

## Update 2011: *Leading for 21<sup>st</sup> Century Learning*

There is intense interest today in the nature of learning and creating the environments for it to flourish. Global drivers are pushing all countries to give priority to generating high levels of knowledge and skills with attention increasing to more demanding forms of 21<sup>st</sup> century competencies (OECD, 2010). What are the 21<sup>st</sup> century competencies?



### 21<sup>st</sup> century competencies

- Higher-order thinking skills
- Generate, process and sort complex information
- Think systematically and critically
- Make decisions weighing different forms of evidence
- Ask meaningful questions
- To be adaptable and flexible to new information
- Creative
- Identify and solve real-world problems
- Acquire a deep understanding of complex concepts
- Gain media literacy and the ability to use advanced information technologies
- Teamwork, social and communication skills

### The Core Goal of Education

The acquisition of **adaptive competence** – the ability to apply meaningfully learned knowledge and skills flexibly and creatively in a variety of contexts and situations.



## **SmartLearning...** leading for 21<sup>st</sup> century learning

We see the *SmartLearning* approach as a model for developing 21st century skills, and the *adaptive competence* people will need to thrive in our fast-paced and continually evolving society. Practices seen in today's *SmartLearning* classrooms reflect the 2010 OECD directions, and offer to prepare learners for waters not yet charted in the sea of change

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The reflections from the over 180 people who participated in the February 18 and 19<sup>th</sup>, 2011 Penticton *SmartLearning* Institute show the power of opening K-12 classroom doors to see learning in action. Thank you to the team of seventeen Penticton leaders, and the classes of students who welcomed so many visitors into their environments. Your classroom work and leadership is making a tremendous difference.

(Note: See the delegate reflections at [www.smartlearning.ca/reflections](http://www.smartlearning.ca/reflections).)

What is it that makes *SmartLearning* so successful? In a nutshell, through the *SmartLearning* approach we develop a growth mindset in learners with a message that *you and your brain can become smarter and through the important tasks we work on, and the simple strategies we teach you, you will see evidence of this every day in your work*. We hold up a series of measuring spoons and talk about how ability can grow and how important it is to continually stretch with tasks just beyond our grasp, and offer a quote or *brain-byte* to explain why:

*People with a growth mindset thrive when they are stretching themselves into being smarter. Believing talents can be developed allows people to fulfill their potential. We tell them an ability can be learned, and the task will give them a chance to do that. (Dweck, 2006)*

We surround them with talk about the brain, and the principles of learning. All curricular documents in B.C. cite principles of learning. In *SmartLearning* environments we share those principles with the learners, and we go one step further. We show how all classroom work is designed to develop in each learner important 21<sup>st</sup> century skills, and that the work reflects the principles of effective 21<sup>st</sup> century learning environments and the principles of learning outlined in important global documents published by intergovernmental organizations like the Paris-based OECD:

We actively engage all learners in complex tasks, tasks that have authentic real-world roles. The learners know the work is important, and that the learning plan will support them to develop and express their understandings as the learning unfolds. Learners set and reflect on goals many times during learning sequences, noticing what is working to support and enhance their own personal learning.

We build ownership and responsibility for learning through partner-talk, and distribute understandings through different forms of class-talk. Knowing that the work is important, and that their voices count, kindles attachment and motivation for learning.

We show learners images of the brain making connections during reading, listening, speaking, recalling... and show how talking and coaching others amplifies learning. We also show them how specific learning strategies exercise both hemispheres of the brain, and how thinking in both images and words stimulates multi-sensory pathways in the brain.

We talk about brain plasticity and the capacity of the brain to change with learning. We show how the brain never stops changing, and how learning a repertoire of 21<sup>st</sup> century learning strategies – *tools for smarter learning* - will help them to personally guide, enhance and self-regulate their own learning process.

We talk about time and what the brain needs to do, over time, to turn information into deep understanding - including the power of mindset, movement, nutrition, and sleep. We give them little *brain-bytes*, quotes from neuroscience and learning sciences' research that explain the science behind their learning. For example, their eyes light up when we show them a picture of what happens in the brain when they are working on challenging tasks:

*The more complex the task... the more complex the sequence of communication between the neurons needed to complete it. More complexity means greater learning.* (Gomez-Pinella, 2008)

We talk about how effort ignites ability and turns it into accomplishment, and how effort and going beyond a comfort zone stretches abilities. We equip them with tools for setting, reaching for, and achieving higher personally-set goals. And we talk about the power of determination ~ focus and determination honed to reach those goals. Over and over they notice they are getting smarter, and they have evidence to prove it.

These grown-in-B.C. practices have stood the test of time and they consistently realize impressive results. Changes in learners and learning are visible in a very short time. You know when you are in a *SmartLearning* classroom; all of the learners feel valued, respected, included, and responsible. They know their work is important and they grow to understand how the learning is making them smarter. Motivation for learning is kindled a number of ways: they develop autonomy through having control over their own work; they develop mastery through working to improve on something that matters; and they understand the purpose behind the tasks they work on, tasks that build a desire to do something that is larger than oneself. The learning is truly differentiated, with each learner reaching to develop and express his or her ever-increasing understandings in personally significant ways.

Thank you to everyone working to learn, implement and study the effects of *SmartLearning*. Through the interactions we are seeing dramatic changes in learners, learning and achievement. Below is a model taking our understandings in *SmartLearning* to a new era. A sailing metaphor shows important aspects of the model. To successfully sail in today's waters, you need highly developed 21<sup>st</sup> century skill sets. We see *SmartLearning* as one way for learners to develop these important skills.

## SmartLearning...



**H•U•L•L ↔ M•A•S•T ↔ S•A•I•L ↔ W•I•N•D**

**Whole-class SmartLearning ↔ Guided Independent Reading ↔ Personal Inquiry**

.....  
supported by Wordwork: development of vocabulary and orthographic knowledge

Teachers use the *SmartLearning* Framework and tools to develop and guide:

1. **H•U•L•L: higher understanding and lasting learning**, with the whole class  
... understandings about learning itself and the science behind learning create a context for each learner to grow new capacities. Through cycles of learning designed to develop particular skills, learners are equipped with learning tools that support them to connect with, process and demonstrate their understandings of new information. Personal goal-setting in relation to criteria developed with the learners, reflection and formative assessment play a critical role in the process.
2. **M•A•S•T: mindful application of skills and tools** to complex tasks in *just-right* texts – *texts read at the speed of speech with high levels of comprehension* -- during independent reading ...  
Application of newly found skills in increasingly more challenging texts is reinforced through personalized coaching conversations, personal goal-setting and reflection, and self-assessment. Learners are guided through the steps in the process.
3. **S•A•I•L: solo application of skills and tools to independent learning** -- during personal inquiries or independent learning projects...  
Personal learning journeys are supported through collaborative interactions, goal-setting and reflection, and self-assessment
4. **W•I•N•D: will-full insights through new depths of understanding**...  
Learners are encouraged to press for insights and more sophisticated understanding in all aspects of *SmartLearning*.
5. **Compass: commitment to personal goal-setting and assessment**...  
All learning starts with goals, and is guided by the development and refinement of criteria along the way. Reflection guides the journey.
6. **Lighthouse: learning is guided by the continual reflection on learning**
7. **anchors: strongly held beliefs about learning**...  
*Hold-fasts* are identified to secure the learning: the power of a growth mindset, tasks, talk, time, tool-choice, balancing brain activity, goal-setting and reflection, assessment...



## Looking Back ↔ Looking Forward

We are often asked about the roots of SmartLearning. Where did it come from? In our work over the years -- first during our multi-district, multi-year *Learning for Success* research project (1990–1999), and later in our *SmartLearning* research we continually asked, “Is what we are doing giving us what we want? We worked to clearly identified what we wanted to develop, and to understand where the learners were in relation to those important skills. The findings always fueled deeper understandings and new applications, applications designed to support teachers and learners to be successful. I wrote a paper called, *Driven by Questions Inspired by Findings*, to showcase the power of action research teams on one district’s achievement ([www.smartlearning.ca/articles](http://www.smartlearning.ca/articles)).

In 1999, when the OECD released its global standards for educational practice, our teams of action researchers had been working collaboratively to implement and study the effects of learning strategies on reading and writing achievement. The findings showed the power of cycles of learning -- where students were taught to apply particular metacognitive strategies before, during, and after learning – to advance reading and writing achievement. Through each cycle of learning, specific sets of learning strategies were sequenced to develop identified skills. Learning was carefully scaffolded to more sophisticated levels of understanding. The focus on equipping learners with metacognitive strategies led to dramatic gains in achievement. The unexpected gains led to deep celebrations of learning, and the findings were featured in publications and presented at major professional conferences in many jurisdictions around the world (see [www.smartlearning.ca/founder](http://www.smartlearning.ca/founder) for details).

The next stage of the action research was highly stimulated by two on-going questions, and one new global question:

- The real methodology for system change begins and ends with ongoing, authentic conversations about important questions (Tony Wagner, 1999).
- Is what we are doing giving us what we want?
- Are we really equipping our learners with the tools they will need to thrive in a complex world?

The challenging diversity of cultural backgrounds, skill needs, and socio-economic realities in our classrooms was pressing us to learn more about the brain and learning, more from the learning sciences including neuroscience, cognitive science, motivation, attachment theory, assessment, and literacy research. One hallmark of our continued work has been the continual influence of research on our understandings. Each new finding is carefully integrated into practices and deeply studied in classrooms.

Ellen Langer's research in *The Power of Mindful Learning* (1997) and her pressing question, "how does a learning situation release the full mental capacities of *all* learners and help them to learn and retain complex skills?" took us to a new place. When we coupled her challenging question with the new international and national standards for proficient reading, we headed into the next literature review.

The new international and national standards for proficient reading require that students think about what they read, explain or describe their thinking.

These new literacies are moving closer to proficiencies that mark a person as literate.

Demonstrations of thoughtful literacy require readers to be able to **consider, discuss and talk** about their **understandings of text**, and also about the **various processes of reading**.

- Classroom talk around a range of texts is critical to becoming thoughtfully literate.
- Students need many opportunities to **interact with text, with partners and with ideas presented to the whole class** ... explaining connections, summarizing, synthesizing, analyzing, interpreting and evaluating ideas (OECD/PISA, 1999).

That literature review led to the formalizing of the *SmartLearning Framework* in the summer of 1999. Over the next two years the learning strategies were aligned with the important processes of reading, and were set out in a grid to support teacher planning. Richard Allington, Robert Pressley, Marian Diamond, Dylan Williams, Daniel Siegel and a number of important researchers deeply influenced our thinking as we worked to develop learners as powerful thinkers, readers and writers. In 2002, I prepared an update for our research teams, called the Six Touchstones of Effective Literacy Learning – fondly called the Six T’s ([www.smartlearning.ca/articles](http://www.smartlearning.ca/articles)). That work seems like a long time ago now. Every year since we have reviewed literature and fine tuned our practice through cycles of classroom-based study.

In November 2010, the OECD published another ground-breaking document, *The Nature of Learning: using research to inspire practice*. In that document 21<sup>st</sup> century competencies are identified, a global goal for education is described, principles of effective learning environments are outlined, and principles of learning supporting those environments are articulated.

As we move forward with our work with the *SmartLearning* approach, we need to know that we are deliberately preparing our learners with the competencies they will need to thrive in a complex, ever-changing world. How do we ensure our teachers and learners acquire adaptive competence? What are the characteristics of the learning when people are acquiring adaptive competence? As you read further, set in your mind a recent learning experience and the environment you found yourself in... apply each lens to the learning, and analyze the learning to see if the experiences were equipping learners with adaptive competence.

## **Acquiring Adaptive Competence: Four Characteristics**

### **1. Learning is constructive**

- *What is essential in the constructivist perspective is the mindful and effortful involvement of students in the process of knowledge and skills acquisition in interaction with the environment.*

- *Using constructive learning processes that promote the acquisition of worthwhile knowledge, cognition and self-regulation skills and the affective components of adaptive competence.*

## **2. Learning is self-regulated**

- *Constructive learning is about the process and ... scaffolding learners toward end-tasks and the learning is self-regulated. Individuals are meta-cognitively, motivationally and behaviourally active participants in their own learning.*
- *Major characteristics of self-regulated learners include: managing study time well, setting higher immediate learning targets than others while they monitor more frequently and accurately, setting higher standards before they are satisfied with more self-efficacy and persistence despite obstacles.*
- *Self-regulation correlates strongly with academic achievement.*
- *Self-regulation can be enhanced through appropriate guidance among primary and secondary students.*

## **3. Learning is situated and contextual**

- *Constructive and self-regulated learning occurs and should be studied in context – in relation to the social, contextual and cultural environment in which these processes are embedded.*
- *Learning is enacted essentially in interaction with, and especially through participation in the social and cultural context.*

## **4. Learning is collaborative**

- *Effective learning is not purely solo activity but essentially a distributed one involving the individual student, others in the environment and the resources, technologies and tools that are available.*
- *The value for learning of collaboration and interaction does not exclude that students develop new knowledge individually. Distributed and individual cognitions interact during productive learning.*

## **5. Learning is cumulative and individually different**

- *Students develop and build new knowledge and skills on the basis of what they already know and can do... the most important single factor influencing learning is the learner's prior knowledge... Prior knowledge explains between 30 and 60% of the variance in learning results*

- *Processes and outcomes vary among students on a variety of pertinent variables: prior knowledge, ability, students' conceptions of learning, learning styles and strategies, interest, motivation, self-efficacy, beliefs and emotions.*

Given adaptive competence as a global educational goal, and the characteristics of learning that lead to acquiring adaptive competence, what principles are present in an effective learning environment that fosters the development of adaptive competence?

## Principles of an Effective Learning Environment

- 1. Makes learning central, encourages active engagement, and learners increasingly understand themselves as learners**
  - The environment encourages learners *to become self-regulated* by developing meta-cognitive skills for learners to monitor, evaluate and optimize their acquisition and use of knowledge; and to be able to regulate one's emotions and motivations during the learning process
- 2. The learning environment is founded on the social nature of learning and actively encourages well-organized collaborative and 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.
- 3. The learning professionals are highly attuned to the learners' motivations and the key role of emotions**
  - Being highly attuned to learners' motivations and the key role of emotions is... first and foremost about making learning more effective, not more enjoyable. The enjoyment is more like the journey to the summit of a mountain rather than the taking of pictures once at the top...
  - **The learning environment is acutely sensitive to the individual differences among the learners including prior knowledge**  
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.
- 4. The learning environment devises programmes that demand hard work and challenge from all , and are demanding for each learner, but without excessive overload**
  - Each learner needs to be sufficiently challenged to reach above their existing level and capacity. 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 without excessive overload.

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

- The nature of assessments defines the cognitive demands of the work students are asked to undertake...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 21<sup>st</sup> 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.
- **Five key formative assessment strategies** play an integral role in an effective learning environment, and in encouraging forward motion in learning (William, 2010):
  - i) Clarifying, sharing and understanding learning intentions and criteria for success.
  - ii) Engineering effective classroom discussions, activities and tasks that elicit evidence of learning.
  - iii) Providing feedback that moves the learners forward.
  - iv) Activating students as instructional resources for one another.
  - v) Activating students as owners of their own learning.

**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 organizing more basic pieces of knowledge in a hierarchical way; discreet objects of learning need to be integrated into larger frameworks, understandings and concepts. 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 21<sup>st</sup> century competences... Meaningful real-life problems have a key role to play in bolstering the relevance of the learning being undertaken, supporting both engagement and motivation... An effective learning environment will... work in tandem with the home and the community.

The principles provide a demanding framework and *all* principles should be present in a learning environment for it to be judged truly effective. The educational agenda they define may be characterized as:

1. **Learner-centred:** the environment needs to be highly focused on learning.
2. **Structured and well-designed:** to be learner-centred requires careful design and high levels of professionalism. This still leaves ample time for inquiry and autonomous learning.
3. **Profoundly personalized:** the learning environment is acutely sensitive to individual and group differences in background, prior knowledge, motivation and abilities, and offers tailored and detailed feedback.
4. **Inclusive:** sensitivity to individual and group differences, including the weakest of learners, defines an educational agenda that is fundamentally inclusive.

5. **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 connection to the community.

### **Effective Learning is:**

- Constructive
- Cumulative
- Self-regulated
- Goal-oriented
- A situated and collaborative process of knowledge and meaning building

### **Principles of Effective Learning:**

- Active involvement
- Social participation
- Meaningful activities
- Relating new information to prior knowledge
- Being strategic
- Engaging in self-regulation and being reflective
- Restructuring prior knowledge
- Aiming toward understanding rather than memorization
- Helping students learn to transfer
- Taking time to practice
- Development of individual differences
- Creating motivated learners

Ananiadou, K. and M. Claro (2009). "21<sup>st</sup> Century Skills and Competences for New Millenium Learners in OECD Countries", OECD Publishing, Paris; EDU Working Paper No.41.



## **The SmartLearning model and the practices within the approach are continually refined in light of research.**

We use findings from the learning sciences literature (cognitive science, neuroscience, motivation, attachment theory, literacy, assessment), and findings from our classroom work, as lenses to examine practice.

The following summary of the cognitive science perspective on learning, from *The Nature of Learning: using research to inspire practice* (OECD, 2010), gives us a set of lenses to continually study and reflect on the work of *SmartLearning*. We will ask, “*Is what we are doing giving us what we want? How do we know?*”, as we work to create contexts for all learners to develop *adaptive expertise*.

### **The Cognitive Perspective on Learning**

The **ten cornerstone findings** focus on knowledge acquisition, because cognitive research shows that well-structured knowledge underlies more complex competences including conceptual understanding, efficient skills and **adaptive expertise**.

- Learners lacking such knowledge are unable to take advantage of the multitude of social, ecological, technological, cultural, economical, medical and political resources that surround them.

The findings have direct implications for the design of effective learning environments. Since they are derived from general principles of how the human mind works, they can be applied to all age groups, school forms and subjects.

- Ten cornerstone results from cognitive research, which are relevant to all who try to understand and improve learning.
- Each point also highlights a different aspect of how learners can build up well-organized knowledge structures.

## Ten Cornerstone Findings from Cognitive Science

### 1. Learning is an activity carried out by the learner

Learners are stimulated to be mentally active.

### 2. Optimal learning takes prior knowledge into account

Making sense of new information by interpreting it in the light of prior knowledge is a fundamental characteristic of all human thinking... Since this knowledge changes during instruction, teachers must **continually assess and diagnose** learners' knowledge during class.

### 3. Learning requires the integration of knowledge structures

Helping students gradually to adopt the perspective of experts by successively linking more and more pieces of knowledge, in different ways... in the students' minds is a major aim of teaching (Linn, 2006). All instructional practices focusing on abstract relations are helpful for achieving this goal... diagrams can help to visualize connections between concepts... comparing similarities and differences often helps students discover abstract relations between examples of the same abstract idea.

### 4. Optimal learning balances the acquisition of concepts, skills and meta-cognitive competence

Concepts and procedures are both important parts of competence (Siegler, 2003). **Well-practiced procedures help students to work toward complex tasks, and to solve routine problems efficiently and with minimal cognitive resources.** The resources becoming available can then be used instead to solve newer and more complex tasks and challenges on the basis of a deeper conceptual understanding.

### 5. Learning optimally builds up complex knowledge structures by organizing more basic pieces of knowledge in a hierarchical way.

One characteristic is common to the **knowledge of all competent persons: it is structured in hierarchical ways.** This is true of perception, language processing, abstract concepts and problem-solving procedures.

- Provide expedient structures in the environment that help learners to develop well-organized knowledge structures.

### 6. Optimally, learning can utilize structures in the external world for organizing knowledge structures in the mind

Provide optimal learning opportunities by preparing well-structured learning environments (Vosniadou, Loannides, Dimitrakopoulou, and Papademetriou, 2001).

- This strategy works because structured information in the learners' social and physical environment will help them to structure information in their minds. Some examples: organization of a curriculum. The order of ideas or tasks introduced in a lesson sequence... the informal social structures of groups of students working together, the design of organizers or work sheets...
- Teachers must be aware of the hierarchical structure of knowledge they are trying to communicate which will reflect in the **end-tasks** designed for learning sequences.
- **Language is one of the most powerful tools for providing structure in the learning environment... structuring classroom discourse – discussion – is important because it helps them to exchange ideas and learn about the existence of different perspectives and opinions.** This helps teachers to assess their students' knowledge and skill. It is important to keep in mind, however, that the **discourse serves a clear purpose within the lesson... ensuring a goal-directed social construction of new insights** (Hardy, Jonen, Moller and Stern, 2006).
- Structuring time well also provides structure... a time-frame, a topic within a time-frame... a lesson within the topic – **all need to be structured effectively with an orienting and motivating introduction, a main part and a consolidating summary.** Teachers have to use considerable time for planning ahead...
- **Teachers and learners must be aware of learning goals** (Borich, 2006)... they will learn little unless the teacher uses learning goals to focus the students' attention on the relevant aspects of the complex situations. Students need to understand the reasons behind their learning activities.
- **...learners cannot be expected to acquire complex concepts through incidental or informal learning...they need structured and professionally-designed learning opportunities that carefully guide their knowledge construction.**

## 7. Learning is constrained by capacity limitations of the human information processing architecture

Working memory where information is actively processed has a limited capacity, and information stored in working memory is quickly lost when it is not updated within seconds. Long-term memory where information is stored has almost an unlimited capacity and can retain information for days and even years... **the more meaningful, more important, or more frequently-recurring the information, the more likely it is to be transferred from working memory to long-term memory.**

- Teachers can make information more meaningful and more important to students by linking it to their prior knowledge and by using appealing examples that demonstrate the usefulness for solving **real-life problems.**
- **Structuring knowledge... or 'chunking' as it is often called, can overcome working memory limitations.**

- Unnecessary working memory load can be further reduced if **pieces of information that can easily be understood together are presented together** (Mayer and Moreno, 2003).
- When a text explains a complex figure, it can help to present the text in auditory form, so the learners can look at the figure while listening to the text instead of jumping back and forth between printed figure and written text.
- Keep learning **materials as simple as possible...** the simpler the language used to explain complex relations, the better and faster students will understand the concepts.
- When students are learning to solve new problems with multiple steps (eg.equation systems), their working memory quickly reaches its maximum capacity. This is because the students must not only execute the concrete steps necessary to solve the problem, but they must also find the abstract principle that underlies the problem solution. In this case, working memory load can be reduced by worked-out examples.  
**By studying solutions instead of generating them, students can focus solely on the big idea behind the solution** and not worry about carrying out the concrete solution steps at the same time (Renkl, 2005).

## 8. Learning results from the dynamic interplay of emotion, motivation and cognition

Motivation and emotion are now recognized as important determinants of thinking and learning...while motivation drives cognitive learning processes; it also results from cognitive learning processes such as learning and reasoning about one's own competence...

**Students' learning goals... their thoughts about their own competence** and their attributions of academic success... and their interests and hobbies all **contribute to the complex interplay of cognition and motivation.**

- Knowledge acquisition and motivation are multi-faceted and dynamically interacting systems that can strengthen or weaken each other in a multitude of ways.

## 9. Optimal learning builds up transferrable knowledge structures.

Even though the brain is plastic, it cannot be trained with just any exercise as if it were a muscle (Stanford Center for Longevity and Max Planck Institute for Human Development, 2009).

- Teach concrete content knowledge in ways that aid subsequent transfer to new situations, tasks, problem-types and content domains... the ability to apply knowledge flexibly is one of the most important characteristics of the human minds (Barnett and Ceci, 2002).
- **The more connections a learner sees between the educational world of learning environments and the outside world, the easier the transfer will be.**

- Teachers should make **use of meaningful real-life problems** whenever possible (Roth, vanEijck and Hsu, 2008; The Cognition and Technology Group at Vanderbilt, 1992).

#### **10. Learning requires time and effort.**

Building up complex knowledge structures requires **hard work over long periods of time for both students and teachers**. Consequently, time and effort invested in practicing, problem-solving and extending one's knowledge and skill base are among the most important factors influencing the success of learning (Ericsson, Krampe and Tesch-Romer, 1993). Learning can and should be satisfying and fun, but the type of fun that it is to climb a mountain – not the fun of sitting at the top and enjoying the view.

### **An effective learning environment creates student engagement and is well-regulated.**

As a growing body of research on cognitive development shows, the level of engagement in cognitively challenging environments influences not only achievement, but also IQ itself. (Dickens and Flynn, 2001; Mercer, Dawes, Wegerif and Sams, 2004).

**Five key formative assessment strategies** play an integral role in an effective learning environment, and in encouraging forward motion in learning (Wiliam, 2010):

- Clarifying, sharing and understanding learning intentions and criteria for success
- Engineering effective classroom discussions, activities and tasks that elicit evidence of learning
- Providing feedback that moves the learners forward.
- Activating students as instructional resources for one another.
- Activating students as owners of their own learning.

We encourage you to read the full OECD document, *The Nature of Learning: using research to inspire practice*. The book and pdf can be purchased through, [OECD.org](http://OECD.org). This profile was created to support team analysis and dialogue in the months ahead.