Università degli Studi di Modena e Reggio Emilia
Dipartimento di Economia Politica

Materiali di discussione

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The Officina Emilia Initiative: Innovative Local Actions to Support Education and Training Systems

by

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May 2009

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Abstract

The issue of the regeneration of skills, in particular in the light engineering industry, is addressed by Officina Emilia (henceforth OE) as a crucial one in order to re-examine the interweaving of education, innovation and local development in the SMEs production systems. The project, aimed at the education and training systems, is designed to enhance the industrial culture in order to strengthen technical and scientific education.

First sponsored in 2000 by the University of Modena & Reggio Emilia (Italy), over the last years OE has gathered the support of local actors dealing with the themes of training, culture, and local development. In 2009 it opened its *museolaboratorio* ("workshop-museum") in which teaching activities promote an interest in the themes of work, technologies and the socio-economic development of the territory among the students and teachers of schools of all types and levels.

The involvement of class groups, of teachers and other visitors takes place through active learning practices that foster motivation and develop a sense of belonging which is likely to lead to a more profitable educational experience, both secondary and tertiary, as well as to contribute to improving career prospects.

Officina Emilia proposes innovative action on a local level, allowing for the implementation of effective teaching practices as well as the broadening and consolidation of best practices which might support a society-wide trend towards maintaining a high demand for a better quality of education and the ability to provide it.

Ten years after the beginning of the initiative, with this paper we intend to open up the discussion on the various research issues and on the actions undertaken, focusing on the analytical tools and the main critical areas in the further implementation of the Officina Emilia initiative.

JEL Classification: I21; J24; I28; O31; R58

Keywords: Analysis of Education; Education Policy; Regional Development Policies; Innovation

This paper has been prepared for the international research project "MIQUA_Improving the quality of the pre-university education", funded by the University of Modena and Reggio Emilia and the Fondazione Cassa di Risparmio di Modena. The views expressed in this paper do not necessarily reflect the opinion or position of the institutions funding Officina Emilia, and in no way commit them.

We wish to thank David Lane, Federica Rossi and Rossella Ruggeri for discussions on the topics presented in the paper.

Summary

1. Preliminary remarks

Many studies have supported the view that the real strength of several local economic systems of SMEs in Emilia-Romagna has been their ability to keep up innovation and social cohesion. Innovation in SMEs systems is viewed as generated by network of competences that sustain at many levels the productive structure of the region. Moreover, the complex interplay between knowledge creation and the abilities to maintain (upgrade and strenghthen) professional relations are considered necessary for innovative processes in networks of small and medium-sized companies.

How is it possible to keep this complex interplay in working order? In particular: how can the regeneration mechanisms of skills be supported?

Ten years ago, by addressing these questions, the University of Modena and Reggio Emilia started the Officina Emilia Initiative, focused on the light engineering industry that is of great importance for the local, regional and national economy. Implementing research and actions to answer this question constitute the key challenge both in theoretical and practical terms for the Officina Emilia Initiative. Based on an ongoing dialogue with theories and research on local development, innovation and learning, Officina Emilia (henceforth OE) focuses on the "regeneration of technical skills" as a social process.

Ten years after the beginning of the initiative, with this paper we intend to open up the discussion on the various research issues and on the actions undertaken. We shall focus on the analytical tools and the main critical areas in the current implementation phase.

Officina Emilia is a rather complex initiative: in terms of the many levels on which research is carried out (economic and technological analysis, didactic planning, documentation, dissemination, communication and information); in terms of the different subjects involved (schools, companies, local administrations); in terms of its experimental nature, which calls for research *and* action through analysis, planning, experimentation, assessment of effectiveness and, to some extent, re-planning. This kind of research *and* action has a complexity not entirely attributable to the linear, iterative framework outlined by Lewin (1946) on "action research"[1], but more consistently requires tools of analysis and planning that valorize the emerging properties of interactions by fostering generative relations that lead to innovation (Lane & Maxfield, 1997).

[1] Lewin (1946) defined 'action research' as a form of research aimed at promoting actions, each of which is made up by a cycle of invention, planning, action, data research, and information on the action carried out and its results (retroaction). As a planner and pallbearer of social interests, the researcher works with others to propose a new form of social action in order to help improve the concrete functioning of the community.

The structure of this paper is the following. We shall first review the relevant literature addressing the topics of the Officina Emilia Initiative on local development, innovation and education (section 2). Section 3 presents two background areas related to the OE initiative: the Emilian model and the state of the Italian education system. Section 4 describes Officina Emilia as an innovative approach with regard to both the school system at a local level and the teaching methodologies adopted. Section 5 presents a synthesis of the lessons learnt and the main critical issues that have emerged from the implementation of the OE initiative, as central elements needed to outline further development over the years to come. The last section summarizes the issues characterizing the OE initiative. The paper is completed by two appendices which schematically describe the Italian education system (Appendix A) and the Officina Emilia's teaching and museum services (Appendix B).

3. Research themes

Local development and innovation

As well described by Brusco (1980), the generation of competences required by production processes is a social process concerning interactions at a number of levels and between a number of actors: young people completing their education, families, schools and other training institutions, companies, and local administrations. The Emilia-Romagna region provided a clear example of social interactions that fed a virtuous circle of high demand for technical skills, a strong supply of qualified professional figures, and subsequent renovation of the education and training offered by schools and University.

The themes of local development rooted in the works of Sebastiano Brusco (1980, 1989, 2004, 2008) were enhanced by an analysis of social mobility (Solinas, 1982), of innovation processes in industrial districts (Russo, 1989, 1996; Lane, 2003), and of the role of large companies in generating skills essential to the development of small enterprises (Brusco & Paba, 1992; Solinas, 1994; Rinaldi, 2000). In this literature, the interpretation of economic action as social action provides the key to interpreting the transformations – those that have taken place over the last 50 years – as part of the economic and social fabric that has characterized the Emilia-Romagna region and in particular the central part of Emilia (Modena, Bologna and Reggio Emilia). Alongside these research themes, in 2000 an empirical research project was undertaken to analyse the competence network in the light engineering industry in the province of Modena (Metalnet, 2000 and 2005; Russo & Pirani, 2002; Bigarelli & Russo 2009). The specific features of this production system were examined

within the wider context of mechanical and engineering specializations in post-war Italy (Rinaldi, 2008; Russo, 2008).

Innovation from a complexity perspective

A complementary research strand concerns the theoretical discussion on innovation in a complexity perspective (Lane & Maxfield, 1997, Russo, 2000, Lane *et al.*, 2009) and policies supporting innovative networks (Russo & Rossi, 2009a and 2009b; Rossi, Russo, Sardo & Whitford, 2009). This highlights three elements essential to the understanding of the 'bootstrap' dynamics of the innovation process: the role of competence networks supporting innovation and production processes, the generative relationships from which innovations emerge, and the 'scaffolding structures' necessary to foster their effectiveness. For an examination of the theoretical issues on this theme, see Rossi, Russo, Sardo &Whitford (2009).

Learning and education

Within the vast field of research on learning and teaching, the OE initiative draws on the strand that associates teaching and educational institutions reforms with the reform of thought and the reduction of disciplinary fragmentation (Bruner, 1996; Morin, 2000). These aims call for changes in the organization and role of school in society, in teaching practices and in teacher training. In fact, the forms of learning and action promoted in the school system are too different from those typical of the areas of work and life, as Resnick (1987) observed.[2] General skills need to be transferred and to be employed in new contexts, but such transfer abilities are not perceived as a key mission to be attained by educational institutions. Teaching-learning activities mostly assume a separation between the knowledge acquisition and the ability to apply it to a task. Although the new information and communication technologies ushered in a number of changes in schools, the 'talk and chalk' approach has not been reduced significantly.

The re-evaluation of the contributions of Vygotsky (1978) has added scope with regard to studies into learning in a particularly fruitful and

[2] Resnick (1987:13) proposes the following four differences between learning in school and out of school: (i) school favours individual learning, while out-of-school learning is socially shared. Furthermore, school measures the failures of individuals, while out-of-school responsibilities are commonly distributed; (ii) school promotes pure mental activity, while out-of-school mental activities are linked to tools and artefacts on which these activities depend and by which they are influenced; (iii) school encourages symbolic thought and theoretical representations of reality, whereas mental activity outside the school is contextual and directly involves objects and contingent situations; (iv) school promotes general abilities and knowledge, while outside school, specific skills are paramount.

stimulating direction, linking learning with the actions and the environment in which people live, interact and learn. Among the numerous studies that may be attributed to this model, the most interesting are those that concentrate on the acquisition of knowledge embedded and contextualized in everyday life, in school and work and on the mediation of artifacts in learning processes[3].

Jean Lave's investigations into apprenticeships (Lave, 1977) and informal learning (Lave, 1988) appear to be particularly important in this research strand. Lave & Wenger (1991) explored the contextualized nature of understanding and communication, describing learning not as the internalization of knowledge, detached from any context, but rather as a process of growing participation in one or more "communities of practice", involving the individual as a whole within a specific social context. The learner, as in the traditional forms of apprenticeship, starts out from forms of "legitimized peripheral participation" to pass through a series of participatory forms to become a competent member of a community. In this framework, the concept of 'distributed knowledge' provides a useful tool in considering the social aspects of situated learning in the construction and maintenance of complex knowledge (Hutchins, 1996).

The research on the mediation of the artefacts in learning relies on the assumption that artefacts determine cognitive relations with the natural, social and economic environment and obviously with peers. They could structure the categories of thought and knowledge or, by developing the ability to act on the environment, they could extend the cognitive capacities. These researches are rooted in the works of Piaget (1973), Vygotsky (1978) and Bruner (1996), and have been developed by Rabardel (1995), Rabardel & Samurçay (2001), Rabardel & Waern (2003), Kaptelinin (2003).

From research to action

In the light of these references, the OE initiative intends to contribute to the improvement of the education system, starting from teaching methodologies and the need for innovation in school curricula, in order to promote skills that respond to the challenges faced by local industrial sectors, especially when the light engineering industry is considered.

[3] A selection of writings by the authors cited below, along with a number of others that are not cited, has been published in Italian by Pontecorvo, Ajello & Zucchermaglio (1995). This translation has brought these studies to the attention of a public wider than the academic community, and has contributed to promoting a debate on the requalification of the education system in Italy.

3. Background areas: the Emilian model and the Italian education system

The Emilian model

What is Emilia?

In Emilia-Romagna, the post-war economic revival was followed by technological, organizational and market transformations, which characterized the productive framework along the lines of flexible specialization, typical of the industrial districts, in which there is generally an interweaving of relationships between companies of different sizes (with a large number of small and very small companies as well as freelance workers) specializing in particular production stages or processes (from product design, to planning, right up to the marketing stage). Industrial production is diversified (light engineering, textiles and clothing, food, ceramics, biomedical) and characterized by niche productions, greatly innovative and able to respond to the specific requirements of industrial clients and large commercial distribution chains (in the clothing industry, for example). Multinational companies are also operating in the region, above all in the production of industrial machinery, packaging machinery, and tractors, but also in the food and ceramic industries (which have localized in this region the strategic production of components or planning). A marked orientation towards export markets has always connected these local production systems to global value chains.

Alongside this industrial production, agricultural production has led to the development of the food industry (in particular Parmesan cheese, salamis, fruit preserves), also heavily oriented towards exportation.

In Emilia-Romagna, the manufacturing industry – light mechanical and engineering in particular – continues to grow and innovate; it faces globalization by offering new products aimed at market niches alongside the fields in which it has traditionally specialized. The sector has brought about a series of transformations that have strengthened the production framework, and which are undoubtedly the reason why the deep recession that first emerged in 2008 has not taken the same toll in the region as elsewhere (Bigarelli & Russo, 2009; Russo, 2009). These results are the outcome of a long and complex process of skill generation (entrepreneurial, technical, commercial, and public administrative) across the territory.

Yet despite the positive signals, the world of production stresses the need to support the generation of skills that drive the innovation and development processes in the local light engineering industry.

Society in the Emilia-Romagna region is typically open to flows of knowledge brought in by the presence of medium-large firms, by a tradition of technical schools, by its long-standing and high quality universities, by

migratory flows (firstly from the countryside, then from the mountains and from the less developed areas of the region, later from the South of Italy and since the '90s from the countries of Africa, Eastern Europe and Asia).

While the region is characterized by one of the lowest birth rates in Europe, it has had high rates of economic and social development: in 2000 it had almost reached the parameters that the European Council of Lisbon had set as objectives for the end of the following decade.

Policies implemented by local authorities: education, welfare and social cohesion

The interplay between the role of the (local and regional) authorities, socio-economic development and education is a key theme in the analysis underpinning the OE initiative.

Social cohesion, social services and welfare are key areas in terms of regional policy, which contribute to frame an economic environment that is broadly favourable to development. Over the last decade, research and innovation have become important policy fields through which the regional administration has attempted to strengthen and more effectively guide industrial research[4].

In the field of education, the most notable examples are the investments made in day nurseries, pre primary schools and "full time" primary schools. Investments in vocational education and training were important and some local administrations set up successful technical and vocational high schools[5]. In order to face the technical transformations of the '80s (the spread of numerical control, of electronics in general and later of information technology) the regional authority took advantage of the massive flow of resources from the European Social Fund, and efficiently employed them to implement thousands of training courses for young people entering the labour market, for unemployed job-seekers and for workers.[6]

The huge contributions made by local and regional authorities shaped the functioning of the whole system of education and vocational training, sustaining the rate of participation (both of young and adult people) and the learning results. Unfortunately, these good conditions did not last. The crisis of the local finances has forced local authorities to leave their high schools to the State and to reduce their investments, especially after the introduction of new rules for the European Social Fund in 2007-2013. At the same time,

[4] In light engineering in particular, the creation of a network of public research centers known as HiMech wants to promote integration between academic research and its application in industry. For details see www.aster.it.

[5] The well known are "Aldini-Valeriani" in Bologna and "Corni" in Modena both dedicated to the industrial sector.

[6] The effectiveness of these courses has been repeatedly assessed according to the guidelines in the MEANS Programme manual (European Commission, 1999).

several elements at national level have hindered the necessary innovations in the compulsory and secondary education system, managed directly by the State.

Changes and challenges

In the last two decades, several conditions changed and contributed to worsen the quality of the education and training outcomes, without effective contrasting actions at institutional level. In the region, the interactions among schools, families, companies and local institutions no longer appear to be effective in the regeneration of the technical and professional competences which, at different levels and in different professional fields, are still necessary to support the processes of production and innovation in the industry and especially in light engineering. Let us investigate briefly these changed conditions.

In general, families do not seem interested in securing technical education and vocational training to their children, who address their choices towards a wide range of 'lyceum' high schools (a generalized trend in European countries). Technical and vocational high schools do not attract an adequate number of motivated students, but all too often simply those who have not done so well at school, many of the children from immigrant families, and all those students who have had learning difficulties and who therefore present special educational needs. Quantity and quality of young people entering the labour market, after their high school diploma, have constantly decreased during the recent decades.

Companies in the light engineering industry (and related services) require qualified workers, mostly without tertiary education, on condition that they must be able to take part in an ongoing training process in order to find solutions for the changing needs of their clients. While it is ever more common for companies to fail to attract workers with adequate professional characteristics and the will to continue training, all too often, young adults are simply unaware of what sort of opportunities may await them, if they seek employment in light engineering companies or even in the manufacturing industry in general.

Moreover, the local universities offer courses of mechanical engineering, but small companies often do not know how to interact with engineering graduates, who, on their part not always are prepared to interact within the organization of SMEs.

Education in Italy

Main critical aspects

Changes in the Italian education system in the last two decades are complex and would require specific presentation to describe in detail what has taken place in primary, secondary and tertiary education. Appendix A outlines the structure of the education system and provides quantitative data about the numbers of teachers, staff and students. Here, we shall point out briefly the main critical aspects[7].

The Italian education system, while having tried to make up for the historic delay in the spreading of literacy and basic education among the population in the post-war era, continues to suffer from clear shortcomings in terms of quality, and struggles before the challenge to integrate the most fragile members of the population: the disabled, immigrants and those belonging to disadvantaged social groups.

The state of the Italian education system is described in great detail in the '*Quaderno bianco sulla scuola'* ('White Book on the School System') produced jointly by the Treasury and the Ministry of Education in September 2007. In this study, the unequal distribution of resources among the Italian territories sharply emerges.

Furthermore, the results of international learning tests (PISA, TIMMS and others) show persistently negative differences between Italy and the other industrialized countries, a wider achievement divide amongst women and the weaker social groups, and above all, sharp territorial differences (Bratti, Checchi, Filippin, 2007), which do not always correspond to shortages in resources.

The main characteristics of school curricula continue to be rooted almost exclusively in a centralized national level, with the sole exception of vocational training being delegated to the regional level. The decentralization process allowing greater autonomy to the schools has been held back over the last decade, particularly by repeated budget cuts and by the delays of a federal reform.

The way in which curricula are organized (what should be taught in the classroom) and the professional qualification of the teaching staff are important elements in affecting the final level of learning that can be attained in schools.

The Italian school maintains a profound separation between the teaching of the humanities and that of science and technology, starting from primary school right up to the various study courses offered at high school level. In high schools, comprehensive schooling has a limited levels of mathematics, sciences and no technology studies, while technical and vocational schools

[7] For a description of the Italian training system, its many reform projects and substantial lack of change, see Butera (2000).

are designed to promote technical learning that may be directly applied in the workplace.

With regard to teacher training, that of elementary and pre-elementary school teachers is delegated to a university degree course which includes the study of pedagogy, teaching methodology and of the cognitive sciences. The training of teachers for low secondary, high schools and for vocational training is largely limited to the knowledge of single disciplines[8]. Periods of apprenticeship in classrooms appear largely ineffective and have not managed to bring about an adequate level of quality in the competences of new members of the teaching staff.

Assessing the education system: ongoing changes

The understanding of the functioning of the education system in Italy has been suffering from inadequate statistic analyses on a national, regional and local level. This situation does not facilitate the establishment of an assessment program of performances and results, nor a sensible allocation of investments[9].

[8] We observe that the 10-year experience of the *Scuole di Specializzazione per l'Insegnamento Secondario* (Specialization Schools for Secondary Teaching), which the universities carried out from 1998 to 2009, has not yet been followed by an assessment on the overall results, in view of the planning of another training structure, recently defined.

[9] The repeated failure of plans for a national assessment body of the Italian education system is worth outlining briefly.
The general delay in the culture of assessing public policies in Italy is most sharply felt in the field of education. All the innovations introduced by the Ministry of Education in schools in the '70s and '80s were made obligatory in the early '90s, through study plans (curricula) and working guidelines for teachers (syllabi), without an effective program to assess the experimentation stage. Up to the beginning of the '90s, assessment research on the national education system, carried out by researchers and functionaries of the Ministry of Education (grouped in an organism called CEDE), broadly coincided with Italy's participation in the research activities carried out by international bodies (IEA, OECD and Eurostat). Furthermore, despite the efforts of the researchers involved, the results of research had little or no influence on national reform policies, and raised almost no interest at all in the trade unions and the media. The participation in international work groups, which carried out research based on thorough methodologies in the selection of samples, indicators and field work, led to the professional enhancement of a number of the system assessors within the CEDE. Most of the researchers of this body, however, were traditionally involved in research projects on the testing and assessing of students' performance.
Some changes began to take place in the mid-1990s. A number of attempts were made to put together an assessment program for the national education system that might fill the information gaps left by the international surveys and allow for an assessment differentiated by region, as well as an assessment of the performance of individual schools. The official assessment exercise, unfortunately, adopted somewhat lax criteria, leading to results that were considered quite puzzling.

The various governments elected to rule the country over the last 20 years have been unable to promote a reliable assessment plan of the national education system. Unfortunately, on at least two occasions, the laws enforced by one government were later blocked or changed radically by the following one. The views of the governments (supported alternately by coalitions of center-right and center-left parties) were diametrically opposed on three issues: (i) the decision whether to use or not the assessment results as a means to promote or sanction each single school; (ii) the need to promote self-assessment (even at an individual school level), either by favouring the growth of national assessment policies, or by creating an independent assessment authority; (iii) the dimension of the assessment itself, i.e. the choice of carrying out either a universal survey or sample-based studies, on a compulsory or voluntary basis. None of these issues has so far been met up with a stable definition.[10]

4. The Officina Emilia Initiative

The 'museolaboratorio*' ('workshop-museum')*

It was the analysis of the looming crisis in the skills regeneration mechanism and the urgent need to support the pre-university education system (Mengoli & Russo, 1999) that provided the driving force behind the OE initiative, which started in 2000 (Mengoli & Russo, 2000; Rinaldi & Ruggeri, 2001; Russo & Ruggeri, 2001). The University of Modena & Reggio Emilia took the initiative onboard, setting up a debate that engaged not only the scientific community but also other local institutions involved in the field of education and training, the Chamber of Commerce, the companies and their industry associations, the trade unions at local level. The aim of this discussion was to implement a program of teaching/learning practices aimed at the education system (from pre primary schools right through to the university), at the vocational training system (from initial to the on-job training) at the system of lifelong learning and training of immigrant workers, in order to promote an interest in the themes of work, technologies and the socio-economic development of the territory.

The key proposal of the OE initiative is to set up a process promoting active knowledge of the local socio-economic and technological context,

[10] The lack of a common assessment strategy of the education system has produced a number of perverse effects. At least two successive editions of the national test on students' learning have produced results in contrast with what emerged from international analyses. In particular, the results from schools in the Southern regions appeared higher than the national average, contrary to what has been found repeatedly in international testing. This phenomenon is a consequence of the incorrect management of the administration of the tests, justified by the school staff's fear of losing resources in the wake of insufficient results.

supported by the use of a specifically designed shopfloor space - the '*museolaboratorio*'('workshop-museum'), eventually opened in January 2009[11]: it provides and interplay between both high-level cognitive experiences and workshop activities[12].

At present, the workshop-museum is divided in six sections: a display of historical machine tools, a tooling workshop with working machines, a true to life video on work in light engineering industries entitled *"I luoghi, le persone, le macchine, il lavoro"* ("Places, people, machines and work"), the "log book" section, the "metrology room" and the "room of the innovations".

The historical machine tools are particularly meaningful. There is a Maserati milling machine and a Ferrari grinding machine. These companies, both located in the Modena province, are famous at international level for

[11] The workshop-museum is located in an industrial warehouse, in Modena, of around 800 square meters (plus 200 square meters of laboratories, offices and stockrooms). Since 2002, a series of educational activities (on micro robotics and local history) were carried out inside the school buildings, directly in the classrooms of the students involved.

[12] When the OE initiative was set up in 2000, there was already in Bologna a museum dedicated to manufacturing culture: the Museum of Industrial Heritage in Bologna. In the 1980s, the original nucleus of this museum was an exhibition to valorize a legacy of the scientific instruments and machinery that two engineers and teachers, Aldini and Valeriani, had left at the end of the 19th century to Bologna City Council. A wide-ranging research project of historical, economic and social appraisal was then undertaken (coordinated by the historian Carlo Poni) on the value of the technical tradition, to which Aldini and Valeriani had contributed in terms of their intellectual work, and which had been supported by the founding of an important public technical institute named after them (see also the volume on Aldini Valeriani technical school). The Museum of Industrial Heritage also founded the house organ "Scuola Officina", which features research contributions into the history of the local light engineering industry, on similar museum projects, on the valorization of technical and scientific culture linked to industrial activity, on the valorization of the architecture of the great industrial plants now in disuse and their conversion for other uses, and on the industrial landscape (a research strand supported by the collaboration with Italian Association for the Industrial Acheological Heritage (Associazione Italiana per il Patrimonio Archeologico Industriale, AIPAI) and The International Committee for the Conservation of Industrial Heritage (TICCIH). It also created a network of companies that sponsor the activities of the museum.
Another museum valorizing light engineering production was set up in 1999 in Campogalliano (Modena) to celebrate the 50 years of activity of the Scales-makers Cooperative of Campogalliano (an international leader in the field of weighing technologies for industrial and commercial uses). The Museum of Weighing Scales as well as valorizing the knowledge of measuring tools and the other specific products created by the Cooperative, over the years opted to develop in terms of a didactic museum featuring temporary sections on specific themes, including one, in 2007-2008, on the technology of light engineering processes.
Both museums constantly focus on the light engineering industry, and couple their public display elements with didactic museum activities. As will be discussed in the paper, Officina Emilia (open to the collaboration with both museums) is more oriented towards research-action in order to implement teaching-learning innovations.

their automobile production. But very few know that, for a period around the second world war, they produced machine tools. Another significant historical machine tool is the Monarch lathe: left over in the city by the US Army after the Italian liberation at the end of the second world war[13], it is a very ponderous exhibit of the workshop-museum.

In the tooling workshop other machine tools (a lathe, a slot drill milling cutter and saw) are operated by technicians and groups of students or individual visitors may see how these machines work and how their main operations are carried out.

Several artifacts (such as tools, semi-finished products, production scraps, cores, components and finished artifacts) are in the *"Log Book"*: a set of shelves running along one wall of the warehouse where the various items may be directly examined and better understood by consulting an interactive database[14].

Gauges, calipers and other measuring instruments are in the "metrology room" and the "room of the innovations" will be dedicated to temporary expositions by enterprises, schools and university research groups.

The workshop-museum is not simply a museum with exhibits featuring hands-on experiments, but a workshop in which to gain an understanding of the functioning of technologies, of the organizational models of production, and of the social relationships that underpin the production and innovation processes in the light engineering industry. The focus on this branch of industry is due to its importance for technological convergences, transversal to the industrial structure of the region as well as for its importance in economic terms, on a regional, national and international level. Nevertheless, the program devised for the workshop-museum could be easily enlarged to other industrial process through the common features of the machineries and the common organizational themes.

Officina Emilia activities and methodologies

The activities produced by the OE initiatives are now described in some details.

Research. Since 2000, the working group[15] engaged in the OE initiative has undertaken a wide-reaching research project into the local production

[13] Soon after, it was employed in the "Corni" technical and vocational High School to train several generations of technicians. Many of them, up to this day, recognize it at first sight as the machine tool on which they have practiced the art of lathing in their old school days.

14 These artifacts have been donated by the companies supporting the aims of the OE initiative.

[15] Overall, about 20 people have collaborated on OE with responsibilities in different fields: planners of educational activities, researchers, economists and engineers, who contacted schools, teachers and companies, produced the necessary documentation for the exhibits within the workshop-museum and implemented the educational activities.

system and innovation processes, also involving the functioning of the local/regional education and vocational training system. They have experimented with 'hands-on' workshops dedicated to classes of students of every school level in collaboration with almost one hundred teachers and directors.

Activities for students and teachers. The teaching/learning activities for students and their teachers, the educational and vocational guidance experiences aimed both at students and their families, the multidisciplinary internships for university students, and the initial and in-service training of teaching staff constitute the complete offer to the local/regional educational and vocational system[16]. The OE initiative promotes a specific campaign in order to improve the educational activities linking the schools and the enterprises, particularly those of the engineering sector. In fact, only very few students manage to put together a knowledge-gaining approach to the socio-economic and the technological context. It is not uncommon for some local high schools, mostly the technical and vocational ones, to organize visits to the industrial plants and internship periods in collaboration with local enterprises. However, when the students participate, they rarely encounter positive learning opportunities.

Proposals for school curricola. In particular, the teaching/learning activities promoted by the OE initiative aspire to introduce into the national curricula the study of technology, competences and innovations as social processes. This helps participants to better understand changes, and to shape their understanding of the present, to raise their awareness and foresee future transformations, thus providing the students with the tools and knowledge to build their future.

In-service teachers training. Acting in this direction calls for a change of perspective, as well as of methods, on part of teachers. And it is with teachers that the OE initiative intends to share the possible paths within the education system: opening up horizons, consolidating teaching practices, supporting the assessment of their effectiveness and adapting them to specific local contexts.

The main methodologies and perspectives of actions are the following.

Integrating background. Officina Emilia operates to support a greater flexibility of school curricula both in terms of the contents of teaching activities and of how these activities are put into practice. It has been noted, in fact, that contents are never meaningful *per se* for the learner, but they become relevant only if the surrounding environment allows them to be so. From the point of view of teaching methodologies, Officina Emilia adopts the practice of building an "integrating background", a strategy developed in

[16] The range of services offered by the OE initiative are available online at the project website (www.officinaemilia.it) and are also outlined in the Appendix B.

Italy by researchers within the framework of institutional pedagogy, (Canevaro & Berlini (1996), and Zanelli (1986)). The integrating background is outlined by the mediators and organizers of the educational activities within the class. It consists above all in a narrative framework that enables the sharing of meanings between students and teachers, and binds together the many stages of educational action over time.[17] This approach has supported the best practices in day nurseries, pre primary and "full time" primary schools in the Emilia-Romagna Region, well known throughout the world thanks to 'Reggio Children'[18].

Hands-on activities. Officina Emilia is largely based on museum teaching experiences, which have developed educational practices such as hands-on activities both in science and technology museums and ethnological, archaeological ones. However, the nature of the experiences that the OE initiative proposes calls for a longer time commitment. The tools, the materials and above all the staff are best suited to groups of three to five students. Officina Emilia proposes workshops that might be integrated with visits to industrial firms, in a teaching framework in line with the curricular activities of various schools.

A gender perspective. Particular attention is devoted to addressing the problem of girls tending to distance themselves from both the theories and practices of science and technology. This issue, widely recognized at all levels, has to be dealt with from the earliest years of school, well before its impact is felt in high school and university, where the pathways aimed at industrial careers attracts a risible number of female students. The spreading of stereotypes with regard to both the innate skills and professional aspirations of women reinforce gender segregation.

Learning technology. The OE initiative intends to operate for the introduction of some technological education in all the high schools, and for the review of teaching contents and methodologies. Only the spreading of effective technological education – that does away with the common computer-centered misconception calling exclusively for the use of the PC to carry out basic tasks – may promote both professional training as a whole, and more specifically training for industrial professions, as well as basic knowledge on the part of all the young people attending the schools and university courses. In short, generalist education needs to come much closer to the scientific and technological characteristics of today's work experience; technical and vocational schools need to increase their capacity to provide students with the tools necessary to act in an intercultural and

[17] In particular, Canevaro's research group proposed the use of the integrating background as a didactic tool designed to encourage the involvement of those with communication problems or with disabilities.

[18] See the internet site http://zerosei.comune.re.it/italiano/reggiochildren.htm as well as issues of "Rechild" magazine.

fast-changing context, which unfortunately they are not equipped to keep up with.

Experimental pathways and evaluation.

Well aware of the difficulties to be met in the promotion of innovative actions in the field of education, the OE initiative works on the basis of an experimental program sensitive to the continuous assessment of the results and their effects on the local labor market. Numerous initiatives have been taken at a central level and enforced on schools in view of particular results, yet unfortunately they have not had a lasting impact on the quality of education nor they have positively influenced the overall system[19].

As argued by Huberman & Miles (1984), the success of innovation investments in schools depends on many factors, such as providing proper resources, implementing an assessment of educational results and the performance of staff, both teachers and administrators.

For many reasons, the application of an assessment program is a controversial issue, especially when the aim is to evaluate initiatives in the medium and long term. To cope with these difficulties, we intend to open up a comparative analysis of the assessment of Officina Emilia initiative[20]. The basic elements in our assessment are related to the effects on schools, teachers, and to the degree of institutionalization[21]. In particular we focus on:

[19] A similar issue is addressed by Huberman & Miles (1984) with regard to innovations in the US education system. They observe "The adopting school [...] assimilates the innovative program as a function of its demographics; its prior history of innovative practices; its organizational practices, procedures and norms; and its user purposes and assumptions. The decision to adopt, as well as a preliminary plan for implementation and support services, follow from a series of negotiations – often tacit – between district administrators, school personnel, and developers or advocates of the innovative program. […] users interact with the program under existing organizational arrangements. [...] the innovation is adjusted through user and organizational pressure, and implementing the innovation also changes users' perceptions and practices." (Huberman & Miles, 1984: 10).

[20] In this perspective, the partnership with the Arizona State University is relevant. ASU has gained a significant amount of widely comparable experience through the 'Program Effectiveness Scale/Rating System' (Ozturk, 2008) and has settled reliable standards to be adopted for the construction of synthetic indicators. The programme was developed by the Arizona State University Assessment Research Unit to evaluate the University education partnerships program.

[21] These are inspired by the analysis proposed by Huberman & Miles (1984) for the assessment of the quality of innovative action in the education system. See also Ajello, Ambrosini & Depolo (2009).

i. implementation of action among students (the impact on students): we intend to assess the increase in the awareness of the characteristics of the economic and social technological context they live in[22];
ii. implementation of action among schools (the diffusion among schools): we intend to measure the share of classes that take advantage of innovative teaching activities out of the total amount of classes in the territory; and to analyze the improvement in the capacity to plan strategies of education, training and work placement;
iii. implementation of action among teachers (the diffusion among teachers): we intend to measure the share of teachers who introduce teaching practices in the curriculum and employ innovative methodologies, materials and guidelines (syllabi);
iv. institutionalization: its degree is measured by the number of schools that officially adopt the local curriculum promoted by Officina Emilia and which then certify the knowledge and skills of their students.

5. Problem issues and lessons learnt

The research contributions and the experimental nature of the activities undertaken by the OE initiative have so far provided a great range of results, as is also shown by the support given to the project in terms of financial backing by local institutional actors and the interest shown by schools and companies. Over the almost 10 years that have passed since the first university conference was organized to discuss the idea, many of the initial conditions have changed. Through some key steps, the University developed the original idea into a project and then the project into practice, with the support of local institutions willing to look beyond their institutional mandates and make investments in view of a collective result. But as in all generative relationships, monitoring is needed to make sure that all the actors involved are constantly able to create new opportunities for change and consider them coherent with their own strategies and priorities. This monitoring is also essential when the resources invested are public and, as in the current economic crisis, the institutions involved are led to question their priorities. In these conditions, the process of innovation fostered by the OE initiative might risk to be sidelined.

In the next section, we summarize the main problem and the research questions that require further investigation: some concern the development of the OE initiative, others concern the more general processes of innovation in education and the linkages between education, innovation and local development.

[22] We assume that a greater awareness is likely to increase students' ability to seek relationships and information within the local context, and to better orient them in education choices, training and work opportunities.

Continuing the OE initiative

The experience gained by the OE initiative allows us to highlight some critical aspects which concern three main issues: the partnerships and the form of governance, the competences required, the planning of the workshop-museum.

Partnership and form of governance

Partnerships and governance of the OE initiative are a crucial issue.

Collaborations have been built with the Faculty of Engineering, the 'Marco Biagi' Faculty of Economics, and the Faculty of Communication and Economic Sciences. Moreover, the OE initiative contacted a wider group of experts, involved on an individual basis, to discuss and consolidate the projects to be implemented. In 2008 the partnership with the Arizona State University was initiated, building on a comparative analysis of the OE initiative and the University Initiative, with special reference to the 'K-12' project. A comparison of the theoretical references and the practices adopted by the two initiatives will be performed in order to improve the quality of the pre-university teaching/learning processes[23].

Partnerships already established with schools and companies allow, through special conventions, to bridge the gap between separate worlds and to create opportunities for teaching/learning through innovative activities for schools, university students and for the general public[24].

Cooperation with similar museum experiences[25] have been built looking forward to sharing tools and methodologies, particularly in view of fostering the lifelong learning approach, by supporting people's sense of belonging and their involvement in the understanding of shared problems and their possible solutions.

Pursuing the objective of all these various partnerships requires not only time, but also the ability to communicate with many different communities, and to integrate the results of these interactions with the planning and implementation of the teaching/learning activities and with the other workshop-museum practices. This constitutes a critical element which has both internal and external implications for the OE initiative.

[23] As part of this collaboration, in particular the international research project *"MIQUA_Migliorare la qualità del sistema di istruzione pre-universitaria"* ("Improving the Quality of the Pre-University Education System") has been developed, coordinated by D. Lane and M. Russo (University of Modena & Reggio Emilia).

[24] The list of supporters (consultable online on the OE initiative site) shows the range of schools and companies already involved.

[25] In the start-up phase of this part of the partnership project, we contacted the Museum of Industrial Heritage in Bologna, the Weighing Scales Museum of Campogalliano, the Documentation Center of the Industrial Heritage of Terni, the Museum of Industry and Labor of Brescia, the Online Center of Industrial History and Culture, dedicated to the industrial and labor heritage which has characterized the territorial identities of Piedmont, Liguria and the Aosta Valley.

The partners involved so far (University, local administrations, Chamber of commerce, foundations, entrepreneurial associations) have participated in an effective exchange regarding common actions. Funding has been provided by the most important local bank foundation, the regional and local authorities and from National and European institutions. In order to consolidate the changes that have been made, activities of the various partners who share the aims and give financial support must become integral to the OE initiative. The governance of the OE initiative has now become a crucial issue to be coped with.

The network of competences required for the functioning of Officina Emilia

A network structure supports the implementation of the OE initiative: action-research calls for a flexible internal organization, able to acquire new competences on top of those already present, and to redesign future strategies on the basis of the emerging objectives and results achieved.

The competences required for the implementation of Officina Emilia involve four macro-areas: research and assessment, activities with schools, activities with companies, museum activities. At present, the first three macro-areas have been developed to a greater extent. Moreover, the documentation activities, IT and data management, logistics and the organization of common spaces, internal and external communications, the network of relationships with similar organizations (eco-museums, museums of industrial heritage and of work, training agencies) are transversal to all the macro-areas.

The necessary competences draw on many disciplinary and technical fields: economics, engineering, IT, science and mathematics, pedagogy, social sciences, organization skills, museum and archive management. Different levels of skills are also necessary: that of the technician, the expert tutor, the ability to plan teaching workshops, the designing and planning of activities with schools, companies and other partners.

Since the activities are extremely complementary, both among the macro-areas and the various levels, the ability to work in multi-disciplinary groups is an essential feature of the human resources required. The experimental nature of many of the activities calls for a high degree of creative knowledge to adapt the offer to the needs of schools and companies, to find a degree of integration with the institutions that might support the training system, the museums and the documentation centers[26].

[26] Transversal collaboration, between the various areas of activity, overlaps with that of other bodies that deal with the same activities in institutional terms. Think, for example, of the competences needed to produce and make accessible – to researchers, planners and teachers – the vast documentation on the functioning of the economic, social and institutional system, on the functioning of the companies and their multiple relationships with the markets.

The critical elements of such an organizational structure regard both the selection and the coordination of collaborators, who must be able to operate with a high degree of autonomy, in an environment not structured hierarchically, in continuous evolution, and extremely intense in terms of mental application. The personal involvement is relatively high compared to the pay offered. In exchange, opportunities for professional growth may be generated and the possibilities to develop skills in high demand in the international labor market as well.

Museum planning: meeting technical content and communication strategies

Museum planning must deal, on one hand, with highly technical contents concerning a wide disciplinary field such as that of the technologies of the light engineering industry; on the other hand, it must also consider the issue of communication. This task requires a range of specialized competences on the workings of machine tools as well as on the planning, implementation and management of museum spaces.

The *museolaboratorio* of Officina Emilia draws the visitors' attention directly on artifacts and processes. Even though this material aspect is, and must remain, in the foreground, some multimedia devices may be usefully introduced for the benefit of the visitors. In fact, the key target users are young people who come into daily contact with videogames, online social networks, etc., a world in which virtual reality, communication and interactive systems promote immediacy of communication, image sharing and the use of sophisticated multimedia technologies.

Much remains to be done to implement in the Officina Emilia venue a more effective planning of activities for individual visitors (children or adults) or for class groups in order to offer information and experiences both of material and non material nature, through the use of specific multi-media technologies and dramatization, together with hands-on activities in relation to the exhibits[27].

Innovation in the education and vocational system

Institutional levels and relevant actors

Three key issues must be considered in the analysis of innovation processes in education systems, taking place at different institutional levels and with the involvement of different actors.

The first concerns the behaviour of national institutions. In the last twenty years, needed changes have been hampered by various hurdles and

[27] Appropriate competences and financial resources are still needed, in order to design and implement multimedia tools that might benefit from international collaboration projects. In general, the eco-museums, which develop territorial awareness, are interested in sharing innovative approaches to communication.

drawbacks. Tasks such as redesigning the objectives of primary and compulsory education, as well as the general content of curricula and the rules for the validation of high school diplomas and of vocational schools qualifications, can only be centralized at the national level. Such processes appear to be under way. Instead, the setup of an effective evaluation system is far from being achieved. Such a process would require changes in the procedures for the recruitment and career progression of teachers and directors. Even national collective bargaining processes involving the unions have been unable to produce shared definitions of standards for work performance.

The second issue concerns the actions of administrators, politicians and other stakeholders at the regional and local level. In the last twenty years, if not longer, it has become apparent that these actors find it difficult to collectively support innovations in education that are adequate to societal needs. They often even find it difficult to agree on what are the shared changes that need to take place. However, certain innovations in the education system can only be promoted, supported and budgeted at regional and local level. For example, the design of curricula aimed at promoting understanding of the local socioeconomic and cultural system, as well as the development of technical and social skills; the development of teaching methodologies that build upon collaborations with local authorities, academics, companies, and other organizations. Improvements in this situation could take place thanks to greater cohesion among stakeholders, maybe fostered thanks to the involvement of local universities.

Finally, the third key issue concerns the schools' ability to support and promote innovation. Granting schools greater autonomy has not been enough. Schools themselves seem unable to grasp local needs and find it difficult to develop appropriate responses. So far, there is no clear sign that greater autonomy has brought the hoped-for virtuous circle of change and innovation[28]. This may depend upon lack of resources, upon lack of local structures able to support these processes, upon the uncertainty surrounding the many attempts at national reforms, upon lack of reform in staff recruitment and wage progression processes. The situation is more akin to a vicious circle, than to a virtuous one.

What are the most urgent innovations?

What are the innovations that could meet the need for re-generation of the sophisticated competences that are necessary in central Emilia? Complete and convincing answers are lacking.

[28] Autonomy has been used by schools to design music curricula, to introduce some new disciplines in the tourism specialization, to organize on the job training for a couple of weeks during the last high school year. These initiative, fragmented and often low profile, are not enough to support qualitative and quantitative changes in the schools.

A schools-based program to integrate social skills and values into core curricula could not be sufficient. A larger teaching/ learning program based on multidisciplinary approach to the understanding of concrete problems at environmental, social, economic and political level could be considered. Gaining practical and theoretical knowledge of the technologies used in production processes and in widely used goods, could become part of any educational process. All this, however, needs to be assessed in the medium term, in order to measure the extent to which such changes produce an increase in applicable knowledge, and in young people's sense of belonging and cultural awareness.

What kinds of interactions are most useful for schools could be assessed through an experimental programme. Good practices in fostering interactions between high schools and firms (through visits, work placements and internships) need to be evaluated. The practice of alternation between school and work could be more widely applied, providing the needed support structure. In order to accomplish all this – with a view to construct a "local curriculum" that can be recognized and validated – the competences of individual schools and of the regional and of the local educational infrastructure (including the local representatives of the Ministry for Education) are not sufficient.

The relationship between education, innovation and local development

The policies promoted by the European Union envisage a close connection between increasing quality of education, increasing participation to secondary and tertiary education and promoting international development and competitiveness.

The OE initiative proposes to carry out a critical investigation into the relationship between formal learning taking place in the education system and people's ability to participate in work environment characterized by ongoing product and process innovation, Key aspects concern the development of both technical and social skills, and people's ability to understand local needs and to collectively build high quality solutions.

The problem is not just to identify appropriate indicators to measure complex processes, but also to investigate the relationship between better quality education and more effective and efficient innovation processes.

Another issue concerns the analysis of which kinds of changes can be implemented in local contexts that are less cohesive and less dynamic than Emilia. How can a "local curriculum" be devised in order to sustain innovation and development in areas that are not pushed to continuous innovation by the pressure of global competition? We can suppose that social and economic stakeholders in those territories have less resources and less interest in promoting collaborations with the local education system.

6. Summing up

The theme of “the regeneration of skills” is proposed by the OE initiative as an issue concerning the interweave among education, innovation and local development. The aim is to valorize the local industrial culture in order to strengthen technical and scientific culture in general for the benefit of the younger generation, in the belief that culture, science, technical skills and innovation are social processes around which a range of actors interact on many different levels. In this valorization process, involvement of individuals takes place through practices of active learning. An integrating background contributes to gaining active knowledge of the local context that may foster the building up of a sense of identity and belonging. This paves the way for a more profitable training in secondary and tertiary education, and in the subsequent working experience.

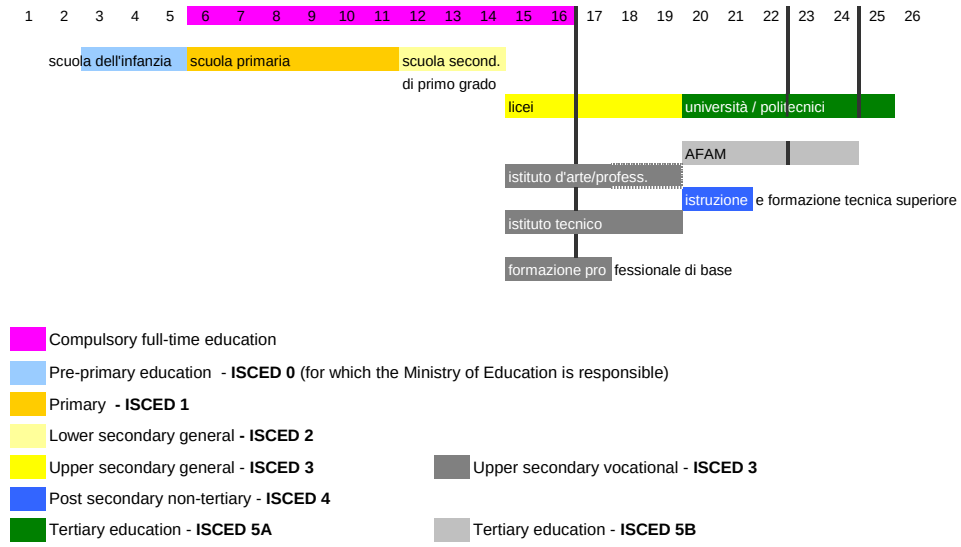
The support from schools and companies bears witness to the fact that the OE initiative offers a concrete response to a need for change in the field of education and in reducing the gap between schools and other local stakeholders. But changing the education system, even though necessary, would appear to be impossible, without a systemic action and institutional backing.

Officina Emilia does not question the fact that this path should be at last undertaken, but we observe that the systemic change of the education system has got bogged down in delays, obstacles and postponements for many decades now. Officina Emilia’s approach calls for immediate action proposing local action with at least a mid-term strategy that may allow for the implementation of effective teaching practices as well as the broadening and consolidation of best practices that support both the demand for a better quality of education, as well as the ability to offer it.

Appendix A The education system in Italy, 2008

To summarize the structure of the Italian education system we refer to the International Standard Classification of Education (ISCED) set by UNESCO (see **Figure 1**). At present, the Italian education system consists of: non-compulsory pre-elementary schooling (kindergarten) [*scuola dell'infanzia*, ISCED 0] for children between three and six years of age; the first cycle of education consisting of: elementary education [*scuola primaria*, ISCED 1], for children between six and 11 years of age; junior high school [*scuola secondaria di primo grado*, ISCED 2] for children between 11 and 14 years of age. The second cycle of education [ISCED 4] consists of: senior high school, meaning the "lyceum" (generalist courses), or technical/vocational courses of study for students from 15 to 19 years of age. Students can also attend initial vocational training courses which fall under the responsibility of the regional authorities. All the other schools fall under the responsibility of the National Ministry of Education.

Figure 1- Structure of the Italian Education System in 2008 according the ISCED classification



ISCED is the International Standard Classification of Education of the UNESCO

Source: Eurydice. http://eacea.ec.europa.eu/ressources/eurydice/eurybase/pdf/section/IT_EN_C2_4.pdf. Focus on the pre-university educational system.

Since 2008; education is compulsory for 10 years (from six to 16 years of age).

Access to tertiary education is reserved for students who pass the national final exam (under the responsibility of the National Ministry of Education) at the end of senior high school. Tertiary education consists of:

universities, polytechnics, higher vocational education, higher education in music and other performing arts (*Alta Formazione Artistica e Musicale*, AFAM, recently introduced to the tertiary level of education, at the ISCED 5B).

In Italy in 2008, the students of the schools under the responsibility of the State numbered over 7.7 million (see **Table 1**), about 13% of the 60 million of the total population. There are around 1 million students attending private schools. Every year the school population changes with around 1 million students leaving and 1 million entering for the first time.

Table 1 - The pre university system in Italy in the school year 2008-2009. Schools, students and teachers of the state schools*

	Pre primary school	**Primary school**	**Lower secondary school**	**Upper secondary school**	**Total**
Schools	13,624	16,031	7,146	5,193	**41,994**
Students	978,302	2,571,627	1,651,680	2,566,462	**7,768,071**
of which disabled	*12,882*	*64,576*	*54,269*	*44,051*	***175,778***
Classes	42,419	137,095	77,645	117,787	**374,946**
Teacher with a tenure position	81,641	240,492	156,809	225,949	**704,891**

* Without the Catholic religion teachers and those teachers currently non in service

Source: Ministry of Education..

There are around 42,000 school buildings. The number of schools and the number of classes reflect a highly articulated situation, made up of only a handful of large metropolitan areas and a great number of small communities distributed all through out the national territory. Transportation in many mountain areas of the country require long commuting times, and the inhabitants in the smaller villages risk suffering isolation. A great number of classes is necessary also because all young disabled students are enrolled in normal classes, which as a rule of thumb, should not be, in this case, of more than 20 students, in order to favor the integration of those with difficulties.

The staff on the payroll of the National Ministry of Education number 1.1 million (school headmasters, teachers, service and administrative staff) (see **Table 2**). Only 16% of teachers do not have a tenure position. The average age is over 45 years and the majority of the younger teachers have a non-tenure position. On average there is one teacher every 9.2 students. This is largely due to the length of the elementary school class time (40 hours a

week in one third of the classes) and to the population of young students with disabilities (176,000 in 2008), included in ordinary classes and supported by auxiliary teaching staff (almost 90,000 teachers).

Table 2 - State schools personnel in the school year 2008-2009 per function, type of charge and type of contract

	Teachers				**Administration, services and other functions**	**Headmasters**	**Personnel not in service**	**Total personnel**
	Ordinary teachers	Teachers for the Disabled	Catholic Religion Teachers	**Total teachers**				
With tenure	654.293	50.598	14.123	719.014	169.437	10.630	5.091	904.172
With temporary contracts	136.617	39.428	11.808	187.853	5.159			193.012
Total	790.910	90.026	25.931	**906.867**	**174.596**	**10.630**	5.091	**1.097.184**
Of which part-timers				*66.722*	*9.877*			*76.599*
Retired since Sept/01/08				*20.039*	*6.434*	*674*		*27.147*

Source: Ministry of Education (2008).

The staff employed by the Ministry of Education makes up the vast majority of the public employees in pre-university schooling. Local authorities employ only a few assistants for disabled students and language mediators for foreigners.

Every year at least 3% of all staff reach pension age. Part time work is relatively uncommon among staff (7%), and, while most teachers (68%) have a tenure contract with a clause making part time possible, very few take up this option.

There are three main issues relative to the functioning of the pre-university education system in Italy. First of all, in Italy only 88% of 19-year-olds obtain a high school diploma (ISCED 3) compared to a 19-state European average of 90% (Indicator A2, OECD, 2008). Secondly, the results of learning tests among 15-year-olds in school remain at an insufficient level (OECD-PISA, 2006). Lastly, there are wide territorial gaps showing the South and islands as somewhat behind the North and Center of the country.

We shall later examine this issue of territorial differences in greater detail.

Table 3- Percentage of 15-year-old population not in school and percentage of population of the same age on vocational training courses held by the Regions

Regions	**Population at school/ total population (a)**	**Population on vocational training courses/ total population (b)**	**Difference (a-b)**	
Piedmont	8.8	9.7	- 0.9	
Aosta Valley	5.7	4.5	1.2	**North West**
Liguria	6.9	4.2	2.8	
Lombardy	12.0	10.1	2.0	
Trentino Alto-Adige	25.6	24.7	0.9	
Veneto	10.6	8.5	2.1	**North East**
Friuli-Venezia Giulia	6.8	6.8	0.0	
Emilia-Romagna	2.3	4.3	- 2.0	
Tuscany	1.8	1.9	- 0.2	
Umbria	1.6	2.3	- 0.7	
Marche*	- 1.0	1.9	- 2.9	**Centre**
Lazio	2.0	4.6	- 2.6	
Abruzzo	5.0	4.1	0.9	
Molise	0.4	n.a.	n.a.	
Campania	8.0	n.a.	n.a.	
Apulia	7.1	n.a.	n.a.	**South**
Basilicata*	- 1.4	n.a.	n.a.	
Calabria	6.1	n.a.	n.a.	
Sicily	7.1	n.a.	n.a.	**Isles**
Sardinia	2.8	n.a.	n.a.	
ITALY	*7.0*	*4.4*	*2.6*	

* data not correct

Source: Paper by D. Checchi presented at the ADI Convention – Genoa, June 20-21, 2008; based on information from the Ministry of Education, ISTAT and ISFOL, referring to 2006.

Table 3 shows the data on the share of the population of 15-year-olds who are not part of the state schooling system (column a), the share of the population in the system of regional professional training schemes (column b) and the difference between the two. The difference shows how many of the resident 15-year-old population are not involved in educational or training activities. As may be noted, there are no data on professional

training in the regions of the South and islands, where these activities are either absent or wholly inadequate from a functional point of view. It may therefore be concluded that in these regions, the population not attending school is largely excluded from any form of training activity.

These data show at even at the age of 15, 2.6% of the population is no longer involved in education or training activities, but this percentage is considerably higher in the regions of the South and the islands, where the percentage reaches 7% in Sicily and 8% in Campania.

Table 3 also shows that in the regions of the North, the population of 15-year-olds is split up unevenly between state schools and regional professional training. In the regions of Trentino Alto-Adige, Lombardy and Veneto, a significant proportion of young people attend regional professional training courses, while in other regions this percentage is far lower. This situation is also a consequence of the different education policies promoted by regional authorities.

Table 4 shows a "productivity" indicator of senior high school. In column (a) we may see the difference over the years between the number of students enrolled in the last (fifth) year of senior high school and the number of students who had started out five years earlier. As may be noted, without significant changes over time, at least one student out of three does not reach the high-school diploma level at the end of the five years of senior high. There are many causes behind these failure rates. First of all, according to the Italian school system, students have the chance to repeat school years that they have failed to complete adequately, and this leads to their reaching diploma level behind schedule. Secondly, a high share of young people drop out of school before completing senior high school. The vast majority of these dropouts (or early school-leavers) have learning difficulties and belong to low-income or disadvantaged families, or ones that have recently immigrated.

Lastly, we present a synthesis of territorial differences with reference to the OECD-PISA learning tests. The results of international learning tests highlight significant territorial differences between the Italian macro-regions, particularly in the field of Math, Science and Technology skills. **Table 5** breaks up the differences between the macro-regions (North, Center and South), comparing the weight of individual and family factors, of school resources, of the use of school resources available in the local context. Almost 10% of the differences between the performances of the students of the North, compared to those of the Center and South, may be explained by differences in the quantity of teaching supplies and technical and scientific equipment available at a school level. As much as 74% of the performance differences between North and Center (only 25% of the difference between North and South) may be attributed to a different use of resources at the school level. Lastly, up to 61% of the performance differences between North and South is due to differences of resources in terms of the territory

surrounding the school. The fact that schools are widely influenced by the wealth or relative poverty of the context in which they are based appears to be self evident.

Table 4 - Difference between the number of students attending the last year of senior high school and the number of students that had enrolled in the senior high school five years earlier

Year	**Difference**	**Difference/ number of students attending five years earlier**
	(a)	(b)
2000	216,805	37%
2001	206,020	35%
2002	188,628	33%
2003	168,470	30%
2004	183,512	31%
2005	191,207	33%
2006	196,285	33%
2007	203,713	33%
2008	203,161	33%
2009	189,245	31%

Source: Elaboration on data supplied by the Ministry of Education (2007)

Table 5 - Analysis of the differences between the results of the Maths test sat by 15-year-old students, by macro-region. Calculated on the OECD-PISA data, 2003.

	Availability of resources on an individual/ family level	**Availability of resources at school level**	**Efficient use of resources at school level**	**Availability of resources at provincial level**	**Overall difference**
North/Center difference	1.6%	10.9%	74.1%	13.4%	100.0%
North/South difference	4.0%	9.8%	25.1%	61.1%	100.0%

Source: Elaboration of data found in Bratti, Checchi & Filippin (2007)

Appendix B The workshop-museum of Officina Emilia in Modena

displays:

- industrial machinery in working order, instruments, tools, the products of a great number of light engineering firms, and original audio-visual installations and documents;

and offers:

- 11 hands-on workshops on science, technology and society for school parties;
- eligible workshops on micro robotics, economics and studies on complexity;
- guided tours of the workshop-museum and the light engineering firms partners of Officina Emilia;
- internships for college students;
- activities for orientation after junior high school and for work after senior high schools both for students and their families;
- teaching activities for classes of immigrant adults;
- education initiatives for adults as part of lifelong learning projects;
- documentation and in-service training for teachers;
- guided tours open to the public.

Its aims are:

- to provide young people with multi-disciplinary activities designed to widen their knowledge of the technological, economic, social, historical and cultural context;
- to involve adults in the active knowledge of the local context, of the issues linked to the regeneration of the technical, organizational and communicative skills needed to support the competitive edge of local companies;
- to promote lasting innovations in schools of every type and level, and to build a local curriculum based on workshop methodologies and a multi-disciplinary approach for the study of the issues linked with local technical, economic social and cultural development;
- to reduce the gender gap among the students choosing science and technology courses;
- to support cohesion and encourage social mobility;
- to foster the regeneration of the skills required by industries in general and in particular by the light engineering industry.

Its interlocutors are:

- researchers in a range of different disciplinary fields;
- school headmasters and school teachers of every type and level;
- staff and managers of training agencies;
- administrative staff and politicians involved in local institutions;
- administrative staff of business associations and workers' representatives;
- the business community, technicians and shop floor workers of industrial firms and industrial service companies;
- experts in historical, scientific, technical and economic divulgation;
- artists;

- theater groups for dramatization activities;
- eco-museums, science and technical museums, labor and industry museums.

Scientific Committee
Anna Maria Ajello of La Sapienza University (educational psychology); from the University of Modena & Reggio Emilia: Angelo O. Andrisano of the Faculty of Engineering (mechanical engineering), Sonia Bergamaschi of the Faculty of Engineering (databases and information and communication technologies), David A. Lane of the Faculty of Communication and Economic Sciences (complex systems), Tommaso Fabbri (organization theory), Alberto Rinaldi (history of economics and history of labor) and Margherita Russo (economics of innovation and local development) of the 'Marco Biagi' Faculty of Economics.

With the Support of
- Università di Modena e Reggio Emilia, Fondazione Cassa di Risparmio di Modena, Camera di Commercio and Comune di Modena

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