INNOVATING TO CREATE 21ST-CENTURY LEARNING ENVIRONMENTS

Innovation in education is not just a matter of putting more technology into more classrooms; it is about changing approaches to teaching so that students acquire the skills they need to thrive in competitive global economies. Based on the OECD study, Innovative Learning Environments, this chapter describes how some schools are regrouping teachers, regrouping learners, rescheduling learning, and changing pedagogical approaches – and the mix of those approaches – to provide better teaching for better learning.

Given the pace and scale of change in the 21st century, there is increasing pressure for individuals and societies to be adaptable and continually learning. Education systems must equip young people with the skills and competencies that allow them to engage with and participate in the rapidly-changing world of today and tomorrow. Are the environments in which students – of all ages – learn sufficiently innovative to keep up with this challenging agenda?

This chapter draws on the Innovative Learning Environments (ILE) study carried out by the OECD. It focuses on innovative ways of organising learning with the aim of positively influencing education reform. The study concludes that schools and education systems will be most powerful and effective when they:

- Make learning central, encourage engagement, and be where learners come to understand themselves as learners.
- Ensure that learning is social and often collaborative.
- Are highly attuned to learners' motivations and the importance of emotions.
- Are acutely sensitive to individual differences, including in prior knowledge.
- Are demanding of each learner, but do not overload students with work.
- Use assessments consistent with their aims, emphasising formative feedback.
- Promote horizontal connectedness across activities and subjects, in and outside of school.

The study also concludes that three additional features and cycles need to be developed in order to implement these principles: a strong focus on, and innovation within, the "pedagogical cores" of schools and other environments; leadership, at all levels, to promote 21st-century learning; and engagement with others, through networks and partnerships, to extend boundaries and build professional capacity.

Innovating using the "pedagogic core" at the heart of schools and learning environments means transforming organisational relationships and dynamics to make them relevant for the 21st century. In many cases, this means rethinking the kinds of organisational patterns that are the backbone of most schools today: the lone teacher; the classroom separated from other classrooms, each with its own teacher; the familiar class schedule and bureaucratic units; and the traditional approaches to teaching and classroom organisation. This is not to suggest that all schools across OECD countries strictly follow this pattern; many no longer fit this profile at all. The case studies described below have systematically rethought many of these practices and have created new learning environments by regrouping teachers, regrouping learners, rescheduling learning, and/or changing pedagogical approaches and the mix of those approaches.

REGROUPING EDUCATORS AND TEACHERS

The case studies highlight three main reasons for abandoning the conventional one-teacher-per-group-of-learners format. First, there are the benefits of collaborative planning, working together and shared professional development strategies (i.e. teamwork as an organisational norm). Second, team teaching allows for a wider variety of teaching options. Third, teamwork can benefit certain groups of learners who might otherwise not get the attention they need when only one teacher is in charge.

In some of the cases, collaboration might be described as part of the general culture of the learning organisation:

Teaching teams are cross-curricular and complementary at *Lakes South Morang P-9 School (Victoria, Australia)*, with team members planning and teaching together, as well as coaching one another. To support this, a collaborative data-storage system is available for sharing documentation, assessments, etc. Experienced team teachers also engage in coaching other teachers on various teaching approaches that cater to different learning styles.

Lobdeburgschule, Jena (Thuringia, Germany): Twenty years ago, teachers introduced teamwork as a structural element. Organisational and pedagogical themes, as well as learning and working practices, are discussed in the teams. In the early 1990s, they established the "morning circle", when all students gather to discuss different aspects of school life.

Teachers in the *Quality Learning Center and Enquiry Zone, Mordialloc College (Victoria, Australia)* used to "teach to the text", according to the assistant principal, within single, closed-door classrooms. This has changed. Now teachers open up their classrooms and work in teams to model and share good practice – not only with their colleagues, but also with students and the broader community.

> ### Box 4.1. Desirable features of contemporary learning environments
>
> Innovate using the elements and dynamics of the "pedagogical core" in line with design strategies and the "learning principles".
>
> Become a "formative organisation" through strong design strategies and corresponding leadership supported by learning information richness and effective feedback channels.
>
> Open up to partnerships to grow and sustain their social and professional capital.
>
> Promote 21st-century effectiveness through application of the ILE learning principles.
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> **Source:** OECD (2013a), *Innovative Learning Environments*, http://dx.doi.org/10.1787/9789264203488-en.

Collaborative planning, orchestration and professional development

The collaborative process of team teaching encourages informal reflection and feedback. When teachers work together regularly, collaboration becomes a tool for recording, learning and sharing good practice. This is very much in line with the development of "professional learning communities" for teachers, which collaboratively analyse pedagogy and lesson content in order to continually refine practice.

Professional learning is a priority in the *Community Learning Campus (CLC), Olds High School (Alberta, Canada)*. Much of the professional learning is embedded in daily activities, such as team teaching, curriculum building (multidisciplinary teams of teachers working collaboratively to design an integrated, multidisciplinary programme of study), collaborative lesson planning and team meetings. Teachers also attend professional learning days scheduled by the school or the district.

An important aspect in *CEIP, Andalucía (Spain)* is the collaborative work of both teachers and students. Adults in the school (teachers, families and volunteers) are organised into working groups, commissions, meetings, the Teachers' Assembly, etc. This teamwork culture is also present inside the classroom, where several adults often work together in the same class.

At *Jenaplan-Schule, Jena (Thuringia, Germany)*, teachers collaborate in regular meetings, such as team conferences with teachers from all classes/grades. In the weekly team meetings, teachers discuss important topics for the forthcoming week and develop the subject matter, materials and methods to be used.

> *With all my teachers, if they don't collaborate with each other, if they don't learn together, if they don't de-privatise their classrooms, then we won't be able to reach the level of deep learning and engagement that we are striving to achieve. It takes everyone working together all the time, learning together every day.*
>
> The Principal, Community Learning Campus (CLC), Olds High School (Alberta, Canada)

Regrouping teachers to introduce different mixes of learning and pedagogy

Several of the case studies refer to team teaching that allows for different approaches by two or more educators working together with a large group of learners. It is worth noting that, in education, small is not always preferable to large. Large groups of students may sometimes be taught together in lecture mode, then broken down into smaller groups for other styles of teaching.

Instead of deploying one teacher in a 30-student classroom, in certain subjects the *Cramlington Learning Village (United Kingdom)* features two teachers for a 60-student class. This adds flexibility to the class schedule and allows teachers to split students into groups in any way that suits their needs, such as for parallel or differentiated instruction. It also allows them to run cross-disciplinary sessions, such as an enquiry facilitated by a science and media teacher. The result is that teachers across many disciplines can build flexibility at no extra cost. The process of team teaching can also help to model and release the creative energies of collaboration, resulting in new and novel ways of orchestrating learning that are engaging to learners.

In *CEIP (Spain)*, the entire class of students is regularly divided into groups of four or five. The lesson comprises activities that each last 15 or 20 minutes, and are accompanied by a teacher or another adult. Once the time devoted to one activity has finished, the adults rotate to another group, so that they spend some time with all the groups at every lesson. Each group carries out a different activity, but the general subject matter of all activities is the same.

Team teaching is used in almost all lessons at *Europäische Volksschule Dr. Leopold Zechner (Vienna, Austria)*. Many of these teachers speak the same language as the immigrant students in the classes.

Team teaching to target specific groups of learners

Specific groups of learners who might not get the attention they need in large-group classes often benefit from team teaching.

Having two teachers in the classroom in *Europaschule (Linz, Austria)* allows for a more personal level of attention. For example, one teacher concentrates on the subject matter and explains tasks, while the special needs teacher primarily focuses on social issues, supports group-building processes and attends to those who need special attention.

Similarly, in the *Hauptschule (St. Marein bei Graz, Austria)*, students are taught in mixed-age classes, including some students with special needs. Instead of streaming students into ability groups, teacher teams apply within-class differentiation, alternating between basic teaching for the whole class and add-on content for highly motivated students or extra support for less-motivated students.

Three to five teachers work with *Dobbantó (Springboard)* students *(Hungary)* on an ongoing basis; two of them are present together in the classroom 40% of the time. Generally, there are three teachers working with the group in the humanities, natural sciences and a vocational field, respectively, with at least one of the three having experience in teaching students with special education needs.

Instead of taking low-achieving students out of the classroom in *CEIP (Spain)*, another teacher joins the class during the two hours each day when flexible groups are organised. As a result, there is less misconduct in classes and low-achievers improve their academic performance.

Enhanced visibility

When teachers work together in teams, they all learn from each other's techniques and practices because they can finally see those practices (enhanced visibility); they are no longer hidden behind a closed classroom door. The visibility is enhanced even further when this becomes organisation-wide rather than just among individual collaborating colleagues (Hattie, 2009). While this practice might be unnerving to teachers at first, it is inherent in the nature of innovation to disrupt established habits before the innovation is integrated and becomes accepted in organisational practice.

Teachers at the *John Monash Science School (Victoria, Australia)* identified the benefits of "knowing what others are doing", and therefore learning from one another, as well as "having a stronger sense of what the students are learning" and the ways in which richer connections could be made between different areas of learning. This was a new way of working for teachers, traditionally used to closed-off private areas and personal desks.

The Distance Learning Classroom in *Lok Sin Tong Leung Wong Wai Fong Memorial School (Hong Kong-China)* gives students the opportunity to learn from their counterparts in different schools, and enables teachers to observe lessons and exchange information with their peers who are not physically "on site". The Smart Classroom is an advanced technological classroom that allows teachers to use a wide variety of media in their teaching. It also serves as a live link with other partner schools.

REGROUPING LEARNERS

One of the most common ways in which the innovative learning environments discussed here regroup learners is by mixing older and younger learners together. When a school is very small, such mixing is inevitable.

Grouping together learners of different ages

There is a variety of reasons offered by the case-study schools for grouping together learners of different ages: as a stimulus to learning; as a way of encouraging diversity and contacts that would otherwise be unlikely to develop; to enable peer teaching; and as a way of reducing bullying and fostering good social relations.

In the Danish *Lisbjerg School,* there are two large groups composed of students whose ages span three years (6 to 9 years and 10 to 13 years). The students are also organised into smaller groups of 12, which are also mixed in terms of age. Teaching is differentiated and alternates between working within the bigger and the smaller groups. Every student follows an individualised learning path (called "the child's storyline"), and documents work in different portfolios.

In the *Community of Learners Network (British Columbia, Canada),* teachers work within and between the walls of the traditional school structures to create innovative approaches to teaching and learning. For example, in elementary (K-7) classrooms, where students are placed in cohorts based on age, teachers collaborate across grades. They have shifted the physical structures and the learning structures to enhance collaboration among students of different ages, and they have shifted the power structures to include students as key resources in the education of their peers – and their teachers.

In the *Presteheia (Kristianssand, Norway),* learner groups vary in age and size but tend to be between 33 and 54 students. Time in the large mixed groups is used to build relations among children who would otherwise not socialise. This reduces the incidence of bullying at school and increases feelings of security and confidence. It also makes it easier for students to find someone with whom they can have a trusting relation because they can choose among more students. Teachers and other staff are deployed flexibly.

> *For me the most important aspect of student learning in mixed-age groups is that this kind of learning gives the student a learning "push". It always leads to success. The children gain a lot of strength from this success, and it is also true for those learning areas where they are not as capable. These learning boosts, kindled by these successes, are irreplaceable.*
>
> Teacher, Jenaplan-Schule, Jena (Thuringia, Germany)

Some of the case studies are very small schools with mixed-grade classes. They intentionally use the heterogeneity of their students as the basis for an individualised education, to encourage integration and autonomous learning.

Gesamtschule Schupberg (Boll, Switzerland) is a small school with a multigrade classroom composed of students of varying cognitive and physical abilities. The school emphasises the heterogeneity of the student group, and regards the heterogeneous student body as a stimulating and motivating influence on the children's social and cognitive development.

All 20 students, from grade 1 to 9, in the *One-room School, Gesamtschule Lindental (Boll, Switzerland)* are placed in one mixed-age class. Although students are assigned to a certain grade, learning activities are adapted to their current level of development, allowing for gifted students to be challenged and for weaker students to develop greater self-confidence as learners.

Smaller groups within the larger groups

Several of the innovation sites operate with a "house" system that offers a more manageable organisational unit and stimulates more "family-oriented" engagement among students.

Subscribing to the principle that learning is a social endeavour, the *Community Learning Campus (CLC), Olds High School (Alberta, Canada)* is both physically and programmatically organised into four learning communities, called "quads". The quads provide a range of learning settings for a wide variety of groupings and configurations of students. The quads are each named according to a colour: Red, Green, Blue and Gold. The Red Quad is composed of grade-9 students. It is the only quad that contains a single grade. The other three quads include a mix of grade-10, -11 and -12 students. Students remain in the same quad, with the same group of teachers, throughout their three years in high school.

A key part of the collaborative environment in the *Australian Science and Mathematics School (South Australia, Australia)* is the Tutor Group Programme. Each student is a member of the same multiyear group for the duration of his or her time at the school. The Tutor Group meets daily for 40 minutes. A key role of the Tutor Group is to "ensure that students feel a sense of belonging within the school" and to "provide care and guidance through strong student-teacher relationships".

65

At *Colegio Karol Cardenal de Cracovia (Santiago, Chile),* the unit is not the "house" or "family" or "quad", but the "ministry", as in a national or regional government. In each ministry there is a student minister, counsellor teacher, parent minister, chiefs of communal departments, mayor of the class and deputy secretary.

The "president" is elected during political campaigns that involve voting boxes and election monitors. The student who wins the largest share of votes becomes president of the school government, and the student who wins the next highest number votes becomes the secretary-general to the president.

Co-operative learning is a prominent feature in many of the innovative sites. In some cases, it is more formalised through the establishment of learner groups that are considerably smaller than the houses or tutor groups described above. In the case of the Hong Kong-China school, there is a deliberate strategy of mixing abilities in small working groups.

Lok Sin Tong Leung Wong Wai Fong Memorial School (Hong Kong-China) has restructured all classes in primary grades 1-6, dividing students into small groups, normally of around 3 or 4 pupils. These heterogeneous groups are formed according to students' academic performance. Each group is made up of both more able and less able students. The heterogeneity of the groups enhances co-operative learning in which students work together to maximise their own and each other's learning.

Mevo'ot HaNegev Kibbutz Shoval (Israel) operates with a projects-based pedagogy, with projects taking place around a specific problem or question that can be theoretical, practical or both. The learners divide into workgroups of 3-4 students each, and then examine a topic or a sub-topic from the wider subject.

RESCHEDULING LEARNING: INNOVATING WITH HOW TIME IS USED

Schedules structure the school day, week or cycle; the school "timetable" provides a central organising tool in schools the world over. Many educators still see time primarily in quantitative terms, i.e. as something one has more or less of, with the effectiveness of teaching directly related to it. But with innovative ways of using time, time is regarded in more qualitative terms.

Timetables, flexibility and time use

The distribution and planning of activities over time is a familiar part of school life. A number of the innovative learning environments described here have moved in the direction of organising learning into fewer, longer periods, partly for greater flexibility, but particularly in order to enhance the opportunities for deeper learning.

Mevo`ot HaNegev Kibbutz Shoval (Israel) has a shorter school week (5 days) and longer lessons (60 minutes) than is customary in Israel, to allow students to engage more deeply in their lessons. The number of subjects covered per week was reduced from 8 to 4 or 5; the relationship between teachers and learners has become more personal; learning has been oriented towards understanding; studying has become more individual and autonomous; and teachers mentor and support the learners.

Every day except Wednesday at *John Monash Science School (Victoria, Australia)* begins with a 15-minute tutorial group meeting. The timetable of the school operates on a four-period day, and a ten-day cycle. Each period is 75 minutes long so as to provide, as described by the principal, "opportunities for deep learning".

The timetable at the *Community Learning Campus (CLC), Olds High School (Alberta, Canada)* consists of five 70-minute blocks with 10 minutes between classes. One of five blocks of time is known as Flex Period (flexible period). Students explained that they have time to eat and also enough time to work on homework or anything else they might wish to work on. They also have access to a teacher during this time.

As some of the schools in the case studies move away from the standard subject-based curriculum, it is not surprising to find that this is reflected in their timetables.

In Spanish schools, time is organised according to subjects; but in the *Instituto Escuela Jacint Verdaguer* the timetable is based on methodology instead. The three areas into which the curriculum is organised are reflected in students' timetables and the "learning pyramid": 25% of the time is devoted to instrumental areas, 25% to personal work and autonomy, 40% to co-operative work, and the remaining 10% to intrapersonal work.

The academic year lasts 36 weeks in *Dobbantó (Springboard) (Hungary)*, as in any other Hungarian vocational school, but the daily and weekly schedules are quite different. Approximately 60% of study time is devoted to general education and 40% is devoted to developing work-related competencies.

Many of the cases that were studied use time more flexibly than do traditional schools. Flexibility goes hand-in-hand with individualised learning plans and with education philosophies that aim to make schooling less bureaucratic.

The *Europaschule (Austria)* has no school bell, since many believe the sound interrupts learning. Teachers start and end their lessons or break a double period when they consider it appropriate.

Instead of the 45-minute rhythm and subject-oriented instruction normally found in the German school system, an open, adaptive form of instruction is applied in the *Jenaplan-Schule, Jena (Thuringia, Germany)*. Individual students have enough flexibility in their schedules and free time to work and learn at their own pace during the day, and to pursue their other interests, apply their creativity and develop their social skills. The goal is to have students understand themselves as active and independent learners who can enjoy the fruits of their efforts.

In Makor Chaim they do not believe in the rigid 45-minute lesson structure. (…) It is not a matter of how many words the teacher said or the students said, but whether learning took place. To make that happen one must induce processes similar to those that exist in the real world, where in addition to situations where grown-ups teach the young ones, there are also situations where people investigate, test and study in collaboration with colleagues.

Researcher, *Makor Chaim (Life source) – Yeshiva High School (Israel)*

Some of the innovative learning environments studied provide their students with the opportunity to "accelerate" their learning. There is international evidence that this leads to improved results (Hattie, 2009).

At the *Australian Science and Mathematics School (South Australia, Australia)*, year-10 students may study subjects at year-11 or year-12 level, while year-12 students have the opportunity to take first-year courses at Flinders University as part of their year-12 studies. The school responds to the learning needs of its most motivated and gifted students by allowing them to self-pace their learning and do away with the confines of the traditional school year cycle.

Rituals can help to structure the school day and make it meaningful; they create routines of reflection or planning. Several of the innovation sites studied begin and conclude the school day or week with such a special moment. For example:

In the *Projektschule Impuls, Rorschach (Bern, Switzerland)* the day begins with a "morning circle" when a "speaker-stone" is passed around and the children can talk about their feelings or thoughts. There is a regular structure to the day. Classes start with a foreign-language session, followed by group work based on learning plans. Afterwards there is a period of absolute quietness, timed by a sandglass that runs for 25 minutes while the students remain at their place and do not speak or walk around.

The Multimedia Programme, including "The Morning Show", the CGPS Radio Show and Film-Making project, has become central to the *Courtenay Gardens Primary School (Victoria, Australia)*. The show is run each morning by a group of senior school learners who apply to do so and undertake appropriate training. It provides the school community with information about their day ahead, transmitted throughout the school at 9.00 a.m. on the television in each classroom, in the staffroom and at the entrance to the school, from a dedicated multimedia classroom. The show follows a structured storyboard that includes an overview of news around the school, including student and staff birthdays, teachers on yard duty, weather, a "maths minute", phone-ins from classrooms, and a film made by students.

Organised learning outside regular school hours

A number of the case-study learning environments systematically structure learning and support for their learners outside regular school hours. There are many more examples than those cited below, as all of those sites using virtual e-classrooms, for instance, have removed the close connection between face-to-face contact and organised learning.

The Entre Amigos association in the *Polígono Sur* is responsible for organising extracurricular activities through an official tender process of the City Council of Seville. From 8 a.m., the selected organisations are in charge of the "Morning Classroom", developed to assist those whose parents go to work early in the morning, most of them at street markets. Evening extracurricular activities start at 3 p.m. and finish at 5 p.m., although *CEIP (Spain)* is normally open later.

The *Lok Sin Tong Leung Wong Wai Fong Memorial School (Hong Kong-China)* has launched a number of activities for students before, during and after school. Those who need to be at school early can join the "Reading is Fun" programme, from 7:15 a.m. through most of the following hour. Students can choose different kinds of books to read and share afterwards. In addition to lunchtime activities, students can join the Student Gardener Team to look after the plants in the school garden and in the community garden during recess. Every afternoon, students have 40 minutes of self-study to work on their homework. There is also a two-hour period at the end of the school day for tutorial classes on academic and creative subjects.

The *Enrichment Programmes, Rodica Primary School (Slovenia)* offers an array of artistic, research, international, linguistic and social activities that encourage creative thinking, constructivist education and diverse paths to knowledge. These complement the regular programme and are offered mostly outside of regular lesson time, in the afternoon or on Saturdays.

WIDENING PEDAGOGICAL REPERTOIRES

Innovative learning environments also work with different pedagogical approaches to expand teaching and learning. Many focus on inquiry approaches and collaborative work, both of which are critical for preparing students for future learning and for equipping students with 21st-century skills. These sites also take full advantage of the possibilities afforded by communication technologies. What is important are the *mixes* of pedagogical approaches. Innovation is not about using a single new teaching method or one kind of technology; it is about employing a combination of approaches, including direct teaching, and tools.

Inquiry learning

> *Inquiry and design-based approaches are an important way to nurture communication, collaboration, creativity, and deep thinking [but] Inquiry approaches to learning are challenging to implement. They are highly dependent on the knowledge and skills of the teachers engaged in trying to implement them... Teachers need time and a community to support their capacity to organise sustained project work. It takes significant pedagogical sophistication to manage extended projects in classrooms so as to maintain a focus on "doing with understanding" rather than "doing for the sake of doing".*
>
> Brigid Barron and Linda Darling-Hammond, in their contribution to the OECD review, *The Nature of Learning: Using Research to Inspire Practice* (2010: 215)

In many of the innovative cases studied, students engage in project-based learning. They are encouraged to acquire knowledge while practising skills, like hypothesis generation, scientific inquiry, self-monitoring and (sometimes online) literary analysis. Some sites have shifted from subject-specific teaching towards more interdisciplinary learning that links knowledge and skills from several subject areas.

The *Jenaplan-Schule, Jena (Thuringia, Germany)* distinguishes among learner group instruction (music, arts, sports, handicrafts/woodworking, etc., and social studies), learner group work, and learner group projects in nature, geography/history, German and ethics/religion. In all learner groups, the project work, scheduled for 100 minutes three times a week, is the central working form.

"Problem-Based Learning" is an important part of students' work in natural sciences, social sciences and technology at *Instituto Escuela Jacint Verdaguer (Spain)*. All such work is planned as a team and carried out either co-operatively or individually. Understanding a problem is considered to be the first step on the path to finding a solution to the problem. The organisation of learning spaces, the timetable, activities, trips and workshops are based on this methodology.

At *Matthew Moss High School, Innovation Unit (England, United Kingdom),* student teams work one day per week on a research project. The teachers first introduce a challenge, which can vary from launching an egg as high as possible and returning it to earth without breaking or responding to a natural disaster, to investigating family histories of migration. The students then gather information about the topic, write a research proposal, and, after the proposal is approved by the teacher, conduct the research throughout the school year. In the process, they are free to organise their own research, while the teachers act as facilitators who present in-time lessons or suggest additional sources of knowledge.

The inquiry cycle method used in the British Columbian example below formalises the stages of inquiry into the cycle as shown in the figure.

In the *Community of Learners Network (British Columbia, Canada),* educators design broad inquiry questions that encompass a range of learning intentions. Background knowledge is developed through direct instruction and a series of information-gathering collaborative processes, such as research, "jigsaw", literature circles, information circles, field experiences and guest presentations. A prominent feature of this phase is a series of "circle meetings" where students' learning is co-constructed and facilitated in small groups. Reflective writing and representations of evolving understanding, using mind maps, follow the small group meetings.

Figure 4.1
The Community of Learners Network classroom inquiry cycle
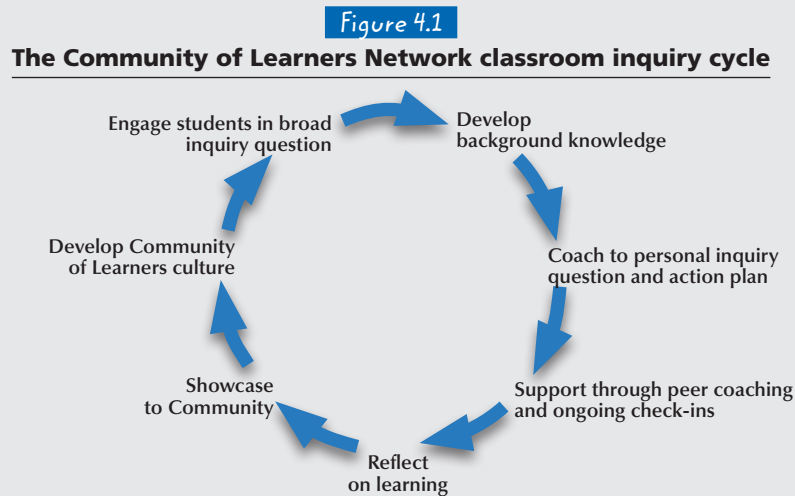
Source: OECD (2012), Inventory Case Study "Community of Learners Network", www.oecd.org/edu/ceri/50301622.pdf.

After this phase, the students are coached to articulate their own inquiry questions that fit within the larger inquiry question. As they pursue their individual inquiries, they often facilitate learning experiences for their classmates. Ongoing progress is supported through multilevel feedback circles that rely on self, peer and teacher support. The inquiry process is followed by a celebration of learning, called a Learning Showcase, where families, fellow students and community members are invited to share in the learning experience. Once the inquiry circle is completed a new one begins, following the same sequencing of activities. This allows the students to become more autonomous in their learning and gradually take on more challenging inquiry projects as they progress.

Authentic learning

It is a common feature of many innovative learning environments to make the learning experience authentic and meaningful by engaging students with real-life problems, offering hands-on experiences, and incorporating the students' historical, natural and cultural environment into learning activities. Central to authentic teaching are "real-life" problems, which are interesting to students because they are more relevant, complex and challenging than simplified problems designed by educators, and because they are more closely linked to the development of 21st-century skills.

In the *Centre for Studies on Design at Monterrey (CEDIM), The Atelier of Ideas, Monterrey (Nuevo León, Mexico),* the college co-operates with enterprises and institutions that submit "real-world" projects that student teams complete – from brainstorming to final evaluation, with instructors acting as counsellors in this process. There are three major steps: project design – coming up with a plan to bring the project to fruition; collaborative work – working together to optimise the process and the outcomes; and evaluation – by the teacher, peers, the individual student and the external agency that came up with the project proposal.

The three-year practical building and living project at *Breidablikk Lower Secondary School (Norway)* involves students building houses on a 1:20 scale. Students get to play the role of builder, gardener, electrician, bank employee, real estate agent and others. To this end, the school co-operates with representatives of different businesses. Students use the same digital tools that architects use, and houses are furnished with electricity and handmade furniture. All designs must be environmentally sustainable.

Work on real-life problems often goes together with hands-on experience. At a few sites, hands-on learning involves inviting native speakers of the languages students are learning into the classroom – or through videoconferencing – for face-to-face conversations, or letting students participate in international events where they can hear and speak the languages they are studying.

Hands-on experience may also entail running a small business, such as producing and selling homemade products or working on problems posed by external customers. The students naturally gain experience in such activities as marketing, accounting and customer service, but also in organisation, co-ordination and team work.

The *Mypolonga Primary School (South Australia, Australia)* has a student-organised shop in which the students sell homemade products, and products commissioned from the local community, to visitors and tourists. All classes are involved in business, craft and tourism, and senior students along with a junior trainee operate the shop one day per week. Students rotate through a series of tasks in the shop, acquiring language, mathematics, art, craft and hospitality skills along the way.

Authentic learning activities often involve aspects of the students' immediate environment. These allow students to explore the world around them and learn about the cultural and historical heritage of the place where they live.

Liikkeelle! (On the Move!), Heureka, Finnish Science Centre (Finland) encourages students to examine everyday settings from the perspective of natural sciences. Activities include investigating air quality and noise levels with the guidance of the relevant experts and authorities. Students place a measuring device near their school, work with a centre for natural-science teaching for analysis, process the data and publish results in an interactive map on an online learning platform. They then discuss the results with students from other schools and with a wide network of experts.

Authentic learning often involves several rounds of review and revision toward a polished result, which may be an exhibition, a stage performance or a portfolio. When students can present their work to a real audience, it becomes a source of public learning and celebration (Barron and Darling-Hammond, 2010). Working towards a final performance also motivates students to achieve genuine mastery because real audiences demand coherent presentations and a high level of understanding. Presentations are also learning events in themselves: setting them up involves skills like organising group efforts and communicating effectively with an audience. Once again, the relationship with 21st-century competencies is clear.

In the *CEDIM, The Atelier of Ideas, Monterrey (Nuevo León, Mexico)*, students present the projects they have been working on – all of which respond to real enterprise and community demands – in front of local enterprises and public and/or private institutions. By doing so, the assessment of their work becomes much more authentic and meaningful to students.

The Showcase is a celebration that completes each inquiry cycle, and has come to be seen as an essential element of the learning process (*Community of Learners Network, British Columbia, Canada*). Classmates, school administrators, families and community members are all invited to view the products that the students have created, and to discuss their learning experiences with them.

Europäische Volksschule Dr. Leopold Zechner (Austria) practices a special performance assessment called "commented performance portfolio" up to the third grade. Twice a year students present their achievements to parents and teachers in a detailed conversation that lasts around 30 minutes. Students present work they have done and answer teachers' questions or demonstrate learning by solving problems they feel confident they can tackle in front of their parents.

The pedagogical possibilities in "technology-rich" environments

While technology is certainly not a prerequisite for project-based work, it can be highly facilitating (OECD, 2010). Technology can provide the tools necessary to complete an investigation. Digital cameras and video recorders can collect real-time data, while laptops can offer easy access to online searches and mobile computing. Technology can offer a platform for inquiry-based learning, providing a collaborative working space for individual learners, groups of learners, and classes or networks of learners. Technology can be the mechanism upon which inquiry-based learning is

built, such as through game-based learning or online simulations, structuring inquiry-based learning in an engaging and relevant way (Groff, 2012).

Engagement and motivation, student-driven learning and inquiry, interactivity and collaboration, personalisation and flexibility, may all be enhanced with technology – but all are possible without it. Still, some forms of learning rely heavily on technology.

Box 4.2. Technology-dependent approaches to teaching and learning

Specific complex learning experiences: For example, with new advances in simulation technology, every student can have the chance to dissect a pig's heart – something that would be very difficult in reality.

Distant communication and collaboration: Now, learners and schools can easily connect to share information and collaborate via free tools, like Skype, or a group of students interested in studying the migration patterns of a certain bird can join an online affinity group and be mentored by a leading expert.

Mobility and access to extensive materials: Technology now brings access to educational materials and experiences of a richness and kind that previously would not have been possible or accessible only in discrete locations such as a university library.

Source: Groff, J. (2012), *Technology-Rich Innovative Learning Environments,* www.oecd.org/edu/ceri/Technology-Rich%20Innovative%20Learning%20Environments%20by%20Jennifer%20Groff.pdf.

A specific learning practice that recurs in many of the cases studied is film production – which cannot be done without technology. Students go through the complete process of filmmaking, from idea generation, to planning, storyboarding and scripting, to production and final presentation.

At *Miwon Elementary School (Gyeonggi-do, Korea),* volunteer fifth- and sixth-grade students choose topics of interest to them and their parents and produce a film. One of the films produced portrayed problems arising in a multicultural society and possible solutions. The project was supported by "Changshi", a Korean creative filmmaking association. Since 2006, these student films have won a number of awards, including the Youth Film Festival Award and the 7th Korea Video Award. Participating students have been invited to a multicultural education seminar and to the 7th Korea Youth Film Festival.

In the *Community/School Film Festival at the Manchester Primary School (Victoria, Australia),* the objective is to engage primary school students with the curriculum by encouraging them to make short films. Filming is used as a cross-curricular activity involving flexible movement around the school and group negotiation, and is regarded as a tool through which students can demonstrate their understanding. Teachers and film technicians support the students, and the project culminates in an authentic film festival, fostering an exchange of resources and expertise.

> *We also do a weekly programme with the students of the 6th year, which is called 'OndAventura' (WaveAdventure). The idea of the radio programme is to have a participative space where students can develop the linguistic skill: they express themselves, they have to prepare it, write the script … and it is supervised by a teacher. The radio workshop takes place in a radio station located in the school, which, like all the school premises, is available to the neighbourhood.*
>
> Head of Studies, *CEIP* (Spain)

Mixes of pedagogies

> *In a well-designed environment, there may well be plenty of occasion for direct instruction as one of a range of methods for introducing and pacing content, to be used in combination with other, less directed approaches (….) The focus on learning environments as patterned mixes of different learning activities that take place in context over time facilitates the insight that the learners need to experience a range, not a single method or pedagogy.*
>
> Istance and Dumont (2010: 328)

The orchestration of learning within the environment is complex, involving many decisions, often taken by teachers working collaboratively or with others in the learning leadership, about when and where and with whom particular pedagogies are appropriate, and how these should be modulated over time. In all of the examples below, part of the day involves whole-group, teacher-led activities, mixed in with other types of teaching and learning.

71

In the *Lobdeburgschule (Thuringia, Germany),* a typical week for a grade-1 student starts with the Monday "morning circle" where various topics are discussed. Then, learners work on their individual plans with partners, sometimes with the help of the teacher and using a range of different worksheets and prepared materials for support ("free work"). Then, it is the "epochal projects" session, which is project-based. Students work for about a week on a single theme that includes different subjects and topics of the Thuringian curriculum. At the beginning of the project, the teacher provides core information; questions about the theme are developed, and sometimes small working groups are formed. The results are presented at the end of the week. Subject-oriented lessons follow, but students are more free to direct their learning in these lessons. The school week ends with the group "final circle" on Friday afternoon.

At the *Mordialloc College (Victoria, Australia),* the daily expedition time (11.00 a.m.-1.00 p.m.) provides opportunities for workshops and student conferences related to the substantive curriculum content, as well as embedded aspects of literacy and numeracy. Guides also hold workshops on areas that address the specific needs of students. These are the key points of direct instruction for students and are generally held for groups of 15 or more students.

Coursework at *Jenaplan-Schule, Jena (Thuringia, Germany)* includes mandatory subjects, but it also demands a high degree of development and discovery by individual students.

In the *Instituto Escuela Jacint Verdaguer (Spain)*, teachers are still regarded as the best source of information on reading, writing and arithmetic, and they perform that knowledge-transmission function for learners who would not be able to discover core concepts by themselves or in a short time.

Traditional methods of teaching can be complemented by e-classrooms for acquiring and strengthening knowledge, as well as for assessment *(Internet Classroom, Kkofja Loka Primary School, Slovenia)*. Teachers' learning materials, prepared in advance, are collected in one place within the e-classroom where they may be used directly without downloading. Instruction via e-classroom takes place through an interactive whiteboard and portable tablets. E-classrooms allow for individual feedback after completed work or activity, with messages or a grade or a knowledge test given before progression to the next level.

Even in learning environments that have deliberately sought to move away from conventional forms of teaching and organisation, there are particular subjects for which those more conventional approaches are judged to be the most suitable even if, in these cases, teachers are always looking to encourage more active engagement among their students. The mix of pedagogies may be realised through the different media and settings used, as when e-classroom work is integrated into the larger menu of teaching and learning options. It may also stem from teachers' preferences and choices as part of the wider orchestration of learning. Again, these innovative learning environments have not simply replaced one approach or methodology with another, but rather use a wide array of approaches, all of which are aligned with the broader learning strategy.

POLICY IMPLICATIONS

The pedagogical changes outlined in this chapter imply that:

- all the participants develop the expertise, attitudes and skills to engage in these forms of advanced teaching and learning;

- the organisational and systemic structures and infrastructure, including technological infrastructure, permit innovative teaching and learning environments to flourish;

- new competencies and expert knowledge are acquired and shared collaboratively, horizontally as well as vertically, within formal systems;

- learning that takes place outside formal schooling is recognised, and new partnerships and hybrids are created to allow this to happen;

- students, themselves, are active partners in learning; and

- the broader climate and culture support innovation.

The policy implications of the innovative learning environments described in this chapter may be summed up around a series of Cs: creating communities and building capacities; collaboration and communication; conducive conditions and climates; and coherence.
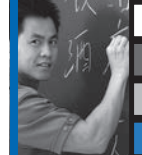
Create communities and build capacities

Micro-level organisational routines that ensure that learning remains the core of all school activity are promising ways forward. They set out to erode the "grammars", or organisational cultures, in which teachers work largely in isolation from one another and are focused more on maintaining the institutional status quo and less on optimising student learning (Tyack and Cuban, 1995). Such routines aim to disrupt these "grammars" through collaborative activity, observation and change. Each teacher in the team becomes used to systematic observation from their colleagues, and all engage in a collective discussion of how to improve teaching and learning. Examples include Lesson Study and Learning Study, associated particularly with Japan and Hong Kong-China and as summarised in Cheng and Mo (2013). They also include the "kernel routines" proposed by Lauren Resnick and her colleagues in *The Nature of Learning: Using Research to Inspire Practice*, which gives examples of collective "learning walks" (Resnick et al, 2010). There is a clear policy role in fostering the knowledge, behaviours and support that enable such routines to flourish: by making information about exemplars widely available, encouraging appropriate professional learning and networking around such routines, and developing the related skills among teachers and school leaders.

> *When chosen purposefully and implemented well, new organisational routines can function as powerful instruments for transforming school practice. Resnick and Spillane (2006) used the term "kernel routine" to denote an organisational routine that has the potential for transforming school practice by "seeding" and "propagating" new forms of practice in schools(…) Kernel routines work by connecting and weaving together other organisational routines in the organisation. Rather than attempting to drive out current practices, the kernel routine recruits and "re-purposes" the familiar ways of doing things… [with] clear articulation of the steps in the routine, the rationale for these steps, and the requirements of each one. This calls for training procedures and a set of tools and artefacts for performing the routine.*
>
> Resnick et al. (2010: 293)

Collaborate and communicate

Technology contributes to all the different components, relationships, partnerships and principles that are integral to learning environments (Istance and Kools, 2013). The role of technology in organising learning data and feedback is central if schools are to become formative organisations. Distributed leadership may very well depend on technology for communication and collaboration, as might teacher learning using online materials, collaborative platforms or social media. Technology is often integral to building partnerships and sharing experiences and knowledge. This is particularly obvious and significant in networking with other learning environments.

Policies to foster innovation in how technology can be used in education require sophisticated approaches to digital materials and technological infrastructure. At the same time, the mere presence of technology in the classroom, in the form of computers or tablets in a school or in mobile phones in the pockets of learners, is not, by itself, sufficient. Education still must be "learning-centred", not "technology-driven" (Mayer, 2010).

Ideally, all primary stakeholders should join together so that the drive to innovate in education is felt throughout the education system, not only in isolated areas. Teachers can play a crucial role as catalysts for change, and other partners can be included as well. Michael Fullan (2011) describes many of the traditional reform instruments as the "wrong drivers" – accountability pressures, individual teacher- and leadership-quality approaches, technology, and fragmented strategies. According to Fullan, these do not lead to culture change and re-professionalisation; often they have a demotivating effect on teachers and school leaders. Instead, the "right" drivers include focusing on the learning-teaching-assessment nexus, social capital to build the profession, and matching pedagogy to technology.

Twenty-first-century learning environments should constantly try to create wider partnerships and connections. Partners bolster the education workforce, resources and sites for learning as a kind of "capital investment" – the social, intellectual and professional capital on which a thriving learning organisation depends (Hargreaves and Fullan, 2012). This is even more critical when resources are scarce, when more is expected to be done with less.

Create conditions conducive to innovation

Strong leadership is essential for supporting 21st-century learning (OECD, 2013b). Such leadership should be exercised at the micro level, in schools, then extend beyond the school through a web of networks and partnerships, and out to the wider education system itself. Change should be informed by evidence. Just as formative feedback should be integral to individual classes, so should it permeate the education system as a whole. Information about the learning taking

place should be fed back to the different stakeholders, and incorporated into revised strategies for learning and further innovation. This means that processes for self-evaluation should be in place and knowledge should be shared. It also means that the knowledge base should be continually developed through meaningful research that engages the worlds of policy and practice. However, "information richness" about learning strategies, students and learning outcomes will quickly become information overload unless that information is converted into meaningful and actionable knowledge.

Developing the "meso" level through diverse networking and partnership arrangements is critical for developing more innovative learning environments. While this depends on local action, it has implications for policy through the creation of knowledge and information, incentives, capacity building, and appropriate governance arrangements so these networks can be developed. To create an environment conducive to innovation in education at the system level, the networks, strategies and connections at the "meso" level must thrive.

Ensure coherence

The complexity of contemporary learning systems, and the need to engage those most involved in teaching and learning on the ground, mean that top-down governance is often inappropriate. Thus, policy should help to create the conditions and climates that foster collaboration and build capacity. Learning-focused networks and communities of practice should be supported, and coherence with overarching education strategies should be ensured so that accountability demands do not work against the kind of innovative improvements described above.

But there is also a clear policy leadership role to be played as well. Many effective strategies depend on government design and leadership. Ministries and education agencies provide the legitimacy and the system-wide perspective to push innovation. Ideally, leadership from the local level, from networks and partnerships, and from education authorities at central and local levels should all be working together to create responsive 21st-century learning systems.
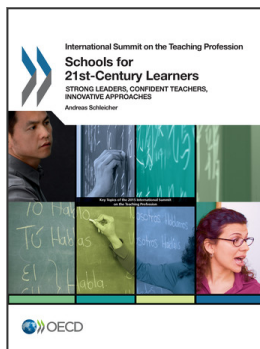
References

Barron, B. and **L. Darling-Hammond** (2010), "Prospects and challenges for inquiry-based approaches to learning", in H. Dumont, D. Istance and F. Benavides (eds.), *The Nature of Learning: Using Research to Inspire Practice,* Educational Research and Innovation, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264086487-en.

Cheng, E.C. and **M.L. Lo** (2013). "Learning Study: its origins, operationalisation, and implications", *OECD Education Working Papers*, No. 94, OECD Publishing, Paris, http://dx.doi.org/10.1787/5k3wjp0s959p-en.

Dumont, H., D. Istance and **F. Benavides** (eds.) (2010), *The Nature of Learning: Using Research to Inspire Practice,* Educational Research and Innovation, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264086487-en.

Fullan, M. (2011), "Choosing the wrong drivers for whole system reform", *Seminar Series Paper* 204, Centre for Strategic Education, Melbourne.

Groff, J. (2012), *Technology-Rich Innovative Learning Environments,* OECD, Paris, www.oecd.org/edu/ceri/Technology-Rich%20Innovative%20Learning%20Environments%20by%20Jennifer%20Groff.pdf.

Hattie, J. (2009), *Visible Learning: A Synthesis of over 800 Meta-Analyses Related to Student Achievement*, Routledge, London.

Hargreaves, A. and **M. Fullan** (2012), *Professional Capital: Transforming Teaching in Every School*, Teachers College Press, London and New York, NY.

Istance, D. and **M. Kools** (2013), "Innovative learning environments as an integrating framework for technology in education", *European Journal of Education*, Vol. X, No. 1, pp 43-57.

Istance, D and **H. Dumont** (2010), "Future Directions for Learning Environments in the 21st Century", in H. Dumont, D. Istance and F. Benavides (eds.), *The Nature of Learning: Using Research to Inspire Practice*, Educational Research and Innovation, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264086487-en.

OECD (2013a), *Innovative Learning Environments*, Educational Research and Innovation, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264203488-en.

OECD (2013b), *Leadership for 21st Century Learning,* Educational Research and Innovation, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264205406-en.

OECD (2010), *Inspired by Technology, Driven by Pedagogy: A Systemic Approach to Technology-based School Innovations*, Educational Research and Innovation, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264094437-en.

Mayer, R.E. (2010), "Learning with Technology", in H. Dumont, D. Istance and F. Benavides (eds.), *The Nature of Learning: Using Research to Inspire Practice*, Educational Research and Innovation, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264086487-en.

Resnick, L.B., et al. (2010), "Implementing Innovation: from visionary models to everyday practice", in H. Dumont, D. Istance and F. Benavides (eds.), *The Nature of Learning: Using Research to Inspire Practice*, Educational Research and Innovation, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264086487-en.

Tyack, D. and **L. Cuban** (1995), *Tinkering Toward Utopia: A Century of Public School Reform*, Harvard University Press, Cambridge, MA.