

Cognitive Challenges for the Realisation of a Collective Intelligence: The New Educational Settings

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Abstract: Understanding Information and Communication Technologies through the networks in which people get connected, communicate and co-operate has been a constant feature in the work of researchers who have not dissociated their view of the meaning of technologies from new social movements. This paper maintains that Information and Communication Technologies are not only networks that people join individually, but they also act as social technologies. Their improvement depends both on the diversity of their functions (social, political, cognitive, etc.) and the flexibility with which they adapt to functional diversity (for example, to life cycles, changing and fluctuating mobility or audiovisual perception thresholds). This idea is supported by the new technological challenge represented by portable devices, such as, personal area networks, high-use user interfaces, and systems designed for home care. These important changes will be explored in this paper in connection with their value for education.

1. The virtual setting as an educational problem

It seems reasonable to state that the current education system is undergoing transformations very different from those it has undergone in the past. At least some of this change can be attributed to the emergence of information pedagogy – a pedagogical approach that shows how both learners and teachers are a form of *mediation* between information and human experience, wherein the processing of information becomes one of the goals of both teaching and learning.

This conception of teaching is not something new in the history of pedagogy, nor does it contradict the idea that education is a form of social technology whose purpose is to equip the individual and society with a powerful tool to cultivate both the development of cognitive functions and socialisation skills. For decades, when people have considered their education, they have not had to reckon with the reality of a world view that is constantly changing. As a consequence of such changes, different aptitudes and cognitive skills will be needed in order to carry out the project of education, facilitating with all the more precision the diverse ways we know, understand and communicate. All of these changes will allow people to better adapt to their cultural and physical environments.

The cause behind these profound shifts in pedagogical perspective has been linked to what some researchers call the *third setting* or virtual setting (Echeverría, 2000). Understanding and adapting to changes introduced by new educational technologies is a problem not only at the practical level of use, but also at the level of pedagogy. Learning how to think of technology as not simply one more channel of communication for information and knowledge, but also as something that shapes social reality, continues to be a profound challenge.

If we think of education as a form of social technology, we might say that in principle the existence of a virtual setting or third setting only increases the potential of education as a social technology. This statement requires two clarifications: on the one hand, we must say what we mean by *technology* and, on the other hand, what definition of *virtual setting* can support a conception of education as social technology that would underscore its potential as a new form of pedagogy.

The problem of technology is usually understood in terms of an instrumentalist approach, that is, as something we must know how to use in order to access other things. According to González Quirós (2004) this conception of technology sees it as something artificial, as something unnecessary for life. The definition also implies that technology may threaten our ability to lead a more natural life, a life devoid of the artifice of any technology. In many ways this definition points to one of the great challenges of the education system: to take technology as a reality born from the symbolic system of culture as a whole, abandoning the utilitarian conception of technology as a mere instrument. Following Quirós, we can distinguish between technologies that allow us to manufacture material objects and satisfy our needs (whether complex or basic) and social technologies. The purpose of social technologies is the generation of symbolic tools that prepare and motivate us in relation to the legitimisation of forms of political and social organisation. So it may be said that not all technology falls under the instrumentalist approach, but that some forms also fall under the banner of social organization. That so much of our lives are now part of the 'virtual setting' is proof of its power as a social media, since it is precisely from Information and Communication Technology (ICT) that the creation of new social spaces arise.

The virtual or third setting can be seen as one more instrument within a wide range of instruments that make up the symbolic tools we use every day, and that shape the educational processes that occur within the most general socialisation processes. We can continue to see the virtual setting as a simple instrument -as artificial as it is contrived- and leave it in a subordinate position with respect to the educational system, or we can view it in terms of its vast educational potential, as something that can be developed to become a new educational paradigm. This latter view would recognize the potential contained in the technology and see it as empowering a certain kind of life, as being part of the political construction of a reality that we can engage.

One of the key consequences of ICT, and the virtual settings it gives rise to, is the realization that the instruments people produce to fulfil specific ends and goals occasionally go beyond their intended usage and the gratification of immediate needs. This point clearly shows that it is not simply instrumentality that defines the *raison d'être* of technologies. In fact, we can see this expanded sense of ICTs in the many educational projects undertaken today that try to develop projects in the virtual setting, and that do this without subordinating their pedagogy and research goals to a conception of ICTs as mere instruments for learning. Instead, ICTs are seen as creating social spaces and symbolic tools that provide learning experiences similar to those that take place in traditional (physical) spaces, whether this is a library, neighbourhood street, classmate's house, farm-school, commercial establishment, or some other locale.

However, although there are many studies that make explicit reference to the need to use ICTs in the classroom in order to conduct research more efficiently, or to introduce innovative pedagogical goals (Martín-Laborada, 2004), it can be said that for the standpoint of the virtual setting to flourish, one must delve deeper into its social and political implications. Educational policies should be designed that directly explore this potential, understand its aims and challenges, and that approach the issue from the perspective of both politics and pedagogy, moving beyond the framework of mere digital literacy.

In accordance with the viewpoint argued by Echeverría (1999, 2000), there is, in our opinion, a way of viewing ICTs and their sister concept, the virtual setting, that can lead to greater benefits for the educational system as a whole. According to this viewpoint, the virtual setting may be considered not only as a "classroom methodology," but also as a standpoint that impels us toward the re-conceptualisation and design of a different educational system, of a system specific to the third setting.

We need to ask ourselves whether the social settings created through these new media might not have the capacity to generate a wholly different conception of *action*, one that concerns our common fate but that, until now, has belonged to the second setting, that is, the urban setting. In fact, hasn't the virtual setting already changed much of our typical activities? For example, the way we invest, work, research, design, pilot, play, form relationships, make art, and even do sport. How can the virtual setting change so much of what we do, and yet not change the concept of human action itself?

2. Virtual settings: the cognitive and epistemic problem of representation

The virtual setting is a social space where nearly all the actions we carry out in the urban setting can be enacted, including collaborative actions or those involving intellectual co-operation. This is a specific type of action with a cognitive, political and even economic dimension of extraordinary importance not only for the education system but also for society as a whole. The development of these actions in the third setting constitutes an exploration of the second sense of the concept of technology as set out above.

Thus, for example, the Dutch project, *Ontdeknet* (www.iptop.com/showdirectory.htm?vCat=kids) which focuses on the development of telematic educational networks in which pupils have regular contact with researchers and experts in some subject, is based on a conception of technology as something more than an instrument to be used; rather, it constitutes a setting which favours the generation of new educational scenarios that enhance cognitive capabilities in powerful ways.

We should see the new educational possibilities opened up in the virtual setting as going beyond the mere management and administrative functions we find in many programs, computer applications and even networks. One example of this would be an urban scenario in which a subject makes economic decisions and therefore has to add, work out equations and probability calculations, etc., in order to optimise his or her preferences in a virtual technological scenario. Although this example illustrates a clear expansion of the concept of *social reality* to embrace the virtual world, it makes no sense from the stand point of education to exclude that expansion from the further charge of remodelling one's participation in the socio-political sphere. Ultimately, it is the education system that remains our most effective form of social technology, containing within it the power to socialise and legitimate other complex symbolic systems.

Despite its potential, there are many difficulties involved with implementing ICTs in the education system. These problems are understandable when we consider the complex changes that new communication technologies force on our cognitive and epistemic processes. The virtual setting is paradigmatic because of the many examples it provides of the difficulties that come with adapting ICTs to educational programmes. At a conceptual level it is easy to see the reticence that many have concerning the radical changes these new technologies can bring. These changes impact not only how we think about educational space, say at the level of the classroom, but at a more radical level they call into question the very idea of an autonomous and national education system, one whose boundaries have traditionally been seen as distinct from the virtual setting and its international telematic curricular models. This possibility (the possibility that boundaries *can* be crossed) is no longer an unrealistic or unrealisable hypothesis. If we consider that the pedagogical charge of education is to generate scenarios that expand our students' concept of reality (and with this the way they experience how the world of *reality* is changed when concepts are instantiated and presented) we can see that education operates by means of representation, that how we define and *experience* reality is itself conceptual, and so depends on a medium that is not physical but rather representational. If education is about representation, then we can see how deficient it is to limit our views of technology to fulfilling largely instrumental functions, diminishing its cognitive, sensory and social dimensions.

The following example should help bring home the point: organising the furniture of a classroom, establishing work groups and dividing the tables into islands, brings challenges that are both similar to, and yet different from, organising electronic networks and projects in the virtual setting that could enhance teaching and research goals. There can be no doubt that the organisation of physical space for pedagogical purposes does have a cognitive dimension, impacting us at the level of sensation and perception. Consequently, we should expect to encounter specific difficulties when organising a virtual educational setting, since the physical environment cannot be relied upon to help guide our perceptions and direct our attention. In the same way, being a *tele-tutor* (or on-line instructor) poses different challenges than it does for a teacher who knows his or her pupils, and who can interact with them in designing a virtual educational scenario.

Overlooking complex differences like those mentioned above often means that the virtual setting ends up being used in a very limited way in the sphere of education. In order to even see the potential opened up by the virtual setting one needs to be aware of how the physical classroom environment both structures and limits students' cognitive processes. These questions need to be confronted when one aims to change to the virtual setting, since this setting brings with it a new and open-ended sub-system of educational scenarios. Therefore, it seems reasonable to claim that if one desires to create a more humanistic conception of technology –as seen in the works of González Quirós (2004), L. Winner (1987) or F. Dyson (1998) –which avoids the narrow utilitarian view of technology as a simple technique for achieving a defined goal, it is necessary to create new kinds of electronic classrooms.

3. “Remote classrooms” and the problem of constant cognitive adaptation

The development of virtual scenarios for the purpose of education gives rise to the idea of *remote classrooms* (Echeverría, 2000). These remote classrooms go beyond regional, national, linguistic, generational, and even cultural boundaries to such an extent they revolutionize the very concept of mobility, shaping in new ways the spheres of university research and education; and this is especially true when it comes to the areas of secondary education, the Baccalaureate, and professional training.

It should be remembered that, in education, the term ‘physical mobility’ refers to the way knowledge is exported and becomes international. This process is further reinforced by the notion of ‘virtual mobility,’ which paradoxically implies the negation of physical mobility but in such a way that this negation carries out even further the internationalization of university education and research. As a result of these distinctions, it would be wise for those educating in the virtual setting to avoid insisting on overly rigid distinctions between the methodological dimensions of ICTs and plans for its specific use. Taking a more open-ended approach has the benefit of making it easier for new technology to serve social ends. In order to reinforce this point we should note that having the aspiration to integrate ICTs as core skills in the teaching of all subjects (Martín-Laborda, 2004) may not guarantee that pupils will acquire skills and abilities in a way that would enable them to make use of their education in a socio-political setting, whether virtual or not. The same can be said for their use of educational skills within a recreational dimension, say in whether a given interest is turned into a hobby (Dyson, 1998).

“Lifelong learning,” “learning to learn” and “digital literacy,” are essential components that inform contemporary research in pedagogy. However, we should realize that if we truly want cognitive and meta-cognitive strategies to take priority over mastery of content (which has to be acquired throughout a life, and requires the collaboration of others), then we need to establish those cognitive, educational and social contexts that will enable us to constantly re-educate ourselves. In light of this we need to see the principles that inform contemporary pedagogy in terms of the challenges posed by the virtual setting. It is precisely here at the level of underlying pedagogical theory that educational principles are introduced and that later take on a normative dimension (in the sense that these principles seek to regulate our actions in real, as well as possible, scenarios). As a consequence, these principles are descriptive not only of pedagogical policy but also inform a political point of view; to the extent pedagogical principles specify the rules that govern where learning takes place, whether in the virtual setting or some other, pedagogy is also politics.

According to the interpretation of A. González Andino and F. Sáez Vaca (2003), the third virtual setting should be defined as a new artificial social space “whose human interactions are sustained by a technological superstructure” (p. 210). Unfortunately, typical educational approaches to the virtual setting often miss its deeper implications. Teaching models that genuinely engage the virtual setting require an approach that does more than just combine old elements, uniting together hardware, software and teaching staff, but that also generate new paradigms of education.

4. ICTs and a new conception of action

Whether virtual spaces are educational depends on the kinds of different relationships that can be established in these spaces. Therefore, the key to education in the virtual setting is to recognize the different forms of interaction that can be derived from technological superstructures. It should be added that the complexity of these interactions will vary greatly, and that some may even be similar to those we would traditionally expect in a regular classroom. However, we need to realize that the complexity of interaction alone does not guarantee the existence of educative scenarios; rather, the issue is whether actions can be linked through a technological superstructure that can contribute to a shared symbolic universe. Such a link is the first step in granting participants access to a communal and ubiquitous virtual space through *remote classrooms* suspended in a constant, unitary time. The kind of education required to maintain such *remote classrooms* is, in theory, inseparable from the variety of possible scenarios that could be designed on the basis of the available technology. For example, a virtual class on sports education would require a technological superstructure to be developed that could create a new kind of class participation, one that expands the levels of sensory engagement beyond just doing individual sport activities.

Consequently, taking education seriously in the third setting means re-thinking all the traditional goals of instruction, such as, speaking, interpreting, reading, adding, writing, reasoning, not to mention the instruction of specific physical activities, like, swimming, playing, acting, painting, climbing, and so on. Under the virtual setting each of these actions would also need to be approached in terms of their modularity, accessibility, communicability through different networks, artificiality, stability, digitization, and so on.

It should now be easier to see how the very nature of action itself is challenged in the virtual spaces of education and which, in turn, creates a new field of difficulties for the educational system. Moreover, given the incredible complexity of these issues and their unprecedented character, this challenge goes beyond principles of pedagogy, nor is it solvable at the level of software, hardware or any one type of technological superstructure (to help bring this point home consider Romeñach and Palacios' discussion of the fate of the *functional diversity model* [2007]).

To understand ICTs in the light of the networks people use to maintain relationships, communicate and cooperate with each other, has been a constant theme in authors interested in the meaning of technology for new social movements (H. Rheingold, 2004). The question of what might define *action* from a social point of view has been made topical once more by studies such as that of Sidney Tarrow (1998), Neil Joseph Smelser (1998) and Alain Touraine (2000). Perhaps one of the most interesting features of Rheingold's contribution is his interest in how principles can be established to explain the nature of telematic networks. For example, what is the effectiveness of such networks from a social point of view? What is the capacity of such networks to generate new networks of collaboration?

It is important to see that it is possible to set out a conception of ICTs within the virtual setting in such a way that their functional diversity is also embraced as an incentive for the development of better technology. Moreover, these technological innovations can be seen not only as a result of responding to the diversity of functions enabled by new technologies, but also as adapting to situations, building off Howard Garner's model of multiple intelligences (H. Gardner, 1998).

Tracing the path of some of these issues, Rheingold offers four principles to explain the effectiveness of networks. What is interesting about these principles is that they attempt to move beyond just an economic or technological point of view, but also point to the effectiveness of networks in light of social co-operation and communication.

1. The first principle is Sarnoff's law, which states: for those networks that transmit from a control centre to multiple places of reception, the value of the broadcasting network is proportional to the number of receivers or viewers.

2. The second principle refers to Moore's law, which states: the extent of any technological revolution can be viewed in terms of its capacity for the miniaturization of electronics.
3. The third principle is Melcalfe's law, which states: the utility of any given network is in direct relation to the number of elements that make up that network.
4. The fourth principle, which I take to be one of the most important laws in Rheingold's argument, is Reed's law, which states: there are some networks whose social impact may grow exponentially with the size of the network.

In all of these principles, and especially the last one, we can observe the social underpinnings of the laws they reference. In saying this I mean that any description regarding the success or effectiveness of electronic networks presupposes some concept of the socio-political sphere. For example, the effectiveness of an economic network depends on the ease with which the members of that network can set up and carry out economic activities. The same thing happens with respect to the success of university networks and, in general, with any educational and research networks, which makes networks of this type one of the most effective forms of social technology. These types of educational networks constitute, by definition, institutions that are embodied in the actions undertaken by their respective members, in which the limitations of physical space are still operative, but yet not in a way that impedes members at the level of symbolic or political participation; indeed, even temporal constraints are overcome to an extent, which presents us with a view of education as true *universitas*.

5. Functional diversity and technological development in education

Palacios and Romañach (2007) discuss the ways in which different models of education have been used in the past to categorise those people who have organs and bodies that function differently from the norm. They contend that the model of 'functional diversity' is the only one that conceptualises these differences as a capacity and a value. The model of functional diversity is an important concept, and one that can combat the narrow lens of traditional educational narratives of history, in which the fact of diversity is often met with by social oppression and discrimination.

Palacios and Romañach show that the degree of social acceptance for a determinate form of functional diversity (for example, being short-sighted) depends on whether socially widespread solutions exist that can rein in or alleviate possible threats of discrimination. Thus, when tools, techniques and available technologies are unable to accommodate physical diversity, that is when diversity enters the stage of discrimination (Palacios and Romañach, 2007: 35). This example should help to illustrate our point that the effective integration of any element within a network depends on the capacity of that element to assimilate tools and technologies in order to adapt competently. This adaptation is not about eradicating differences, but rather in finding a technology that can help make people functional. Adaptations of this sort should result in not only the gradual cessation of discrimination against people of certain disabilities, but also lead to the development of new technology that can meet the challenges of diversity more directly.

Seen as a form of social technology, education in the third setting has the potential to promote processes of individual and/or collective socialisation that can tackle discrimination head on. In fact, if we accept the idea of education as social technology the following parallel seems to hold. First, just as the social impact of the educational network and its effects grow exponentially with the size of the network, so too does its capacity for discrimination (exclusion). Second, the likely acceptance of a subject's functional diversity depends on the degree that subject can be integrated into the social network. What this parallel should illustrate is that ICTs in the virtual setting are not just a network to which individuals are added, but rather act as social technologies that depend for their improvement as much on the diversity of their functions (social, political, cognitive, economic, etc.) as on the flexible adaption to our functional diversity (to our life cycles from infancy to old age, our changeable and fluctuating power of movement, our thresholds of audiovisual perception, etc.). Proof of this can be seen in the many technological innovations spurred on by the challenges posed by devices like portable electronics, personal area networks, *high-use* user interfaces, and care systems in the home.

6. The expression of a collective intelligence

The approach put forward here places ICTs at the service of educational processes, and explores not only the profound potential of such technology, but also the challenges it poses for the domain of education. The revolutionary impact of this technology is clearly shown by the vast body of programmes that continue to be developed, and which range from speech rehabilitation and ergonomic keyboards to the development of guidelines to evaluate the accessibility of web pages, and even the creation of meta-languages to increase the levels of accessibility of computer applications (on this subject see J. Cabero, M. Córdoba and J. M. Fernández Batanero [2007]).

Finally, it must be pointed out that this conception of ICTs is also supported by P. Levy's research (2002) into the existence of a collective intelligence. Levy conceives of cyberspace as the expression of a *collective intelligence* (or *inter-legere*) that joins people together by continually reconstituting social ties. One need not accept all of Levy's claims in order to see its value at both the descriptive and prescriptive level. From the descriptive level of cognitive functioning, it seems true that the advent of electronic networks and the development of ICTs can be seen from an evolutionary perspective, with advances in technology changing the very way we process and engage information. And from the prescriptive standpoint, it also seems true that the combination of ICTs with education has the power to generate new normative ideals of *collective intelligence* (and of collective action), some examples of which we explored earlier.

The normative dimensions of the virtual setting are already observable in the fact that so many contemporary projects are designed around developing electronic systems of social space. These projects are responses, at least in part, to those who seek to eradicate situations of isolation, either related to age or other circumstances of daily life. This example demonstrates the plausibility of Levy's ideas about cyberspace as an expression of collective intelligence, an intelligence that is at once both descriptive and prescriptive of reality at the same time. We are left with a single social space that can be expanded infinitely into systems of social spaces, wherein the divide between the virtual dimension and the social dimension collapses. And so cyberspace is both a description of social reality as well as a creation of social reality. With possibilities like this, is it any wonder that the virtual setting would fundamentally transform the meaning of education from the inside out.

Notes

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