

# The Nature of Learning

Using Research to Inspire Practice

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Practitioner Guide  
from the

**Innovative Learning Environments Project**

*How can the learning sciences  
inform the design of 21<sup>st</sup> century  
learning environments?*



Centre for Educational Research and Innovation

# Introduction

Over recent years, learning has moved increasingly centre stage and for a range of powerful reasons. A primary driver has been the scale of change in our world—the rapid advances in ICT, the shift to economies based on knowledge, and the emphasis on the skills required to thrive in them. Schools and education systems around the world are having to reconsider their design and approach to teaching and learning. What should schooling, teaching and, most especially, *learning* look like in this rapidly changing world?

At the same time, empirical research on how people learn, how the mind and brain develop, how interests form, and how people differ in all these has expanded tremendously. This science of learning underscores the importance of

*“rethinking what is taught,  
how it is taught,  
and how learning is assessed.”*

The learning sciences are importantly enriching our understanding of how people learn best, and showing that many existing school learning environments are in direct contrast to this. Classrooms, schools and education systems cannot change overnight but neither is it possible to accept arrangements that are in direct contrast to what makes for good learning. If instead today’s schools were designed to leverage knowledge about learning, tomorrow’s generation will more likely become the powerful learners, skilled workers and engaged citizens we want them to be.

The OECD project *Innovative Learning Environments* has sought to provide material to help to do this. It has put together a volume called *The Nature of Learning: using research to inspire practice*, which is based on extensive research findings on different aspects of learning and applications. It provides a powerful knowledge base for the design of learning environments for the 21<sup>st</sup> century.

This booklet is a summary of *The Nature of Learning*, created to highlight the core messages and principles from the full report for practitioners, leaders, advisors, and policy-makers—indeed, for anyone interested in improving the design of learning environments. The principles outlined serve as guides to inform everyday experiences in current classrooms, as well as future educational programmes and systems. This summary is intended as a “practitioner guide” but for the full account and explanation please refer to the original publication.

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# The Fundamentals of Learning

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*The learning sciences are a rich field of research that has helped us to better understand how we learn. Understanding the fundamentals of how we learn allows us to address more effectively the conditions in which successful learning can occur.*

## How People Learn

During the 20<sup>th</sup> century, the concept of learning underwent important developments. Today, the dominant concept is **socio-constructivist**—in which learning is understood to be importantly shaped by the context in which it is *situated* and is *actively constructed* through *social negotiation* with others. On this understanding, learning environments should be where:

- Constructive, self-regulated learning is fostered
- The learning is sensitive to context
- It will often be collaborative

Theoretical concepts do not yield concrete prescriptions for classroom application but good theory can be used flexibly and creatively by teachers in their planning and educational practice. At the same time, not all learning takes place in the classroom as much of it occurs at home, on sports fields, in museums, and so forth (*non-formal learning*), and sometimes implicitly and effortlessly (*informal learning*).

## Adaptive Expertise

Many scholars agree that the ultimate goal of learning and associated teaching in different subjects is to acquire **adaptive expertise**—*i.e.* the ability to apply meaningfully-learned knowledge and skills flexibly and creatively in different situations. This goes beyond acquiring mastery or routine expertise in a discipline. Rather, it involves the willingness and ability to change core competencies and continually expand the breadth and depth of one's expertise. It is therefore central to *lifelong learning*.

There are different broad pedagogical approaches that can help to develop adaptive expertise:

**Guided Learning:** the teachers take the main relevant decisions about the goals of learning, learning strategies, and how to measure outcomes, while taking care of feedback, judgements and rewards.

**Action Learning:** the learners play a much more active role in determining the objectives of the learning than in guided learning; there is a strong element of learner self-organisation and self-planning.

**Experiential Learning:** this is not controlled by teachers and there are no predetermined objectives. What is learned is determined by context, learners' motivations, the others with whom they come in contact, discoveries made, etc. It is a by-product of the activities in which people are involved.

In order to support the progressive acquisition of adaptive expertise, there must be a balanced, integrated use of all three approaches. Such a balance should allow for structure and guidance by the teacher and it should create space for substantial self-regulated and self-determined learning. It should leave open opportunities for “expressive outcomes”—unanticipated results from the learning that takes place in a variety of situations outside schools and classrooms.



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## The Gatekeepers of Learning: Emotion & Motivation

**Emotions** are the primary *gatekeeper* to learning. Emotion and cognition operate seamlessly in the brain to guide learning. Positive emotions encourage, for instance, long-term recall while negative emotions can disrupt the learning process in the brain—at times leaving the student with little or no recall after the learning event.

This has significant implications for teaching and learning, whether negative emotional states are a result of classroom experiences or of experiences outside that are carried into the learning environment by the student. Any debate about whether learning institutions should be concerned about learners’ emotions and their development is thus irrelevant—as schools are responsible for cognitive development they inescapably already are.

**Motivation** ensures that students acquire knowledge and skills in a meaningful way. Like emotion, the presence of positive motivation towards a learning task markedly increases the likelihood that students will engage in deep learning. Helping students become aware of their motivation systems and how that influences their learning leads to them becoming more effective learners. Teachers need to remain current with what their students are capable of achieving by monitoring their progress closely. Since teacher expectations have a significant impact on students’ achievements, those expectations need to be positive yet realistic. Teachers should provide the time, space and support for students to reflect on the learning strategies they have used and how these have affected what they have learned. If student experiences have been negative, the teacher may fruitfully provide incremental successful experiences in order to compensate for the impact on motivation from that negative experience. More generally, learning environments should aim to identify and foster personal interests and the intrinsic motivations of students.



## The 8 Basics of Motivation

Students are more motivated to engage in learning when:

- 1 they perceive stable links between specific actions and achievement
  - 2 they feel competent to do what is expected of them
  - 3 they value the subject and have a clear sense of purpose
  - 4 they perceive the environment as favourable for learning, and
  - 5 they experience positive emotions towards learning activities.
- 
- 6 Students direct their attention away from learning when they experience negative emotions.
  - 7 Students are more persistent in learning when they can manage their resources and deal with obstacles efficiently.
  - 8 Students free up cognitive resources for learning when they are able to influence the intensity, duration and expression of their emotions.

Emotions have diagnostic value for the teacher because they reveal underlying cognitions, commitments, and concerns. Teachers who are aware of their students' motivational beliefs and are sensitive to their emotions can very usefully use this information in orchestrating the learning process. Their own behaviour and their teaching and evaluation practices trigger specific emotions and motivational beliefs in the students, which in turn affect the quality of the learning that takes place. Fortunately, emotional regulation can reduce negative responses and serve as a coping mechanism. The strategies involved include *re-appraisal*, reframing a situation in a more positive way, and *de-personalisation*, encouraging the learner to be objective rather than taking setbacks too personally.

### Quality over Quantity

Modern cognitive science confirms that the *quality of knowledge and understanding* is of utmost importance rather than just how much knowledge is acquired. Knowledge is also multi-faceted: there is knowledge about abstract concepts, about how efficiently to solve routine problems, about how to master complex and dynamic problem situations, and so on. All these facets interact in contributing to a person's competence. When knowledge is structured in detrimental ways, the person may know a lot about a domain but be unable to apply that knowledge to solve relevant real-life problems.

From this research we are able to generate transversal conclusions on learning and the structure of learning environments.

# The 7 Principles of Learning

This project has explored the nature of learning through the perspectives of cognition, emotion, and biology, and provided analyses of the implications for different types of application in learning environments. The research was synthesized to create seven transversal “principles” to guide the development of learning environments for the 21<sup>st</sup> century.

## 1

### Learners at the centre

The learning environment recognises the learners as its core participants, encourages their active engagement and develops in them an understanding of their own activity as learners.

- Learners are **the** central players in the environment and therefore activities centre on their cognition and growth.
- Learning activities allow students to construct their learning through engagement and active exploration.
- This calls for a mix of pedagogies, which include guided and action approaches, as well as co-operative, inquiry-based, and service learning.
- The environment aims to develop “self-regulated learners”, who:
  - develop meta-cognitive skills
  - monitor, evaluate and optimise the acquisition and use of knowledge
  - regulate their emotions and motivations during the learning process
  - manage study time well
  - set higher specific and personal goals, and are able to monitor them.

## 2

### The social nature of learning

The learning environment is founded on the social nature of learning and actively encourages well-organised co-operative learning.

- Neuroscience confirms that we learn through social interaction – the organisation of learning should be highly social.
- Co-operative group work, appropriately organised and structured, has demonstrated very clear benefits for achievement as well as for behavioural and affective outcomes. Co-operative methods work for all types of students because, done well, they push learners of all abilities.
- Personal research and self-study are naturally also important, and the opportunities for autonomous learning should grow as students mature.

## 3

### Emotions are integral to learning

The learning professionals within the learning environment are highly attuned to the learners’ motivations and the key role of emotions in achievement.

- Learning results from the dynamic interplay of emotion, motivation and cognition, and these are inextricably intertwined.
- Positive beliefs about oneself as a learner in general and in a particular subject represent a core component for deep understanding and “adaptive competence”.
- Emotions still tend to be regarded as “soft” and so their importance, though accorded in theory, are much more difficult to be recognised in practice.
- Attention to motivations by all those involved, including the students, is about making the learning first and foremost more effective, not more enjoyable (though better still if it is both).

## 4

## Recognising individual differences

The learning environment is acutely sensitive to the individual differences among the learners in it, including their prior knowledge.

- Students differ in many ways fundamental to learning: prior knowledge, ability, conceptions of learning, learning styles and strategies, interest, motivation, self-efficacy beliefs and emotion; they differ also in socio-environmental terms such as linguistic, cultural and social backgrounds.
- Prior knowledge – on which students vary substantially – is highly influential for how well each individual learns.
- Learning environments need the adaptability to reflect these individual and patterned differences in ways that are sustainable both for the individual learners and for the work of the group as a whole. Moving away from “one size fits all” may well be a challenge.

## 5

## Stretching all students

The learning environment devises programmes that demand hard work and challenge from all but without excessive overload.

- Being sensitive to individual differences and needs also means being challenging enough to reach above their existing level and capacity; at the same time, no one should be allowed to coast for any significant amount of time.
- High-achieving students can help lower-achieving students, which helps stretch all learners.
- This underscores the need to avoid overload and de-motivating regimes based on grind, fear and excessive pressure—not just for humanistic reasons but because these are not consistent with the cognitive and motivational evidence on effective learning.

## 6

## Assessment for learning

The learning environment operates with clarity of expectations using assessment strategies consistent with these expectations; there is a strong emphasis on formative feedback to support learning.

- The learning environment needs to be very clear about what is expected, what learners are doing, and *why*. Otherwise, motivation decreases, students are less able to fit discrete activities into larger knowledge frameworks, and they are less likely to become self-regulated learners.
- Formative assessment should be substantial, regular and provide meaningful feedback; as well as feeding back to individual learners, this knowledge should be used constantly to shape direction and practice in the learning environment.

## 7

## Building horizontal connections

The learning environment strongly promotes “horizontal connectedness” across areas of knowledge and subjects as well as to the community and the wider world.

- A key feature of learning is that complex knowledge structures are built up by organising more basic pieces of knowledge in a hierarchical way. If well-constructed, such structures provide understanding that can transfer to new situations—a critical competency in the 21<sup>st</sup> century.
- The ability for learners to see connections and “horizontal connectedness” is also important between the formal learning environment and the wider environment and society. The “authentic learning” this promotes also fosters deeper understanding.

# KEY SHIFTS in the 21<sup>st</sup> Century

Redesigning learning environments is critical because of the significant changes taking place, which challenge us to redefine the critical skills and abilities of citizens in the 21<sup>st</sup> century.



**Far-reaching technological change:** Technologies have developed apace, with change quickening all the time. This has far-reaching consequences. The information revolution is transforming how we work, play, read and think; it is changing the nature of our economies and societies from the most personal level up to the global. We are living in an era of incredible invention and growth in information and communication technologies.



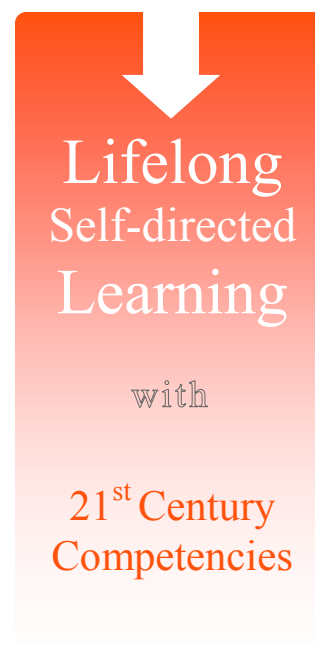
**Profound transformation from 'industrial' to 'knowledge' economies.** Knowledge is now the central driving force for economic activity, with innovation critical. The relocation of economic activities to other countries and world regions is forcing the “re-skilling” of our societies. As knowledge has become so fundamental then so has learning.

**Self-directed, lifelong learning.** The capacity to continuously learn and apply/integrate new knowledge and skills has never been more essential. Students should become self-directed, lifelong learners, especially as they are preparing for jobs that do not yet exist, to use technologies that have not yet been invented, and to solve problems that are not yet even recognised as problems.

Lifelong learning—the ability continuously to develop over one’s life span—is essential so that each citizen may be able to access the requisite resources and support in order to learn the content and competencies they need. The ability continuously to learn is fundamental in developing *adaptive expertise*—i.e. the ability to apply meaningfully learned knowledge and skills flexibly and creatively in a variety of contexts and situations.

Lifelong learning, 21<sup>st</sup> century skills, and “adaptive expertise” are critical in a world that is constantly shifting and demanding higher cognitive capacity. The higher-order skills increasingly prioritized in workplaces and in society as a whole include the capacities to:

- generate, process and sort complex information
- think systematically and critically
- make decisions weighing different forms of evidence





- ask meaningful questions about different subjects
- be adaptable and flexible to new information
- be creative
- be able to justify and solve real-world problems
- acquire a deep understanding of complex concepts
- media literacy
- teamwork, social and communication skills

Laying a foundation that cultivates lifelong, self-directed learning starts at an early age. While much of the discourse on lifelong learning focuses on the later stages of life, it is actually the knowledge, skills, values and attitudes acquired during the early life-stages that provide the foundation for the lifelong learning habit. Schools are pivotal organisations for laying such foundations, yet their contribution in this regard has been neglected.

The same is true for the teaching of 21<sup>st</sup> century competencies. The pedagogic model underlying too many schools and classrooms is still aimed at preparing students for the industrial economy, and is very different from the activities at the heart of knowledge-based organisations, societies and economies.

The curricula, learning experiences and overall environment must be centred on fostering the skills and mindset of self-directed lifelong learning, with 21<sup>st</sup> century competencies strategically interwoven through the learning experiences.



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# BUILDING BLOCKS

for

## Innovative Learning Environments

### Cooperative Learning

In essence, students work together and are responsible for one another's learning as well as their own. Emphasising thinking and increasing higher-order learning, it has a range of educational benefits, including an alternative to ability grouping and as a way to prepare students for an increasingly collaborative work force.

### Service Learning

Education engages students in community service that is integrated with the learning objectives of core academic curricula. This experiential approach is premised on providing students with contextualised learning experiences based on authentic, real-world situations in their communities.

### Home-School Partnerships

The home is our first, and highly influential, learning environment so that building connections between the home and school is vital to learner success. This includes proactively involving families in their children's schooling and extending personalised invitations to them to become involved. After-school programmes and extra-curricular activities also offer ways to connect with the family and provide greater connection between home and school.

### Learning with Technology

Learner-centred approaches to technology-enabled learning can empower learners and leverage good learning experiences that would not otherwise have been possible. Technology also often offers valuable tools for other building blocks in effective learning environments, including personalisation, co-operative learning, managing formative assessment, and many inquiry-based methods.

### Formative Assessment

Formative evaluation guides learners to better outcomes by providing feedback that continually informs the learner, the teacher, and the learning itself. It is targeted towards three key questions:

*Where are the learners in their learning?*

*Where are the learners going?*

*What needs to be done to get them there?*

### Inquiry-based Approaches

Students need opportunities to develop higher-order cognitive skills. One important context to do this is through inquiry-based approaches in complex, meaningful projects that require sustained engagement, collaboration, research, management of resources, and development of an ambitious performance or product. Relevant approaches include:

- Project-based learning
- Problem-based learning
- Learning through design

# Conclusions

***The Nature of Learning: Using Research to Inspire Practice*** reviews very extensive research on learning to identify key lessons for practice. It summarises these lessons as a set of “principles” to guide the design of learning environments, encapsulated by the following headings:

- Learners at the centre
- The social nature of learning
- Emotions as integral to learning
- Recognising individual differences
- Stretching all students
- Assessment for learning
- Building horizontal connectedness.

It may be tempting to respond to the “principles” that they offer little that is new. In that *The Nature of Learning* has reviewed decades of research, there is inevitably familiarity with many of the individual findings and proposals. Their force and relevance do not stem from each one taken in isolation, however, nor whether they are formulated in an unfamiliar way. Instead, ***their force and relevance derive from what they add up to as a whole***.

We would go further to assert that

***all the principles should be present in a learning environment for it to be judged truly effective.***

Cast in this light, the agenda defined by these “principles” is in fact a demanding one and scarcely typical of many schools and classrooms. The “principles” will not be realised in the same way in different learning environments nor in the same learning environment at different times; they are flexible and for adaptation to circumstances. However, if one of them is absent, effectiveness will not be maintained via greater emphasis on one of the others. ***They all are needed.***

The “principles” provide an interpretation of educational aims, such as “personalisation” and “inclusion”, which command widespread support in the endeavour to reform education through what they mean for learning. They show how important are design and the orchestration of learning rather than simply providing opportunities for young people to learn “by themselves”. This in turn calls for high levels of professionalism among teachers and everyone directly involved.

This Practitioner Guide has been prepared to bring headline messages and findings from the enormous learning literature to those who should most benefit from it – teachers, practitioners, and educational leaders. It offers evidence-based signposts to effective practice and the redesign of schools and classrooms.

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