

Knowledge and Curriculum Boundaries?

Sousa, Jesus Maria
University of Madeira
Email: angi@staff.uma.pt

Abstract

Starting from Theaetetus, one of Plato's Dialogues, to discuss the nature of knowledge (what?) and the ways to access to it (how?), and confronting rationalist and empiricist positions, this theoretical analysis aims at critically analysing the meaning of knowledge originated from the scientific revolution, based on Bacon's *Novum Organum* and the Cartesian rationality, as a way to reach the "ideal" stage of humanity.

Turning to curriculum-making, questions related to "what to teach/learn" and "how to teach/learn" necessarily evokes issues concerned with knowledge, a scientific and socially valid knowledge.

But the "black-and-white" mental organisation evidenced by the knowledge boundaries of various disciplines in hierarchical order composing the study plans, characteristic of the modernist technological curriculum, is now undermined by the recognition of the complexity of the phenomena to be studied.

Challenged by new theories from the field of the hard sciences, the curriculum studies has to seriously reflect about the real meaning of what is a scientific and socially valid knowledge conveyed by the school in the present context of paradigm shift and be consequent, i.e., be bold enough to put the reflection into action.

Keywords: Scientific knowledge; Socially valid knowledge; Complexity; Paradigm shift; Post-modernity.

1. Introduction

The critique of the academic disciplines as limited and confining is as long-standing as the disciplines themselves. Historically, this critique has often taken the form of referring back to an older, more unified form of knowledge, usually located in an undisciplined subject such as philosophy (Moran, 2010, p. 13).

The questions related to "what to teach/learn" and "how to teach/learn" necessarily evokes issues concerned with knowledge, a scientific and socially valid knowledge, as the core of curriculum. And the concerns about the nature of knowledge (what is it?) and the ways to access to knowledge (how do we get to it?) are as old as the philosophy itself, leading us to the field of the epistemology.

Plato, in one of his Dialogues - the Theaetetus (Bostock, 1991; Waterfield, 1987), put the famous mathematician Theodorus of Cyrene's brilliant young student Theaetetus dialoguing with Socrates and with his teacher. Questioned about "What is knowledge", Theaetetus started mentioning a list of disciplines, such as geometry, astronomy, arithmetics, arts and crafts.

Not pleased with Theaetetus's answer, Socrates refined the question: "But what is knowledge exactly?" This problem is much more complex, since in Greek as in English, there is just one word, contrarily to what happens in Portuguese ("saber" and "conhecer") or in French ("connaître" and "savoir"), for example. In this Dialogue, Socrates presented a tripartite division of knowledge:

1. Knowing an object (a person, a thing): knowing by contact, corresponding to "conhecer" and "connaître";
2. Knowing how (knowing how to do things): knowledge of skills;
3. Knowing that: a propositional knowledge.

The Dialogue went on focusing on this third dimension, referring to "saber" and "savoir". It is also on this dimension that we are interested to critically analyse in this paper: the Socratic propositional knowledge as the source of the scientific and socially valid knowledge prescribed by the curriculum.

Apart from the association of knowledge to perception, given the argument that a breath of wind can cause a chill to someone who is more sensitive to cold than to another person, Socrates elicits from Theatetus, making use of the maieutic method, like a midwife who helps a woman give birth, the idea of knowledge as belief: we must believe what we think we know. And then, he continues to reflect, it is necessary that this belief is true. Quite often it is proved that what we thought to be true is not true after all. Therefore it is necessary to justify such a supposedly true belief. So the justification was the third condition of knowledge. Deductive, inductive or abductive arguments are needed to configure the existence of the knowledge we are now writing about: knowledge as a belief (1) which is true (2) and justified (3). "The preliminarily standard definition is that knowledge is a justified true belief" (Grayling, 1996, p. 37).

And now the second classic question is: how to get to it?

Abstractly speaking, and since every belief is based, in chain, on another one, there will be a point where you can no longer go further, because it will not be possible to scrutinize any other justification in the end. We say here that these beliefs are self-justified, or self-evident: we are then at the level of the foundational beliefs, that is to say, the origin of everything, namely the myth of the datum, the pure datum. And then we can question about whether there is or there is not a prior knowledge... In fact we can only say that we do not know something, if we know something.

But has knowledge existence regardless the human being who wants to achieve it? Is knowledge just waiting to be discovered? How do we get to it then? Or is knowledge a reality constructed by the subject?

Throughout the history of the epistemology, we have been confronted with two schools of thought: rationalism and empiricism. For the "rationalists", the objects of knowledge were propositional, that is to say, they were truths that were achieved by rational, logical-mathematical inferences, by the Reason. The only sources of knowledge were the ideas of the intrinsic Reason, as reflected in the syllogistic reasoning, for example, where the major premise was a "kind of self-evident and undeniable statement regarding a metaphysical truth or a dogma" (Sousa, 2000, p. 19). In this case, mathematics and logics were the core disciplines necessary to achieve this knowledge.

As for the "empiricists", what counted were the natural sciences, with their procedures of observation and experiments. For them, one came to the truth by experience, by the senses, although they recognized some limitations in this approach: the colour, the taste, the smell, the sound, the texture of an object varies according to the condition of the subject who perceives it, or the conditions under which the object is perceived. To overcome this perceptual relativity, some

instruments were created, such as microscopes or telescopes as more refined extensions of the human senses.

Over time, these two groups have been struggling over about the nature, the origin and the reliability of knowledge. The Aristotelian and medieval knowledge were used to face with despise everything that was not exclusively based on the Reason. For them the knowledge applied for practical resolution of daily problems had not the same status of that propositional knowledge exposed by Socrates in Plato's Dialogues. It was only an ordinary knowledge, at the level of the common sense: irrelevant, illusionary and false.

As for the Curriculum, since this word has entered the educational lexicon, the concept of knowledge has also been changing according to different paradigms.

Contrary to Gundem (2010), who considered that the word Curriculum was first used by Daniel Georgius Morhof (1639-1691), professor in Rostock from 1660, Doll (2002) anticipates its use to almost a century before, saying that "[i]t was in one of Ramus's works, a taxonomy of knowledge, the 'Professio Regia' (1576), published four years after his death, that the word curriculum first appears referring to a sequential course of study" (Doll, 2002, p. 31).

But both authors are unanimous in considering that Curriculum appeared as a reaction against the medieval Scholastics which aimed at the validation of Christian dogmas by means of the Platonic and Aristotelian logic in the attempt to reconcile Faith and Reason. In a context of solitary deep study, knowledge was achieved by the students who were let alone unravelling complex and confused information.

So Curriculum aimed at the simplification of knowledge making it accessible to the students with a purpose of "teaching and not thinking", focusing on Didactics rather than on Dialectics. The taxonomy of knowledge, or syllabus sequentially arranged in an "unbroken linear progression" is by Doll (2002) called a "logical map of knowledge". Therefore there is a close relationship between "the mapping of knowledge" and "the accomplishment of instruction". That is to say: to make knowledge clear and understandable it should be simplified as Hamilton says: "Starting with a map of knowledge, Ramus reduced such knowledge into a tree of knowledge, using repeated binary division" (Hamilton, 2003, p. 08).

2. Modern Scientific Knowledge

The idea of simplification of knowledge, to make it accessible to other non-ecclesiastic people, was contemporary to the emergence of science, as the substitute of God who had reigned in the medieval ages. The solution for all problems of the mankind was then optimistically laid on science and technology, in the hope to control nature which had been in God's hands before.

The negation of the Earth as the centre of the universe has shaken the current esoteric conceptions, triggering a revolution in the way of organizing men's way of thinking and reading the reality. Modern science, born with the scientific revolution of the sixteenth century, brought another kind of rationality to access to knowledge

... represented by Copernicus's heliocentric theory of planets motion, Kepler's laws about planets orbits, Galileo's laws on the bodies falling, the great synthesis of

Newton's cosmic order and finally the philosophical awareness given by Bacon and particularly Descartes (Santos, 1988, p. 3).

The Aristotelian deductions started then to be refuted. In the Preface to *Novum Organum*, Francis Bacon (1620/2002) showed the relationship between these two types of approach to knowledge (rationalism and empiricism), emphasizing the primacy of knowledge that enables action.

... But if there be any man who, not content to rest in and use the knowledge which has already been discovered, aspires to penetrate further; to overcome, not an adversary in argument, but nature in action; to seek, not pretty and probable conjectures, but certain and demonstrable knowledge — I invite all such to join themselves, as true sons of knowledge, with me (Bacon, 1620/2002).

In one of his Aphorisms on the Interpretation of Nature and the Kingdom of Man (Aphorism LXXI), Bacon picked up the prophecy of an Egyptian priest about the Greeks, to compare them to children:

they were always boys, without antiquity of knowledge or knowledge of antiquity. Assuredly they have that which is characteristic of boys: they are prompt to prattle, but cannot generate; for their wisdom abounds in words but is barren of works (Bacon, 1620/2002).

In this case the focus is an objective knowledge aiming at some kind of action, a concrete knowledge with no interference of human values or religious beliefs. And if it is true that modern science raised Man to the place of an epistemic Subject, the fact is that this same science expelled him from the scientific area, as it had done to God.

This new scientific rationality aimed at isolating the researcher from his/her object of research, in favour of a knowledge the most possibly objective, not permeable by human emotions. It was then recommended the "inductive method, which means the use of multiple observations of the phenomena and not religious assumptions or other kind of authority to reach conclusions or generalizations" (Sousa, 2000, p. 19). The observation of natural phenomena should be free, non-committed and systematic, bearing an attitude of permanent distrust of the evidences generated from the immediate experience.

In this new type of scientific rationality, the "ideas" were not ignored. They configured the hypothesis, not as an assumed truth at the departure (the major premise) but as a question to be ascertained by observation and experimentation. In his "Discurso sobre as ciências" (Discourse on Sciences), Santos drew our attention to the quantification and simplification of the modern scientific knowledge:

From this central place of mathematics in the modern science derive two main consequences. Firstly, the quantification: to know means quantifying. The scientific rigor is determined by the rigor of the measurements. The intrinsic qualities of an object are, so to speak, disqualified and replaced by the quantities that could eventually translate them. What is not measurable is scientifically irrelevant. Secondly, the simplification: the scientific method is based on the reduction of the complexity (Santos, 1988, pp. 4-5).

And this happened in a context of stability and constancy, in the presupposition of an absolute order that ruled over everything in the universe, a context in which it would be possible to predict future situations based on present situations, or to provide for situations over there, on the basis of situations here.

Quoting Osberg, “[w]ith cause and effect thinking we understand the world in a mechanical sense where everything is made up of isolated parts and their rules of interaction and there is only a single way for the process to ‘unfold’” (Osberg, 2009, p. vii).

Modern scientific knowledge thus assumed a functional and utilitarian dimension aiming not so much at understanding the essence of Nature, but at knowing it in order to dominate and transform it.

Basically, we were witnessing the affirmation of the nomothetic sciences able to explain and foresee general laws: faced with similar conditions, the same results would occur whether here or there, whether they were yesterday, today or tomorrow. This universal and timeless determinism made everything seem extremely simple and transparent (Sousa, 2000, p. 21).

If Isaac Newton (1642-1727) had dared to go beyond the distinction between Heaven and Earth, seeking to show that the laws that governed the celestial sphere were the same kind of those causing the falling of an apple, he was not able, however, to abandon the static cosmic vision of the galaxy – The Milky Way as the entire universe – which remained rooted in the minds of scientists until the twentieth century. According to E. Burt (1932/1955, cited by Doll, 2012), Newton’s metaphysical assumptions gave modernism’s cultural milieu its distinctive flavour.

Four of these assumptions are (1) that ‘Nature is pleased with simplicity’; (2) ‘To the same natural effect we must ... assign the same cause’; (3) ‘God in the Beginning formed Matter into solid, massy, hard, impenetrable particles’; and (4) that ‘Nature is conformable to herself and simple’ (p. 15).

It is then understandable why all hopes for the resolution of natural and social problems that plagued the world were laid on this scientific knowledge. There was an absolute belief that we would reach the final and ideal stage of the evolution of the humanity. For example, the theory of Auguste Comte (1798-1857) on the Positive Social State is an example of this general belief, as the stage reached after having overpassed the previous Theological and Metaphysical States; the same way as it is the theory of Herbert Spencer (1820-1903) on the Industrial Society, facing it as the most civilized and developed society, after the Simple, the Double and the Triple composite Societies, based not only on its form of organization and division work, but also on the decentralization policy and the idea of the State serving the citizen, the representative government and free initiative, religious freedom and monogamy, among other aspects. We can also mention the theories of Émile Durkheim (1858-1917) on Organic Solidarity through the division of work, which in his view, would make the individuals become interdependent, cohesive and supportive, not by family, religion, customs or traditions, as in the type of Mechanical Solidarity characteristic of pre-capitalist societies, but because, like a biological organism, where each organ has a function and depends on others, in society too, each individual would have a specific function, needing others for other functions. That is what, in his view, would generate solidarity among men.

These theories are good examples of the optimism the modernity started to congregate in its break with the medieval past, in which everything was due to one single and supernatural cause. The modernity was finally giving way to

a social condition that is both guided and sustained by enlightened beliefs in rational scientific progress, the triumph of technology over Nature and the ability to control and improve the human condition by applying all this scientific knowledge and technological expertise to the field of social reforms (Hargreaves, 1998, p. 9).

Imbued with a desire of transparency and simplification, reflected in the decomposition of the whole into parts, or in the Cartesian separation between Subject and Object (*ego cogitans* and *res extensa*), the subjective emotions were put aside to formulate general laws at the light of observed regularities.

Sharing the same paradigm, understanding it as "... what the members of a scientific community have in common", and thinking about scientific community as "... people who share the same paradigm" (Kuhn, 1983, p. 240), the affirmation of Curriculum as an area of study and research could not be made but through the technological model launched by Bobbitt (1918; 1924) and reinforced by Tyler Rationale, stressing the importance of the objectives to be defined before anything else in a linear instructional design: objectives unfolded into cognitive, affective and psycho-motor taxonomies, from the simplest to the most complex operations; and general objectives unfolded into specific, behavioural and operational objectives.

It is worth reflecting about the ideology of order, routine and method, characteristic of a Protestant culture installed by the Puritans in England and America (Doll, 2012) two centuries ago that led to the methodization and simplification of knowledge, through a Curriculum strongly expanded with the help of the printing press. Metaphorically speaking, the passage from the 'text' (solitary study in monastic and cathedral schools) to the 'text-book', with the purpose of simplification and fragmentation of knowledge to generalize it, demanded a sort of selection of some knowledge, in detriment of other. This is what Sousa and Fino (2014) called "o pecado original do currículo" (the original sin of curriculum) that has marked the History of Curriculum until now. Nevertheless, talking about the modernism's tendency to categorize, within the "Aristotle's either/or (excluded middle) logic", Doll (2012) brings some hope saying that "such logic with its sense of domination – right better than wrong – is being challenged today" (p. 14), to which I add: just at the level of curriculum theory.

3. Scientific Knowledge and Complexity

As a matter of fact, the 'black and white' thinking to achieve scientific knowledge, in the line of a cause-effect or stimulus-response mechanistic and deterministic logic has already started being undermined by the advent of the new sciences of chaos and complexity and the recognition of the density of the phenomena to be studied, in a trend curiously initiated at the level of the hard sciences.

Edwin Hubble (1889-1953) demonstrated in 1929 that, after all, the universe is not static, but constantly expanding: the conclusion was drawn from the finding of nebulae in other galaxies moving away from us at tremendous speeds. This discovery raised the question about the origin of the universe, giving bases to the Big Bang theory formulated by Georgy Gamow (1904-1968), a Russian-born American physicist.

Nevertheless it will be Albert Einstein (1879-1955), who initially resisted to the idea of a cosmic origin, to question Newton's independent concepts of space and time, presenting the idea of space-time as one geometric entity, with his theory of relativity (special relativity, in 1905, and general relativity, in 1915, this latter adding the effects of gravity to the former).

Gaston Bachelard (1884-1964), when referring to the era of the New Scientific Spirit in contrast to the Pre-scientific and Scientific ones, clearly says:

Nous fixerions très exactement l'ère du nouvel esprit scientifique en 1905, au moment où la Relativité einsteinienne vient déformer des concepts primordiaux que l'on croyait à jamais immobiles (Bachelard, 1993, p. 7).

The quantum mechanics of Max Planck (1858-1947), the probabilistic theories, the wave mechanics of Louis de Broglie (1892-1987), the correspondence and complementarity theories of Niels Bohr (1885-1962) and the uncertainty principle of Werner Heisenberg (1901-1976) among others have brought a new conception of physics which already contemplates the irregularities, disruptions and disintegrations, reconsidering the inevitable interference of the Subject in the observation, striking down the absolute vision of what is 'reality'. In this sense, knowledge appears as "representations of reality" (Osberg, 2009, p. v).

Thus science itself is redefined, the same way as the access to knowledge, in a rupture with the prevailing paradigm. What is scientific knowledge then? Are scientific theories descriptions of the 'reality'? Or are they just instruments that allow us to better understand the 'reality' until other better explanations emerge? For Karl Popper (1902-1994) "all science is based on quicksand". His principle of falsifiability underlines the idea that a theory is scientific only if it is proved that it is false. "Je les conçois les théories scientifiques comme autant d'inventions humaines, comme des filets créés par nous et destinés à capturer le monde" (Popper, 1984, p. 36).

The philosophy of mathematics itself, from the point of view of the incompleteness theorem of Kurt Gödel (1906-1978), recognizes that the measurement accuracy of mathematics, like any other form of accuracy, is always based on a selectivity criterion. Someone has always to 'subjectively' select the 'objective' criterion.

A new relative and complex order emerges, "a complex sense of order, where order and disorder are structurally intertwined" (Doll, 2012, p. 14), spreading from the physical and natural world to the human and social field.

It's a new order, where it will be very difficult to accept simplistic and dichotomous divisions, I would say a Cartesian order divided into reason on the one hand, and emotion on the other, right on the one hand and left, on the other, man on the one hand, and woman, on the other, black, on the one hand, and white on the other. On the contrary, we are now experiencing the time of ethical, philosophical, political and ideological mestizage (Sousa, 2009, p. 3).

In this context, the book by Jean-Francois Lyotard, "La condition postmoderne", is published in 1979, laying the foundations for thinking about (scientific) knowledge in the new era we now live. Being a pioneer in the use of the term 'postmodernity' and featuring knowledge as a kind of scientific discourse, Lyotard announces the end of metanarratives. For him, metanarratives are the major explanatory schemes of the world, the absolute truths we can find

whether in ideology or in totalitarian systems of knowledge as it was the case of science itself. Patrick Slattery synthesizes this way:

Metanarratives do not problematize their own legitimacy, and thus they attempt to order history logically according to the preconceived modern notions of totality as reflected in patriarchal, technological, colonial, anthropocentric, rationalistic, militaristic, and Eurocentric paradigms. These modern paradigms deny the historical and social construction of their own first principles (Slattery, 2006, p. 41).

The modern metanarratives ignore the specificity, the contingency and the difference. Analysing Lyotard's position, Henry Giroux affirms that "[a]gainst metanarratives, which totalize historical experience by reducing its diversity to a one-dimensional, all-encompassing logic, Lyotard posits a discourse of multiple horizons, the play of language games, and the terrain of micro-politics" (Giroux, 1993, p. 52).

While Anthony Giddens believes that the transitions that are occurring "should rather be seen as resulting from the self-clarification of modern thought, as far as the remains of tradition and providential views are being removed", he does not hesitate saying that "[w]e have not come beyond modernity, we are living precisely a phase of its radicalization" (Giddens, 2000, p. 35). On the other hand Gilles Lipovetski (2004) prefers to use the term hypermodernity instead of postmodernity, just to convey the idea that there is not a rupture with modernity yet, as the prefix 'post' implies, but an accentuation of specific characteristics of modernity, such as individualism, consumerism, hedonism, and others.

Being either a break or an evolution of modernity, naming the present era either as post-modernity (Lyotard, 1984), radicalized modernity or late modernity (Giddens, 2000), liquid modernity (Bauman, 2006) or hypermodernity (Lipovetsky, 2004), among other designations, what is true is that we are living in a time marked by dizzying acceleration of change at all levels under the umbrella of information and communication technologies, which have brought a new meaning to globalization. We are living in a period marked by the collapse of the components that shaped modernity. Stability, permanence, security and certainty are hardly words that fit into our everyday lexicon nowadays.

And if we consider the relationship between language and thought, we would say that the postmodern mental organization is based on the so-called "absolute relativism", on the systematic doubt against "universalizing presumptions" (Lyotard, 1984), in a permanent questioning of the neutrality and the universality of the Reason, because "the postmodern world is fast, compressed, complex and uncertain" (Hargreaves, 1998, p. 10).

And in this environment of uncertainty, complexity and chaos, how is knowledge envisaged? Is it a whole, resulting from the summing up of well divided and delimited parts? How strict and static are the knowledge boundaries? For Santos (1988):

1. All natural-scientific knowledge is social-scientific;
2. All knowledge is local and total;
3. All knowledge is self-knowledge;
4. All scientific knowledge aims to become common sense.

In this new context of paradigm shift, boundaries between what is scientific knowledge and common sense are not clear the same way as the boundaries between the physical and natural sciences and the humanities and social

sciences start disappearing. There are not clear boundaries between different disciplines, and even less boundaries between the Subject who investigates and the Subject/Object to be researched...

And about the ways to access to knowledge, Paul Feyerabend (1924-1994), with his famous "Against Method", brings the anarchist vision of science, rejecting the existence of universal methodological rules for considering them elitist and even racist. It is interesting to know that this book was born from a project initially conceived by himself and Lakatos, to be entitled "For and Against Method", where each one would have the responsibility to defend his position: a position in favour of a rationalist view of science, by Lakatos, and a position against it, by Feyerabend. However, the premature Lakatos's death in 1974 prevented them to successfully complete this plan, only remaining Feyerabend's "methodological anarchy". This author asked, for example, about the reason why the effectiveness of the rain dance or the astrology was refused just because it was not supported by scientific research. In his view, science was becoming as much repressive as an ideology, regarding other alternative routes (traditional or not). And if science was liberating, in the beginning of its affirmation, it is now imprisoning us in a supposedly scientific dictatorship.

4. Knowledge and Curriculum Boundaries in a Paradigm of Complexity?

Focussing the attention on education in general, inspired by Morin's paradigm of complexity (Morin, 1990), Sousa (2000) reflected on scientific knowledge about education, saying that it is 'global and systemic', 'unique and specific', 'procedural and dynamic', 'uncertain and unstable', and 'personal and subjective' (Titles of sub-chapters).

For this curriculumist, the scientific knowledge in education is 'global and systemic', because it is not possible to parcel it in separate subjects. Any analysis of an educational phenomenon needs a multitude of references from diverse fields ranging from history to philosophy, from psychology to sociology, from economics to policy, from methodologies to practice: any scientific analysis in education needs a multi-referential view (Ardoino, 1993). Acknowledging the overall dynamics of a system (Bertalanffy, 1968), we know that the intervention in one of its subsystems immediately echoes in all the other ones, because an open system is characterised by the existence of networks of relationships with "qualities of wholeness, interdependence, hierarchy, self-regulation, environmental exchange, balance, adaptability and equifinality" (Littlejohn, 1982, p. 33), as it is the case of a situation with living beings: a society, a community, a school, a group of students, and so on.

The scientific knowledge in education is also 'unique and specific', having to do with a given situation, a certain place and certain players, *hic et nunc*, without pretensions to generalization. Instead of large groups, it is interested in the study of small communities, a school, a class, a group of teachers, or a single teacher. The case study is so privileged, understanding the experience as unique and unrepeatable. It is very difficult to extrapolate the results of a certain research to other contexts, losing the statistic sample its *raison d'être*.

The scientific knowledge in education is 'procedural and dynamic' too, requiring a historical overview of the ecological context, from the past, to fully

understand it, because any situation, the most concrete it may be, is shaped by its historical and anthropological roots. It is no longer possible to delineate with rigor the precise temporal boundaries of a particular event, or to cut the dynamics of educational phenomena in well-defined slices. It is necessary to know the life stories of the subjects involved to get to the meaning of an educational phenomenon.

The scientific knowledge in education is also 'uncertain and unstable' because it cannot give us absolute certainties or securities that previously the impersonal, anonymous and superior determinism did. It is not through the data quantification and the measurement accuracy and its statistical analysis that we conclude about the truth of the observed facts. The permanent falsifiability of conclusions in the research findings is what opposes science to beliefs or religious and ideological dogmas.

Finally this curriculumist states that scientific knowledge in education is 'personal and subjective' because it takes the subjectivity of the researcher as a tool for research, emphasizing the perceptions, conceptions and representations not only of himself/herself, but those of the subjects of research, trying to apprehend the meanings given by them to the observed situations, opening the way for methodologies of ethnographic approach and action research in education, as if the researcher were a native of that particular culture. Therefore, knowledge in education demands personal and subjective implication of the researcher.

As we see, challenged by new theories from the field of the hard sciences, the social sciences and particularly the education have started rethinking about the nature of knowledge and its boundaries when dealing with their object of research. Defending knowledge as the "never ending conversation", Weinberger (2005), cited by Osberg (2009, p. ix), affirms:

There is a big difference between a relativistic world in which contrary beliefs assert themselves and a conversational world in which contrary beliefs talk with one another. In the relativistic world, we resign ourselves to the differences. In the conversational world, the differences talk. Even though neither side is going to "win" – conversation is the eternal fate of humankind – knowledge becomes the negotiation of beliefs in a shared world.

But if there is already a general consensus about the complex nature of knowledge, specifically in education as scientific object of research, how does the school operationalise this idea in terms of learning and teaching? Being the school the privileged place for knowledge initiation, how does the Curriculum reflect the ongoing complexity thinking of the academy at the present moment? How to put in action an alternative to simplistic linear models in education that fragment knowledge in autonomous disciplines with strict times to go in and go out, even without the ringing bell? How to analyse the world phenomena at school? Will it be enough to envisage the problems from a disciplinary view? Or should we cross the boundaries of disciplines to access to that scientific and socially valid knowledge in its foundational complexity?

Exploring the common spaces of education and complexity, Davis and Phelps (2005) relate transphenomenality with transdisciplinary and interdiscursivity saying that

Just as transphenomenality entails a sort of level-jumping, transdisciplinarity compels a sort of border-crossing – a need to step outside the limiting frames and methods of phenomenon specific disciplines (Davis & Phelps, 2005, p. 2).

Acknowledging that knowledge is no longer absolute, simple, aseptic and decontaminated, it has to be dealt differently at school. Sousa (2012) proposed the “Curriculum-as-Life” focused on the greatest problems of the humanity in the present days, in a context of imprevisibility, by Osberg (2005) designated as the “space of emergence” (p. 82), where knowledge is radically contingent, and not static.

According to the Centre for a Postmodern World (1990), cited by Slattery (2006), instead of a modernist knowledge fragmented in disciplines disconnected with the reality, the curriculum should be imbued with

a post-anthropocentric view of living in harmony with nature rather than a separateness from nature which leads to control and exploitation;
 a post-competitive sense of relationships as cooperative rather than as coercive and individualistic;
 a post-militaristic belief that conflict can be resolved by the development of the art of peaceful negotiation;
 a post-patriarchal vision of society in which the age-old religious, social, political, and economic subordination of women will be replaced by a social order based on the “feminine” and the “masculine” equally;
 a post-Eurocentric view that the values and practices of the European tradition will no longer be assumed to be superior to those of other traditions or forcibly imposed on others, combined with respect for the wisdom embedded in all cultures;
 a post-scientific belief that although the natural sciences possess one important method of scientific investigation, there are also moral, religious and aesthetic intuitions that contain important truths which must be given a central role in the development of worldviews and public policy;
 a post-disciplinary concept of research and scholarship with an ecologically interdependent view of the cosmos, rather than the mechanistic perspective of a modern engineer controlling the universe;
 a post-nationalistic view in which the individualism of nationalism is transcended and replaced by a planetary consciousness that is concerned about the welfare of the earth first and foremost (Slattery, 2006, p. 20).

With these goals in mind knowledge conveyed (through the curriculum) has to be as it really is: fluid, discontinuous, ephemeral, unpredictable and chaotic. No boundaries can maintain different territories impermeable, either in knowledge or in curriculum.

That is why I consider the curriculum studies have to seriously reflect about the real meaning of what is a scientific and socially valid knowledge conveyed by the school in the present context of paradigm shift and be consequent, i.e., be bold enough to put the reflection into action, the curriculum theory into development, and assume the change in curriculum practice.

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