge with new information and concepts, effective teaching requires inquiry into students' prior knowledge. The purpose of such inquiry is not just to interest students in a topic but to assess whether students have the prior knowledge assumed by the selected task and whether that prior knowledge includes misunderstandings that need to be challenged.

Third, teachers need well-developed skills in managing groups of diverse learners while they grapple with intellectually challenging tasks. As already discussed, since comprehension or understanding tasks creates more cognitive load than procedural tasks, students may resist such tasks or seek so much teacher guidance that they become, in effect, procedural tasks. Over time, this teacher-student dynamic may lead teachers to rely too much on memory and procedural tasks for which they are more likely to gain and retain students' cooperation (Doyle, 1983; Fulmer & Turner, 2014).

For example, in a study of elementary teachers' responses to professional development in implementing challenging instruction, the most

common reasons teachers gave for their difficulties were the motivation and resistance of their students (Fulmer & Turner, 2014). Some teachers were able to overcome students' resistance by communicating confidence in students' abilities to do the tasks, explaining why they were going to focus on students' reasoning rather than the correctness of their answers, and giving more autonomy to students by ensuring that each member of their group understood the task and could explain their reasoning (Fulmer & Turner, 2014).

Fourth, teaching of the metacognitive skills required for the development of critical thinking, independence, adaptability, and other competencies should be integrated into the subject matter students are learning rather than presented as separate content-free processes (Bransford et al., 2000). The reason for this advice is that different metacognitive strategies are used in different subjects.

For example, the types of questions students ask about a word problem in math ("What pattern or principle might be relevant here?") are quite different from those they should ask in their analysis of a historical document ("Who was the intended audience?" "Why was this written in this way?"). Teachers should also be mindful that explicit teaching of metacognitive skills, even when embedded in content, adds cognitive load (Van Gog et al., 2011).

In summary, teaching for deep learning involves careful inquiry into students' relevant prior knowledge and the provision of multiple opportunities for students to develop rich and well-organised domain-specific knowledge. There should be an integration of, rather than opposition between, the learning of facts and higher-order thinking, for the "ability to plan a task, to notice patterns, to generate reasonable arguments and explanations, and to draw analogies to other problems are all more closely intertwined with factual knowledge than was once believed" (Bransford et al., 2000, p. 16).

Self-determination theory suggests specific ways that leaders and teachers can foster student autonomy, intrinsic motivation, and learning. Fundamental to all such strategies is the need for adults to be curious about and inquire into the perspectives of students so that they learn how to create a bridge between their curriculum and the values, interests, and goals of their students. Such inquiry involves careful listening, including to students' reasons for their dislike of particular tasks and teacher actions. Without such information, it is very difficult for

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teachers to provide choices that meet students' need for autonomy, competence, and relatedness. In short,

having choice or the act of selecting alone is not enough to support motivation. Rather, choices need to be relevant to students' interests and goals, provide a moderate number of options of an intermediate level of complexity, and be congruent with other family and cultural values in order to effectively support motivation. (Patall et al., 2010, p. 898)

In addition to providing meaningful choices, teachers support the development of autonomy by linking tasks to students' values, interests, and goals. Once again, maintaining a student-centred perspective is critical in making these links. For example, intrinsic motivation is much more likely to be increased when students themselves, rather than their teachers, explain why particular tasks and activities are relevant to their lives (Yeager & Walton, 2011). Just as respectful teacher inquiry into student thinking is critical to uncovering cognitive understanding and misunderstandings, so it is key to uncovering aspects of their socioemotional learning—to discovering whether they are intrinsically motivated, whether they are truly engaged or “doing school” and why.

So far, I have argued that the science of learning and teaching tells us quite a lot about how to achieve the distinctive purposes of educational institutions. In Part B, I take the argument further by discussing the implications of that science for doing the right work of educational leadership.

SUMMARY

Pursuit of the distinctive purposes of education should be strongly informed by the science of how students learn and of how teachers foster that learning. If leaders are committed to the purposes, understand how those purposes are enshrined in competencies, and understand how teachers should develop those competencies, then they know, at least in broad outline, what constitutes the right work of educational leadership.

The competencies that are enshrined in modern curricula require deep learning—that is, the ability to learn and transfer learning to real-world problems. Such learning is fostered by multiple opportunities to complete problem-solving and comprehension tasks. It requires students to

develop well-organised bodies of knowledge that align with the structure of the discipline rather than to learn isolated facts. Deep learning also includes the development of the metacognitive skills that enable students to regulate their own learning.

Self-determination theory suggests that students learn better when three basic psychological needs are met. Their need for control is met when they have the opportunity to exercise autonomy, in small and large ways, of elements of their lessons. Their need for competence is met when they can see that they have succeeded in their learning, and their need for relatedness is met when they work collaboratively. Students who are in control of their own learning are likely to be more intrinsically motivated and successful than those who have little control over and understanding of what they are learning, why, and of how they can succeed.

Teaching for deep learning involves careful inquiry into students' relevant prior knowledge and provision of multiple opportunities for students to develop rich and well-organised domain-specific knowledge. There should be a predominance of comprehension and problem-solving rather than procedural tasks and an integration of, rather than opposition between, the learning of facts and higher-order thinking.

In addition to providing meaningful choices, teachers support the development of autonomy by linking tasks to students' values, interests, and goals. Just as respectful teacher inquiry into student thinking is critical to uncovering cognitive understanding and misunderstandings, so it is key to uncovering aspects of their socioemotional learning—to discovering whether they are intrinsically motivated, whether they are truly engaged or “doing school” and why.

REFLECTION AND ACTION



1. How familiar are you and your colleagues with the science of learning and teaching as summarised in this chapter? Is it assumed in your context that you have sufficient knowledge in these areas and that your professional learning should thus be focused on leadership itself?
2. How would you tell if the teachers in your area of responsibility were planning, teaching, and assessing in ways that promoted deep learning?

3. Teachers may be unwilling to assign cognitively demanding tasks because they fear losing control of the class. How would you help such teachers?
4. Deep learning requires integration of rather than opposition between the learning of facts and higher-order thinking. To what extent is the importance of this integration recognised and applied in your context?

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