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Nature and structure of virtual education: An approach from the fractality

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Abstract: The potential generated by ICT in education raises reflect on the underlying frameworks. In this sense, the fractality is an opportunity to explain how it organizes and manages virtual education. This approach recognizes that educational dynamics are recursive and iterative processes instituted as progressive sequences, by way of fractals. This understanding allows for mediated and articulated successive levels. In each dimension own activities are embodied and in turn, it involves the recurrence of subsequent levels as possible solving of problem situations. Thus, the knowledge built in response to a collaborative action, participation in networks, ranging from autonomous to the cultural level or conversely.

Keywords: Virtuality, Fractality, Virtual Education, Interactivity, Educational Factors

1. Introduction

The present time is marked by vertiginous transformations generated by Information and Communication Technologies (ICT) that cause a deep impact on thinking and cultural actions, and above all on aims, challenges and ways of apprehension . In consequence it is indispensable to reveal the conceptions and practices that underlie it; that is to say how the training conditions are structured in the computerised society. It is also interesting to recognise the use of ICT in the effectiveness of educational proposals; since "education consists, first of all, in doing available the world that is not covered by the experience that the subject, on their own, could not obtain" [1].

Properly, the paradigm of Virtual Education (VE) offers possibilities of interconnection and intercommunication favoured by the abilities of ICT to create networks from the Internet, especially the World Wide Web [2]. To opt for VE means to recognise "that the communicative relation initiated between teachers and disciples is a relation mediated for information and communication technologies, which makes possible the meeting without the necessity of bodies, times and space to merge" [3]. An exchange based on the potentiality that virtuality incarnates; a dynamic course that subverts the digital to represent a more realistic possibility.

In this sense, to reflect on VE is important, in order to channel means and resources in the socio-technological management of Teaching and Learning Processes (TLP). An in-depth look will show the complex connection of raised relations and interrelations, the multiplicity of levels that are put together and the variety of systems put into operation in the titanic task of educating. Basically, education is communication, and in VE it is characterized by the movement of digital technologies, which "teaches that communication is not only to transmit, but provide freedom of connectivity and intervention of the interlocutor. Communication is only made by means of his or her participation" [4].

Multiple dense internal connections are established in the educational task, by way of fractals, generating a multiplicity of groupings. This type of spatial organization reveals the presence, among other elements, of some vertexes highly connected that tend to connect with other vertexes highly connected and distributed hierarchically [5]. In that development, it is possible to conceive an educational process grown from the growth in a network, with the same characteristics, and whose purpose is to produce more prolonged networks, which can be used as

platforms to develop a socio-dynamic phenomenon, as VE, which is produced by the indefinite mixture of diverse processes (contents, tutorial…) and is showed as of the high degree of recursion that configures every educational node (student, class, classroom, school…).

To recognise the structural complexity of VE requires a theoretical approach that assumes the fractality as a framework of successive support for its understanding. It implies consecutive approximations from connectivism, integrating the principles explored through theories of chaos, networks, complexity and self-organization [6], in order to understand decisions that connect the structures of VE, and to understand how it works the present situation of its knowledge.

2. Dynamic of Virtual Education: the Fractal Character

Education is explicitly and implicitly the practice of a type of communication in the diverse scenes where knowledge is constructed (school, classroom…) and from which diverse communicational functions are established (to transmit, to store, to process information). In virtual educational environments "we will almost always find the next elements:

- to make reference to previous shared experiences;
- to obtain information;
- to offer information (that becomes a shared resource);
- to justify ideas and proposals;
- to evaluate others' contributions;
- to repeat and reformulate what others say" [7].

The staging of VE represents a complex task that covers the environment, the organization of space and educational time, the motivation, the cultural contents, the educational method, etc. ICT offer options for the construction of knowledge as of asynchronous and synchronous time and space and the facility and variety of communication spaces (forum, chat, videoconference…), in reactive environments with capacity of electronic response (websites, database…) and with options of virtual reconstruction (interactive multimedia…). To promote interactivity in that way makes possible connections, causes conversations and participations in cooperation, opens scenes of comparing ideas, and expresses the degree in which communication transcends the reaction, forming a variable of process that is related to dimensions where messages follow a sequence and interrelate each other and with previous messages [8].

Educational processes in virtual environments are a sequence of connected acts organized in several levels and dimensions, which goes beyond a simple interaction between persons in the roles of apprentice and teacher. These processes represent an interaction between problems and the capacity to deal with problems in a particular culture, in the same way society deals with the world.
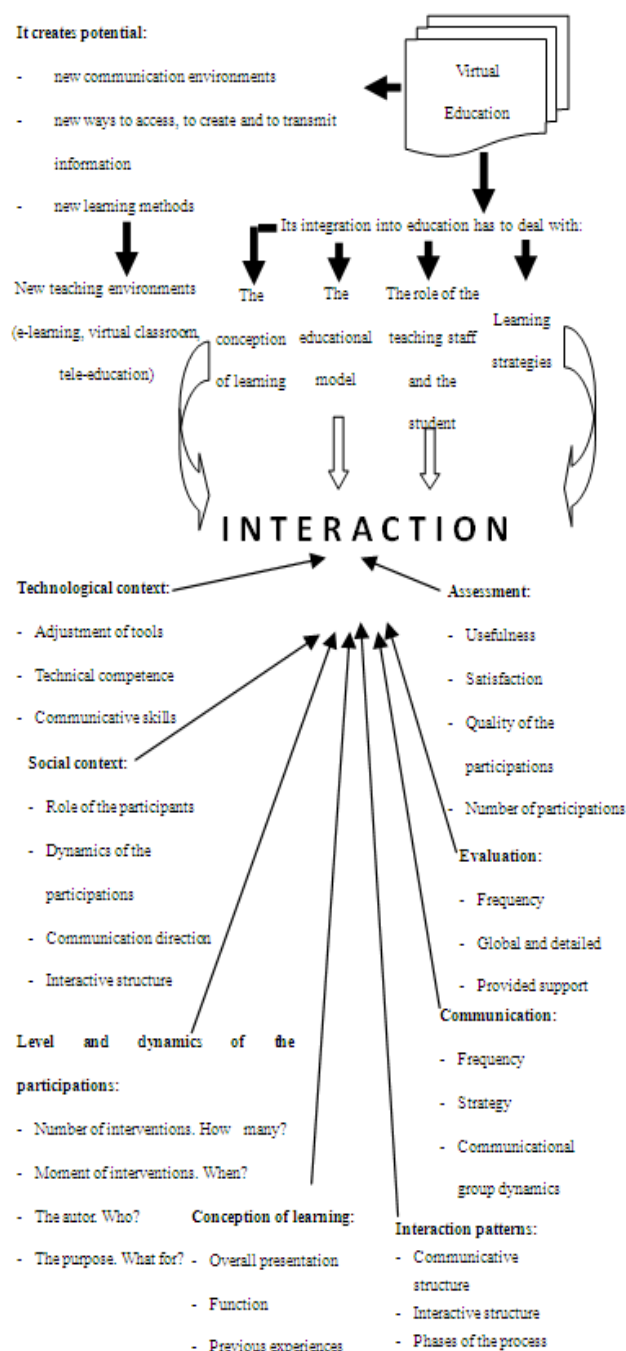

Figure 1. *New information technologies: communication and interaction (adapted from Meneses, 2006).*

Consequently, education is the process that transmits the pile of knowledge culturally acceptable [9]; by means of effective virtual educational spaces that guides three basic aspects of ICT: 1) the capacity of working in a network to make possible a geographically different location of participants and, at the same time, a synchronism or asynchronism of training activities; 2) multimedia abilities and hypermedia of heterogeneous digital information represented in different formats (text, graphics, sound…), and 3) a complete pedagogical intuitive simple interaction between person and computer, which is supported by interfaces of user that promote the notion of usability

instead of seeking spectacular and momentary enchantment of the user [10].

The evolution of human cultural horizon increased the field of intermediations. We went from a basic tool of tribal organization to a complex system of extremely differentiated tasks; that is to say from personal reflections to harmony with the cultural context. This course was constructed through an intricate interconnection of webs, which articulate all together diverse levels of social life (individual, family, school, community, culture), configuring favourable fields to educate, reflecting a level of interaction and susceptible to be modified by virtual space and time.

In this age of digital technology, education as a communicational act is built on diverse orders, by way of fractals, that participate as concise structures that are added as legal forms of social relationship and historical nature, revealing a recursive process. Recursiveness shows the repetition of a same action endlessly; perceptible events in education and learning , and sometimes working as elements but at the same time as pioneers and generators of the process.

But how is it organized education as of fractal sequences? In Maths "a fractal is a geometric object whose basic structure is repeated at different scales… In many cases, fractals are self-similar patterns and they can be generated by a recursive process independently of the specific scale. Fractals combine irregularity and structure" . To understand it we must decipher the "properties applied to every fractal:

• Fractional dimension.
• Complex structure at every scale.
• Infinite bifurcation.
• Self-similarity" [11].

Logically, fractals are not only present in the field of mathematical structures. The extension of the concept make possible to recognise objects that can be identified virtually in every part of the natural world. The main difference is that "non-natural" fractals (created artificially, as education) are not exactly self-similar but randomly, in a statistical way. In addition, in natural fractals there are lower and upper limits for the scale rank, where these objects are really fractals; while in "non-natural, artificial or social", the rough or smooth form (not self-similar), in other words, conventionally Euclidean, reveal a scale only approximately similar to the one obtained in a different scale. In any case, all natural or "artificial" fractals have fractional dimensions, divisible with each other [12].

Between fractals are also recognisable some of them known as multifractals, which are geometric spaces where connections between their parts are changing in every repetition; retaining some type of self-similarity, a characteristic more local than global [13], educationally, as the content to competence or to educational unit.

In dynamic systems – those that change their behaviour over time –, as VE, become unpredictable or chaotic, requiring some plan to make possible to change from order to chaos by means of fractals (attractors or "defined" spaces). These objects are not real physical identities but abstractions that exist in the phase space, a space with many dimensions to describe the dynamic behaviour; where every point in the phase space represents a single measuring of the state of a dynamic system, at the same time that evolves in the course of time. When all these points are put together, they make a trajectory that is over the surface of a strange attractor [12]. Some strange attractors (education and learning opportunities) have been identified in these cases, suggesting the existence of many routes that go from order to chaos; that is, from a diversity of educational prescriptions to get the apparent acquisition of knowledge that, at the same time, it causes a new need to follow with the investigation in understanding.

In the dynamics of VE, the complex transition of pedagogical task makes possible to create renewed fractal images of educational complexity, understanding that "the new paradigm will be successful while facing many problems that appear on its way, knowing that only the old paradigm has failed in some cases" [14].

In that task, the new created "landscapes" or nodes make supports from many other scenes that contribute in the educational task in static or animate form. The process demands certain refining in order to specify which types of structures are included or not, how are iterative processes generated and which roles are played by every educational subject; with the purpose of articulating and making equivalent the educational experiences, in the interest of equity and propriety [15].

To think about the complexity of VE from the fractality implies to conceive a state of interrelations constantly changing. A constant construction of educational phenomenon characterised by combining continuity and innovation, order and chaos, with instabilities in supposed balance. A state that allows to understand and to act over this framework, that is, a process of (re)construction defined by an immense interaction, which is signed by two different constructs, one is virtuality, represented by the potentiality or progressive latency of real, and the other one is fractality, for its growing complexity and apparent lack of definition; but both of them interact together to configure stable and consistent structuring patterns and thus defining a state of understanding of reality.

To assume this attitude implies to conceive the virtuality and fractality interaction as an understanding between subjects and objects, because of the latency and complexity that express them and do not represent them and, therefore, we cannot conceive one of them without the other one; allowing it to be specified [16, 17] as a connection between culture and persons that are not determined in any sense (from virtuality to fractality or vice versa) but a scale; that is, both of them are at different scale, expression of the same dynamics [18].

Considering this, VE from the fractality assumes a progressive sequence of levels, which evolves just as the needs and demands of the subject in the training dynamics.

3. Virtualization of Education

In common speech, virtuality is usually expressed as the opposite to reality. In cognitive terms, this passes beyond the imaginable, "it corresponds to a transformation of the process by means of that we can learn, state (note) and explain the world; processes that are in harmony and dependency with the level of development of digital media at the present historic moment" [19].

What is virtuality? A detailed tour through the semantic history of the term, understanding the phenomenon, notes that in the restricted sense it is not related to falseness, unreality or imagery but that expresses a sense of potentiality. In no way it is the opposite to tangible and real but a way of being productive and feasible, which opens horizons, digs founts full of sense under the surface of the immediate physical presence.

In Aristotelian terms, virtuality is potential, what can be, but not yet. As Levy exemplifies [19], the tree is virtually in the seed; consequently, it is not the opposite to what exists but a way of being of reality, a moment in the process of extension that develops reality. Thus, virtualization is a revitalizing phenomenon of reality, one of the vectors of creating reality, which allows "thinking that we are able of spreading our body simply simulating that we do not depend on it" [20].

Virtuality conjectures a restructuring of classic coordinates of space and time, to a system where they do not disappear but are virtualised, what it does not mean absence or extinction in configuration, on the contrary, it is the entrance to a different time-space where we must access for its usufruct [21]; or as Castells says [22], cross-linked and informationalized coordinates, set on spaces of fluxes and timeless times.

Exactly, in VE the classic spatial structure "evaporates" to enter in a kind of simulated and unlimited classroom, where the space is recreated as a reality of simulation: of virtualization, a space where there are immense possibilities. Also, the structure of time is broken, a course is not taught during a term or certain schedule. The study and enquiry are played down, the same as tutorial or work groups. In virtual reality, activities are made outside the timeframe, within a system where time and space are virtual, according to demands of flexibility and accessibility.

More conveniently, activities have been (re)converted to place and event, territory and moment, introducing personal and collective references, marks, signs, traces of action and movement, of creation and destruction of spaces. A time-space whose places allow processes of symbolisation and significance on the basis of appropriation, orientation and use of the users, from a temporal appropriation, equally showing the relevance of social time, in the measurability of connections between the past and the future of a present [23].

In these environments, still with the loss of physical contact, there is a more active and rewarding interaction than the one offered in a traditional class through the diverse communicational tools; whose "quality of the goal of the action does not exclusively depend on technological mediation but on the situation created by intentional agents within the technical system where they configure their practices" [24].

In those conditions, VE as communicational task organised on levels similar to fractal organisation will be efficient and challenging if held to the joint resolution of problems, and it will depend on the way in which participants put into practice some solid foundations of common understanding.

This approach considers sharing individual resources of knowledge where it is probable that the success of a joint activity depends on well-established collaborative basic rules to work jointly; since the information age and the interconnected world are making teachers to pose again their experiences. A context where it is evident that the added value of the "future based on knowledge" will be that which promotes the ability to think and to learn on a self-sufficient way and at the moment; and promotes students to be critical and self-guided, motivated and able to reflection about cooperation; and also to continue learning throughout life [25].

Fundamentally, to opt for virtuality answers to its understanding as resemblance of reality (but not real), which has been always present between us. Before, the potentiality of virtuality was the possibility of making imagination to be real, in ideas, in beliefs; and today, the potential of technologies makes possible a new way of reconstructing imagination, of making reality the virtuality of our ideas; in a passage that is paradoxically denominated "virtual reality".

Virtuality is the dominant paradigm in relation to other human expressions. This is transcendental and important for educational practice. It represents the comparison on which to build a conscious practice, establishing the way of representing, organising and communicating the product of the practice of the symbolic function that human beings make. In contrast to other means, virtual is defined as highly interactive, eliminating the passivity of the spectator that the media, as television, present **[26]**. And that Baudrillard understands as a reference to a substance, which generates models of something real without origin or reality: the hyperreal [27].

In its pedagogical extension, virtuality goes beyond the use of new technologies in education. It is not predictable or mechanical. It comes from the process, it is dynamic and evolves, and it can turn an unpredictable event into a relatively trivial event [9]. In its course virtuality generates "spaces that allow people to move, to express and to share opinions, feelings, values, to handle and exchange objects, etc., and thus to create progressively groups, communities of action" [28].

In particular, when we refer to virtualization of education, we are before a paradigm that is translated "in a virtual campus with a group of virtual spaces whose functions must be interrelated, in the same way as the functions of knowledge management [15]. This adaptation requests

proactivity and a high rate of stable renovation of knowledge.

In that way, educational virtualization turns into a factor of structures and functions transformation, an instrument to increase the coverage, to impulse the quality, propriety and equity of access, and a way to create a new training scheme.

In order for VE to achieve meaningfulness and implication in human and social development, is advisable to prepare the land and to share with the teachers involved in the virtualization of classrooms and with the students the following aspects:

a) the way in which virtualization changes the own conception of the class and the educational process, responding how is modified by virtual incorporation;

b) the specific location of virtual activity and the main uses of computer in such situations, responding to relative doubts, to the dimensions on which learning activities must been prepared;

c) different representations that can have a virtual classroom, responding to which kind of formats are "fair" or can establish a virtual classroom, and

d) specific elements that will define that virtual classroom, responding to what can we find inside a virtual classroom [29].

And now we will see how is VE organised and how is it made synergistic to achieve the interaction in an effective way, which [9] propose in the information society. This involves connecting students, teachers, knowledge and problems to solve on a network, transcending the simple student-teacher interaction; including a series of convergent and fundamental aspects increased from the Zone of Proximal Development (ZPD) of Vygotsky as of three critical factors of educational process:

• someone in the role of apprentice,
• someone in the role of instructor; and
• something that is a problem that the apprentice is trying to solve with the assistance of the instructor [30].

By implication, there is a fourth factor –the needed knowledge to solve the problem. Tiffin and Rajasingham explain "that the interaction of these four factors – apprentice, instructor, knowledge and problem in a particular context– is the fundamental process of communication that is education" [9].

4. Fractal Levels of Virtual Education

Education is a communicational act, constructed and reconstructed in several applications and sequences, that requires "at least five abilities:

1. To presuppose the participation-intervention of the recipient, knowing that to participate is more than answering "yes" or "no" and much more than choosing a given option; to participate is to modify, it is to interfere with the message.

2. To guarantee the bidirectionality of emission and reception, knowing that communication is a joint production of emission and reception; the speaker is

potential recipient and the recipient is potential speaker; the two poles code and decode.

3. To make available multiple articulated networks, knowing that a closed message is not proposed; on the contrary, information is offered on connection networks that give to the recipient a wide freedom of organisations and significances.

4. To generate cooperation, knowing that communication and knowledge are constructed between students and teachers as co-creation.

5. To cause the expression and confrontation of subjectivities, knowing that free and plural speech supposes to fight with differences in tolerance and democracy construction" [4].

In the digital era, the fractal order of VE coordinates an organic whole, from a basic structure, where every dimension is a complex patron of interactions whose links shared similarities and are built on infinite bifurcations, as of its division in different stages of expression.
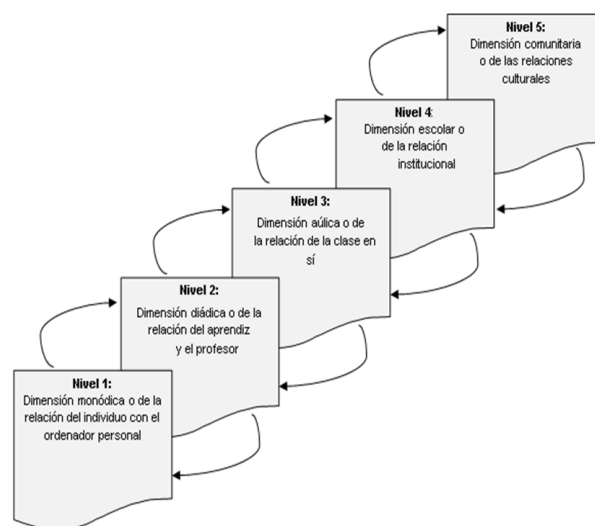

Figure 2. Iterative levels of fractal organisation of VE.

4.1. Level 1: Monodic Dimension or Dimension of Connection between Individual and Personal Computer

Virtuality is a characteristic become from the creative process of human beings, where education goes through the limits of space and the restrictions of time.

In VE a symbiotic connection is established between the individual as an apprentice and telematics technology. Virtual reality makes possible that the student analyses "models from every angle, from macro and micro-perspective, from inside and outside, only a part or the whole model" [9] and, at the same time, it favours self-sufficient learning, because the action becomes interactive participation.

Apparently, this mental activity is an isolated labour, but not, the gears of information that comes from fundamental factors of education, seems to appear on the networks of mind, contributing to socialization [31]. The process of

structure of knowledge establishes a neural network of interrelations (an undetermined number from 10 to 100 billion of neural nodes connected by electro-chemical synapses) that cause knowledge, making and being, coming into contact with knowledge, technologically distributed (via computer, connected or not to a network and/or a net of networks) and internalised by the apprentice through a problematic situation.

This connection seems to lack the figure of the teacher, but not, the role is shared with the apprentice who makes as self-teacher in the interaction with the computer, he is the one who learns and controls the sequence and dynamics of learning, assuming consciousness of the problems that tries to solve, by means of a "conversation" similar to a teacher-student conversation about a problem; and this is possible if we assume it as a "means to assimilate the world, it can approach reality from perceptive perspectives unknown up to now" [32].

In the "self-directed and assisted study" emerges the image of a hard-worker student, who in the interaction with the computer will be able to send works or enquiries by email, to search for information in a digital library or a data base, to interact with the multimedia provided by a CD Rom or DVD, a video or sound recording, or a software, or a virtual platform. These mentioned aids have intelligent instructions assisted by computer, which assumes "the role of automatized teacher or being a source of knowledge and problems" [7].
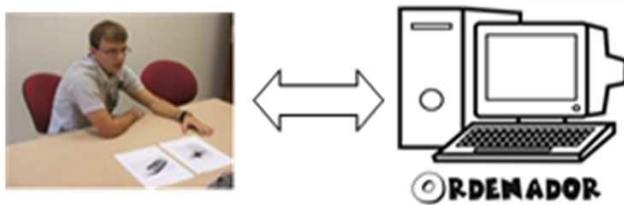

Figure 3. Monodic dimension (first node).

When the connection "with me" is unsatisfactory, the next fractal level of education can be viable as unleashing of fractals to make propitious the knowledge structure.

4.2. Level 2: Dyadic Dimension or Dimension of Connection between Apprentice and Instructor

When the student finds difficulties for a self-sufficient learning in VE, when he tries to solve a problem and it becomes impossible, he establishes an educational connection with other node that contains the knowledge. In this way, he asks for help to a classmate or calls the teacher. Thus, he opens again an educational network, but this time he connects with a teaching node that could be also a source of knowledge [9]. In this connection a variety of available resources combine each other to study a specific problem. Frequently, there is someone who has some knowledge on the topic and someone who will appear as a teacher in relation to the problem, in the same way as a "community" that helps to understand the really specific

and new knowledge and does not add analytical confusion to move away from the understanding (García, 2002).

In this process the telematics technology encourages people to use it, because it contains the potential to develop an educational environment to satisfy cognitive requirements, through an educational design assisted by computer (a group of instructions, an electronic blackboard, a projection system, surfing through hypertext…).

In that purpose, the environmental aspects have a conciliator role; every node of the network will represent an ability that is subsidiary in the resolution ability of the problem or needed requirement [9], but it will be the person who started from the established connection will help with the knowledge structure, "based on the use of powerful recourses of democratic expression between student and teacher" [7].
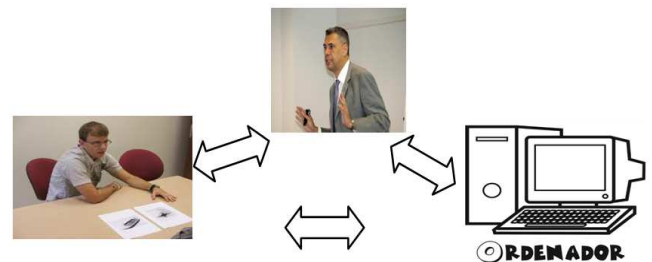

Figure 4. Dyadic dimension (second node).

Transmitted abilities by means of this educational connection are noted by each other, as an alternative process of analysing and synthesizing abilities, expressed at different fractal levels [9]. These are represented as a "map of education" where we can select the ability node desired, receiving instructions hierarchically structured. This proposed procedure is not a linear sequence, but depends on the user to assign the most appropriated course for his needs, motivations and interests. All the alternatives are susceptible of different treatments that go from working on a problem and to solve it, alone or with assistance; to ask for explanations to someone (the teacher, an advanced classmate…) for the knowledge needed in the presented contrarieties; or to ask for a demonstration of how to use the understanding with the analyzed problems.

In this dynamics, despite many possibilities of finding help, it may be possible that is not enough to pass through a problematic situation on our own. Then, the apprentice can turn to a teacher (or an "artificial intelligent" programme) to get a feedback about the progress in some specific ability.

The relation "you and him/her" results convenient and appropriate, it is usually distorted by other improper factors given that education is communication and it expresses in different fractals dimensions. If this happens, it will be necessary the search for other fractal level that could make possible student-teacher and knowledge-problem axis to understand each other and to interact with node connection, that favour interpersonal relationships and activities to make.

4.3. Level 3: Aulical Dimension or Dimension of Class Connection

The student is present in all the educational systems, maybe more visibly in the classroom scene. Here, communication should be direct and involves more intensely vivid situations through teaching and learning processes. In VE the users are in constant contact with technology (laptop, mobile phone, palmtop…). The teacher is open to the emerging communicational culture to modify the learning environment in the classroom and to educate following the characteristics of this time [7]; the teacher also assumes, as much as he can, design, planning, development and evaluation of these convergent technologies, understanding the classroom as a network, reflecting what happens on the society-network, similar to "social networks with a geometry and variable composition" [33].

In the environment of connection of the classroom many knowledge nodes appear, coming from the external environment or from factors generated during the interaction in the classroom. Interactions built on these neural and contextual networks can provide the possibility of changing from a fractal level to other, when the group network is not contributed.

Information society leaves open the possibility of an external classroom, favourable environment for VE, irradiating communication for a dyadic exchange in a star network, where student and teacher are conscious of the fruitful generating conversation. Virtual reality proposes a series of telematics resources (forums, chats…) so that the interaction causes an indirect effect on the others. The educational process favours that the teacher helps the student to use the knowledge in the resolution of the problem, taking as interactivity platform the virtual classroom, by means of a synchronic and asynchronous communication. The model presupposes several teleconference centres joint on the network for an organised study, with the figure of a moderator or teacher, or several at the same time, but coordinated. Every student on his own educational fractal knowledge will guide his understanding, assuming, if precise, a different part of the problem to synthesise then the results, by changing networks, from a macro to micro or vice versa. Thus, the elaborated knowledge is a shared product that passes through several fractals levels of the network in course.
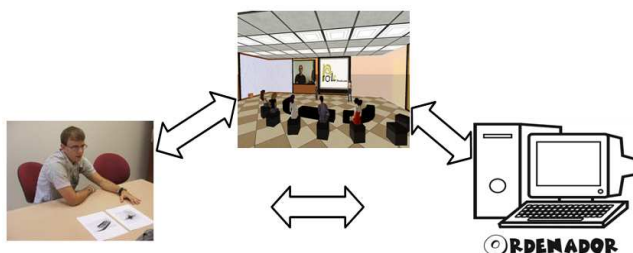

Figure 4: *Classroom dimension (third node).*

Within this type of classrooms, classes are made flexible and the study can be taught in a self-sufficient way, can be made with a virtual teacher, in pairs or small groups. Teachers can meet the students on telepresence to teach individually, or meet the group in a virtual classroom [9], in order to concrete the previously organised and established contents. Its accreditation or certification requires a higher instance, the following level of confirmation (school, university, educational system).

In this combination of facts everything is fit together, the critical factors of educational process with the fractals levels of organization of education. The system generates a great variety of distant or close communities and cultures through a "characteristic or typical behaviour (eigenbehaviour) of psychological and social systems" [34].

The main driving force is the common interest on learning how to employ knowledge in a specific problematic field, from different perspectives and on a level of growing complexity. This demands a fractal level of grouping that organised all this knowledge and return it depending on the permitted requests.

4.4. Level 4: Scholar Dimension or Dimension of Institutional Connection

The term school, by extension, refers to educational institutions (school, secondary school, university, postgraduate school…), where the class or the classroom is a processing node of the network. It is part of a wider educational system, regional or national, in which diverse pedagogical processes are put together (learning courses, modules, degrees, structures of classrooms…).

The educational system controls the functioning of teaching and learning connections according to social and economic demands, determining the design and planning of education and regulating the "scholar transition" in time and space. In VE this is overcome, the apprentice decides what he wants to study, when and how, and he is the one who searches for the learning more significant for him, what motivates him to learn [9].

Virtual classes give rise to "virtual communities of learning".

These instances, more complex, provide services, libraries and support administration to concrete the educational estimates. In that progressive course diverse institutional experiences of VE emerge, as Virtual Universities, Open or Distance (National Distance Education University, Open University of Catalonia…) or programs combined with face-to-face classes (blended learning), not only in tertiary education but at lower levels (telesecundaria in Mexico, Huascarán Programme in Perú…).
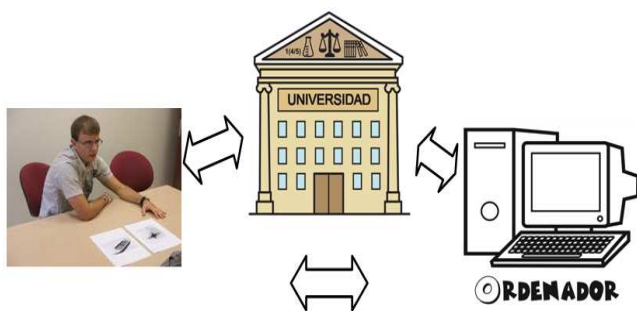
Figure 5: Institutional dimension (fourth node).

Institutional versatility will make feasible to course properly through this level, where fundamental external supports for human beings to cause transformations on mind are needed. For this reason, objects that are used to organise and to replace information externally are considered psychological instruments, while allowing increasing and extending intellectual functions of human being, that is placed closer to the condition of "cognitive tool" [34].

In relation to didactics, the student interacts with the institution. The apprentice-user constitutes a node on the network of virtual institutions. These will also have an internal network in which nodes will function as tele-administration, tele-support services, tele-library and its academic departments. Every department, at the same time, has its own hierarchy of fractals levels. And the tele-library as a network of collections, a collection formed by a network of books, a book as a network of chapters, a chapter as a network of paragraphs and so on [9].

The fractal nature of educational organization is patented from now. Educational institution is a network of teacher-students interactions in classrooms; there, the interactions happen during classes. A class implies a teacher-student interaction. A student can interact with his own person. In all interrelations fundamental factors of educational process interact: apprentice-teacher-problem-knowledge. This relationship defines a dynamics of surrounding communication with defined proposals.

4.5. Level 5: Community Dimension or Dimension of Cultural Connections

Educational experiences are built on "a kind of information networks at levels which can vary from the neurological network of human's brain to the telecommunications network of global village" [9].

The technological emergence of telematics favours that frontiers superimpose each other, creating situations of globalization in every order of human and social events. Education is included in this task and it "appropriates" the dominant paradigm, in order to contribute to the deregulation of education, changing its actual form, from face-to-face to virtual.

Cultural interactions go beyond the educational institution, they work within logic of global connection,

where knowledge is constructed and reconstructed from personal experience that, amplified with information, becomes understanding by means of knowledge structure. Its acknowledgement is orientated to an action of personal and social importance and, to continuous enrichment of the frame of reference where the future experience will take place.

Naturally, this experience offers the starting point of a new course, so, from the perspective of the evolutionary trajectory of an individual or a community, a spiral would be a better metaphor. As Well says, the understanding seen as a media will allow changing as much the individual as social environment continuously and, therefore, it should be the goal of every educational activity [35].

The current system, characterised by feasible utopias, places education between the structural frameworks of economical politics, in the conception of yielding, driven by motives of profits, subject to competition within an open market and paid by a demanding user, in opposition to the mixture of social and cultural politics interested on equality of opportunities and the preservation of national culture, and the local way of life [9]. Before this dichotomy, education is responsible of generating globally competitive abilities (social, cultural, labour…), not to compete with others but to share with them through the use of the network: Internet; to strengthen educability, the socialization with the environment and the world, as "an essential means of communication and organization in all the areas of activity" [33].

5. As a Conclusion

To prepare people for their performance in a network-society is to create an effective system of educational communication founded on a fractal dynamics that allows overlapping every level simultaneously at apprentice's convenience, and not regulated by any request. Thus, education will have achieved coherent conviction, giving sense to the educational activity made in the network, establishing the fertiliser to give results.

This approach presupposes "an immense transformation in the way of using and even thinking about media, as well as the knowledge they transport" [36]. In this sense, the fractal approach of the structure of VE seems to explain the operational functioning around how diverse connections and pedagogical processes are applied, being conceived as groups constituted by an infinity of nodes where every node is self-similar to the whole, being infinity nature recursive-iterative.

The fractal organization of VE, on its dimensional levels, expresses the idea of generating every level from the predecessor, respecting in everything but the measurement (the covered place) to the previous; and it suggests the idea of existing reason between the first and the second in relation to their purposes [37]. This reason appears as the ability to reproduce, move or exist in a certain degree, independently of the environment that delimits it, moving

from a self-sufficient level of learning to the socio-cultural learning, or vice versa. However, it does not mean that there is a linear continuity but, on the contrary, within disorder the ability of pedagogical adaptation is susceptible, depending on the possibilities of knowledge apprehension; making viable the evolution of the first information and communication environments that could be thought as pre-existing just on the first level, with respect to the nature of the "artefact" that supports it, the computer; to training environments of higher recursion, as the conceived on the fifth level.

In that understanding, the spatial organizations "reconstructed" as "inhabited" virtual environments display sociality. To favour interactivity makes possible the coexistence and combination of actions and situations of different types of educational agents and subjects, from different origin and influence level, without requiring spatial or temporal contiguities; that does not mean to deny the existence of space-time components and framework [21]; clearly represented on the fractal nature of VE, as recursive processes equally accessible without major limitations.

In this point, in a latent way we leave our uncertainties and aspirations in the presence of virtuality. Facing that, it concerns an intense dialectic reflection about the functioning of virtual technologies and if they will help to change the spectrum of crisis that education is living. What's more, if the proposed fractal approach explains what happens in the dynamics of teaching and learning processes in these scenes, and if the clear artefactual structure expresses what happens in diverse educational nodes; or maybe we are facing other effort that stays in the public eye; that is, it does not reveal the pedagogical essence of training virtual environments.

Pretending to explain VE as educational policy, that is, as "a programme of governmental action in a sector of society or in a geographical space" [38], of making viable some principles to concrete possibilities. It is understood that the most practicable scenes for virtuality pass through the Higher Education and Adult Education levels (for instance, in the Continuous Training of teachers).

To summarise, the fractal consideration of VE affords an approximation framework to safeguard the access and continuity of citizens' rights to education, with criteria for equality, respect to diversity, and opening to more opportunities. This training space does not answer to unilineal logic but chaotic (from conscious order) of a context that needs either the expansion of coverage or about all the quality (of fundamental and continuous improvement).

VE can contribute in the reversion of information illiteracy, popularising the use of technologies searching for regular updating. In one hand the social, constituting an instrument to get inclusion because of the differential characteristics that it presents. On the other hand, the pedagogical, explaining analytical and explicative approaches about design and evaluation of environments,

materials, etc.

Consequently, it is our task as educators to follow the investigations about how VE evolves. Progressively, this inquiry must make us get closer to reveal the intrinsic reality of training act presented on virtual networks.

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