

# Learning And Education After the Industrial Age

A discussion paper for the Confederation of Finnish Industries EK project:

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January 2011

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# Learning And Education After the Industrial Age

## **Introduction and Summary**

Each historical era creates a system of education that addresses its needs. In the 19th century, the educational revolution was driven by a radical shift from family-centric production to manufacturing and industrial organization, and the associated rapid urbanization and social mobility in industrializing countries. In this process, the home, the workplace, community life, and the church lost many of their earlier functions in the educational system. The school became a central institution in education, to the extent that we now often think that education equals schooling.

At present, the knowledge society transformation is again changing the system of education. To understand these changes and their implications, we have to understand the fundamental needs that education addresses in society.

In this paper we argue that the key functions of education are stable from a sociological point of view. Education addresses fundamental needs of social life that exist across time. As times change, however, the content of education and the division of educational labor between home, community, workplace and institutional elements of the educational system change.

The Industrial Age was characterized by an exceptionally prominent role that formal schooling played in education. As the industrial modes of production, organization, and value creation decline in importance, formal education will play a less important role in the future. Education, itself, becomes a future-oriented activity that prepares the educated for an unpredictable world.

To understand the ongoing change, we have to understand the historical specificity of the current educational system and its social function. Present educational institutions address important social challenges generated in the transformation from the pre-Industrial to the Industrial Age. The content, the processes and the forms of formal education are optimized for a historical era that is now disappearing.

Since the early 19<sup>th</sup> century the transformation from the pre-Industrial Age to the Industrial Age created a radically new articulation of the educational system. The current transformation will also create a new articulation of this system. The transformation towards the Knowledge Society is, however, even more revolutionary, as it changes the fundamental processes of communication, cognition, memory, and identity construction that provide the foundation for social life and knowledge creation. At present, we are not only changing the tasks of and division of labor between the different components of the educational system. We are also changing learning itself.

In this paper we discuss history with the aim of understanding the future. Instead of focusing on the institutions of higher education, research and innovation, we focus on the foundations of the system. We conclude that the emerging Knowledge Society appears to need less schooling. The industrial era alignment of interests between existing educational institutions and economic, social and political needs may be, in many instances, turning into a conflict. New modes of value production will transform both the industrial system of production and the societal requirements for education. If these new modes will become as predominant as the industrial modes have been

in the past, then the societal requirements for education will also change. Current educational institutions may or may not adapt, but in our vision of the Knowledge Society, the position of today's conventional providers is peripheral. In these circumstances, the focal point of educational policy moves to the Knowledge Society infrastructure. Industrial Age institutions, such as MIT, will not lead educational transformation; they will play a peripheral role. The traditional dominant stakeholders, including educational experts, slow down educational reform, instead of enabling it. In the Knowledge Society educational policies are based on redefined aims, objectives, and institutions of education.

### **The Functions of Education**

Educational systems exist because they fulfill two important social functions. One of these is the integrating and socializing function. A newborn child lacks almost all of those capabilities needed to survive and participate in the world. A child needs education and upbringing to mature into a competent adult. Social life requires that the members of society speak the same language, obey the same explicit and implicit rules and routines, and share the same beliefs. The social world needs to be stable and predictable for us to operate in it, and it stays stable only if we continuously make it so.

Cultural transfer through education is an important means to generate the stability required by the continuation of social life. Cultural transmission, however, is not only a means. As John Dewey noted hundred years ago, it to an important extent defines what a society is about.

“Society not only continues to exist *by* transmission, *by* communication, but it may fairly be said to exist *in* transmission, *in* communication. There is more than a verbal tie between the words common, community, and communication. Men live in a community in virtue of the things which they have in common; and communication is the way in which they come to possess things in common. What they must have in common in order to form a community or society are aims, beliefs, aspirations, knowledge – a common understanding – like-mindedness as the sociologists say. Such things cannot be passed physically from one to another, like bricks.”<sup>1</sup>

Thus, societies need a system of education to exist. School, obviously, is only one element in this cultural transfer – and a rather superficial one, as Dewey noted. Much of this cultural transfer occurs elsewhere.

The other key function of education is diametrically opposite to its integrating function: Societies can continue to exist only because they adapt and change. For this they need variety, incremental innovation, and revolution. Complete integration of aims, beliefs, aspirations, and knowledge would be fatal. Education is therefore also needed to generate and facilitate social change and innovation. Although the members of a society cannot but use the same language, new words and interpretations emerge constantly. Rules are twisted, broken and reinvented, beliefs are contested, and new knowledge is created. The educated members of the society use their capabilities for their own purposes, and the resulting problem solving and innovation generates new openings for social progress and change. Diversity makes societies dynamic and allows them to survive when the world changes.

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1 Dewey, J. (1916) *Democracy and Education: An Introduction to the Philosophy of Education*. New York: Macmillan, p. 5.

At a societal level, education therefore plays an important balancing role between stability and change. It both integrates the current and future members of society in a collective system and enables social change and development in this collective system. This inner contradiction generates a tension that produces different forms of educational system in each historical era and in each social context. Sometimes conformism is emphasized, as in many Confucian cultures. Sometimes education is perceived as a source of innovation, empowerment, and revolution, as in critical pedagogy. Sometimes educationalists simply define their identities and missions by resisting one or the other of the basic functions of education, as in some anti-school movements that view formal education as a totalitarian social control of thought and individual freedom.

Modern societies have a complex system of division of labor that creates heterogeneous and diverse communities of knowing and practice. The integrating function of education plays an important role also at this social “meso-level;” at the level of professions and specialized communities of practice. The increasing specialization of division of labor pushes the society apart and, in turn, generates a need to find new levels of homogenization and conformism to pull the pieces back together again. Efficient division of labor thus generates diversity and, at the same time, a need for stronger integration and homogenization. When the division of labor extends across regions and cultures, interdisciplinary and intercultural integration become important aims for education.

The modern system of education has, of course, complicated structures and processes that embed more than the basic social functions of education. When education becomes institutionalized, the institutions start to acquire their own lives and purposes. Teaching and teacher training become professions, universities gain budget lines and become participants in business ecosystems, and the state sets up bureaucracies and legal structures that maintain and manage the sub-systems of education.

The emergence of the institutions of formal education has also created a context where specific types of educational processes and sub-functions have gained prominence. Today schooling is used in various ways for social selection, industrial policy, and reproduction of social, economic and political structures. In some countries, including France and Japan, educational institutions have acquired a key role in reproducing social elites. As Paul Willis described in *Learning to Labour*, explicit and implicit educational curricula can also effectively reproduce social classes. In Willis' study, the incentives for schooling were visible and relevant mainly for kids who did not come from working class families. As a result, working class kids learned to hate school, and happily repeated the life patterns of their relatively uneducated families.

Two key factors, therefore, shape the evolution of educational systems. First, although the key social functions of education remain the same over time, the concrete implementation of educational processes generates institutions that start to live their own lives and which are creatively “misused” for novel purposes by their stakeholders. The viability of educational institutions, therefore, does not only depend on their effectiveness for education. The primary motive and driver for the emergence of the institution can well disappear and be replaced by other motives that keep the institution alive. Schools, for example, can gain new functions as locations for employment, neighborhood congregation, child care, self-expression, social innovation, or production.

Second, at each historical period of time, the concrete implementation of educational change depends on pressing social needs, and tools and concepts available for the implementers. The social actors develop education based on the currently perceived challenges and problems.

### **Education in the Industrial Age**

The expansion of factory-based production meant a major shift in educational opportunities. In the pre-industrial society, family was a focal point in education, and children were able to perceive and participate in almost all productive activities. In the old system, everyone knew why and how the system of production worked, and what each of the participants was doing. As Dewey noted, this shift led to a radical change in education:

“Instead of pressing a button and flooding the house with electric light, the whole process of getting illumination was followed in its toilsome length, from the killing of the animal and the trying of fat, to the making of wicks and dipping of candles. The supply of flour, of lumber, of foods, of building materials, of household furniture, even of metal ware, of nails, hinges, hammers, etc., was in the immediate neighborhood, in shops which were constantly open to inspection and often centers of neighborhood congregation. The entire industrial process stood revealed, from the production on the farm of raw materials, till the finished article was actually put to use.”<sup>2</sup>

In contrast to this open system of production, the industrial system created a complicated division of labor, where the household lost its capability to provide vocational education and where specialized locations of learning had to be set up. The rapidly accelerating urbanization and migration, driven by the increasing role of factories as centers of work and earning, also generated unprecedented social diversity. Widely varying social groups mixed in the cities into a shared socio-economic system. The transfer of useful learning from earlier generations to younger ones was increasingly difficult, and became a national problem.

At this time, the educational system, as we know it today, started to align with the pressing needs of the industrial organization. As competition increased in the 19<sup>th</sup> century, the requirement for improved efficiency led to increasing specialization. A side effect of this development was that there was less time and narrower opportunities for learning at the workplace. Education and production became increasingly separated on the factory floor, and vocational education was outsourced to schools.

In this new world, the industrial mode of production generated important new requirements for education. First, the effective combination of human workers with machinery requires clocks, punctuality and tight coordination. Second, the splicing of productive activities into specialized tasks requires hierarchical control and obedience. Third, factory workers have to accept the fact that the motives and meaning of productive tasks are increasingly unknown. Fourth – specifically after the introduction of scientific management methods in industry – the workers had to be able to read and write documents that defined work processes and standards. Fifth, the rather miserable living conditions of the early factory workers, both adults and children, pushed some factory owners to set up schools to improve living conditions and survival rates of their workers and productivity in their factories.

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2 Dewey, J. (1900) *The School and Society*. Chicago: The University of Chicago Press, p.23.

These changes most directly influenced education that was oriented towards the productive layer of the society. Indirectly, however, the newly acquired capabilities and attitudes also influenced the broader society, as well as education that was oriented towards personal growth and development. As a side-effect, the industrial model of production became the foundation for large-scale administration and governance and enabled wider participation of citizens in public life and political processes, facilitating the expansion of the information society and democracy.

By the early 20<sup>th</sup> century, the link between productive work and personal development became increasingly loose. Factory work was organized in a way where work tasks typically lacked intrinsic meaning and motive. Work also consumed much of the time that otherwise could have been used for personal growth. Formal education was thus also needed to compensate this decline in opportunities for personal development at work. The idea of personal development was also adapted to the current setting. As William Whyte described in 1956 in *The Organization Man*, one expression of this was the emergence of corporate-centric identities and a new concept of human development, where climbing an organizational hierarchy was understood as progress.

As its name indicates, the Industrial Age was to an important extent driven by a revolution in the systems of production. Yet, it also enabled the spreading of democracy in many nations around the world. In democratic societies, the citizens needed more and more knowledge that related to distant locations, abstract institutions, and conceptual systems. The production process, itself, used more scientific knowledge and systems of theoretical concepts. Education responded by supplying increasing amounts of explicit and formalized knowledge. At the same time personal development became increasingly linked with work. In this historical period, when people were asked who are you, they could answer by describing their job or profession.

In this increasingly specialized, interdependent and diversified world, schooling became compulsory. Literacy and counting were required for full participation in the political and economic systems, either as a simple subordinate and consumer, or as an empowered citizen and economic agent. In both cases, schooling provided an increasingly important foundation for society. Schooling, in turn, was increasingly organized around specialized locations and institutions, as households, communities, workplaces and the church lost their capability to educate. The Industrial Age, thus, became the Age of Schools.

### **The Knowledge Society**

The system of education in the Industrial Age focused mainly on the integrative aspects of education. It facilitated integration at the national level, and it integrated people within their vocational and professional groups. In this period of time, wealth generation was dominated by the expansion of production, and production focused on areas where needs were similar for large segments of population. Vocational groups were statistically significant and relatively stable, and formal education was often seen as an input in a system of production.

Towards the second half of the 20<sup>th</sup> century, the educational system was already quite well aligned with the requirements of the Industrial Age. This led to a relatively stable state, where advancement equaled parallel expansion in production and education.

Now this stable state is disappearing. We are heading towards a similar disruption that generated the present system of education at the emergence of the Industrial Age.

### ***Transformation of the Industrial Model***

In the Knowledge Society, the traditional models of production and industrial organization do not disappear. In those industries where competitiveness can be based on natural monopolies or privileged access to natural resources, the old model of production will have little need to change. In most industries, the model, however, is rapidly changing. Production now occurs in global networks and ecosystems where innovation is a key driver for both cost advantages and the expansion of market.

The transformation of the industrial model is at present driven by three major factors. First, production is now much more modular than it was half a century ago. This modularity facilitates rapid recombination of product and service components, but it also requires efficient management of global production networks. Information and communication systems obviously have a key enabling role here.

Second, information systems enable a qualitatively new form of globalization where production occurs in global networks that are configured at the point of consumption. For example, when a consumer today purchases a product through the Internet, a complex system of production activities are spawned across the world. The network includes suppliers and subcontractors, service integrators, financial establishments, and other actors that contribute to the final provision of the ordered good or service. This dynamic creation of transient production systems is a radically new mode of globalization that could be called “the third globalization.” John Zysman has argued that such a dynamic ICT-based production model can be defined as “the algorithmic revolution.”

One implication of this model is that work that can be programmed and represented in algorithmic procedures will be automated. In dynamic and transient production networks, there is no natural place or time for human interaction. Thus there will be no need to worry about the alienation of workers who are mechanical parts of a production machinery. In those tasks where people can become working automata, they will be replaced by algorithms. This algorithmic revolution will thus move industrial automation from the factory floor to white-collar offices. As a result, rule-based work in offices and bureaucracies rapidly disappears.

Technically, the algorithmic revolution relies on “service-oriented” business and information system architectures. These architectures, however, also enable rapid reconfiguration of the underlying capabilities at the system level. At present, much of the growth in the Internet is based on such recombination, “mashups,” and re-use of available capabilities for new purposes. In principle, there is a possibility that even though actual production would be increasingly based on real-time transient global networks, human workers will do most of the recombination and reconfiguration. In such a world, workers need capacity for combinatorial innovation and creativity.

Third, whereas the scaling of production was often enough to maintain profitability in the Industrial Age, now both cost advantages and growth is almost always based on continuous innovation. In such a world there are no sustainable competitive advantages. Time and novelty are the sources of profit, and such profits are temporary, at best. This development characterizes the

innovation-based economy. At this stage, workers need to become innovators. The balance shifts from the integrating function of education towards the diversifying function.

Comparing these generic emerging requirements of industrial production with the historical requirements that shaped the current educational system, it becomes clear that the educational system needs to change. For example, we may ask whether schools actually can deliver the types of education that are needed in the future. We may also ask whether the increasing efficiency requirements mean that learning in the workplace is becoming as impossible for white-collar workers as it was in many 19<sup>th</sup> century factories for blue-collar workers. Is it better to put children back to work, replace or complement schools with learning communities, organize cultural integration through Internet participation, or set up a compulsory system of blogging for everyone over 65? Does the transformation of industrial production imply that formal education increasingly needs to focus on personal development and capability expansion, fine arts, "leisure," and things that constitute the "efflorescence of civilization" that so many 19<sup>th</sup> century educationalists considered a waste of time?

### ***The Emerging Value Production Model***

The transformation towards the Knowledge Society does not only mean the transformation of historical models of production. More importantly, it also introduces a radically new model of value creation. Indeed, this is the very reason why it makes sense to talk about the Knowledge Society, as an era different from the past. Knowledge Society is not only a revision of the industrial society, with information and knowledge added and playing an increasingly important role in the economy and everyday life. It also generates fundamentally new modes of value production. The central organizing principle in this new model is not the factory and the expansion of production volume; instead it is value.

The emerging production model is difficult to see partly because our current indicators of growth and development have been tailored for monitoring and managing Industrial Age production. In practice, we become aware of new modes of production only when they start to have a clear impact in our current production systems. Economics, as we know it today, has a conceptual structure that renders much of the emerging value creation either invisible or anomalous. Value, as it was understood by most economists of the Industrial Age, will be understood in a new way in the future.

This emerging mode of value creation is, however, in many ways visible already today. It is characterized by the rapid blurring of the traditional boundary between producers and consumers, downstream innovation, peer production, and unique user-generated products and services. Value is also in this model created "on the spot," in the unique context that makes production valuable for its creators. This model obviously does not define current forms of industrial production; instead, it is an alternative model, with an increasingly clear impact also on traditional production.

In the industrial model value was essentially generated by extracting it from nature. In the new emerging model value is created by creating value. Another way of characterizing this transformation is that we are moving towards a meaning-based economy. This can be seen as the essence of the Knowledge Society.

In the new model, the fundamental source of value is the capability to see what is valuable and how it can be realized. At each specific instance, the capability to perceive and realize value is constrained by the current systems of meaning, including language, the social and physical environment, the available repertoire of internal and external motives, and imagination.

The realization of value requires that the producer is able to perceive latent possibilities of value. She needs to be able to see how the world could be different or how it could be understood differently, in a way that realizes its latent value. The realization also requires that the producer is able to move from the current state towards a state where the value is realized. Value creation, thus can also be understood as movement in this “zone of proximal development.” This movement, as educational theorists know, requires social support, tools and fundamental cognitive capabilities such as memory, imagination, and play. Often the movement towards value also requires collaboration, communication and mobilization of social resources.

Value is thus created by creating meaning. New meaning, in turn, is defined as the difference between what we already understood and what we learn that we didn't understand yet. This value creation process, therefore, could also be called learning. Knowledge Society, thus, could also be called Learning Intensive Society.

In advanced industrial economies, much of the material consumption has already become part of this new economy of meaning production. We buy clothes, cars, and food not so much as to survive in the world as to become the persons who we want to be. The importance of meaning, identity and experience is well-known also in the most traditional industries today. What is new, however, is that in the transition to the Knowledge Society, an independent system of value production becomes a key for individual and social development. This unlinking of material production and meaning production signals a major shift, and leads to a fundamental reorganization of education.

### **New Requirements for Education**

Both the transformation of the traditional production model and the emergence of the new value production model generate new requirements for education. It is, of course, impossible to predict the outcomes of the ongoing transformation. Some new requirements and drivers for change in education are, however, visible.

The vocational-economic aim of education will be less dominant in the future. Value creation will require both generic social capabilities and personal development capabilities. It is not obvious that schools will be able or required to support the development of such capabilities.

The household lost its dominant role in education in the early stages of industrialization partly because the transfer of vocational knowledge and skills from older generations and traditional practices became difficult. In innovation-based economy, schools will face similar challenges. Education will be increasingly outsourced to informal communities and peer-to-peer groups.

Although value in the new production model is increasingly generated on the spot and in a personal context, this context itself is a product of social and historical evolution. Value creation capabilities, thus, strongly depend on understanding history, culture, and the constraints and possibilities for change.

The dominant aims and objectives of educational reform are defined by the current institutional stakeholders. The emerging new modes of education, in contrast, are peripheral, anomalous and difficult to manage and administer in the context of the current system. The strong historical alignment of the educational interests of industry and educational institutions is lost in the Knowledge Society. Similarly, the historical coupling between schooling and socio-economic development disappears. As a result, in the Knowledge Society context, policymakers and economic actors increasingly perceive educational institutions as a constraint for change. Policymakers are confronted with the dilemma of dealing with the tension between the old and the new, the dominant and the emergent. Progressive policies may respond, for example, by focusing on informal learning that leads to socio-economic development.

Value generation capacity depends on the capability to differentiate between valuable and less valuable alternatives. Good differentiation capability requires good evaluation capabilities. Preferences need to be based on coherent value systems that are also aligned with social requirements. Ethical principles and concepts become important content in education.

The algorithmic revolution will lead to a decrease in traditional employment, white-collar employees following the route of blue-collar workers. Traditional employment will retain importance mainly in research, development, innovation and reflection tasks. Educational policies that aim at "full employment," "global competitiveness" and "economic growth" will be increasingly replaced by policies that focus on societal and individual well-being and development.

The emergence of the Knowledge Society brings entirely new fields of economic and social life to the forefront. Like with the shift from agricultural work to industrial jobs the attributes and organization of "success" also change. Although competition remains as a selection principle for investing time and attention, still sending signals about winners and losers, the low input cost - high economies of scale approach of the industrial era becomes peripheral.

One practical conclusion is that we need to rethink the roles of secondary and tertiary education. To address the requirements of the Knowledge Society, the formal institutions of secondary and tertiary education could to a large extent be replaced by systems that focus on the evaluation and coordination of learning. The future may well require considerably less schooling than the Industrial Age, not more.

### **The Personal Level: New Forms of Learning**

The systems of production and the models of value creation will change in the Knowledge Society, with associated changes in the organization and functions of education. The impact of the Knowledge Society, however, does not stop there. Although the focus above has been on education, as a system that maintains societies by simultaneously creating homogeneity and heterogeneity, the Knowledge Society will also change the social and cognitive processes of learning itself. Learning is a fundamental mode of human existence, and thus independent of particular historical contexts. The processes of learning, however, greatly depend both on the intent and technologies of communication and meaning creation.

Writing and the printing press changed learning, enabling externalization of explicit knowledge, rapid expansion of conceptual systems, and diffusion and transfer of cultures. The emerging

information and communication infrastructures have an equally profound impact on learning. Learning is a process that requires memory, perception, and sensemaking. It usually depends on social interaction, and almost always the results of learning can be realized only through communication.

An important consequence of this is that the global information and communication network will become a critical infrastructure for learning. We will outsource major parts of our memory to it. Our perception will greatly depend on it. We will use it to make sense of ourselves and the world. And, obviously, our communications will rely on it.

The most fundamental educational policies, therefore, will be about this infrastructure.