Executive summary

Why such interest in learning?

Over recent years, learning has moved increasingly centre stage for a range of powerful reasons that resonate politically as well as educationally across many countries, as outlined by Dumont and Istance (Chapter 1). These define the aims of this important volume from the work on Innovative Learning Environments produced by OECD's Centre for Educational Research and Innovation (CERI).

OECD societies and economies have experienced **a profound transformation from reliance on an industrial to a knowledge base**. Global drivers increasingly bring to the fore what some call "21st century competences". The quantity and quality of learning thus become central, with the accompanying concern that traditional educational approaches are insufficient.

Similar factors help to explain the **strong focus on measuring learning outcomes** (including the Programme for International Student Assessment [PISA]) over the past couple of decades, which in turn generates still greater attention on learning. To move beyond the diagnosis of achievement levels and shortcomings to desirable change then needs a deeper understanding of how people learn most effectively.

The rapid development and ubiquity of ICT are re-setting the boundaries of educational possibilities. Yet, significant investments in digital resources have not revolutionised learning environments; to understand how they might requires attention to the nature of learning.

The sense of reaching the limits of educational reform invites a fresh focus on learning itself: education has been reformed and reformed again in most OECD countries, leading many to wonder whether we need new ways to influence the very interface of learning and teaching.

The research base on learning has grown enormously but many researchers observe how inadequately schools tend to exemplify the conclusions of the learning sciences. At the same time, far too much research on learning is disconnected from the realities of educational practice and policy making. Can the bridges be made to inform practice by this growing evidence base?

The coverage of *The Nature of Learning*

This volume aims to help build the bridges, "using research to inspire practice". Leading researchers from Europe and North America were invited to take different perspectives on learning, summarising large bodies of research and identifying their significance for the design of learning environments, in such a way as to be relevant to educational leaders and policy makers.

The early chapters address the nature of learning, including through the cognitive, emotional and biological perspectives. The contributions that follow review approaches and evidence for different types of application: formative assessment, co-operative and inquiry-based forms of learning, technology-based applications – as well as learning beyond classroom environments in communities and families. The penultimate chapter considers strategies to refocus educational organisations with their in-built resistance to innovation and change.

The chapters do not offer exhaustive coverage of all the relevant research findings but together they provide a powerful knowledge base for the design of learning environments for the 21st century. As summarised by De Corte (Chapter 2), many scholars now agree on the key importance for organisations and policy to develop in learners "adaptive expertise" or "adaptive competence", *i.e.* the ability to apply meaningfully-learned knowledge and skills flexibly and creatively in different situations.

Transversal conclusions on learning

The transversal conclusions, recasting the evidence reviewed in the different chapters more holistically, are synthesised by Istance and Dumont in the final chapter together with discussion of the challenge posed by their implementation. The conclusions are presented below with a small selection of the key arguments made by the different authors.

> 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.

The learning environment recognises that the learners in them are the core participants. A learning environment oriented around the centrality of learning encourages students to become "self-regulated learners". This means developing the "meta-cognitive skills" for learners to monitor, evaluate and optimise their acquisition and use of knowledge (De Corte, Chapter 2; Schneider and Stern, Chapter 3). It also means to be able to regulate one's emotions and motivations during the learning process (Boekaerts, Chapter 4; Hinton and Fischer, Chapter 5).

Wiliam (Chapter 6) notes that many have called for a shift in the role of the teacher from the "sage on the stage" to the "guide on the side." He warns against this characterisation if it is interpreted as relieving the teacher, individually and collectively, of responsibility for the learning that takes place.

Resnick, Spillane, Goldman and Rangel (Chapter 12) identify as critical the gap between the "technical core" (*i.e.* classroom teaching) and the formal organisation in which it is located and the wider policy environment, a gap which reduces learning effectiveness and innovative capacity.

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

"Effective learning is not purely a 'solo' activity but essentially a 'distributed' one: individual knowledge construction occurs throughout processes of interaction, negotiation and co-operation" (De Corte, Chapter 2). Neuroscience shows that the human brain is primed for interaction (Hinton and Fischer, Chapter 5). However valuable that self-study and personal discovery may be, learning depends on interacting with others.

There are robust measured effects of co-operative forms of classroom learning when it is done properly as described by Slavin (Chapter 7). Despite this, such approaches still remain on the margins of much school activity. The ability to co-operate and learn together should be fostered as a "21st century competence", quite apart from its demonstrated impact on measured learning outcomes.

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

The emotional and cognitive dimensions of learning are inextricably entwined. It is therefore important to understand not just learners' cognitive development but their motivations and emotional characteristics as well. Yet, attention to learner beliefs and motivations is much further away from standard educational thinking than goals framed in terms of cognitive development (Boekaerts, Chapter 4).

Being highly attuned to learners' motivations and the key role of emotions is not an exhortation to be "nice" – misplaced encouragement will anyway do more harm than good – but is first and foremost about making learning more effective, not more enjoyable.

Powerful reasons for the success of many approaches using technology (Mayer, Chapter 8), co-operative learning (Slavin, Chapter 7), inquiry-based learning (Barron and Darling-Hammond, Chapter 9) and service learning (Furco, Chapter 10) lie in their capacity to motivate and engage learners.

> 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, as well in socio-environmental terms such as linguistic, cultural and social background. A fundamental challenge is to manage such differences, while at the same time ensuring that young people learn together within a shared education and culture.

Prior knowledge is one of the most important resources on which to build current learning as well as one of the most marked individual difference among learners: "…perhaps the single most important individual differences dimension concerns the prior knowledge of the learner" (Mayer, Chapter 8). Understanding these differences is an integral element of understanding the strengths and limitations of individuals and groups of learners, as well as the motivations that so shape the learning process.

"Families serve as the major conduit by which young children acquire fundamental cognitive and social skills" (Schneider, Keesler and Morlock, Chapter 11), meaning that prior knowledge is critically dependent on the family and background sources of learning and not only what the school or learning environment has sought to impart.

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

That learning environments are more effective when they are sensitive to individual differences stems also from the findings stressed by several authors that each learner needs to be sufficiently challenged to reach just above their existing level and capacity. The corollary is that no-one should be allowed to coast for any significant amounts of time on work that does not stretch them.

Learning environments should demand hard work and effort from all involved. But the findings reported in this volume also show that overload and de-motivating regimes based on excessive pressure do not work because they do not make for effective learning. For Schneider and Stern (Chapter 3), a fundamental cornerstone is that "learning is constrained by capacity limitations of the human information-processing architecture" (also stressed by Mayer, Chapter 8).

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

Assessment is critical for learning. "The nature of assessments defines the cognitive demands of the work students are asked to undertake" (Barron and Darling-Hammond, Chapter 9). It provides "the bridge between teaching and learning" (Wiliam, Chapter 6). When assessment is authentic and in line with educational goals it is a powerful tool in support of learning; otherwise it can be a serious distraction.

Formative assessment is a central feature of the learning environment of the 21st century. Learners need substantial, regular and meaningful feedback; teachers need it in order to understand who is learning and how to orchestrate the learning process.

The research shows strong links between formative assessment practices and successful student learning. Such approaches need to be integrated into classroom practice to have such benefits (Wiliam, Chapter 6).

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

Complex knowledge structures are built up by organising more basic pieces of knowledge in a hierarchical way; discrete objects of learning need to be integrated into larger frameworks, understandings and concepts. (Schneider and Stern, Chapter 3).

The connectedness that comes through developing the larger frameworks so that knowledge can be transferred and used across different contexts and to address unfamiliar problems is one of the defining features of the 21st century competences. Learners are often poor at transferring understanding of the same idea or relationship in one domain to another.

Meaningful real-life problems have a key role to play in bolstering the relevance of the learning being undertaken, supporting both engagement and motivation. Inquiry- and community-based approaches to learning offer extensive examples of how this can be done (Barron and Darling-Hammond, Chapter 9; Furco, Chapter 10). An effective learning environment will at the least not be at odds with the influences and expectations from home; better still, it will work in tandem with them (Schneider, Keesler and Morlock, Chapter 11).

A demanding educational agenda

The force and relevance of these transversal conclusions or "principles" do not reside in each one taken in isolation from the others. Instead, they provide a demanding framework and all should be present in a learning environment for it to be judged truly effective. The educational agenda they define may be characterised as:

- **Learner-centred**: the environment needs to be highly focused on learning as the principal activity, not as an alternative to the critical role of teachers and learning professionals but dependent on them.

- **Structured and well-designed:** to be "learner-centred" requires careful design and high levels of professionalism. This still leaves ample room for inquiry and autonomous learning.

- **Profoundly personalised**: the learning environment is acutely sensitive to individual and group differences in background, prior knowledge, motivation and abilities, and offers tailored and detailed feedback.

- **Inclusive:** sensitivity to individual and group differences, including of the weakest learners, defines an educational agenda that is fundamentally inclusive.

- **Social:** The principles assume that learning is effective when it takes place in group settings, when learners collaborate as an explicit part of the learning environment and when there is a connection to community.

The final discussion of the volume addresses the challenge of implementation. While many suggestions for change relate to teacher skills and professional development, the implications extend deeply into the "routines" of schools (Resnick, Spillane, Goldman and Rangel, Chapter 12), raising the importance but also the difficulty of sustained innovation.