

## **Pedagogy for Economic Competitiveness and Sustainable Development**

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*“Throughout our history, there has been a tension between those who have sought to conserve our natural resources for the benefit of future generations and those who have sought to profit from these resources . . . this is a false choice. With smart, sustainable policies, we can grow our economy today and preserve the environment for ourselves, our children and our grandchildren.”*

President Barack Obama

March 3, 2009 speech to re-install the *Endangered Species Act*

### **Hope of Change**

There are two important change forces affecting education today. First, raising the length and quality of education that are driving human capital is seen as imperatives in contemporary knowledge societies that aim for sustainable economic growth and prosperity. Second, education is also viewed as one of the keys for raising the level of understanding of the fragility of the global ecological situation. Education for entrepreneurship, or economic development, and education for environmental sustainability, or sustainable development are often seen as conflicting goals in education reforms. Teachers today also encounter a number of other and equally important challenges in their work, such as educating youth for insecurity, tolerance, new technologies, peace and active citizenship, to mention but a few.

In order to educate young people to play a role in both future economic competitiveness and environmental sustainability, education policies need to be based on a proper understanding of these key concepts. In any knowledge-based society people need to be able to work with knowledge, play with new ideas, collaborate with other people and adapt to unpredictably changing situations (Hargreaves, 2003). National economic competitiveness is linked to intellectual and creative capital and is therefore driven by knowledge, creativity and innovation. Similarly, sustainable development requires an understanding of the complexity of the global ecosystem and of creative problem-solving to find solutions to ‘wicked problems’ (Murgatroyd, 2010) such as that of reconciling economic activity with a sustainable environment.

There are several ‘calls for action’ for policy-makers to raise awareness about the importance of education for entrepreneurship, economic competitiveness, environmental sustainability and climate change (Volkman *et al.*, 2009; UNESCO, 2005; European Commission, 2002; Commission of the European Communities, 2008a). Recommendations listed in these campaigns involve actions considered necessary to make progress in each area of concern. But they often fail to encourage policy-makers and practitioners to focus on common

elements in these concerns that have broader functions in education. The twin argument put forward in this article is that:

- (1) much, if not most of the practical response to education for national economic competitiveness and global ecological sustainability can employ similar pedagogies; and
- (2) many, if not most educational theories and teaching methods for productive learning relating to both broad issues already exist.

This article joins many others in insisting that education systems and schools must change. In doing so, it accepts that a radical transformation of education systems is not likely to happen rapidly enough. It is fashionable to call for fundamental rethinking of education and reforms in schools but it is much more difficult to get to the level detail that would help teachers to change the way they teach day by day. Education policies in many countries have left them trapped between the demands of teaching for testable results and providing their students with an education that is relevant for an unpredictably changing and complex world.

### **The Lisbon Strategy 2010**

Ten years ago, optimism that new technologies and steady economic growth could be extended to benefit most of us stimulated a future vision of better living conditions in the world. After the economic and political turmoil of the early 1990s, financial markets were seen as a growth factor at the turn of the new millennium. North America and the European Union with its 15 member states held the sceptre of world economic order. Climate change was not the priority and the role of emerging economies in Asia was still too immature to be given priority. This was the global landscape in which European leaders in 2000 created the idea of Europe as the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion. This commonly accepted goal was the core of the Lisbon Strategy for Education and Training in Europe by 2010. Although education has been an important vehicle in fulfilling this European dream, it was not seen as the key priority. Only later, in March 2002, did the European Council (European Commission, 2002) state that:

however effective the policies in other areas, making the European Union the leading knowledge-based economy in the world will only be possible with the crucial contribution from education and training as factors of economic growth, innovation, sustainable employability and social cohesion. (p. 9)

The importance of education and training has been increasingly acknowledged since 2000, but only recently has education been recognised as a key priority in the overall Lisbon Strategy. Its value and its vision '*Education and Training 2010*' have been the adoption of a single comprehensive strategy for education and training in Europe. The Lisbon Strategy has been implemented through a common Work Programme and its 3 generic goals and 13 specific objectives of education and training systems. The comprehensive approach was based on the 'open method of coordination' that enhanced consistency and sharing of good practices in the

EU Member States. The guiding principle of this integrated approach was lifelong learning in a worldwide perspective. The Lisbon Strategy was an influential strategic framework in the Member States in shaping their education and research policies. But its rhetorical impact in the new EU Member States and the accession countries has been even more significant.

The main means of achieving the Lisbon goal were to improve quality, access and openness of education to the wider world. Much of the concrete work was based on two principal areas. First, education systems in Europe were adjusted to enable greater mobility of students and teachers between different education systems and institutions. Harmonisation of qualification frameworks as a consequence of the Bologna Declaration, creating a transferable credit system that offers new incentives for students and teachers to study and teach in other countries was an important aspect of education reforms in Europe. Second, common exchange programmes that increase collaboration between individuals and institutions were introduced to facilitate learning and development towards common goals. Interestingly, however, the initial Lisbon Strategy and its Work Programme for education and training are silent about the role of creativity and innovation in ensuring steady economic growth that is compatible with ecological sustainability. They were based on an assumption that a greater number of mathematics and science graduates affected research and innovation.

At the time of the launch of the Lisbon Strategy, improving the quality of and increasing access to education were perceived as the best drivers of reforms aimed at promoting national economic competitiveness in Europe. The Lisbon Strategy included few new ideas that education systems and their schools should adopt. Rather, it suggested that national education policies should focus on decreasing early school leaving at upper secondary level and on expanding tertiary education. A strong accent was placed on increasing the number of students studying mathematics, science and technology in tertiary education. Indicators that were selected to monitor the progress of the Lisbon Strategy were based on quantitative data from national education systems. The OECD PISA student achievement database became an important source of evidence and increased the political value of this international student assessment in the Member States. Indeed, in many European countries, mathematics, reading and science, or 'core subjects' as they are sometimes mistakenly called, have become priority areas of improvement in national education reforms. It is now obvious that the goals set by Education and Training 2010 will not be reached (Commission of the European Communities, 2008a). In particular, the number of low achievers in reading and of early school leavers in Europe in comparison to other parts of the world is becoming a chronic problem.

The Lisbon Strategy was designed using a discourse of development based on improving quality, access and efficiency. The concept of innovation, for example, is primarily driven by the view that it is a part of the knowledge triangle (education, innovation and research) and, as such, more of an issue of higher education and research. Indeed, the Lisbon Strategy is not specific in its call for education and training to contribute to innovation in a knowledge-based society. Moreover, there is almost no mention of the role of creativity and innovation in teaching and learning. The most concrete reference to increasing innovation in schools is made in the statement in the Education and Training 2010 (European Commission, 2002):

there is a need to support decision makers, at all levels, with a view to addressing current education policy issues (such as the integration of non-traditional learners, curricular and didactic innovation, European and international collaboration) and providing them with means to implement 'ICT-induced' changes in education and training programmes (p. 18).

Typically at that time, innovative pedagogy was seen as integrating information and communication technologies into teaching and learning processes. This is an important aspect of education development but not sufficient to enhance creativity and innovation in education. It is therefore necessary that the post-Lisbon Agenda moves beyond rhetoric and contains policies that will gradually build trust, enhance collaboration and thereby cultivate cultures of learning that make creativity and innovation possible.

### **Expanding the Lisbon Strategy for 2020**

According to Gros and Roth (2008), a new Lisbon Process, will have to be designed with a new background. First, the European Union with its current 27 members and possible new members in the near future differs from the EU-15 in 2000. There is much more cultural, political and economic diversity. This is both a risk and an opportunity for Europe as a region. Second, financial markets that used to be seen as an element of growth have now turned into a risk factor. According to many, the structure of European financial markets is no longer compatible with the more dynamic global economy and thus needs to be renewed. The main assumptions for the next decade are that:

- (1) demographic change will increase the number of older people by 2020;
- (2) climate change will require radical new policies and action to limit carbon dioxide (CO<sub>2</sub>) emissions; and
- (3) global challenge from the emerging economies will gradually shift the focus from the US and Europe to Asia.

The question now is: on what basis could Europe maintain and strengthen a competitive position vis-à-vis emerging BRIC (Brazil, Russia, India and China) economies and simultaneously consolidate its leading role in sustainable development?

Europe has one comparative advantage over its rivals: education. The Lisbon Strategy has made good progress in many of its key areas, for example access and mobility. This provides a positive point of departure for the next phase of change (Commission of the European Communities, 2008b). It is clear that strengthening basic knowledge and key competences in education must remain an important policy. But 'more of the same' will not be a sustainable solution. Mathematics and science are important but so are social sciences, arts and music. Technology needs to be part of the curriculum but so do drama, entrepreneurship, environmental awareness and ethics. With the next decade in mind, European education shares two common problems that need to be clearly stated upfront and addressed by the new Lisbon Strategy 2020, both of which are relevant for this article.

First, most education systems in Europe are based on a structural logic that is derived from the industrial world. Schools are organised according to similar principles of work: 45 minute lessons, a subject-based curriculum, studying with

age-groups and a common timetable for all. In many education systems teaching and learning are also organised in modular units and mastering these units determines success. The industrial world required this kind of organisation and order, but this is no longer necessary. The second problem, a natural consequence of the first, is that only very few education systems in Europe pay adequate attention to developing students' individual natural talent. In other words, schools are still first and foremost designed for masses, standards and averages. Therefore many people leave the education system without fully realising their potential. Instead, too many young people learn to dislike studying and avoid situations that require 'going back to school'. These are two of the most serious flaws of modern education systems. The Lisbon Strategy included an objective to make learning more attractive. Very little has been done to achieve this in most countries.

In this article, we argue that re-conceptualising creativity and making it a key priority in education reforms are critical in making Europe a more advanced knowledge economy and ecologically more sustainable by 2020. According to Robinson (2001), creativity means the inventiveness to come up with new ideas, processes and products that have value. It is important to understand that all students are creative but may not be aware of this. School education can have a key part in helping them to find their talents. Moreover, creativity is not only promoted through arts, music and drama curricula. It should be part of the entire culture of the school and lifelong learning (Sahlberg, 2009a). However, many education reforms are doing quite the opposite. In the quest for higher standards and better performance in international rankings, education systems are becoming more standardised and focused on 'core subjects', harmonised frameworks and key competences. Standardisation, many claim, is the worst enemy of creativity and innovation because it narrows down the curriculum and steers teachers to teach for predetermined results and tests (Hargreaves, 2003; Robinson, 2009).

Learning basic knowledge and skills should remain an important task of schooling. Similarly, developing a broad range of key competences should be the guiding principle of lifelong learning. A new Lisbon Strategy 2020 should, however, go beyond these present assumptions if human capital is to provide the necessary impetus for economic competitiveness and ecological sustainability in Europe. Indeed, being able to come up with new ideas, processes and products that have value should be raised to the same level of importance as that which literacy has enjoyed so far. This requires wider and more frequent use of adequate methods of teaching and work that promote collaboration, creativity and focus on students' individual talents. Furthermore, students need to be taught about the power of human imagination in all areas of education. This includes a need to be prepared to make mistakes and to be wrong — and learn from this.

### **Economic Competitiveness and Global Sustainability in Educational Policies**

Competitiveness and sustainability have become buzz words in the discourse on global prosperity and development strategies. One popular indicator used in ranking the performance of nations is their ability to compete in global markets. Position in the international rankings of national economic competitiveness has indeed become a pretext for economic and labour market reforms in many countries. National education policies therefore aim at helping their economies to become more competitive.

Competitiveness as one aspect of the twin challenge of nations is, however, not a clear concept for either policy-makers or education practitioners. Sometimes it refers to competitiveness in education which often means the overall effectiveness and efficiency of a national education system vis-à-vis other education systems (Sahlberg, 2006; West, 1993). In other cases, education for competitiveness implies a certain kind of education that will increase employability and productivity in national or global markets. This is closely linked to the 'competitiveness of education' interpretation since better education improves employment opportunities because of its positive impact on knowledge and skills development and hence on productivity. In this article, we look at education as one of the main drivers of human capital development and thereby of national economic competitiveness. Again, it means better quality of, broader access to and more mobility within education. But it also means considering what type of education is needed to cultivate those qualities that are necessary in a sustainable knowledge society.

All democratic nations desire sustainable economic development and prosperity for the well-being of their people. According to Porter *et al.* (2008), prosperity is driven by the productivity of an economy which, in turn, depends on the value of goods and services produced per unit of national human capital and national resources including those derived from 'natural capital'. Both the value of a nation's products and services and the efficiency with which they are produced determine productivity. Competitiveness is thus measured by productivity.

Contemporary economic theories and empirical evidence suggest that many things matter for competitiveness (Porter *et al.*, 2004; 2008). The New Global Competitiveness Index (GCI) framework designed by the World Economic Forum (WEF) that covers more than 130 economic systems incorporates a complex set of these factors in order to help policymakers to explain the strengths and weaknesses of productivity in their countries and to craft policies accordingly. The quality of public institutions, for example, is a national condition that creates opportunities for higher productivity across the economy. Available human capital, especially the average skill level of the labour force, directly affects productivity. According to the WEF (Porter *et al.*, 2008):

differences in the mechanism of influence often coincide with the policy process that governs them: general conditions affecting productivity tend to be under the control of national governments, while many direct productivity drivers are often the result of involvement by many parts of government, the private sector, academia, and other institutions (p. 44).

The New GCI aims to reveal the underlying causes of productivity. Three domains affect national economic competitiveness in this framework: endowments, macro-economic competitiveness, and micro-economic competitiveness. Endowments affect productivity directly through geographic location, natural resources, or size of the domestic market. Micro-economic factors operate directly on firms and hence drive productivity. It is the macro-economic domain that, through its indirect influence on productivity of firms in an economy, becomes relevant for education policies. As defined by the New GCI (Porter *et al.*, 2008), macro-economic competitiveness consists of two distinct areas: macro-economic policy, and social infrastructure and political institutions. The latter, as described in contemporary literature, includes basic human capital, i.e. well-educated and

skilled people, quality of political institutions, and the rule of law. Empirical research on economic growth has found social infrastructure and political institutions to be the most important factors for long-term differences in prosperity (Bils & Klenow, 2000; Glaeser *et al.*, 2004). The New GCI as a measure includes enrolment rates in primary, secondary and tertiary education and the quality of the education system in general and of mathematics and science education in particular. These aspects of human capital fall into the province of national policies. However, economic competitiveness, as determined by the New GCI and other global indices, does not suggest any directions for pedagogies in the schools of competitive knowledge societies.

Another element of the twin challenge facing nations is the global ecological threat. After three decades of mounting concern about global environmental problems, the United Nations proclaimed a Decade of Education for Sustainable Development in 2005 to highlight the fact that *'education and learning lie at the heart of approaches to sustainable development, a powerful concept that could ignite the interests of people around the world to shape a more sustainable future'* (UNESCO, 2005, p. 26). Five years into the Lisbon Strategy, economic competitiveness became closely tied to the challenge of preparing the next generation of students to deal with global threats to the future sustainability of our economic, political and social systems and the ecological systems upon which it depends. These threats arise from the demographic and technological overload of the planet. The priority given to increasing national economic competitiveness is seen by many as contributing to rather than solving the problem of ensuring a sustainable global environment (Rees, 2003; Steffen *et al.*, 2007).

The large-scale, complex and interacting global threats that seem increasingly out of control have finally moved significantly onto the media agenda, although the UN and other supra-national organisations have been addressing them for years. The environmental community has been campaigning since the 1950s for a more global and long-term commitment to sustainable balance — the fundamental principle of the planet's ecological systems of which humans are a part. Population and competitive economic growth and their associated impacts on the environment will provide a very different context for the New Lisbon Process 2020 following the new wave of concern based on growing scientific evidence that the 'Limits to Growth' predicted by the models of the Club of Rome in the early 1970s have now been reached and even surpassed (Meadows *et al.*, 2004). The Brundtland Report (Brundtland, 1987) defined sustainable development as:

development which meets the needs of the present without compromising the ability of future generations to meet their own needs . . . The changes in human attitudes that we call for depend on a vast campaign of education, debate, and public participation (p. 10).

This 'vast campaign' seems to have started in the last decade. It is generating a new discourse and vocabulary that include 'global social-ecological system', 'tipping points', 'population overshoot', 'climate destabilisation', 'global warming', 'rising sea levels', 'fossil fuel over-dependence', 'peak oil', 'carbon footprints', 'resource conflicts' and are now penetrating the media as never before. However, schools are notoriously slow to incorporate new scientific, social and environmental problems into mainstream curriculum and pedagogy.

The inter-disciplinary study of the interaction between complex social and ecological global systems has made rapid progress in research communities but there is still what Doppelt (2008) calls widespread ‘systems blindness’ among economists, politicians, businesses and education communities that must be addressed urgently. The resilience of the global financial system has recently been profoundly challenged by the unexpected impact of excessive credit mismanaged by reputable banks and fraudulent traders. But coverage of the disturbance in the financial system is not generally linked to the long-term systemic pathologies that arise from the interaction of human and ecological systems. Steffen *et al.* (2007) refer to the ‘Great Acceleration’ of the human impact on the global environment that followed exponentially growing populations and economies post-WWII. Alongside the emphasis on social and human capital as drivers of economic competitiveness, natural capital must now enter the equation. Natural capital has generally been omitted from balance sheets by economists, governments, and corporations. It includes non-renewable resources, such as fossil fuels and mineral deposits; renewable resources, such as fish or timber; ecosystem services, such as fertile soils, species diversity, pollination, or the purification of air and water; and the capacity to absorb waste from human economic activities. The urgency of the global situation is summed up by Steffen *et al.* (2007) as follows:

Enormous, immediate challenges confront humanity over the next few decades as it attempts to pass through a bottleneck of continued population growth, excessive resource use and environmental deterioration. . . . There is also evidence for radically different directions built around innovative, knowledge-based solutions. (p. 620)

The desire for ever-increasing growth dominates EU economic policy without taking into account its environmental consequences for fundamental ‘life support systems’ for human and other species. Education and training — as quite correctly described in the Lisbon Strategy — are important in addressing this urgent issue if critical destabilisation of complex dynamic man-made and ecological systems is indeed imminent.

### **Common Teaching Methods for Different Learning Goals**

Fortunately, the qualities and the pedagogies that prepare young people to make a creative and collaborative contribution to national competitiveness and address global ecological challenges for a sustainable future are similar. Teaching and learning for uncertainty, risk-taking, ingenuity, collaboration and creativity are *means* that can focus equally on the different *ends* of economic competitiveness on the one hand and on global social and ecological sustainability on the other. In curricular terms, whether the ‘subject’ to be studied is entrepreneurship or sustainable development the most appropriate pedagogies will have much in common. Both require a high level of ingenuity, creativity and problem-solving. The scientists, policy-makers and ordinary consumers of the 2020s onwards who are now being prepared in formal education institutions will meet unprecedented economic and ecological system challenges in their adult professional lives that will require concerted action at every level, from local to global.

Many see the ends of competitiveness and sustainability as conflicting. Manteaw (2008), for example, discusses education for sustainable development

and corporate social responsibility as emergent discourses that need conscious efforts to align their ideals. If education for sustainable development is to make a significant contribution to educational thinking and practice, he claims, it does so recognising that the current market-oriented agenda related to formal schooling contradicts the ideals of education for sustainable development. In an analysis of the role of education in promoting a sustainable society, Bottery (2008) challenges an unquestioning commitment to economic competitiveness by highlighting the following overarching needs to:

- give a higher profile to the notion of interdependence: how closely one part of an ecosystem is linked to and depends upon another; making humanity more aware of its own fragility on this planet;
- highlight the role of cooperation: problems currently faced will only be resolved by international cooperation;
- develop the notion of a global public good: environmental sustainability can only be achieved by transcending particular national or individual needs.

He advocates a 'sustainable school' in which longer impact horizons, environmental sustainability, an awareness of global fragility, ecological interdependence, global cooperation and a concept of a public good are embedded. This contrasts with the core values of economic growth and global competitiveness in the Lisbon Strategy, but it is a vision that needs a similar creative and innovative pedagogy for collaboration and arguably for a particular and targeted form of competitiveness if it is to be pursued. For example, competitiveness and creative ingenuity can equally promote the growth of sustainable technologies as well as high-carbon emitting technologies that produce non-essential consumer and luxury goods. Competitiveness and ingenuity will also be needed to create strategies that re-stabilise global systems and stimulate peoples' will to change to a morality, mindset and lifestyle implied by the 'overarching needs' spelt out by Bottery (2008).

Various predictions of the imminence of a deep crisis have been made, but most concur that the price of inaction would almost certainly lead to a major global economic collapse. Predictions about the timing of this vary but the rise of the world population to 9 billion by 2050 is widely accepted as a fundamental problem (Diamond, 2004; Meadows *et al.*, 2004; Rees, 2003; Sachs, 2008). If this is true, then it would be a great risk to continue with 'business as usual' in the way we run education systems, maintaining the 'industrial model' with standardisation as the main driver of policy and failing to produce the human and social capital that could be generated by redirecting formal education towards greater creativity and collaboration. This transformation is needed for the benefit of the knowledge society which is becoming an unsustainable society because of the advanced depletion of natural capital and ecological services that is now evident at the global level.

It is important to realise the sheer scale of the challenge of turning educational policy into practice at the key interface between millions of learners and hundreds of thousands of their formal teachers. It is also important to recognise the intensification of teachers' work and raised expectations of their performance arising from the greater demands for accountability in recent years (Sahlberg, 2009b). Only if new priorities are clearly signalled at the political level can the necessary

context be provided to move towards pedagogies that are appropriate for the decades ahead. Both pedagogy and curriculum must be seen within the overall values and goals of a given education system.

Common rhetoric in Europe is moving in the right direction, as the following quotation in one of the Lisbon Strategy implementation documents suggests (Commission of the European Communities, 2006), but sustainability is still not fully in focus:

Entrepreneurship refers to an individual's ability to turn ideas into action. It includes creativity, innovation and risk taking, as well as the ability to plan and manage projects in order to achieve objectives. This supports everyone in day-to-day life at home and in society, makes employees more aware of the context of their work and better able to seize opportunities, and provides a foundation for entrepreneurs establishing a social or commercial activity.  
(p. 4)

Risk-taking, creativity and innovation are, as expressed in the quotation above, often seen as features of a special form of curriculum, in this case entrepreneurship education. But this discourse needs to be extended to all areas of education. Even more importantly, ingenuity and creativity should also be woven into the culture of schooling. Can education promote risk-taking, ingenuity, entrepreneurship and competitiveness to serve global sustainability as well as competitive success in the global market?

### **Education, Innovation and Cooperation**

Governments have an essential role to play by offering and guaranteeing good education that emphasises the core determinants of economic competitiveness and environmental sustainability. However, it has been difficult to translate this central role of education into concrete actions and programmes that lead to improved human capital and thus contribute to social and economic progress. There are several aspects of competitiveness and sustainability that have a direct relation to teaching and learning in schools. Three key conditions that make teaching compatible with the needs of the competitive and sustainable knowledge society are: renewing the conception of knowledge, understanding innovation, and enhancing social capital through schooling.

*New conception of knowledge.* Formal education, especially at pre-tertiary level, has long been criticised for static conceptions of knowledge and learning (Lehtinen, 2004; Sarason, 2004). Traditionally, the foundation of knowledge was based on a positivist scientific method. Therefore knowledge was viewed as objective and knowledge-formation as a linear, cumulative process free from subjective values and interpretations. Knowledge is now understood differently in economics, mathematics, natural sciences, neuroscience, cognitive sciences and information technologies. It is seen as relativistic and diverse in terms of its interpretations. Furthermore, according to Capra (2002), it is created through multiple processes, including hermeneutic and subjective 'scientific' methods alongside the systems analytical advances in understanding non-linear dynamics of complex life, and human and ecological systems.

This shift in the paradigm of knowledge has created a challenge for education. Teaching and learning in schools should focus not only on mastering the basics

and achieving predetermined learning standards but also on coming up with alternative perspectives, new ways of constructing knowledge and creating ideas that have value. However, many countries seem to be moving in the opposite direction: what is valued is conventional knowledge in some core subjects that can be easily measured and then turned into criteria of success and failure. OECD's highly influential PISA study, for example, is seen by critics as reinforcing this narrowing of purpose, as Grek (2009) suggests:

The focus on 'real-life' circumstances and on students' capacity to enter the labour market with core skills, such as literacy and numeracy, has taken PISA's focus of interest away from less explicit educational aims that resist measurement (e.g. democratic participation, artistic talents, understanding of politics, history, etc.), towards a more pragmatic view of education's worth . . . PISA results now receive a very high profile within national media and are present in the consciousness of senior policy-makers. Media coverage of PISA results is very substantial and perhaps represents another manifestation of the 'mediatisation' of education policy processes (p. 27).

*Better understanding of innovation.* Innovation involves the extraction of economic and social value from knowledge (Sahlberg, 2009a). It puts ideas, knowledge and technology to work in a manner that brings about a significant improvement in performance. It requires not just an idea but rather an idea that has been made to work. This means that innovation and entrepreneurship are closely interdependent. Therefore, living in and working for a world of innovations require fundamentally different attitudes, knowledge and skills from the citizens. Technological adaptation and innovation have been the main drivers of economic growth in developed countries since World War II and are also proving to be important factors in many developing countries (Chen & Dahlman, 2004). Innovative models of wealth creation, referred to as 'natural capitalism', are emerging in the business world (Hawken *et al.*, 1999). They illustrate how environmental responsibility can be highly profitable. In order to be able to contribute successfully to the development of innovation in the sustainable knowledge economy, education systems also need policies that encourage working with and learning from innovations.

*Focus on social capital.* Success in the world of work and living in a world of global risks require different knowledge and skills. Coping with increasing amounts of knowledge has changed the ways we think about education and schools. Individual performance and inventions created by one person only have given way to collective intelligence, shared knowledge and team-based problem-solving (Reich, 2001; Hargreaves, 2003). Interestingly, successful economies and highly creative communities are based on the idea of strategic alliances rather than raw competition for markets and clients. Indeed, sustainable development and economic competitiveness require a stronger focus on the development of interpersonal skills and social capital throughout the cycle of education. More specifically, social capital that is necessary in productive group processes, whether in or out of school, is becoming more important in the schools of those countries that are genuinely concerned about their economic competitiveness and sustainable development.

Competition and collaboration are central concerns in an exploration of global economic and environmental futures and related pedagogies. Figure 1 maps the dynamic relationships between three main dimensions, namely *personal benefit*

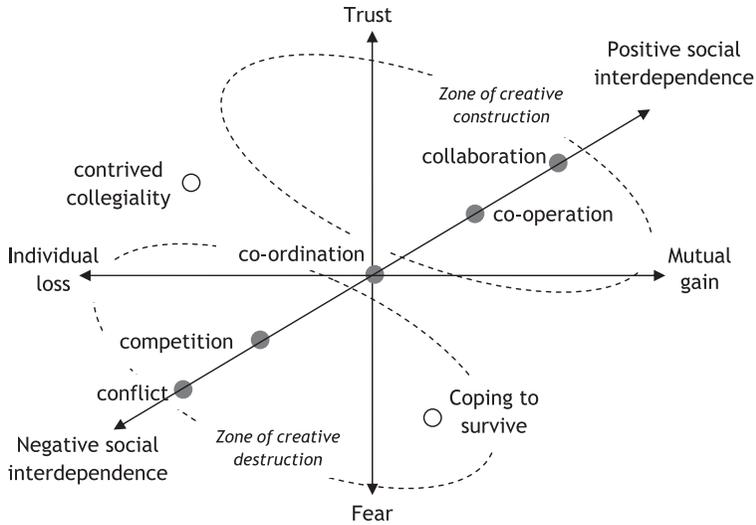


FIGURE 1. Dynamic tension between Zones of Creative Construction and Creative Destruction in economic and sustainable development

(win-lose axis), *mutual trust* (trust-fear axis) and *social interaction* (positive-negative social interdependence axis) using the concepts of creative construction and creative destruction. The *Zone of Creative Construction*, based on trust and collaboration, is as relevant to international economic and political system relations as it is to classroom or personal relations. This is the area that promotes risk-taking and imagination and creativity and leads to win-win outcomes. It thus increases possibilities of innovation. On the other hand, coping to survive, imitation (as opposed to originality) and competition are essential elements of the transformation of economic structures and typically result in win-lose consequences. ‘The entrepreneur tries to preserve his high profit for as long as possible’, writes McCraw (2007, p. 255), ‘through patents, secret processes, and advertising — each move an act of ‘aggression directed against actual and would be competitors’. These are forms of economic competition that Joseph Schumpeter called ‘Creative destruction’ in his seminal book *Capitalism, Socialism and Democracy* and they define the *Zone of Creative Destruction* in Figure 1. The purpose of pedagogy for economic competitiveness and sustainable development is to strengthen the three dimensions in the *Zone of Creative Construction*, i.e. common win, mutual trust and positive social interdependence.

Both collaboration and competition confer evolutionary advantage. In-group collaboration to give comparative advantage to one group over another is a key to economic as well as political success in market-based democratic societies. It also advantages individuals within the groups who benefit from a sense of identity and belonging. Increasingly at the local level of schooling, the creation of collaborative cultures in schools is seen as offering competitive advantage in the quasi-market that sets schools in competition for parental choice; even within classrooms modern pedagogy based on constructivist principles of learning is increasingly characterised by collaborative student projects and problem-solving activities.

Creativity in the classroom has long stressed the efficacy of such activities both for motivating learners and for promoting ‘21<sup>st</sup> century skills’ needed for labour

and enterprise in the knowledge economy. Every school population and every classroom group are an 'in-group' and if school leaders and teachers are skilful in creating a positive culture they can provide individual pupils with the security that comes from a sense of identity and belonging (Smith *et al.*, 2003). Excessive in-group competition and emphasis on win-lose relationships can obviously damage such benefits, particularly for the losers. In their seminal work on cooperative learning, Johnson and Johnson (1989) summarise the differences between three forms of social interdependence (see Table I), stressing the intrinsic benefits

TABLE I. Three modes of learning compared according to Johnson and Johnson (1989)

	Mode of learning		
	COOPERATION	COMPETITION	INDIVIDUALISTIC
<i>Interdependence</i>	Positive	Negative	None
<i>Interaction pattern</i>	Mutual encouragement	Oppositional	None
<i>Outcome 1</i>	High effort to achieve by all	Low effort to achieve by many	Low effort to achieve by many
<i>Outcome 2</i>	Positive relationships	Negative relationships	No relationships
<i>Outcome 3</i>	Psychological health	Psychological illness	Psychological pathology

of cooperative learning and the negative effects of the other two. Research evidence shows the broad range of educational benefits of cooperative learning that is based on the social interdependency theory (Johnson & Johnson, 2009; Sharan, 1999). Together with academic gains, students are also able to improve their 'soft' skills, such as helping behaviours and problem solving, and experience safety and mutual trust.

### **Pedagogies for Economic Competitiveness and Ecological Sustainability**

New fields of interdisciplinary study and associated professional networks are emerging to replace or supplement traditional subject disciplines as a way of organising formal study programmes. The following are two examples of these programmes. First, *Entrepreneurial Education and Training* (EET) is an approach to promote entrepreneurship in lifelong learning. In Finland, Poland, Norway and Spain, entrepreneurship is explicitly included in the national curricula at secondary level. In Poland, 'Basics of Enterprise' is a compulsory 'subject' in all comprehensive secondary and vocational schools. In the UK, an Enterprise in Higher Education Initiative started in 2001. In Finland, Nuorten Akatemia (Youth Academy) among many other non-governmental organisations promotes and coordinates actions for active citizenship and entrepreneurship for young people in and out of school (Ministry of Education, 2009).

Second, *Education for Sustainable Development* (ESD) has been promoted by the United Nations since the Brundtland Report (1987) popularised the phrase 'sustainable development'. It is a recent inclusion in school curricula in Scandinavia where, in Sweden, the Institute for Research in Education for Sustainable Development, in a survey (Osterman, 2007), found three approaches to ESD:

- *Fact-based*: inform the citizens (14% of teachers surveyed)
- *Normative*: teach the values and techniques of sustainability (52%)
- *Pluralistic*: engage the pupil/citizens in critical democratic debate that reflects many attitudes and encourages individual choice and action (34%).

Supporters of such interdisciplinary curricular approaches argue that the focus on separate subject disciplines and standardised international comparisons of educational performance in core subjects divert the attention of policy-makers and practitioners from both competitiveness and sustainability (Volkman *et al.*, 2009). In particular, the traditional curriculum is not broad or future-oriented enough and fails to orientate the next generation towards the evidence of urgent and diverse but interrelated threats to human society.

A recent OECD study reinforces such elements of pedagogy for competitiveness, collaboration and creativity by concluding that the most effective learning environments will be characterised by customised learning for each child; availability of diverse knowledge sources, such as books, web sites, and experts around the globe; collaborative group learning on authentic, inquiry-oriented projects; and assessment for deeper integrated, coherent, and contextualised understanding. However, the report (OECD, 2008) concludes that:

The ‘standard model’ of schooling is seen to align poorly with these. While some of these characteristics can be implemented within the standard model (e.g. collaborative learning tasks as many schools are doing today), others are much more difficult to implement (for example, customised learning is inconsistent with a high degree of standardisation) (p. 13).

Fortunately, the repertoire of available pedagogical methods and approaches is rich enough to provide schools and teachers with powerful tools that fit the needs of competitiveness and sustainability. Typically, such methods require a high degree of social interaction, active engagement and a redesigned curriculum that puts an emphasis on open-ended tasks or problems. Most, if not all of these methods are quite complex and thus require considerable effort and time on the part of teachers who hope to use them effectively. Table II illustrates some good examples of research-based pedagogical methods that align with pedagogy for competitiveness and sustainability. Interestingly, many of these models rely primarily on human interaction and require the teacher to lead the teaching and learning process.

Creative pedagogies have a long-standing pedigree in education (Osborn, 1948, Osborn, 1953; Wallas, 1926), even if they are not widely practised for the reasons suggested by Bentley. Nevertheless, Osborn’s ‘brainstorming’ techniques are now central to generative learning processes such as Co-operative Learning (Sharan, 1999), Creative Problem Solving (Isaksen *et al.*, 1994) and the Critical Skills Programme (Weatherley *et al.*, 2003). Creativity can indeed be taught and Wallas’s steps of preparation, incubation, implementation and verification have been elaborated since the 1920s. Gardner’s (2004) work on multiple intelligences has been applied in many programmes designed to appeal to all learning styles, for example, visual, auditory and kinaesthetic modes of learning. Accelerated Learning (Smith *et al.*, 2003) is but one of dozens of approaches that incorporate a more holistic ‘whole-brain’ or ‘head, heart and hand’ approach described by Oldroyd (2008) to formal learning activities informed by cognitive and neuro-scientific

TABLE II. Teaching and learning methods relating to creative skills for future competitiveness and sustainable development

Title of the Method	Approach	Theorists and pioneers	Skills for competitiveness and sustainable future
<b>Co-operative Learning</b>	Cooperative learning is a generic term for various small group teaching procedures. Students work together on academic, simulation or 'real life' tasks in small groups to support each others' learning. They are positively interdependent, tasks are structured so that students need each other to accomplish their common goals or activities, and take individual responsibility for their work and learning.	Morton Deutsch Kurt Lewin David and Roger Johnson Shlomo Sharan Yael Sharan Robert Slavin Elizabeth Cohen Elliot Aronson	Academic achievement Positive about self, subjects, learning and teachers Positive about others More effective interpersonal skills and relations Awareness of group collaborative processes
<b>Problem-based learning (PBL)</b>	Engages students with problems similar to those they will encounter in practice (for instance, a case description on the basis of which a diagnosis must be made and remedy prescribed). Under tutorial guidance, the students work in groups to identify and obtain needed information, discuss proposed solutions, and arrive at consensus.	Howard Barrows (McMaster University) Jean Piaget Lev Vygotsky	Problem-solving with application to both entrepreneurship and sustainable development based on finding creative solutions and building consensus.
<b>Project learning</b>	Authentic project-based learning 'focuses on student-designed inquiry that is organised by investigations to answer driving questions, includes collaboration among learners and others, the use of new technology, and the creation of authentic artefacts that represent student understanding'. The 'driving questions' are preferably ones of social importance (such as environmental issues) and the project work is typically supported by dedicated software, instrumentation, and data representation formats.	John Dewey William Heard Kilpatrick Lev Vygotsky	Project skills with application to both entrepreneurship and sustainable development with particular focus on use of ICT and evidence-based decision-making.
<b>Central Conceptual Structures</b>	A limited number of conceptual structures lie at the heart of human intellectual competencies. Mastering these structures is essential for educational attainment. Conceptual structures were identified for number sense (in essence a mental number line), proportional reasoning, causality, story production, and even musical composition. These structures were taught through a combination of instruction and games of graduated complexity, and in each case the results significantly exceeded those of conventional instruction.	Jean Piaget Robert S. Siegler Yukari Okamoto	Creative pedagogy of gaming, story production, musical composition, etc. that can apply conceptual structures to the calculations, causes and responses to competitiveness and sustainability issues.
<b>Creative Problem Solving</b>	Sophisticated approach to problem identification, analysis and solutions-generating that includes: peeling back the layers of causation; establishing criteria for 'good solutions'; group brainstorming and selection.	George Polya Scott G. Isaksen K. Brian Stead-Dorval Donald Treffinger	Powerful meta-cognitive process involving divergent and convergent thinking that can be applied to both entrepreneurial and environmental challenges.

research that recognise that a learner's positive trust is a precondition for effective mental processes requiring a cooperative culture in the classroom.

There are many pockets of good practice in creative pedagogy and many are to be found in less constrained private schools. One example is a small school in Falun, Sweden for 7–15 year-olds, *Soderbaumska Skolan*. It was established by a teacher who had become disillusioned with the pressures that she observed in state schools that seemed to squeeze out the ingenuity, imagination and creativity in the students, with negative effects on their motivation, especially as they moved into adolescence. Using the arts as a central organising thread through the curriculum and structuring the staff into cross-disciplinary teaching teams (*arbetslag*) for thematic rather than subject-compartmentalised learning, the whole of year eight was devoted to the creation and production of an original musical theatrical production by the students. The motivation and self-efficacy of students were enhanced by this particular approach to creative project-based learning that was possible in a trusting culture guided by a dedicated school leader and carefully selected teaching staff freed from constraining testing regimes and the rigidities of 45-minute lessons and a subject-based timetable (Oldroyd & Hoberg, 2004). A recent advertisement for a teacher at the school illustrates the priority given to collaboration, creativity and a cross-subject thematic curriculum:

We are looking for a teacher who is safe and clear in leadership, who wants to work together with teams, works thematically and across subjects, let students have influence over education and believes in the creative process as a tool for learning.

Schools are not prepared to cope with increasingly accumulating knowledge, expand creativity across the curriculum or move to more collaborative modes of teaching. As stated by OECD (2009, p. 88), 'schools are conventionally poor at using the key motors of innovation — research knowledge, networking, modular restructuring, technological advance'. Indeed, the problem of the dissemination of innovative pedagogies is not only the individuals — school principals, teachers and students — who are not able to teach and learn in other ways. There is a more fundamental aspect of educational change that needs to be addressed in more systemic ways: the organisation of schooling. As long as schools are operating according to a bureaucratic model that relies on subject divisions, age and ability cohorts, sequenced daily schedules and rewarding only individual efforts, they are likely to find it difficult to adjust to the new realities of our times.

## **Discussion**

Human capital is recognised as a key condition for better national economic performance. Education that is at the heart of human capital development also plays an important role in raising awareness of and promoting action for an ecologically sustainable future. The goals of economic competitiveness and environmental sustainability are not completely incompatible but huge changes in public policy and practice are needed in order to decouple economic competitiveness from unsustainable growth. The qualities and skills needed by the next generation for both national economic competitiveness and global ecological sustainability are very much the same and can be enhanced by appropriate schooling and pedagogies. The good news is that these pedagogies and models of school

organisation — many of them mentioned in this article — are already available and have been tested by large-scale field experiments and empirical research since the early 20<sup>th</sup> century. The bad news is that the prevalence of many of these solutions and practices, as shown by Yael Sharan (2010) and much of the research on the dissemination of educational innovation (Lehtinen, 2004; Sarason, 1990), is limited and often constrained by market-driven education and teacher policies that are becoming fashionable in many countries.

Future-oriented pedagogies involve large measures of collaborative and creative problem-focused learning to release wide-ranging talents for innovation and to liberate teachers and learners from bureaucratic constraints, as concluded by Murgatroyd (2010) in his call for more ‘wicked problems’ to be included in the school curriculum. Indeed, a broader and less constricted curriculum and system of assessment are needed to facilitate reformed methods of teaching. In addition to the core emphasis on language, mathematics, science and the arts, we need:

- (1) a thematic study of globalisation and the human impact on environmental systems;
- (2) creativity and innovation skills;
- (3) information media and technology skills;
- (4) life and career skills; and
- (5) the freedom to take risks and permission to be wrong and learn from our mistakes.

All should be universally part of the curriculum of formal schooling.

It is common that reformers insist that *radical transformation* in our education systems are needed before things will be significantly better (Volkman *et al.*, 2009; Weatherley *et al.*, 2003). We do not call for a fundamental reform of our education systems. More important than reform is to change the way we think about education in the future, as Hargreaves and Shirley (2009) also insist. However, we recognise that much can be done immediately at reasonable cost and with realistic political capital. In order to make this happen, two main principles need to be more widely accepted.

First, as we have described earlier, smarter pedagogies and a more adequate organisation of schools and teaching will bring significant improvements to knowledge, skills and competences that are needed for raising national economic competitiveness and increasing ecological sustainability. Specially well-developed teaching methods include cooperative learning, problem-based learning and creative problem-solving and seeking separate pedagogies for these two global challenges is unnecessary.

Second, innovations in teaching are important but so are those research-based pedagogies that have been developed, tested and practised since the rise of pedagogy as a field of social sciences in the early 20<sup>th</sup> century. Much can be done by better and more frequent implementation of teaching methods and school arrangements that have proved to work. In this article, we have mentioned some that should be better incorporated into teacher education programmes and professional development in schools.

Teachers are key to the necessary change but the gaps between policy reformulation, teacher education and the classroom remain large. Although revolution is not what we call for, the scale of the multi-level challenge of injecting into formal

education the required creativity and innovation may be realised only through the ‘vast campaign of education, debate, and public participation’. Sir Ken Robinson (2009) has argued that creativity today has become as important as literacy and it should therefore be given similar status. Given the urgency of the challenges ahead, it may be that nothing less than a global project equivalent to the ‘moon shot’ that took men to the moon half a century ago is needed. Education and pedagogies to make economic competitiveness and environmental sustainability compatible and achievable in the coming decades need to be a part of such a global project.

## REFERENCES

- BILS, M. & KLENOW, P. (2000) Does schooling cause growth? *American Economic Review*, 90, pp.328–335.
- BOTTERY, M. (2008) *Redefining the Focus of Educational Leadership: the case for environmental sustainability* (unpublished manuscript).
- BRUNDTLAND, G. (Ed.) (1987) *Our Common Future: The World Commission on Environment and Development* (Oxford, Oxford University Press).
- CAPRA, F. (2002) *The Hidden Connections: a science for sustainable living* (New York, Anchor Books).
- CHEN, D. & DAHLMAN, C. (2004) *Knowledge and Development: a cross-section review*. Policy Research Working Paper #3366 (Washington, DC, World Bank).
- COMMISSION OF THE EUROPEAN COMMUNITIES (2006) *Implementing the Community Lisbon Programme: fostering entrepreneurial mindsets through education and learning*. Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, 13.2.06 (Brussels, European Commission).
- COMMISSION OF THE EUROPEAN COMMUNITIES (2008a) *An Updated Strategic Framework for European Cooperation in Education and Training*. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 16.12.2008 (Brussels, European Commission).
- COMMISSION OF THE EUROPEAN COMMUNITIES (2008b) *Progress towards the Lisbon Objectives in Education and Training: indicators and benchmarks 2008*. Commission staff working document (Brussels, European Commission).
- DIAMOND, J. (2004) *Collapse: how societies choose to fail or succeed* (New York, Viking).
- DOPPELT, B. (2008) *The Power of Sustainable Thinking* (London, Earthscan Publishing).
- EUROPEAN COMMISSION (2002) *Education and Training in Europe: diverse systems, shared goals for 2010*. European Commission Directorate-General for Education and Culture (Brussels, European Commission).
- GARDNER, H. (2004) How education changes: considerations of history, science and values, in: M. SUAREZ-OROZCO & D. QIN-HILLIARD (Eds) *Globalization: culture and education in the new millennium* (Berkeley, University of California Press) pp. 235–258.
- GLAESER, E., LA PORTA, R., LOPEZ-DE-SILANES, F. & SHLEIFER, A. (2004) *Do Institutions Cause Growth?* NBER Working Paper No. 10568 (Cambridge, National Bureau of Economic Research).
- GREK, S. (2009) Governing by numbers: the PISA ‘effect’ in Europe, *Journal of Education Policy*, 24, pp. 23–37.

- GROS, D. & ROTH, F. (2008) *The Post-2010 Lisbon Process. The Key Role of Education in Employment and Competitiveness*. CEPS Working Document No. 308 (Brussels, Centre for European Policy Studies).
- HARGREAVES, A. (2003) *Teaching in the Knowledge Society. Education in the Age of Insecurity* (New York, Teachers College Press).
- HARGREAVES, A. & SHIRLEY, D. (2009) *The Fourth Way: the inspiring future for educational change* (New York, Sage).
- HAWKEN, P., LOVINS, A & LOVINS, H. L. (1999) *Natural Capital: creating the next industrial revolution* (New York, Little, Brown and Company).
- ISAKSEN, S. G., STEAD-DORVAL, K. B. & TREFFINGER, D. J. (1994) *Creative Approaches to Problem Solving* (Dubuque, Kendall/Hunt).
- JOHNSON, D. & JOHNSON, R. (1989) *Co-operation and Competition: theory and research* (Minneapolis, Interaction Book Company).
- JOHNSON, D. & JOHNSON, R. (2009) An educational psychology success story: Social interdependence theory and cooperative learning, *Educational Researcher*, 38, pp. 365–379.
- LEHTINEN, E. (2004) Koulutusjärjestelmä suomalaisen yhteiskunnan muutoksessa [Education system in changing Finnish society], in: *Artikkelikokoelma tutkimushankkeesta 'Sosiaaliset innovaatiot, yhteiskunnan uudistumiskyky ja taloudellinen menestys'* (Helsinki, Sitra), pp. 520–590.
- MANTEAW, B. O. (2008) When businesses go to school: neo-liberalism and education for sustainable development, *Journal of Education for Sustainable Development*, 2, pp. 119–126.
- MCCRAW, T. (2007) *Prophet of Innovation: Joseph Schumpeter and creative destruction* (Cambridge, MA, Harvard University Press).
- MEADOWS, D., RANDERS J. & MEADOWS, D. (2004) *Limits to Growth: the 30 year update* (Vermont, Chelsea Green Publishing).
- MINISTRY OF EDUCATION (2009) *Yrittäjyyskasvatuksen suuntaviivat* [Directions of entrepreneurship education] (Helsinki, Ministry of Education publications no. 7).
- MURGATROYD, S. (2010) 'Wicked problems' and the work of the school, *European Journal of Education*, 45, pp. 259–279.
- OECD (2008) *Innovating to Learn, Learning to Innovate* (Paris, OECD).
- OECD (2009) *Education Today. The OECD Perspective* (Paris, OECD).
- OLDROYD, D. & HOBERG, S. (2004) Helping the dog to wag its tail: evaluation through dialogue for the learning school, in: D. OLDROYD (Ed) *Leading Schools for Learning* (Ljubljana, National Leadership School), pp. 273–287.
- OLDROYD, D. (2008) *The New Pedagogy: VET Teacher Trainers' Guide* (Slovenia, CPI).
- OSBORN, A. F. (1948) *Your Creative Power* (New York, Scribner).
- OSBORN, A. F. (1953) *Applied Imagination* (New York, Scribner).
- OSTERMAN, L. (2007) *Education for sustainable development*. Paper presented at the 2007 Enirdelm Conference (Uppsala, Sweden).
- PORTER, M., DELGADO, M., KETELS, C. & STERN, S. (2008) Moving to a new Global Competitiveness Index, in: M. PORTER & K. SCHWAB (Eds) *The Global Competitiveness Report 2008–2009* (Geneva, World Economic Forum) pp. 43–64.
- PORTER, M., SCHWAB, K., SALA-I-MARTIN, X. & LOPEZ-CLAROS, A. (Eds) (2004) *The Global Competitiveness Report 2004–2005* (New York, Oxford University Press).

- REES, M. (2003) *Our Final Century* (London, Heinemann).
- REICH, R. (2001) *The Future of Success* (New York, Alfred Knopf).
- ROBINSON, K. (2001) *Out of our Minds: learning to be creative* (Oxford, Capstone Publishing).
- ROBINSON, K. (2009) *The Element. How Finding your Passion Changes Everything* (New York, Viking Books).
- SACHS, J. (2008) *Common Wealth. Economics for a Crowded Planet* (New York, Penguin Press).
- SAHLBERG, P. (2006) Education reform for raising economic competitiveness, *Journal of Educational Change*, 7, pp. 259–287.
- SAHLBERG, P. (2009a) Creativity and innovation for lifelong learning, *Lifelong Learning in Europe Journal*, 14, pp. 53–60.
- SAHLBERG, P. (2009b) Learning first: school accountability for a sustainable society, in: J. C. COUTURE, K. D. GARIÉPY & B. SPENCER (Eds) *Educational Accountability: professional voices from the field* (Rotterdam, Sense Publishing) pp. 1–22.
- SARASON, S. B. (1990) *The Predictable Failure of Educational Reform. Can We Change Course Before It's Too Late?* (San Francisco, Jossey-Bass).
- SARASON, S. (2004) *And What Do You Mean by Learning?* (Portsmouth, NH, Heinemann).
- SHARAN, S. (Ed) (1999) *Handbook of Cooperative Learning Methods* (New York, Praeger).
- SHARAN, Y. (2010) Cooperative learning for academic and social gains: valued idea, problematic practice, *European Journal of Education*, 45, pp. 300–313.
- SMITH, A., LOVATT, M. & WISE, D. (2003) *Accelerated Learning: a users' guide* (Buckingham, Alite).
- STEFFEN, W., CRUTZEN, P. J. & MCNEILL, J. R. (2007) The anthropocene: are humans now overwhelming the great forces of nature? *Ambio*, 36, pp. 614–621.
- UNESCO (2005) *United Nations Decade of Education for Sustainable Development (2005–2014), International Implementation Scheme* (ED/DESD/2005/PI/01) (Paris, UNESCO).
- VOLKMAN, C., WILSON, K., MARIOTTI, S., RABUZZI, D., VYAKARNAM, S. & SEPULVEDA, A. (2009) *Educating the Next Wave of Entrepreneurs. Unlocking Entrepreneurial Capabilities to Meet the Global Challenges of the 21st Century. A Report of the Global Education Initiative* (Geneva, World Economic Forum).
- WALLAS, G. (1926) *The Art of Thought* (New York, Harcourt, Brace and World).
- WEATHERLEY, C., BONNEY, B., KERR, J. & MORRISON, J. (2003) *Transforming Teaching and Learning: developing 'critical skills' for living and working in the 21st century* (Stafford, Network Educational Press).
- WEST, E. (1993) *Education and Competitiveness*. Discussion Paper No. 93-02 (Toronto, Government and Competitiveness School of Policy Studies, Queens University).