REFRAMING THE ROLE OF EDUCATIONAL MEDIA TECHNOLOGIES

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Distance universities excel in using digital media technologies for content delivery and collaborative interaction to compensate for limited face-to-face opportunities. Now that an ever-growing variety of media technologies, devices, and services are flooding the market, possession of expertise about the educational opportunities of these technologies is becoming a strategic asset for any education provider. Distance universities may act as informative examples in this regard. This article discusses how distance universities face the challenges of the ever-shortening lifespans of these new technologies. We describe some of the disruptive changes effected by the Internet and discuss the critical factors for adopting and implementing the associated information and communication technologies in education. Although many practical, organizational, pedagogical, and financial factors are relevant, this article focuses on hidden conceptual barriers that are the result of misconceptions about the role and function that technology possesses and that seem to foster education's intrinsic conservatism. Particularly, the notion of technology instrumentalism, which emphasizes the one-sided subservient role of technology, is a widely popular, but at the same time a naïve, greatly outdated, and fallacious view of technology that confuses the discussion and hampers educational innovation. This article aims to contribute to the removal of these misconceptions by framing technology in a contemporary view that emphasizes the enabling role of technology—particularly media technologies—to develop new pedagogical models and to offer new opportunities for augmenting human cognitive performance.

INTRODUCTION

By their very nature, distance universities strongly rely on a variety of technology-based media for instructional delivery and interaction. Print, television, telephone, and the Internet are used to compensate for the absence of lectures, practicums, and other face-to-face sessions. For quite some time, the extensive use of media in distance education was viewed as a "second best" replacement for face-to-face tutoring, i.e., an occasional solution meant to control the perceived damage that might result from the loss of traditional instructional delivery methods. To this end, distance education was often qualified as second-hand education, which is an ironic reference to distance education's original raison d'être: second chance education (Edwards, Hanso, & Raggatt, 2002). Nevertheless, distance universities are reputed

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The Quarterly Review of Distance Education, Volume 16(2), 2015, pp. 19–32 ISSN 1528-3518

for their high standards of education, and they often outperform their nondistance counterparts in national reviews and student polls (cf. National Student Survey, 2014). In recent years, many traditional universities have been extending their face-to-face models with online services for offering enhanced flexibility to their students. Notwithstanding this blended model, the expertise of traditional universities, including workflow and business processes, remain directed to their main delivery channel, which is face-to-face teaching. Clearly, distance education remains a distinct branch of education that requires a different set of expertise, specifically, a state-of-the-art knowledge of instructional design, educational media, and their associated technologies. Distance universities recognize these requirements and have designated advanced research and innovation in these key areas as a strategic priority. Most distance universities have established dedicated educational research and development units, many of which have gained worldwide reputation (Ozcinar, 2009).

Nevertheless, responding appropriately to the ever-growing flood of media technologies and devices is anything but a straightforward matter. This paper discusses how distance universities cope with the rapid pace of technological change. We first discuss conceptual factors and issues that influence the uptake and implementation of new digital media technologies in education. Next, we describe the special nature of media technologies, which is in the direct connection of technology with our cognitive functions: thought, processing, memory, and perception. Third, we briefly review the use and role of media in distance education. Fourth, we highlight the role of the Internet as a catalyst and driver of disruptive societal change that makes possible new power relationships and new modes of communication. Fifth, we discuss the intrinsic conservatism that dominates education, and elaborate explanations that are associated with the fundamental misconception of technology instrumentalism. We conclude by briefly describing the main challenges for productive educational innovation that are connected with the described concepts and factors.

THE TRUE NATURE OF THE MEDIA REVOLUTION

Obviously, the flood of media technologies, devices, and services will continue to expand in the coming years and will continue to have sweeping impact on the ways society functions. Notwithstanding the disruptive nature of the Internet, the true nature of its impact is not in its scale, abundance, or in the induced redistribution of powers; rather, the impact is seen in the manner in which its associated media technologies support and augment our cognitive functions. To explore what is actually occurring in this setting, we assume a human-centered view and examine the role of media in human cognitive functioning.

It is of paramount importance to note that media technology is not just common technology. Media technology is quite different from common tools such as a chain saw, a refrigerator, or a toothbrush, because it directly links to what is generally considered to be the defining feature of the human species: our cognitive abilities, our thinking capacity, our intelligence. Essentially, media are a means of communication, facilitating the expression and exchange of ideas between individuals. Obviously this also holds for educational technologies, which are readily identified as information and communication technologies (ICT), including a wide variety of applications and devices, e.g., smartphones, tablets, learning management systems, games, and electronic tests. But the same applies to many nonelectric educational aids, such as papyrus paper, quill pens, and the blackboard and chalk: they all are directly linked with human cognition. Media, including educational media, is therefore a part of the shared class of inventions that support interhuman communications, including such varied examples as cave paintings, gestures, speech, smoke signals, clay tablets, the written alphabet, writing,

the printing press, mathematics, musical notation, Morse code, the telegraph, film, radio, television, and many more. Any of these inventions are both the product of our cognition and the enabler of new cognitive achievements. The symbol systems that go with our media allow us to express new ideas and to realize outstanding intellectual and artistic achievements. For instance, written musical notation enabled us (or more specifically, geniuses such as Ludwig von Beethoven) to create and consolidate brilliant symphonies; similarly, mathematics enabled us (or, that is, the genius Albert Einstein) to develop the theory of general relativity. Hence, our media are functioning as cognition amplifiers (Westera, 2013), since they enable humankind to express and elaborate, communicate, and consolidate our thoughts. They expand our view of the world and enhance our thoughts. Through media we are the only creatures on Earth that are capable of accumulating knowledge and transferring this knowledge from one generation to the other. This accumulation of knowledge eventually formed the basis of human culture and civilization. As Isaac Newton put it: "If I have seen further it is by standing on the shoulders of giants." Evidently, our cognition makes the difference with animals, which lack speech and writing, and therefore must commence again each generation due to an inability to consolidate and pass down any such thoughts and experiences.

For evaluating the impact of media, we should take into account the era of modern man, which started some 100,000 years ago. Initially, human communication was primitive, and progress was limited. Various human inventions, however, effected radical changes: for instance, cave paintings (+/– 30,000 years ago), clay tablets (+/– 5000 years ago), the alphabet (+/– 3000 years ago) and the printing press (+/– 600 years ago). Not until the 20th century we have witnessed the uptake of electronic media such as the telegraph, the telephone, radio, and television. In recent years, new developments in digital technologies have enabled an explosion of new communication tools, nodes, and devices, such as, the microcomputer, the Internet, Short Message Service, social networks, smartphones, global positioning satellites, tablets, and many more.

During the era of modern man, we have witnessed a dramatic acceleration of technology innovations. While it previously took hundreds or even thousands years for a new mode of communication to develop, in the last few decades we have seen new ICTs emerge at an unprecedented pace. If one were to visually display the emergence of new media during our 100,000 years of existence on a high definition computer screen, this digital revolution would appear only at the very right-hand side of the screen, and take up less than one pixel of width. At the same time, the "time horizons" of these new technologies are concurrently reducing over time, which means that new technologies are more likely to become obsolete sooner after their introduction. This explains the difficulties that distance education providers have in keeping up with emerging technologies and to select the right candidates for their operations. Moreover, as Kurzweil (1990) explains, the pace of technological development has become much faster than the pace of our biological evolution. Indeed, the hardware of our brain hardly changed over the last 100,000 years, which raises the question to what extent our brain will be able cope with these overwhelming developments that imply nothing less than a redefinition of the conditions of life (Westera, 2013).

MEDIA IN DISTANCE EDUCATION

Since the emergence of distance education in the 18th century (Diehl, Moore, Thompson, & Schied, 2013), the dominant delivery model has been printed matter and private correspondence through mail. During the twentieth century a richer media mix has developed, including a variety of electronic media, such as, radio, TV, audiocassette, et cetera, that complemented printed matter. In the 1980s computer-based media became available that

broke through the existing regime of one-way communication and allowed for interactive programs, including tutorials, drill exercises and simulations. In recent years the Internet has become a major platform for learning content delivery and communications with students. Distance universities were the first education providers that widely adopted this new wave of technologies for the online delivery of products and services. These education institutions soon recognized the new opportunities that the Internet would offer for removing some of the ongoing handicaps associated with early versions of distance education.

Being able to monitor and respond appropriately to emerging media technologies is today considered one of the key competences associated with distance education. Because of the strategic importance of media for distance education, all distance universities have sought to develop strong expertise in educational technologies by incorporating media production units as well as educational media research units that expressly cover technology scouting and assessment, media prototyping and testing, empirical research and evaluation, and media policy making. These units tend to be much larger and much more advanced than those of regular universities. An important challenge for these expertise centers is to appropriately address emerging media technologies and decide in a timely way about their potential and importance.

This process of existing technologies being displaced by new technologies has been extensively described by Schumpeter (1942) as "creative destruction" and is associated with a "technology life cycle." It is often difficult to determine whether a new technology will be a major innovation or no more than just short-lived media hype. In the early 1990s, a major dilemma was raised when a new standard was introduced defining the CD-interactive (CD-i), a technology which directly competed with the existing CD-ROM standard. The former (i.e., CD-i), was TV-based, and included full interactive presentation features, while the latter (i.e., CD-ROM) was computer based, and was essentially no more than a file storage system made available on an optically readable plastic disk. Naturally, both media were extensively explored and tested for their educational potential, while taking into account a variety of factors including costs, production load, operational model, and market uptake, among other things. The exploration of CD-i was inspired by its promise of reliability: it would work on any television set, so no helpdesk would be required. Nevertheless, CD-i died soon after its introduction. The market favored CD-ROM, because of its larger flexibility and better integration with existing computer systems.

One decade later, a similar dilemma occurred with respect the new world standard DVD-Video versus online content distribution. DVD-Video combined extensive file storage capacity and full interactive functionality based on TV standards that enabled easily accessible multimedia tutorials. At the time, online distribution through the Internet was also recognized as a potential alternative, although Internet connections in those days tended to be both slow and expensive, prohibiting the distribution of anything but plain text, e.g., bulletin boards. Obviously, both technology standards were explored at the time for viability. In those days, DVD-Video greatly amplified the uptake of video shops distributing feature films for home cinemas, but the number of educational DVD videos remained low. The accelerated expansion and adoption of the Internet, along with ever-increasing bandwidth, pressured distance education providers to opt for the online distribution channel. It was recognized that the online channel would offer more content flexibility (i.e., easy updating, rather than fixed content on a stand-alone carrier), and would enable a return channel for communication with learners.

The need for such exclusive media decisions is explained by the impracticality of having and maintaining a wide variety of media platforms at the institutional level. If for no other reason than cost, education providers must be selective and decide upon a limited set of priority media to be used in their institu-

tional operations. An exemplary case would be learning management systems (LMS), which entered the market in the early 2000s. Driven by the principle that innovation by academics requires sufficient staff autonomy and time for exploration, many bottom-up initiatives emerged for trying out these new technologies. Soon, distance universities found themselves saddled with a dozen or more of these LMS, which initially served for exploration purposes only, but gradually were used as production systems (Westera, 2003). At some stage, however, it became unavoidable to remove most of the systems and define a shared institutional infrastructure. Obviously, this is was (and is) a delicate process because many people need to be convinced, if not sometimes forced, to commence using a single institutional system, one that they also may not prefer. This example reflects the subtle balance that is required between bottom-up innovation efforts and top-down alignment. It also establishes the importance of having state-of-the-art expertise centers available that monitor and explore emerging educational technologies.

THE INTERNET AS A DRIVER OF DISRUPTIVE CHANGE

The emergence of the Internet did not imply yet another medium to be included in the media-mix of distance education. The all-embracing nature and scale of the Internet produced a new conceptualization of information access, information services, and social connectedness that affected society at large. The initial growth of the Internet was spectacular from its inception, and has remained so ever since. Worldwide, the number of Internet users increased from 26 million in 1995 to 2,802 million in 2014, reaching a penetration rate of 39% of the world's population (Internet World Stats, 2014). The Internet has amplified the global economy and the exchange of cultures. By enabling access to an abundance of information, the Internet has promoted liberal, democratic (Western) values, as well as the development of independent, self-directed, and responsible citizens who represent these values. At the same time, however, it should be recognized that the Internet has also widely accommodated swindling, international crime, terrorism, political manipulation, censorship, espionage, human trafficking, data theft, child abuse and many other unfavorable activities.

The emergence of the Internet marked a fundamental change of the ways distance education providers functioned. Through the Internet, the microcomputer, which had gradually been entering the educational institutions, transformed from an isolated, local tool into a worldwide communication dashboard. During the early stages of the Internet, no learning management tools and platforms were yet available on the market. Distance universities started to develop their own online portals, notwithstanding the fact that in those early years the connectivity, bandwidth, and speed of the Internet were quite limited. At first, web portals were used simply for publishing course catalogs, schedules, and other administrative contents. Later, e-learning surfaced as an alternative channel for the delivery of learning content. Although printed matter, such as, hard copies of study books, never disappeared, their role only slightly reduced as textual documents and other resources could now be displayed on-screen. So far, the Internet was mainly viewed as an alternative channel for distribution. Gradually, the social dimension of the World Wide Web developed by building on these core elements. The launch of social network services by companies such as Google, Facebook, Kazaa, and MySpace transformed the Internet from a network of connected information nodes ("Web 1.0") to a network of connected human individuals ("Web 2.0," or the social web): the web of hyperlinked pages now was extended to include a web of users who could interact and collaborate. While Web 1.0 maintained users as *consumers* of information, Web 2.0 allowed users to both read and write, thereby transforming them to both consumers and *producers* of information (or "prosumers"; cf. Toffler, 1980). In the distance education

domain, these developments obviously created new opportunities for interactions between teachers and learners, as well as between learners themselves. The focus shifted from the exclusive delivery of learning content to the arrangement of educational support services: online tutoring, collaborative learning, personalized guidance and feedback, and community building. This reflected a shift of focus from the object of learning (i.e., learning content) to the subject of learning (i.e., the learner). What used to be highly impracticable in distance education, namely, direct interactions between individuals, became well within reach through the Internet. Distance education was no longer about *products*, but about *services*.

The emergence of Web 2.0 entailed a new philosophy of powers that greatly influences the educational supply chain. Along with the social web, a wide range of high-quality productivity tools, such as graphics tools, video-editing software, and collaboration tools have become accessible for free or mostly free, which enables learners to actively engage in the providers' traditional role of content developer. Hence, Web 2.0 "elbows out" and replaces traditional content development models that are more hierarchical and company-driven, with bottom-up models governed by learners. The prosumer model thus enables new didactic approaches that allow learners to create, adapt, share, and annotate their own learning content and contribute to ongoing debate among peers. The democratic nature of the "read-and-write" web therefore extends over the domain of education and affects the traditional power relationships between teachers and learners. In addition, its nature affects the role of educational publishing companies who previously unilaterally created, controlled, and delivered learning materials, in favor of an open model that includes a wide variety of online resources developed by the widest possible audience of content producers.

The Internet has been a driver of disruptive change that has affected existing societal processes, the skills required within professions, and the manner in which we deal with knowledge and information. The field of education at large should therefore not neglect to remain up-to-date with these changes, and reconsider the content it supplies, the methods it uses to deliver that content, and the technologies it employs to support the overall endeavor.

TECHNOLOGY SKEPTICISM IN EDUCATION

Education has never excelled in innovation. For quite some time, education has been based on traditional models using lectures, books, blackboard and chalk—and, to a great extent, still is. In the past, various authors (Bates, 1995, 2000; R. E. Clark & Estes, 1998) have denounced the conservative culture in education that was considered to be rooted too much in the intuitive and traditional methods of pre-medieval apprenticeship, featuring an omniscient master and a naive pupil. According to Bates (1995), teaching has failed to develop into a full-fledged profession, but instead remained largely craft-based (as opposed to scientifically based). Great and principal skepticism was raised by Sarason (1993), who ascribed the education system an oppressive impact, hidden behind unseen power relationships and cultural patterns that stifle any change or progress.

Westera (2010) has previously pointed out the similarities between teaching and farming. Both teaching and farming are associated with a never-ending cycle of "sowing," "growing," and "harvesting" from year to year, reflecting an intrinsic conservatism. Rather than professions, both teaching and farming are a *vocation*, a passion, a way of life, a mixture of craft, skill and devotion aimed at personal care and attention for maturing organisms. New media technologies that might affect this routine can, of course, expect to face skepticism, particularly when innovation is driven by the ambitions of policymakers, managers, and politicians to increase output at reduced costs. Teachers' aversion to the rise of new, strongly innovative technology is understandable, as

they are fighting for a good cause: avoiding the transition to industrial teaching models that reduce tutoring efforts to costs and that reduce pupils to numbers. There is no doubt that behind the façades of schools and universities, committed teachers continue to support their students as much as they possibly can, but it is inescapable that education modernizes its services in agreement with technological developments. Farmers started 200 years ago to trade in their shire horse for a tractor, which eventually led to unparalleled agricultural productivity and quality (albeit not without negative impacts). Education has often historically attempted to do the same, but often failed. From the twentieth century, a parade of new learning technologies emerged that was purported to assist in the modernization of educational practice. Such technologies included instructional film, Pressey's teaching machine, school radio, instructional television, programmed instruction, the videocassette, the microcomputer, and many more (Westera, 2012). A common pattern emerged in which innovators announced these technologies with great fanfare as the ultimate breakthroughs that would procure a fundamental change of the educational system, but eventually typically failed to live up to these promises.

Instructional film is an exemplary case in point. After Thomas Edison patented his motion picture camera in 1891, he claimed that film would revolutionize education by enabling a new modality of learning content, bringing recorded realities into the classroom. Learners would no longer need to read texts about how things work, but instead they could just watch the recordings. Edison, like many innovators, had high expectations for his innovation. But technical practicalities surrounding the innovation troubled the teachers. The required projectors were bulky, noisy, and expensive. The celluloid strips could easily break and were highly flammable. Few instructional films were available and the licenses were expensive. Eventually, an issue of power was decisive: when sound-films were introduced, teachers perceived the built-in narration as unwanted interference with their teaching duties. Teachers preferred to do the talking themselves, and film, at least in the purely educational content, never lived up to its promises.

It is tempting to blame the innovators and their technologies for such failures, but generally the reasons for failure were in the altered roles and responsibilities of teachers, the lack of integration in the school curriculum, and the limited flexibilities to adapt the contents to instructional preferences and needs. Today, however, conditions surrounding technology have dramatically changed. The pressure on education is high, new technologies are flooding the market, and schoolchildren grow up immersed in new digital communication technologies (and increasingly wonder why their schools are still not employing common media technologies in their classrooms). In such a setting, education has to lay aside its intrinsic conservatism and put forth effort at integrating technical innovation. Interestingly, distance education providers may offer inspiring examples of such.

EDUCATIONAL MEDIA AND THE TENDENCY TOWARD SUBSTITUTION

As explained above, an important argument that was used in favor of instructional film was the more realistic presentation of content: that is, offering motion pictures rather than textual descriptions. At the time, film proponents proposed to replace books with this new instructional medium. Edison, the inventor of film, even claimed that books would become superfluous and disappear (Cuban, 1986). The very idea of replacing one medium with an alternative medium is easily equated with innovation by substitution. Once the audiocassette—which was frequently used in language teaching—had reached the end of its technology lifespan, it was easily substituted with the compact disc, which offered superior sound quality and easier access. One might consider

this as a useful innovation (it probably was), but essentially the technology was no more than an alternative method of content distribution and presentation through switching to another audio carrier mechanism. Although such substitution process may help to achieve improved services and functionalities for learners, its fundamental innovative power is limited, because the underlying pedagogical approaches and governance models remain the same. In contrast, innovators of a more radical nature would opt for more far-reaching and systemic transformations, and view substitution as an inferior and illusionary way to innovation because it does not address the fundamental failures of the educational system (Westera, 2004). Substitution tends to avoid radical changes, preserve existing practices, and focus on short-term gains. Therefore, many consider innovation by substitution inferior to innovation by transformation (Van der Klink & Jochems, 2004). Some also consider substitution as an early, necessary phase of transformative change (Itzkan, 1994).

From the mid 1990s the emergence of the Internet enabled a new type of distance learning that utilized web technologies for the electronic distribution of learning content across institutional borders. This so-called e-learning paradigm was revolutionary in that it allowed for enhancing the flexibility of learning with respect to the time, pace, and place of learning. Distance education providers were the very first to develop and offer e-learning services on behalf of their students. Soon after, many other universities started extending their face-to-face models with online services via LMS. LMS were fundamentally different from the educational media that had been previously employed, because they represented an infrastructural solution at an institutional scale, implying radical consequences for everyone involved. University board members would proudly qualify their LMS as a transformative innovation, because it redefined the technical and organizational conditions required for delivering flexible and versatile learning opportunities to their learners. Critics, however, argued that most LMS were likely to reinforce existing patterns and hinder innovation (Coates, James, & Baldwin, 2005; Dron, 2007). In particular, critics denounced the hidden bias that would force LMS users—both teachers and learners—into predefined concepts and templates loaded with implicit pedagogy. Coates et al. (2005) argue that LMS are based on an overly simplistic understanding of the relationship between teachers, knowledge, and student learning, and do not allow for experimentation with sophisticated pedagogical practices. Dron (2007) refers to world-leading LMS that were designed to support the American culture of teacher-led instruction and the standard concepts of classes and courses, thereby prohibiting pedagogical variation. In particular, distance universities experienced problems because their models of distributed learning (Wagner, 1999) did not fit the LMS assumptions of synchronized cohorts, classes, and teacher-led instruction. Although LMS vendors candidly advertised the pedagogical neutrality of their products, pedagogical bias within a given LMS is unavoidable. Friensen (2004) dryly remarks that a system cannot be simultaneously pedagogically neutral and pedagogically beneficial. Such implicit pedagogy that is strongly rooted in pedagogic traditions is a severe impediment to developing new teaching approaches (Wise & Quealy, 2006), such as, based on communities of practice, open content, informal learning, badges, prosumer models, cocreation, role-play games, and other opportunities offered by the Internet.

Now that in recent years social software (e.g., Facebook, Twitter, LinkedIn, etc.), smartphones, and tablets have radically changed the media landscape, LMS vendors have reluctantly started to incorporate social media components in their LMS. But this seems to somehow conflict with the LMS basic tendency to provide closed systems that implement the existing power structures and prevailing teaching models. Hence, despite their institutional scope, LMS reflect innovation by substitution: they substitute prevailing

educational control mechanisms with their digital counterparts. Despite their appearance, LMS are likely to reinforce the intrinsic conservatism of education.

Clearly, it is a natural tendency of humans to perceive and understand the world in terms of existing patterns. New technologies are likely to be interpreted and used according to old models. This explains the early successes of e-learning, which substituted good, existing texts within a changed, digital format (e.g., .pdf, .rtf, .doc, etc.); the successes of electronic whiteboards, which substituted existing "blackboards" with electronic versions, while leaving the content unchanged; and it also explains the recent excitement about MOOCs (McAuley, Stewart, Siemens, & Cormier, 2010), which substitute face-to-face lectures with recorded variants. These examples argue that simple substitution is a barrier for fundamental innovation.

THE INERADICABLE INSTRUMENTALISM

Substitution is a manifestation of technology instrumentalism, which is the widespread notion that technology is a neutral and subservient means for achieving our aims: technology is viewed as an instrument that supports our actions and that liberates us from burdens by making available a multitude of goods like heat, light, water, food, information, etc., with less effort. Technology instrumentalism may appear obvious, because, indeed, few would deny the productive role that technology has. But technology instrumentalism is actually a restricted and outdated view that does not cover the complex role that technology plays for human functioning (Hickman, 1990). The origin of instrumentalism is in the era of the industrial revolution, when technology was massively substituting human labor as an instrument for production: human craftsmen were increasingly replaced with machines, which could do the same tasks better, faster, and cheaper (Jaspers, 1931). Instrumentalism typically reduces humans to simple toolmakers and tool users; it reflects a pattern of applying new technologies in existing models. However, today's media technologies have become an integral part of our lives and fundamentally alter the ways we perceive, experience, and interpret the world by attaching meaning to it (cf. Heidegger, 1977). In fact, technology is assumed to mediate and give form to the relationship that individuals have with the world in which they are living. Modern media technologies can no longer be considered neutral and interchangeable instruments, since they reinforce new patterns of behavior, new codes of communication, and new modes of living that would not be possible without them. This is what Feenberg (1991) calls technology's *substantive impact*. Accordingly, the intrumentalist view, which assumes that technology simply accommodates our needs, has been replaced with the substantivist view, which asserts that human life adapts to the opportunities that new technologies offer. Rather than an instrument for fulfilling our needs, technology is now viewed as a main determinant of the ways we arrange our lives.

In education, however, instrumentalist views still appear to prevail. Among scholars, educational technology is often still regarded as simply another instrument to meet pedagogical demands. Such instrumentalism is readily identified as the hidden premise in the notorious debates in the 1980s about the effectiveness of educational media (Clark, 1983; Kozma, 1991). Based on a variety of comparative studies Clark (1983) expressed pure instrumentalism by claiming that media do not influence learning under any conditions: "media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition" (p. 445). A main cause of this misconception is the common methodology of comparative media effect studies, which dominate the domain of educational research. Comparative media research involves concealed misconceptions of an instrumental nature, because it

tends to measure the changes that occur when replacing one medium with another. From a substantivist perspective, two responses to these misconceptions could be posited. First, it can be asserted that learning from one medium is not necessarily *better* or *worse* than learning from another medium, but is essentially *different* because of using different symbol systems for representation and addressing different senses. Second, in evaluating the role of media it is not sufficient to consider only their technical and functional characteristics; it is necessary to include their context of use and to consider their impact on the human experience (Heidegger, 1977). While misconceptions about media for learning often continue to appear, various authors have called on shifting the focus of the conversation away from *whether* or not media affect learning, but on *how* media would contribute best to learning (Hastings & Tracey, 2005).

CHALLENGES OF MEDIATED EDUCATION

Our discussion thus far has proposed that various principal and contextual factors determine the successes or failures of educational media. Distance universities have managed to acquire a front runner position in this regard by the structural arrangement of expertise centers in educational media technology. These centers keep their expertise up-to-date by exploring state-of-the-art knowledge and technologies and researching these in practical contexts. These institutions thereby collect experiences that prepare them for making substantiated and necessary decisions about which media to follow up and which media not to follow up. In the near future these media issues will not be limited to distance education, but will increasingly impact education at large, such as, in blended learning and the flipped classroom (Lage, Platt, & Teglia, 2000). So far, however, both scholars and practitioners have demonstrated conservatism with regard to educational media technologies. Misconceptions of the true nature of media technologies preserve naive instrumentalism as the dominant view of technology's role in society. Innovation is accordingly positioned as the substitution of one technology by another, thus framing new technologies in the old paradigms and obstructing the development of new educational approaches. It is a main challenge for the educational community to remove these barriers for innovation. In conclusion, we will now briefly touch upon some related issues that should be addressed in regard to productive innovation within the educational setting.

THE INHERENT CONFLICT BETWEEN RESEARCH AND PRACTICE

Possessing an in-house, state-of-the-art expertise center in educational media has been shown to be a successful strategy of distance universities. Both researchers and practitioners should be involved to cover the full range of activities encompassed by the center. Often both are combined in the same expertise institute, which is designed to help bridge the gap between research and practice. However, researchers and practitioners often represent quite different interests that take on different aims, tasks, and responsibilities. While practitioners tend to be subservient and pragmatic in solving problems at the operational level, such as, help to create a new course in the LMS, assist at assessing test items for an exam, or develop a simulation program for students, etc., researchers sometimes tend to downplay practical constraints, generally taking a theoretical stand and seek to identify problems rather than solely solving them. Unfortunately, the specific skills and attitudes of researchers and practitioners are rarely combined in individual members of staff.

THE FRONTRUNNER PARADOX

Even a world-class expertise center of educational media cannot avoid the "front runner

paradox," which is the problem of the dialectics of progress: being the first to implement a new technology, and thereby being plagued by teething troubles and unknown pitfalls. Being the first with a new media technology comes at a high price: high costs, unstable technology, little penetration among end-users, limited support, limited bug fixes, and so on. As time progresses, better and cheaper solutions become available on the market. But since migration to another system is a major operation, the front runners find themselves stuck with the system and they are easily overtaken by their competitors who waited until better systems became available on the market. This phenomenon was experienced by distance universities, which were the very first education providers that developed and exploited LMS-based technology. Within a few years, these educational providers fell behind their late majority competitors that had waited and purchased commercial solutions (Westera, 2003). It seems that being "the first one" is not always the optimal place in which to be.

TECHNOLOGY IMPLEMENTS PEDAGOGY

It is politically correct to state that technology should serve pedagogy. The mantra that "Education is about pedagogy, not about technology" can be heard in almost any discussion about educational innovation. But political correctness is not the same as correctness. As previously discussed, the subservient role of technology is easily associated with the outdated model of instrumentalism, which neglects the fact that technologies, especially media technologies, create new opportunities for amplifying human cognition. Rather than advocating the instrumentalist notion that pedagogy is leading and thereby determining which technologies are needed for its implementation, one should take up the substantive position that technology is an *enabler* for new pedagogies. Accepting technology as the driver of pedagogy, rather than the reverse, helps to break through the dogma of using new technologies within old models. The challenge is to address the concealed or often manifest instrumentalism that trickles into the discussions and to procure a change of conception in favor of the soft, deterministic substantivism.

THE NEGLECT OF COGNITIVE EXTERNALISM

The direct link between communication media and cognition, as described before, is easily linked with cognitive externalism (A. Clark & Chalmers, 1998), which suggests that our mind is not confined within the boundaries of our skull and skin but extends into the outside world. Pencil and paper, calculators, and smartphones are cognitive extensions of ourselves and are inextricabilities connected with our cognitive abilities. In this view, communication media are viewed as cognitive prostheses that augment our performance (Westera, 2013). Hence, our cognitive capabilities are to a great extent defined by the media that we use. The pedagogical counterpart of this externalism can be found in John Dewey's theory of experiential learning (1938), which asserts that learning something new cannot take place in a vacuum and should somehow be connected with the external world for it to make sense. Hence, our cognition is directly linked with the world that surrounds us and comes to expression in direct interaction with it. The most relevant implication of this notion is that the media we use are not just tools, but are cognitive enablers that actively shape our mind, which is in accordance with the substantive view of technology.

THE PERSISTENT CALL FOR SCIENTIFIC EVIDENCE

Whenever a new technology becomes available, its proponents tend to promote its application, pointing at the new opportunities that the new technology offers. The innovation, drive, and enthusiasm of these proponents may

be contagious, but it is also likely to raise skepticism among teaching staff and operational managers, because the displayed lack of neutrality is suspect and may well be interpreted in a lack of credibility. In a defensive response, existing staff may ask for scientific evidence in favor of the new approach. This is no more than an expression of obstinacy. First, building a body of evidence requires the accumulation of numerous empirical studies and would take many years to accomplish. Second, many people will ask for scientific evidence of the new technology, but few seem to ask for scientific evidence of the current teaching methods. Third, in many cases the practical evidence (e.g., exam marks, pupils' responses, increased throughput, etc.) is so obvious that a scientific study would not produce additional value. Moreover, scientific methods, such as randomized controlled trials, have been permanently under attack because of the Novelty Effect (R. E. Clark, 2001; Kulik, Bangert, & Williams, 1983), the Hawthorne Effect (Franke & Kaul, 1978), wrong inferences, the uncontrollable conditions in a practical context (Shaver, 1983), and disputes about the *p* value of statistical significance (Gelman, 2013; Johnson, 2013; Lew, 2013). It is the tragic fate of new instructional media technologies that all stakeholders defensively call for scientific evidence for the new claims that are made, without mirroring this to existing practices, and without realizing the negative impact of obstructing the innovation dialogue and progress.

CONCLUSION

As explained above, distance universities have a main interest in monitoring emerging media technologies and selecting the most promising ones for experimentation in their educational practices. To support this strategy many distance universities have arranged one or more in-house expertise centers that cover educational media research and practical implementation. One of the biggest challenges that these expertise centers are facing is the ever-shortening lifespan of today's media technologies. Also, the abundant flood of new technologies requires these centers to be quite selective during the technology scouting process. But it is quite difficult to predict in an early stage whether a new technology will turn out to be short-lived hype or a fundamental breakthrough. In addition, persistent instrumentalist misconceptions may easily hamper the preparedness of teachers, trainers, and education managers to adopt new educational technologies. Yet, it is beyond doubt that our relationship with the world will be increasingly mediated by digital technologies, which will shape our cognition by augmenting our processing capabilities, memory, and perception. Our life, viz. our self, will be increasingly defined by the digital media technologies that we use. It seems we are on our way to become cyborgs.

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