On strategies of educational innovation: Between substitution and transformation

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Abstract

The innovation of education seems to be self-evident. Boosted by a wide range of new technologies, educational institutes all over the world are innovating their educational systems, in order to extend their services, to improve their performances or to reduce costs. The apparent self-evidence of educational innovation hardly prompts the educational staff to reflect on the very idea of innovation and its consequences. This paper treats the basic principles that support the phenomenon of technology-induced educational innovation. It aims to contribute to a better insight and understanding of its implications to anyone engaged in education. It also aims to effect a growing awareness of the premises on technology and to support the right attitude to realise improvements in practice. The paper goes into strategies of change, while discussing both substitutional and transformational strategies. It explains its supposed differences by referring to the philosophical frameworks of Jaspers, Heidegger and Borgmann. Starting from Borgmann's "devices paradigm", four principles for educational innovations are formulated, referring to the transparency and interactivity of educational technologies, the socio-cultural significance of products, the importance of values beyond efficiency and the political bias involved with technological innovation.

Keywords
ict, innovation, innovation strategy, learning technologies, philosophy of technology, substitution, technology, transformation

Introduction

During the last decade, the emergence of information and communication technologies (ICTs) has prompted educational institutes to reflect on its impact on their educational systems. New technologies hold many promises to improve the quality and efficiency of educational services. Web-based learning technologies readily enhance the students' learning environment: these promise instant access to a vast amount of learning resources, customised learning programmes and instant support, while overcoming the restrictions of place and time. Schools and universities are deploying increasing numbers of computers to improve their educational systems, be it for administrative purposes, content development or content delivery. More and more, innovation departments are set up, innovation experts are recruited and at best innovation policies are outlined. Indeed, the topic of educational innovation has been put firmly on the agenda.

Yet, innovation of education is a diverse and complex field of action. It concerns a mix of new developments in pedagogy and technology, it implies changes at organisational level and human functioning and it touches on fundamental concepts like progress, change, control, functionality, anticipation, mediation, acceptation, etceteras. At an institutional level, innovation of education appears a toilsome process. It always involves various parties and many "educated" people, having their own opinions and

preferences. If there is agreement at all about the need to innovate, discord about the road to innovation easily arises.

This paper treats the basic principles that support the phenomenon of technology-induced educational innovation. Hence, it may be of relevance for anyone involved in education, who wishes to develop a better understanding of the key issues that make up innovation. The paper may contribute to a growing awareness of the premises on technology and it may support the right attitude to realise real improvements.
First, we analyse how today educational institutes are considering innovation. Second, we will analyse the idea of innovation from a historical perspective and explain its premises, our motives to innovate, its meaning and its implications for our worldview. Next, we will analyse the premises underlying two opposite strategies of change, the substitutional (or instrumental) view and the transformational view, and explain its meaning from the angle of technology's impact on human life. Finally, we will formulate possible implications and try to identify some critical factors for successful educational innovation.

Innovation in education

Intrinsic conservatism

For centuries, the use of new methods and technologies in education has never been an issue. Educational institutes have been known for their solid and respectable approach rather than their innovative power. The introduction of class room lectures, which goes back many centuries,meant a fundamental change of the system which was until then based on a one-to-one apprenticeship model of individual tuition. The class-teaching model realised a higher efficiency, while one tutor could teach many pupils at the same time. The model of "class teaching" became a "classic": it is as simple as it is effective and even though new pedagogical models like resource-based learning or problem-based learning and the use of modern technologies increasingly take root, the model of classroom teaching or rather its implicit pedagogical premise that teachers control the students' learning processes is still widespread. One might signal some intrinsic conservatism here, related with the fact that all staff members involved are products of the educational system itself and probably are pervaded with common patterns and role models (Westera, 1999). Conservatism may also arise from the very idea that education is all about consolidation and transfer of existing knowledge, skills and attitudes from one generation to the next generation. This not only applies to the learning content but also to the methods of delivery: proverbial is the primacy of written texts, especially in higher education, which hampered the use of "new" media. Finally, many an educational institute, while dealing with hundreds or even thousands of learners, represents an operational system exhibiting the intrinsic inertia associated with any large system: any departure from the rule is presumed to have a negative effect on the primary processes. Indeed, education has intrinsically conservative traits.

Changing demands

Increasingly, new technologies are boosting innovative initiatives. In a direct way, new technologies enable educators to procure improvement both in the content, the method and the organisation of education. The large-scale introduction of learning technologies would be an example here. Even more fundamental is technology's far-reaching impact on society as a whole. Only for the last decade(s) or so, signals appeared that the branch of education has to innovate its programmes in order to keep up with

rapidly changing demands of society. New information and communication technologies (ICTs) but amplify the impact of immaterial, knowledge-rich contributions in production, which gives rise to profound and continuously changing demands upon employees. These can no longer be considered ignorant labourers who carry out routine jobs. Today's employees are expected to be proactive, enterprising, responsible and self-reliant professionals. Moreover, they should be competent and flexible team players who are able to apply and share their expertise in service of shared goals and who adapt their expertise continually to new insights and developments (Barnett, 1994; Walton, 1985). In this respect, the term "life-long learning" should be mentioned, indicating the importance of continuous growth and change at a personal level: the learning doesn't stop at the phase of initial education.

Technology's role in educational innovation

Urged by these developments, educational institutes are getting firmly busy with introducing new technologies. The availability of advanced technological equipment has become an interesting marketing asset against less modern competitors. Institutes bid against each other, while none of these wants to be labelled "old-fashioned" or "set in their ways". However, various authors (Bates, 1995; Westera et al., 2000) point out that the widespread adoption of teaching technologies is easily mistaken for educational innovation. At the introduction of campus-wide virtual learning environments, which top-down approach suggests a transformational change model, the emphasis is on technology per se and only little attention is paid to its pedagogic and organisational consequences. For the greater part, educational institutes seem to adopt a substitutional, instrumental strategy, while preserving existing pedagogical patterns. Technology is thus considered a mere supplement to conventional teaching. According to Bates (1995), teaching as such is not professionalised. It has hardly been influenced by research into instructional design, psychology of learning or other topics concerning human functioning. Teaching remains largely craft-based, while favouring the model of apprenticeship learning. Indeed, many teachers seem to run a one-man business, while they prepare the lessons, write the lecture notes, carry out the lectures, coach the students, design the exercises, provide feedback, examine the students and eventually even evaluate their own performance. Such a craft-based model hardly allows for any division of labour to increase the efficiency. Instead, the innovation effort is additional to regular work and readily leads to increased unit costs.

Apparently, educational institutes feel an urgent need to innovate their educational systems, but their strategies of change are inadequate and merely seem to produce adverse effects. At worst, such schools and universities are destined to "pine away" on the market of educational service providers, because of poor performance, bad quality education and disproportionately high costs. This raises the question what the objectives of innovation should be and what requirements strategies of change should meet to be successful. Before elaborating on these questions, the next paragraph goes into the question why we pursue innovations at all. It tries to look beyond straightforward, opportunist and superficial reasons for innovation and analyses in depth the intrinsic motives and premises that drive us to innovation.

The innovation drive

Innovation and the human being

To pursue innovations may appear straightforward, but it isn't. The metaphor of human development, from childhood to maturity, strongly supports the suggestion that growth and progress are logical and natural phenomena. Especially when considering education, knowledge, science and other domains reflecting the mental capabilities of man, the continuous progress and innovations can hardly be overlooked. Humans are essentially creative beings that permanently come out with new ideas and thus add something that didn't existed before. It is the ideas that are the basis for new solutions, new patterns and new products that change our way of living. In essence, civilisation is ideas and no more than ideas (Mises, 1957). Civilisations are determined by ideas rather than biological or physiological aspects of human life: civilisations differ precisely in the ideas that compose them and that make them develop at different ways. Richness of ideas is a unique human feature that strongly corresponds with innovative power. Therefore innovation is a phenomenon that is inextricably bound up with humankind.

Techno-optimism

Over the last centuries innovative efforts have produced impressive achievements. An abundance of scientific and technological breakthroughs provided us with sophisticated medical cures, agricultural methods, modes of transport, communication media, information technologies etc. which are convincing agents of progress and improvement for the benefit of all. It fosters the optimism for prosperity, increasing standards of living or, in a broader sense, better conditions of life.

The cradle of the optimism goes back to the Enlightenment, an intellectual movement in the seventeenth and eighteenth century that strongly influenced the portrayal of mankind. It marked the liberation from the medieval doctrines of magic, superstition, prejudices and the fear of God by replacing it with human rationality. It claims that man is rational and good by nature. It advocates equality for all man (and women), individual liberty and tolerance. It asserts that the individual as well as humanity as a whole can progress to perfection. The enlightenment is the era of great scientists, philosophers and writers: Descartes, Newton, Leibnitsch, Locke, Kant, Voltaire and Diderot to mention a few. Also Darwin should be mentioned, which theory of evolution was exemplary for the collision between science and religion while it conflicted with the idea of creation of life according to the Bible book of Genesis. Rather than the creationist belief that every species was created individually by God and is not subject to change or progress, it claimed that life has developed in a progressive way from primitive forms to complex organisms. In the era of Enlightenment the fear of God makes way for scientific description and explanation of the world. Beliefs are not anymore accepted on the authority of priests, sacred texts, or tradition, but only on the basis of reason. Reinforced by the idea of natural regularity and material cause the Scientific Revolution successfully proclaimed the ideology of upward development, progress and improvement of the world, encouraged by an ever-increasing knowledge, understanding and control of nature's processes.

Ever since, society still adheres a nearly sacrosanct belief - as if this weren't a prejudice in itself - in the "makability" of the world, the idea that any problem can be solved and controlled by designing the right plans and choosing the right means. Indeed, in close co-operation science and technology produced new insights, new tools and applications that made progress tangible, if only for part of the world population.

Criticism and conservatism

Although innovation may be considered an essential cultural asset of mankind, objections against innovations can be heard frequently; innovations often encounter criticism and resistance and are suspected of promoting decline rather than progress.

In many domains criticism and conservative attitudes dominate the susceptibility to innovations, be it by the unconditional promotion of the status quo, by adulating the past or by disqualifying the consequences of innovations. It should be noted that such criticists should not be disqualified as regrettably being stuck in existing patterns; they are often reputable, highly esteemed individuals well capable of substantiating their judgements. For instance, leading scientists as Fromm (1941), McLuhan (1964), Postman (1986) and Baudrillard (1995) denounced the role of modern mass media (radio, television, Internet), which incoherent flow of trivialities is supposed to reinforce a primitive and fragmented view on the world at the expense of engagement, reflectivity and depth. Often political ideology or religion comes into play to oppose to new achievements. Sombart cited in Mimes (1957) observes that "a continuous and unlimited increase in material wealth brings ruin to the soul and confusion to society". Tawney, also cited in Mimes (1957), commends the Middle Ages in which "collective institutions, such as the church, township, village community, clan and family and guild, the individual was kept warm and sheltered like the fruits in its rind". Also the political and historical significance of language often urges people to proclaim a return to former days, before an hostile army invaded and conquered the country, destroyed its culture and established the occupier's language as the official one, while leaving those speaking the native tongue in subordinate positions. Even after many generations such far-reaching events may give rise to a lively patriotism which advocates the return to bygone days, despite practical disadvantages that such return to the native tongue would have after so many years (Mimes, 1957).

Also, optimism and the idea of progress were greatly challenged by negative side effects like vanishing nature, depletion of fossil materials, pollution of water, soil and air, not to mention the uncontrollable threat of biological, chemical and nuclear armament.

From the start the very idea of rationality has been subject of intensive debate. At a philosophical level rationality, highlighting human reasoning raises profound problems about the nature of emotions, feelings, ethics and moral. The strict depreciation of non-rational aspects of man disregards what probably is the predominant factor of human functioning. Consequently, the concept of progress is not applicable to happiness, compassion and other states of mind. Put differently, progress does not imply that modern man is happier or more compassionate than his ancestors were. During the Enlightenment's rationalism, education is restricted to cognitive development, emphasising knowledge rather than attitudes and competence development (Westera et al., 2000). This greatly contrasts with contemporary views on learning which recognise the importance of affective and attitudinal determinants like motivation and perseverance. Also, the absolute rejection of beliefs on authority disregards the knowledge that has accumulated during past generations. Such strategy would be highly theoretical and would seldom lead to high levels of expertise.

Innovation and values

Without going into these disputes or taking positions it is clear that the assessment of innovations strongly depends on prevailing values. The simple notion that innovation implies progress and thus leads to a better

world, unmistakably reflects the values of our modern society. To mention a few: economy of growth, capitalism, materialism, competition, techno-optimism and scientific positivism. Being tightly linked with the premises of modern society, innovation is a sine qua non for all economic functioning. Innovations, be it a new products and services or a new approach to the design, production or marketing of goods gives an economic actor an advantage over competitors. The adage runs like "innovate or pine away". We seem to be trapped in our own frame of reference in which growth, change, progress and innovation are a matter of course. Indeed, according to Charles Darwin survival depends on our ability to change. Abandoning innovation means stagnation, stagnation means decline. This decline would not only manifest itself in the economic sense but will also affect our culture as a whole. Innovation is not straightforward. It is inevitable within the constraints of our societal system.

Strategies of change

Substitution versus transformation
While recognising the importance and inevitability of innovation, the question of successful change strategies is highly relevant. Roughly, two kinds of approaches to educational innovation can be discerned: substitution and transformation. While innovation by substitution is characterised by little steps (increments), the transformational approach advocates a dramatic jump (discontinuity) based on (technological) breakthroughs. As we will explain below, the discrepancy between these approaches exists only on the surface.

The substitutional model represents a moderate strategy of change, which aims to cautiously substitute common methods, tools and technologies by new ones, however, without affecting beforehand the existing functions and patterns. Indeed, technologies like educational radio, instructional television, videoconferencing, or Web-based instruction can easily be applied to improve or extend the model of classroom teaching. Examples of substitutional approaches are Total Quality Management and Kaizen (Bounds et al., 1994). Total Quality Management starts from the idea that incremental change and improvement are realised by applying measurable quality standards to all products and processes. The Kaizen method, which originates in Japan presupposes that anything can be improved and focuses on creating favourable circumstances for employees to identify problems and to come up with solutions. It thus heavily relies on people applying simple ideas and common sense rather than advanced technologies as such. A third example along this line would be the "no-model approach" which is quite common in education: innovation is considered bottom-up and decentralised while relying on the enthusiasm and initiatives of educational staff members. Clearly, these approaches implicitly support the predominant paradigm, namely the paradigm of classroom teaching. Substitutional approaches are basically instrumental, incremental and long-term focused; they require substantial time and sustained investment.

The transformational model suggests a radical and integral strategy of change, which considers both technological change, pedagogical change and organisational change. Adherents of this approach want to put behind them deeply rooted, but outdated ideas, still considered straightforward by many, but essentially impeding real innovation. In fact, by explicitly questioning the primacy of classroom teaching, transformationalists aim to alter the instructional paradigm. Its radicalism is based on an unfaltering technology-optimism and a joint belief in the technology-induced prospects.

Clearly, technology-push is of great importance. Also, a top-down approach is found necessary in order to manage and control the organisational transition. Examples of transformational change strategies would be Procedure Redesign which involves streamlining workflow, automation of activities or improved information dissemination (Grotevant, 1998), and Business Process Redesign (Martin 1995) (also known as Valuestream Reinvention) which aims to redesign a set of activities that deliver particular result to a given customer.

In education, the substitutionalists outnumber the transformationalists by far. Substitutionalists are not prepared to unconditionally relinquish former achievements that have been the result of many hundreds of years of experience. Their innovative successes are frequent, because of the direct involvement of teachers. Mostly, however, such innovations remain confined to particular components of the educational system (e.g. particular courses, locations, teachers) and never seem to realise structural change. The transformationalists see themselves as the one and only real innovators. They consider substitution an inferior and illusionary way to innovation, because it will never redress fundamental failures of the prevailing educational system. They reproach the substitutionalists with intrinsic conservatism, which will never lead to innovation at a fundamental level. In turn, the substitutionalists blame the transformationalists to preach revolution just for the sake of revolution. They blame them for their centralists' view that easily conflicts with the (perceived) autonomy of educational staff. They comment that transformational change presupposes a clear view of what this change should lead to. They accuse the transformationalists of unbridled speculation and utopism, which, in the end, will undo all important achievements. And why, they wonder not without any cynicism, would a radical strategy be preferable while even realisation of simple changes like the introduction of classroom video proved to be problematic?

Itzkan (1994) suggests that substitution is just a stage in the process of technological diffusion that is preliminary to transformation: during the substitution stage common practices occur using new technologies, while after some time the transformation stage is reached, where new technologies induce new practices and old practices disappear (see also Pelgrum, 1993). Clearly, such interpretation favours the transformational view, while imputing the substitutionalists some innovative immaturity. It is important to note that substitutional change strategies and transformational change strategies are not mutually exclusive nor is one inherently better than another. The choice between various approaches is troublesome, because their characteristics are multidimensional, while successes and failures are known for each (Grotevant, 1998; Utterbeck, 1994).

From the above, it can be concluded that none of these approaches are neutral with respect to the instructional paradigm. Less pronounced, but essential is the fact that each approach considers technology in a different way. To analyse and understand the underlying ideas of both substitution and transformation it is necessary to go into the ways technology is viewed as an agent for innovation.

Interpreting technology-induced change

The impact of technology on human life

New technologies are the most discernible outcomes of man's creative exertions. Clearly, technology has greatly affected and changed the world we live in. Ever since rationalism was rampant, new technologies, be it the telephone, nuclear energy, the computer or the Internet have always been associated with the promise of a new glorious era. Yet, this techno-optimism often seems to have been premature and incorrect, or at least selective in neglecting or downplaying adverse effects. Increasingly, technology's role on society has been subject of analysis and reflection, often resulting in criticising unconditioned techno-optimism and technocracy. Indeed, educational technologies comprise many failures (Kaufmann, 1998). Taking account of the treatments of technology in philosophy can be quite instructive, in particular the destructive analyses of the classical existentialism and phenomenology.

Technology according to classical existentialism

In its original form, the early 20th-century existentialism (Jaspers, 1931) advocated the alienation thesis: technology, while creating a totally new material environment, alienates human beings from the world. In this era of the industrial revolution, technology is beginning to dominate society in an unprecedented way. Machines are gradually replacing human craftsmen and allow for the mass production of objects that meet constant quality standards. In highly rationalised and controlled production processes, human workers are degraded from unique individuals to interchangeable workers, destined to be just a cog in the machine. In addition to this, the highly bureaucratic organisational form makes people dissolve in their functional roles rather than supporting human identity and individuality: it is what you are that matters, not who you are.

As a direct consequence of mass production, human individuals are more and more ignorant of the origin, composition or working of industrial products, be it food, clothes or consumer electronics. In fact, people take these products for granted. Moreover, the availability of many identical and exchangeable replicates associated with mass production, makes that values like economy, frugality and sustainability loose ground: indeed, broken products are easily replaced with a new specimen. People are thus captured in a pattern of passively fulfilling ones material needs by ever-replaceable stuff that is abundantly available.

In this classical view, inspired by the negative effects of the industrial revolution, technology seems to have become a goal in itself and it seems to control society as an autonomous power alienating human individuals from the world and from themselves. Note that this view partly corresponds with the instrumentalist position of substitutionalists who regards technology as a neutral tool subservient to humans and who disapprove of the transformers' technology-optimism. In contemporary treatments of technology, however, Jaspers' gloomy view is more or less refuted by indisputable results, in particular by a convincing string of medical successes.

Technology according to phenomenology

Husserl (1913), Heidegger (1977) and other phenomenologists considered technology by investigating its role in the way individuals perceive and experience the world and interpret it by attaching meaning to it. They investigated how our material environment determines our identity and how it changes the way we arrange our life, e.g. how television influences our plan for the day, how the telephone alters inter-human relationships and how the availability of fast food changes the role and function of common meals. Like the existentialism, it opposed the absolutism of logic positivism and techno-optimism. In contrast, it abandoned the instrumental view on

technology. Heidegger's central (hermeneutic) idea is that technology fundamentally alters human existence, while becoming an integral part of life. Technology has no "essence" as such, but can only be understood by considering the context of its use. In fact, technology is assumed to mediate and give form to the relationship that individuals have with the world they experience. Television, for instance, creates new ways to open up reality. To evaluate the role of television it cannot be considered in isolation; it is necessary to consider its impact on the human experience. Put differently, technology has to be analysed by linking the object of experiences (the world) with the subject of experience (the individual). It thus overcomes the dichotomy between object and subject as claimed by Descartes and his fellow rationalists and replaces it with their mutual involvement: object and subject are assumed to constitute each other. As McLuhan (1964) and Postman (1986) demonstrated, television is not just an information channel that is additional to books, newspapers or lectures, it fundamentally changes the way we experience and interpret the world. Likewise, a car is not just a functional device to travel from A to B, but it highly determines the way we wish to manifest and distinguish ourselves, and thus the way society is arranged.

Currently, this position has been widely accepted both by phenomonologists and existentialists (Verbeek, 2000). Now, it is important to notice that this philosophical debate goes to the heart of the matter when considering educational innovation. We must conclude that naive instrumentalism, which reduces human beings to simple tool makers and tool users, doesn't adequately describe technology's interaction with society (Hickman, 1990). It is an illusion that the introduction of a particular technology or technological artefact can be regarded an isolated substitution. First, each new introduction of artefacts should take into account the material and social context in which it takes place. According to Dewey (see Hickman, 1990), technological tools and instruments are never value-neutral but rather teeming with values and potentialities, which may cause unexpected responses. Second, new technologies should allow for changing human behaviours and experiences. Technological artefacts often appear to generate new, unforeseen behaviours, which may strongly deviate from the initial intentions (e.g. telephone, car, tv). According to Procee (1997), any technology carries a built-in, implicit "user manual" which only becomes manifest in interaction with humans. Procee uses the term 'script of technology'; Idhe (1990) calls it 'technology's intentionality'. For instance, the introduction of the biro involved new writing styles that didn't meet the standards of tidiness and precision that could be achieved with the fountain pen (Procee, 1997 quoting Baudet). Also the successive introductions of the typewriter and the wordprocessor involved new writing styles and strategies that differed from existing styles. Therefore, technology's impact and use are highly unpredictable. Third, new technologies are always considered functional solutions for practical problems. In practice, however, such technocratic approach hardly ever reckons with psychological or emotional factors that may create additional values, meanings or impediments to it. To assess the impact of technologies, one must go "beyond functionality". Hence, plain substitution of old means by new technologies as claimed by the substitutionalists is literally impossible. It is unavoidable that any replacement will cause secondary changes in patterns and behaviours that will be hardly predictable. But it is not only the substitutionalists that have to be disqualified. The transformationalists loose their key argument that breakthroughs are the only means to arrive at veritable innovation. After all, small increments may have pronounced consequences as well. From this analysis, it follows that the discrepancy between substitutionalists and

transformationalists is highly artificial. Substitution and transformation can hardly be regarded sound scientific concepts. Instead, these terms are no more that practical labels, be it unprecise and confusing.

Synthesis

Borgmann's devices paradigm
Following Heidegger a growing interest developed in the mediating role of technological artefacts. When refocusing on educational innovations it is plausible to outline Borgmann's 'devices paradigm'. Borgmann (1984) describes and explains the impact of technological artefacts on society from an existentialist perspective. His theory cautiously combines both elements of techno-optimism (technology can solve any problem) and Jasper's initial alienation thesis (technology detaches us from reality). According to Borgmann, technology promises a lightening and enrichment of human existence. It liberates humans from burdens by making available a multitude of goods like heat, light, water, food, exotic food, information, etc, without any effort whatsoever. In ancient times, our ancestors needed a full day's work to find enough food, gather wood, make fire etceteras. These were tough times: lighting the stove required not only knowledge, but also dedication, perseverance, goal-orientedness and involvement with the tools available. Today, the availability of goods is straightforward, omnipresent, easy, safe and immediate. Heat, light and information become available by simply pressing a button on 'technological devices' like central heating, electric lighting and tv-sets. What used to be an achievement, has become a simple commodity by technological devices, which demands no commitment, no proficiency and skills, acquired by effort, discipline and involvement with the world. The efforts are now taken care of by the devices' machinery, which is viewed purely instrumental: in most devices the machinery, i.e. the technology, is deliberately kept out of sight. After all, only by 'hiding' the machinery and separating it from the commodity, commodities become available in a straightforward and effortless way, that is, without any commitment or skills involved. According to Borgmann, such pattern of separating the commodity from the machinery only leads to apathetic and indifferent consumption, which is detached from any social or material context and which removes the involvement with the world. He calls on breaking out this technological consumerism not by simply rejecting technology, but by restoring the relationship of commodity and machinery. Indeed, from an existentialist view involvement is more important than availability. To this end, Borgmann suggests to support "focal practices", that is, activities that demand high degrees of involvement, that require discipline, perseverance, concentration and skills, that are physically and mentally defiant and are difficult to master, that provide satisfaction and pleasure, that make use of artefacts that stimulate rather than discourage our ties with the world, that serve no particular goal other than being a focal practice and have no other use than being useful in itself. Examples of focal practices would be jogging, cooking or collecting stamps or any other activity that demands intrinsic involvement and hence serves the existential relationship with our world.

It would be not too difficult to link Borgmann's idea of focal practices with educational technology. Although educational services are more and more considered straight commodities that are being delivered and consumed within a commercial framework, it is clear that the acquisition of skills and knowledge by learners request large commitments. By nature, a major concern of teachers is to keep their students motivated, self-reliant and responsible; the learning itself can frankly be labelled a focal practice. In

addition, ICTs in education provide many opportunities for involving rather than instrumental devices. Involvement is promoted by user-defined preferences, active object manipulation, real-time events, multiple representations of data, intelligent responses and participation in games and communities, among other things.These observations designate education as a favourable domain for sensible application of technologies. To conclude this paper we will briefly indicate the implications of our analysis for the application and implementation of new technologies in education. These can act as guiding principles for educational innovations in practice and may help avoiding problems we touched upon earlier in this paper.

Transparent and interactive devices

For the design and development of technological artefacts it is important to reveal its machinery to its users. Devices should be transparent to allow involvement from its users. As a first step sensory involvement should be pursued, which means that the device's machinery is visible, audible or tangible. The next level of involvement would be conceptual in kind: by revealing the machinery's functional components, it becomes clear how the device operates, even if most technologies are often too complex to be fully understood by laymen. The third level is operational involvement: it is important that users can practically and diversely interact with the devices, in order to develop their own unique methods and routines of use (cf. a piano). The ultimate level of involvement would be material in kind: by offering accessibility to the machinery, users are enabled to care for it, to maintain it and to carry out repairs and upgrades. Such involvement matches the idea of sustainability and counteracts the pattern of mass consumption where faulty products are easily replaced with new, identical specimens.

Products as carriers of meaning

Until now, the motto "form follows function" is exemplary in education. The motto goes back to the modernism of 1930s which proclaimed that all products should be modelled after machines: simple and prepared for their function. It represented a rocklike faith in technology. Likewise, in education any offer is extremely restricted to practical value, that is, anything that does not evidently contribute to the achievement of learning goals is resolutely omitted. Such approach, however, neglects the socio-cultural value of products, which refers to the symbolic role that products may fulfil by signifying additional meaning. By buying and exhibiting a product consumers can distinguish themselves from others, while indicating a particular lifestyle, preference or subculture. From the 1960s, the "form follows function"-motto gets outdated, while products become carriers of meaning more and more (Verbeek, 2000). The outward appearance of products becomes an decisive asset at the expense of functionality. The association with lifestyle strongly stimulates involvement of the owner and supports the mediating role of products. By lagging behind, education seems to miss this opportunity to enhance the involvement of learners. As stated before, educational technology should go "beyond functionality". Education should link its products with favourite lifestyles and emotions, even if this insight is just a result of the detested consumer society and its advertising men.

Beyond efficiency

According to Ellul (1964), technology is the defining force of a new social order that is obsessed by the values of rationality, efficiency, usefulness and materialism. He criticises our oppressing dependence on technology

that is bound to determine all human activity. He observes that technology is not subservient to humanity, but that instead human beings have to adapt to it and accept drastic change (Ebersole, 2000). Ethical and esthetical considerations seem to play no role whatsoever. Clearly, such development is at odds with the ideas of involvement and focality. To counter this technocracy, educational technology should extend its values beyond efficiency: education should be interesting, attractive, entertaining, challenging, pleasing, intriguing or even fatiguing, deterring and only useful in itself. This is no plea for inefficiency, but a plea for values that harmonise with the characteristics of man. After all, education can play an important part in the individual's life fulfilment.

Political meaning

Any vision on innovative technology suffers from political bias. Technology's promise of lightening and enrichment is assumed to support and establish the liberal democracy (Borgmann, 1984). The pattern of continuous availability against forever lower costs gives the less wealthy the perspective of possessing tomorrow what the wealthy already possess today (Verbeek, 2000). Such perspective on upward mobility of citizens produces a stable situation in Western, industrialised democracies, as long as technology advances.

Yet, unlike its typically capitalist suppositions, the tendency and necessity to innovate is not exclusively linked with a single political preference: indeed, republicans, democrats, conservatives or communists are all well prepared to strive for innovation in service of their political goals. Although the importance of innovation for society has been demonstrated extensively, life demands a mixed mode of developing new ideas and preserving former achievements. Again we may learn from commercial advertising, sometimes emphasising a product's novelty (i.e. cars, detergents, tv-sets), sometimes emphasising its constancy (i.e. whisky, cake, gingerbread), which are associated with industrial production and with traditional craftsmanship, respectively. Such mixed mode would be applicable to education as well. Not only because knowledge itself cover both state of the art insights and well-established ones, but also because the educational arena is characterised by both new industrial technologies and traditional teaching craftsmanship.

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