Plain language summary

Australian Education Research Organisation

Explainer

Knowledge is central to learning

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The Australian Curriculum identifies the knowledge that is important for all young Australians to learn. Knowledge plays a central role in building skills, thinking critically and creatively, and solving problems with increasing independence. The successful and efficient acquisition, retention and application of knowledge is important to support young Australians to become confident and creative individuals, independent lifelong learners, and active and informed members of the community (Australian Government Department of Education, Skills and Employment, 2019).

This explainer provides an introduction to the role of knowledge in learning, implications for effective teaching, and describes how building background knowledge facilitates higher-order thinking and learning outcomes. Related explainers focus on explicit instruction and how to manage cognitive load to optimise learning.

Acquiring knowledge

Learning happens when new knowledge is acquired, processed and retained in memory for later use. Two types of memory are important for learning: working memory and long-term memory. We learn by using working memory to focus on and process new information, allowing us to connect it to what we already know. Under the right conditions, this information (including knowledge of facts, concepts and procedures) is then transferred to long-term memory, where it is stored as knowledge within a mental model that reflects understanding of that area of learning. Once stored, recalled and used enough to consolidate the memory, knowledge from long-term memory can be retrieved for use and further learning.

As knowledge is stored in long-term memory, students build increasingly complex mental models. They do this by retrieving stored knowledge from long-term memory, where it can be processed and connected in working memory with other new or remembered information to generate deeper understandings and ideas. Long-term memory is like a vast network of connected ideas that we've learned and things that we have experienced over time. This network provides the foundation that can be drawn on to support our capacity for higher-order thinking and problem solving (Kirschner et al., 2006).

Solving problems and generating ideas

People have evolved to use an innate, basic 'trial and error' approach to problem-solving, but require deep, relevant background knowledge to be able to solve complex problems and to think critically and creatively. When confronted with a familiar problem or prompt, people can quickly search memory to retrieve the familiar response (Willingham, 2021). When the task is unfamiliar and requires a more creative response, people can search memory for potentially relevant information, and combine and recombine prior knowledge into creative ideas or potential strategies until satisfied with the response (Ackerman & Thompson, 2017).

Our capacity to be creative, critical thinkers and problem solvers is enhanced by the amount of knowledge stored in our memory relevant to the task at hand (Geary, 2002, 2005). Having *access* to large amounts of information in the world around us does not provide a significant advantage. Rather it is having access to relevant prior knowledge already *stored in our long-term memory* that helps us most. This is because we can only process small amounts of new information at any one time before our cognitive functions become overloaded. Most people, however, can store vast amounts of knowledge in long-term memory and access this knowledge when needed. For example, a student with a wide vocabulary can generally produce more sophisticated writing than a student with a narrow vocabulary, even if the second student accesses a dictionary during the writing task.

Key ways to optimise learning by building knowledge

Policymakers and school leaders can promote teaching and learning that achieves the effective acquisition and application of deep and rich content knowledge and understanding. Learning may be optimised with consistent and coherent policies and guidance that support the following practices:

» Plan teaching and learning tasks with a focus on the knowledge to be acquired

Instructional materials that are rich in the content that students will need to know and apply can support effective teaching (Black & Wiliam, 1998). When programs, scope and sequence documents, unit plans, lesson plans, and activities available for schools make clear and unpack the required knowledge, teaching and learning can more effectively and efficiently achieve the learning goals expressed in the Australian Curriculum (Steiner et al., 2018). Materials rich in content knowledge will identify the particular knowledge that students will learn, including facts, concepts and procedures, and take a cumulative approach where knowledge in each year builds on that acquired in earlier years. These materials can assist teachers to work with students to create a strong foundation for ongoing success in their learning (Knowledge Matters, 2016).

» Teach knowledge explicitly to build students' skills

Knowledge is the *precursor* to students performing skilled tasks (Willingham, 2021). While people may think of skills as an area of learning that is distinct from knowledge, skills are more accurately considered as the *application* of acquired knowledge (Anderson, 1982). For example, language comprehension is the ability to derive meaning from spoken and written words. It consists of vocabulary, background knowledge and an understanding of how words are combined to form sentences. Many words used in the texts students read are not used in everyday speech and must be explicitly taught. Explicit instruction also supports students to learn the techniques and routines required to become self-regulated, independent learners who are equipped with both the knowledge and dispositions needed to successfully perform skilled tasks and make informed decisions about their learning and other aspects of their lives.

» Focus on meaningful retention of knowledge, not just access to information

Students' capacity to process newly encountered information will always be restricted by the limitations of their working memory (Craik & Lockhart, 1972; Kirschner & Hendrick, 2020), and so they cannot rely on ready access to information alone. Once exposed to new information, students need time to consolidate this in their long-term memory as knowledge before they can understand it deeply and apply it effectively (Brown et al., 1989; Collins et al., 1991). Despite ready access to information through the internet, searching for information while also trying to use it can overwhelm the limits of working memory and interfere with accurate, meaningful retention and effective application of learning. Systematically building and connecting knowledge in long-term memory equips students with the fuel to drive the engine of creativity that exists in the human brain.

» Connect problem solving and critical thinking skills to the domain in which they are taught

Policies and programs that focus on developing and assessing *general* problem-solving and critical or creative thinking skills are not effective or efficient. One reason for this is because such an approach endeavours to grow a capability that students already naturally possess (Kirschner et al., 2006). Another reason is that problem-solving and critical thinking skills are domain-specific – that is, they are usually not transferrable to other topics or learning areas. Trying to generalise problem-solving and critical thinking skills they've been taught can leave students feeling discouraged. They may struggle to use strategies across a range of contexts beyond the specific area in which they learned them.

» Focus on building and retaining knowledge with explicit instruction to equip students' capacity for higher-order thinking and creativity

Explicitly teaching knowledge and skills supports students to become independent learners who are equipped with what they need to complete higher-order tasks (Sweller, 2016). To think critically and creatively, and to solve complex problems, students draw on relevant background knowledge from memory. Recalling knowledge from long-term memory and combining and testing potentially relevant ideas with working memory is the *driving mechanism* behind creative thinking and problem-solving. Students' capacity for problem-solving and critical thinking is extended effectively with domain-specific tasks that explicitly teach deep factual, conceptual and procedural knowledge, and then prompt students to draw on and apply what they know and understand from across the relevant learning area of learning with varied tasks that build in detail, complexity and abstraction (Fiorella & Mayer, 2016).

Implications for policymakers

- Evidence shows that building student knowledge provides the foundation to achieve Australia's educational goals.
- Teaching that prioritises content knowledge enables students to develop critical and creative thinking skills by drawing on the domain-specific knowledge they have acquired.
- The best way to support student learning is to deliver policies and instructional guidance that advocate for well-sequenced, knowledge-rich, explicit instruction.

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