

Analogical Thinking, Inter-Disciplinary Communication, and Case Studies

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Abstract

The purpose of this short reflection-essay and partially experienced in practice is to briefly describe and show the importance of analogical thinking, its relationship to logical thinking, the cybernetic loops that might be emerge when both both kinds of thinking are related with systemic and holistic perspective for an integral, integrative, and integrated Hybrid Thinking; which, in turn, may have systemic-cybernetic, and potential synergistic relationships with Inter-disciplinary Communication, Case Studies, Case Studies Methodologies, as well as for processes of integrating academic activities, i.e. Research, Education, and Consulting or Real Problem Solving. In few words, our objective is to provide an initial essay draft in progress to explain the real and the potential relationships shown in figure 6.

Analogical and Logical Thinking

“Analogy is a mental tool that every one uses to some degree” (Holyoak and Thagard, 1995; Preface) “Everything is analogy”, said Pask (1993). Hofstadter (2007) affirmed that “all meaning comes from analogies” and “analogy is everything, or very nearly so”. Minsky (1988) concludes that “Most of our ordinary mental work ... is based more on ‘thinking by analogy’.” George Polya (1957) claims that “Analogy pervades all our thinking... [including] the highest scientific achievements.” Lakoff and Núñez (2000) conclude that “conceptual metaphor [which is based on analogy] plays a central, defining role in mathematical ideas within the cognitive unconscious.” Many more scholars emphasized on the importance of analogy in thinking and, in spite of many “Historians, philosophers, and psychologists of science have documented many instances of analogical thinking” (Holyoak and Thagard, 1995; p. 185), “analogy has never been quite accepted as the legitimate child of pure thought and reason.” (Haskell, 1968; p. 162)

Although analogy has not been accepted as legitimate thought, it has actually been a fruitful tool in the creative thought required for scientific discovery, engineering design, technological innovation, art expressions, and religious reflections. (Holyoak and Thagard (1995) affirm that “Religion and science are often taken to be entirely different enterprises, but analogy plays an important role in both. Scientific theories, like systems of religious belief, often propose unobservable things like subatomic particles, lack holes, and gravity waves. Scientific theories, unlike religions, must eventually be evaluated in relation to observable evidence.” (p. 10). *Unobservable* things, in scientific theories, are described, and even thought, in terms of *observable* things, transferring and/or communicating knowledge from observable domain to unobservable ones. This kind of

activities requires, by definition, the use of analogies. Knowledge transference and/or communication from different observable domains, or scientific disciplines, also require the use of analogies.

“Analogy by its very nature freely oversteps the traditional boundaries between knowledge domains, making it possible to use ideas from one domain to achieve insight in another.” (Holyoak and Thagard, 1995; Preface) Consequently, Analogical Thinking is a knowledge transference means for creative interdisciplinary communications as well as from non-disciplinary to disciplinary knowledge, and among different non-disciplinary knowledge domains.

Human beings when confronted with new situations that need quick decisions and cannot wait for knowledge accumulation through a large period of time, they usually try to understand the new situation by means of past experience and in terms of what already is known, even if such kind of connections require a *mental leap* (Holyoak and Thagard, 1995), based on analogies. The younger human beings are the more frequently they need to make these mental leaps, because they face more novel situation with smaller pool of known situations. The younger human beings are the more they need to know about new situations by means of what they already now, and the more active they are constructing their world. A similar situation might happen with new knowledge domains or disciplines. The younger a knowledge domain, or a discipline, is the more might nurtured from previous knowledge domains, or older disciplines. Since non-disciplinary knowledge usually precede disciplinary ones, analogies based on non-disciplinary knowledge might be very effective conjectures production, hypothesis formulation, or even in theory creation in the context of disciplinary knowledge. Non-disciplinary knowledge and analogies production seems to be a desirable, if not necessary, condition for the input required by scientific methods in both intra-disciplinary thinking and inter-disciplinary communication.

Analogical Thinking, or reasoning by *analogy* is the mental process by means of which we explore connections between very different domains, trying to understand what is not known by means of what is known, to comprehend what is not familiar through what is already familiar. The known domain is named the *source analog*, because it is actually the source of the analogy, and the relatively unknown one is the *target analog*. Analogical Thinking is not “logical” in the sense of formal deduction or experimentally based induction. But, it is a process of reasoning or thinking where the source domain *constrains* the mental process. This is why some authors consider that Analogical Thinking is based in some kind of logic that they propose to name as *analogic*.

Aristotle’s Theory of Syllogism (in *Prior Analytics*) is frequently considered as the origin of Modern Logic. But, he also presented a Theory of Analogy (in *Poetics*) which he used in *practice* oriented thinking, especially in Ethics (in *Nichomachean Ethics*), but we may also add scientific and engineering *practice*. Some authors interpret that Aristotle believed that logic and analogy are both valid forms of thinking. But, today many authors consider Logic as primary and analogy can be, or should be, reduced to logic. In this sense, analogical thinking is accepted as legitimate as long as it is part of logical thinking

(figure 1). In this context, logical thinking about analogical thinking has been used to work out different models of analogical thinking which are supporting computer algorithms made with the purpose of implementing Analogical Artificial Reasoning. An example of this approach can be found in “A *Logical Approach to Reasoning by Analogy*” (Davies and Russell, 1987).

Turney (2007) affirms that “Many of the efforts to model analogy have *reduced* analogy to logic... However, there is a minority view that logic *reduces* to analogy” (emphasis added). Sowa and Majumdar (2003), for example, affirm that “formal logic is actually a highly constrained and stylized method of using analogies. Before any subject can be formalized to the stage where logic can be applied to it, analogies must be used to derive an abstract representation from a mass of irrelevant detail. After the formalization is complete, every logical step —of deduction, induction, or abduction— involves the application of some version of analogy.” (p.16) From this perspective, Logical thinking is part of analogical thinking and can be reduced to it (figure 2)

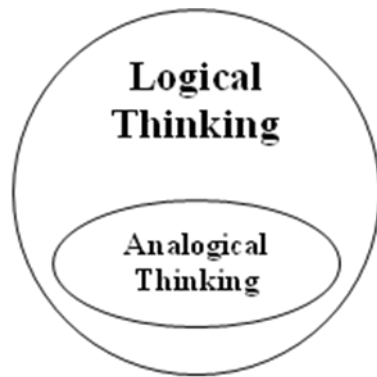


Figure 1

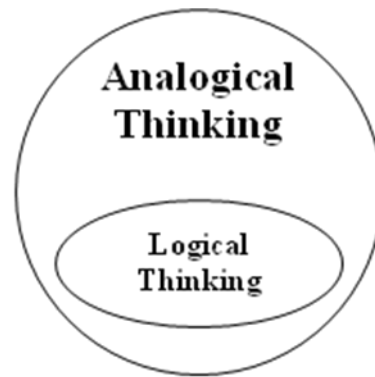


Figure 2

We propose, from a *systemic* and *non reductionist* perspective, that Logical and Analogical Thinking might be conceived as complementing each other in regulative and synergic cybernetic loops, by means of negative feedback, feedforward, and positive feedback (figure 3).

We are using the word “logic” in its more general meaning: the study of inference (the act or process of deriving consequences conclusions from premises); which includes the 4 notions distinguished by Thomas Hofweber (2004) in the Stanford Encyclopedia of Philosophy, i.e.

- “the mathematical study of artificial formal languages
- the study of formally valid inferences and logical consequence
- the study of logical truths
- the study of the general features, or form, of judgments.”

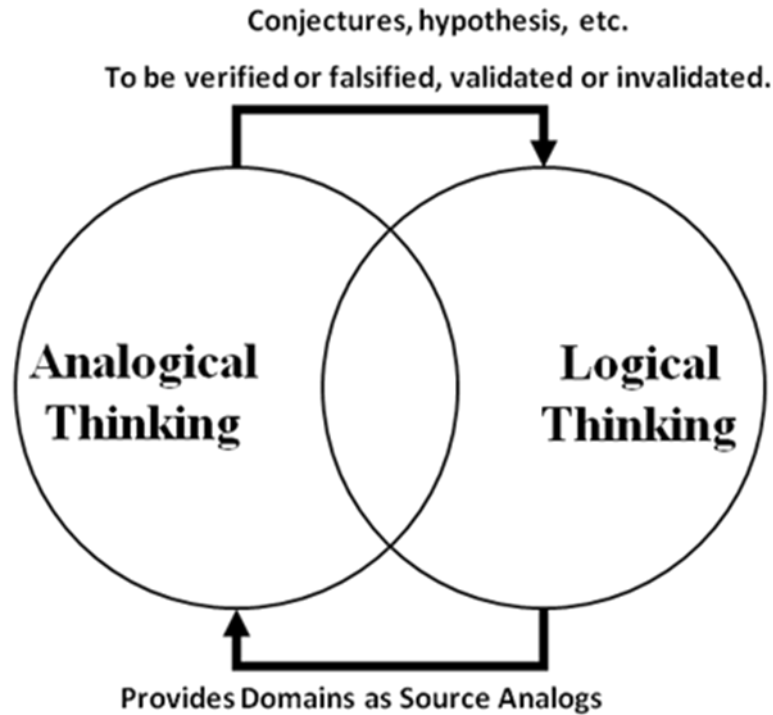


Figure 3

Hofweber (2004) shows and conclude that “there are many ways in which [these four notions] are connected, and many in which they are quite different.” Because it is not our objective, in this article, to adhere to any particular notion of “logic” or to restrict it to some of their differences or relationships, we prefer to use the word “logic” in its general meaning, i.e. any of the four senses distinguished by Hofweber (2004).

Our objective in showing, in figure 3, an intersection among the domains of logical and analogical thinking is a) to be as comprehensive as to include, as special cases, both reductionisms visualized in figure 1 and 2, and b) to represent a grey area (between logic and the analogic) which is allowing the generation of different perspectives produced by different meanings of both concepts and different intellectual points of view.

Authors who value analogies in the scientific domain explain the role of them as aids in scientific research. But, some authors affirm that analogies are not just aids in the establishment of scientific theories, but they are an *utterly essential part* of scientific theories. The diagram of figure 3 takes into account both perspectives.

Analogical thinking processes, explicitly or implicitly, provide conjectures and hypothesis as input for deductive and inductive logics to be proved or validated as belonging to certain kind of truth, or otherwise falsified or invalidated. *The output of analogical thinking might be the required input for its logical processing.* On the other hand, logical constructions are usually the source analog of analogical thinking. *Analogic provides inputs to Logic, and Logic provides the source analogs required be Analogic.* Logic and Analogic require and complement each other for an *integral, integrated and integrative* thinking. This is why the System Movement, since its very beginning,

promoted the explicit use of analogical thinking, and tried to legitimate this kind of thinking as a way of identifying *isomorphisms*; which might be or might lead to mathematical ones.

The English physicist N. R. Campell, affirms that “analogies are not ‘aids’ to the establishment of theories; they are utterly essential part of theories, without which theories would be completely valueless and unworthy of the name. It is often suggested that the analogy leads to the formation of theory; but that once the theory is formulated the analogy has served its purpose and may be removed or forgotten. Such a suggestion is absolutely false and perniciously misleading.” (Campell, Physics, *The Elements*, p. 129. Cfr. Hesse, 1966, pp.4-5)

Analogies are even necessary for human understanding of his/her internal and external environment. Pask (2003) affirms that “Analogy is a way of thinking and *understanding* the world, of gaining insight into different phenomena in nature, which are linked by common properties or similar behavior. To comprehend the depth at which analogy is rooted in our consciousness, it is worth noting that *human being operate with analogies even at the neuron level* (Quoted by Dragoman and Dragoman (2003), p. 1).”

Analogy is also an important strategy for reasoning and *problem solving*. Analogical thinking is also a powerful *learning process*. The process of comparison involves a structure-mapping, in which the two representations are aligned and further inferences are projected from one to the other (Gentner, 1983; 1988; 1889). Thus, one way that analogy facilitates learning is via projection of knowledge from a well-understood situation to another that is less familiar or more abstract. Another important form of analogical learning occurs when two situations are compared and their common relational structure is highlighted. There is abundant evidence that such highlighting renders the common structure more available for subsequent processing, including transfer to new contexts (Gentner, Loewenstein & Thompson, 2003; Gick & Holyoak, 1980; 1983).

Inter-disciplinary Communications and Analogical Thinking

We said above that the “*System Movement*, since its very beginning, promoted the explicit use of analogical thinking”. Pask also referred to “The use of analogy and parable in *Cybernetics* with emphasis upon analogies for learning and creativity” Both, the General System Theory (and, in general, Systemics) and Cybernetics provide ***trans-disciplinary*** concepts, theories and methodologies. Consequently, it might be expected that Analogies and Analogical Thinking are, implicitly or explicitly, used in many disciplines and, consequently they might provide a common substratum to many disciplines, if not all of them, which my reflection-based opinion. Guarini, et. al. (2009), for example affirm that “Work on analogy has been done from a number of disciplinary perspectives throughout the history of Western thought”. They provides and a not completely comprehensive list of 1460 references “primarily to journal articles and monographs” where “classical through to contemporary sources are included.” (p. 87). They identified works on analogies in at least the following disciplines, “argumentation theory, artificial intelligence (AI), cognitive science, linguistics, mathematics, natural

sciences, philosophy, psychology, and (other) social sciences,” (p. 87) which were presented according the following categories: Arts or Aesthetics, Normative Treatments of Action (Law, Ethics or Action), Religion or Theology, Language, Logic, Metaphysics, Sciences or Engineering, Mathematics, Mind, Consciousness, or Cognition, General or Wide Ranging (Child Development, Learning, Pedagogy, and Problem Solving, Language or Metaphysics, Visual Analogy, Animal, Memory or Retrieval, Logic, etc.

Consequently, it is evident that using analogies and analogical thinking is a trans-disciplinary area, along with Systemic and Cybernetics. This means that methodologies, for Analogical Thinking might, at least some of them, almost comprehensively be cross-disciplinary; which might support inter-disciplinary communication. Elsewhere (Callaos and Horne, 2013) we provided more details with regards the potentiality of inter-disciplinary communication to foster the creation of analogies and analogical thinking.

A concept, theory or methodology in a disciplinary known or observable domain (*source analog*) could generate *target analog* in the mind or imagination of a researcher of another disciplinary domain, less known or less observable (figure 4) Conversations and dialogs among researchers from different disciplines might even generate cybernetic loops between them where two different disciplinary domains might be alternatively be source analog and target domain (Figure 5)

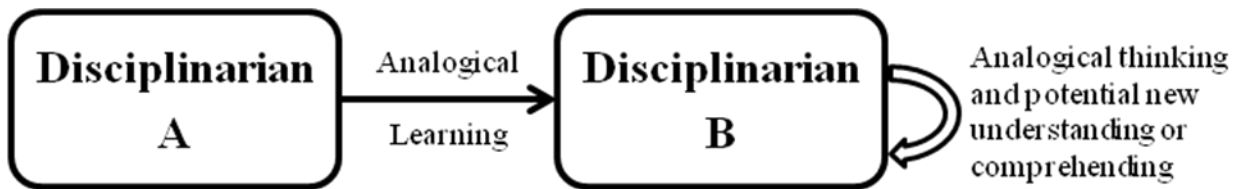


Figure 4

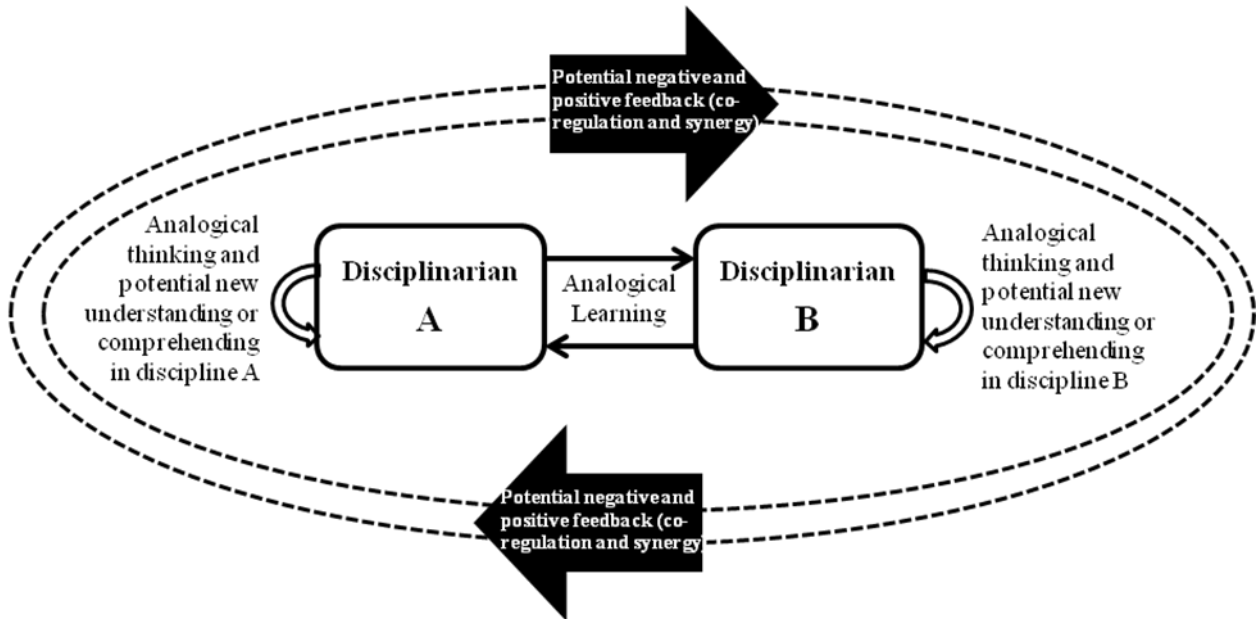


Figure 5

One of the most used methods or methodologies to foster analogical thinking is Case Studies. It describes specific known successful cases of understating, problem solving and/or making decision may which serve as source analog in order to apply them to similar or analog cases (target domains, or cases) via analogical thinking. Consequently let us now provide some details regarding Case Studies because they are not just very used but also in many disciplines and frequently requiring inter-disciplinary communication and analogical thinking. Furthermore, Case Studies are the result of effective methodologies to relate, and even integrate, *Theory and Practice*, including scientific, engineering, humanistic, and educational practice. Since practice usually requires, implicitly explicitly multi-disciplinary approaches and, hence inter-disciplinary communication, then Case Studies Methodologies relate, sometimes synergistically, analogical thinking, Inter-disciplinary communication, and was of integrating academic activities (ICA), i.e. integrating research, education, and real life problem solving (IREPS). We will also see below some details in this kind of potentially cybernetic and synergic relationships, while examining briefly the notion, the history, and the applications of case studies

Case Studies and Hybrid Thinking

In this section we will explore the notion of “case” and the implicit or explicit case studies or reports that have been done in the past in order to show that reporting on cases or cases studies has been used for a long time and, consequently, we will suggest that in most cases they were used as implicit or explicit way to relate, or integrate the different phases of thinking processes (logical and analogical) as well as to relate hybrid thinking and practice. We will address first the notion of “case Study”, then its historical roots and this will provide the context to briefly describe the application of case studies in multiple disciplines via hybrid (analogical and logical) thinking)

The notion of “case study”. The phrase “case study” has been used to mean different, but related, concepts, methods and methodologies. It has different denotations and connotations. This is why we prefer to refer to it as a notion.¹ As notion it should be *described* instead of *defined*, because it might have different related definitions and connotations. We will attempt to include and briefly describe in this short article, the most important concepts and definitions. We will also try to identify the potential relationships between them and the different uses with which the phrase has been used. When possible, we will also suggest probable relationships between the notion of “case study” (or “case report”²) and its implicit or explicit reason of being used. We will show that implicitly or explicitly case studies have been used to generate analogical thinking which combined with logical inference can relate and integrate research, education and/or practice, or real life problem solving (IREPS)

Our epistemological and praxiological approach is inserted in the context of evolutionary epistemology, scientific pluralism, perspectival approach, and a systemic pragmatic-

¹ A notion is a set of related concepts/definitions, uses of the term along with their different denotations and connotations. For more details see N. Callaos, 2013.

² Case reports can stand alone or be (implicit or explicit) input to, or important part of, case studies.

teleological notion of truth. Multi-cultural and multi-disciplinary effectiveness in the conception, design, and applications of “case Studies” necessarily require of this multidimensional and adaptive approach. Even in the same culture and the same discipline, different effective case studies might require different intellectual and/or methodological approaches. This approach is even more important if we are going to suggest the application of case studies as a way of designing a general methodology of IREPS which might be applied in different disciplines and in different cultures via analogical thinking generated by inter-disciplinary and/or inter-cultural communication. It is good to remember a discipline might be perceived and an intellectual culture.

Historical Roots. The clinical case reports from Egyptian antiquity are among the historical roots of case studies/reports. Nissen and Wynn (2014) affirm that “Probably the oldest example of preserved medical literature containing clinical cases is a text from an Egyptian antiquity papyrus. The Edwin Smith Papyrus dates from the 16th to 17th dynasty, circa 1600 BC, but was probably rewritten from texts some centuries before that time Among these there are 48 cases ... [in which] the title of each of them there is a word that denotes *‘knowledge gained from practical experience’*. These are not individual case histories but *typical* ones.” Consequently, it seems to be evident that, since about 4000 years, case studies or reports were used 1) as an integrative tool (implicit method?) for relating the process generating new knowledge (**research**) and **practice**, via analogical thinking required to go from the case course (analog source) and the particular and specific *case target*. At least in medical novel thinking (research?) and practice, and 2) as an approach to describe types of medical cases, i.e. as a generalization tool for thinking (which also has been argued to require analogical thinking), perceiving and dealing with similar cases (analog) that have common features that can generate **similar decisions** in medical diagnosis and treatment. This means that implicitly medical case reports and studies has been used as a methodological way of thinking, deciding, and practicing, via analogical thinking.

There are several case histories/reports in the Hippocratic Corpus written around 400 BC, which were related to physical cases, or case types (including the potential mental aspect of the diseases). Nissen and Wynn (2014) affirm that “The Hippocratic case histories, assumed to have been written by Hippocratic physicians, were **retrospective accounts** emphasizing accurate descriptions of only clinically relevant findings” [emphasis added] Consequently, it is evident that the case method or report was also used as a dissemination tool with very probably educational purposes, which implicitly development the analogical thinking of the reader or the student, This means that case studies and report were (at least implicitly) used as a way or relating medical thinking (clinical research) with education (knowledge transmission) and practice, at least since 400 BC. They were also used as a vehicle for communicating the past, with the present and the future in medical thinking (clinical research) and practice, again via analogical thinking. This is one of the essential aspects of scientific and technological advancement.

While in the Hippocratic Corpus case studies had their focus on an objective description of processes and findings, the Galenic³ case reports were in a “more conversational tone. Galen places himself in the text in the first person, being an active agent in the case description.” Nissen and Wynn (2014). This is important for the description of the *thinking process* (including explicitly or implicitly analogical thinking) that generates the potential conclusions. This definitely have an *educational purpose*, and not just an informational one regarding the new knowledge that has been achieved. This educational process contains substantive knowledge and formative processes of analogical thinking. With Galen case studies included self-studies of his own thinking processes. Consequently, they were written with the purpose of describing the medical thinking process (which is in essence a hybrid one), the results of the reflection process, the reasons and analogies supporting the respective practice decisions as well as to provide hybrid (related to process and results with logical and analogical thinking) educational support and ways of preserving the potential advancement that might have been achieved with the respective case study or report. *Reflections, practice and education were related and very probably integrated via case study writing*, generated by hybrid thinking and writing, and oriented to reading with hybrid thinking, since the time of Galen.

So it is evident that we can conclude that since the Egyptian medicine, Hippocratic medicine, and Galen, case studies have shown to be an effective method of integrating (or at least relating) a) Clinical Research, Medical Education and Practice or Real Life Problem Solving, and b) *hybrid thinking in two dimensions*: informing about *processes and products* and requiring *logical and analogical thinking*. This use of case studies continued, with up and downs, implicitly or explicitly, up to our days, in other disciplines different to medicine.

In the Middle Ages Islamic medicine prospered generating a lot of medical literature most of which were based on case studies. Rhazes (865–929 AD), for example, wrote a 25-volume medical encyclopedia (*Kitab al-Hawi*, or *Liber Continens*) which include several case studies. One of these cases was translated to English. This short report, according to Nissen and Wynn (2014), “is very similar to the case histories of both Hippocrates and Galen as concerns the astute clinical observations. The inference from clinical signs to topical lesion is impressive. A contemporary neurologist could hardly have done better.” Consequently, we can notice that in the Middle Ages, cases studies (cause and effect of hybrid thinking) were also used in the context of clinical research for disseminating the results of reflections, conclusions, and decision made in medical practice. Writing these case studies should have been made with an educational purpose for those who might find similar cases in their medical practice. Once again, case studies were used to relate medical reflections (clinical research) with education and practice, via the two above mentioned dimensions of hybrid thinking (analogical and logical thinking regarding process and products).

Nissen and Wynn (2014) also affirms that “the case report in the 17th and 18th centuries still adheres to the conversational tone of the Galenic case reports, but puts even more

³ “Claudius Galen (129–circa 200 AD) wrote extensively and his texts are preserved for posterity” Nissen and Wynn (2014)

emphasis on patients' subjective experiences.”⁴ This means that report in the 17th and 18th centuries, both the medical practitioner and patients subjectivities were taken into account as part of the case studies, i.e. both subjective processes are part of case studies, which should certainly was meant to better support the practice of other medical practitioners and, hence, *relate clinical research/reflection with education and practice*. Another commotional dimension emerged during this time, “*The Royal Society of London for the Improvement of Natural Knowledge* had pointed to *the importance of plain speech fearing that the linguistic trend could be a threat ‘to the reporting of scientific observations’*”⁵ [Emphasis and italics added]. Consequently, case studies were used not just to relate research, education, and practice, via hybrid thinking but also to relate research results with Society at large via popularization of scientific results, which usually require more analogical thinking from both: the author and the reader, because sometime this kind of writing make frequent use of explicit metaphors.

Regretfully in “the 19th century the texts became more sober ... Case reports dealt less with the patients’ subjective accounts of their illnesses. The focus was on clinical findings that were described in *technical* terms. Authors used various distancing devices.” (Nissen and Wynn (2014) [emphasis added]). Consequently, they required less analogical thinking from themselves as well as from the reader. This tendency continued up to the present in the mainstream of medical case studies.

Case Studies in Experimental Science. Case studies also were used to report scientific/technological processes and results in other disciplines. Boyle’s scrupulous and very detailed reports regarding the process of his experimenting activities was done with the purpose of sharing the results of his work in a way that any scientist could repeat them in order to be verified by others. This verification certainly requires hybrid thinking in the two mentioned dimensions. As a consequence his written scrupulous and very detailed reports, which can be considered case reports or studies in experimental Science support an educational process for other scientists as well as for students. Boyle (Father of Modern Chemistry) is the epitome of experimental scientist who used the equivalent to written case (experiment) studies or report in order to not just communicate new knowledge to the scientific communities but also to provide a learning means to repeat the experiment (process & product) and to verify it again (logical and analogical thinking). Following Boyle example, the two volumes “Harvard Case History in Experimental Science” used the case method to teach Science to non scientists (which can only be done including analogies in the hybrid thinking of the writer and the reader) Expectedly, these two Harvard’s volumes started with Boyle experiments.

This “Harvard Case History in Experimental Science” is an example of the intense and frequent use of Case Studies in Science and Technology which were written with the purpose to share reflections, processes of scientific/technological processes and the results that these processes have generated. This evidently requires, implicitly or explicitly, hybrid thinking from the author and the reader. The inclusion of processes description and not just reporting the results obtained have, in our opinion, an educational

⁴ Nissen and Wynn (2014) made this affirmation based on the work of B. Hurwitz (2006).

⁵ B. Hurwitz (2006), quoted by Nissen and Wynn (2014) (emphasis added)

purpose and not just knowledge dissemination which implicit purpose is to share new knowledge rather than to explain how this new knowledge was obtained, i.e. how were the processes (with hybrid thinking) that included failures and ways in which these failures were the source of a learning process that ended up generating new knowledge. *When case studies are used in describing the processes and the products generated by scientific and technological activities, education and research are implicitly or explicitly related, via hybrid thinking.* When scientific and technological articles report just the results achieved they are oriented to share new information and/or knowledge. No educational purpose motivates the writing of the respective article. Such article can be used in *instructional processes* which are a necessary condition in **Higher Education**, but certainly not a sufficient condition. Consequently *cases studies methodologies are more educational* than just the description of research results via mere instruction. To present the results of a research activities describing both processes and products might relate more effectively research, education, and practice, via hybrid thinking, which is more effective that a mental process mostly oriented by Logic.) Case study methodologies are more oriented to what we briefly and visually described in figure 3 above.

It is good to notice that a method is a *general* way to proceed, not The ***Specific and Concrete*** process that was used, with its intrinsic “trial and error” sub-processes and consequential learning processes. This is why case studies are such an effective approach of learning and teaching in almost any discipline. This is why case studies are, in our experience-based opinion, effective in integrating (or relating) 1) *logical and analogical thinking* even with potential cybernetic loops, 2) *theory and practice*, and 3) any two or all the three activities of *research, education and practice, or real life problem solving or consulting*. Indeed, Boole solved real life problems via experimental research, and writing a detailed case study for each of his experiments, for educational purposes, which was and still a real life problem requiring, in my opinion, the *formation of mental skills in both Logic and Analogic Thinking*.

Consequently, there is no reason not to believe that there is high probability of success in using a case methodology as a research and educational tool for Integrating Research, Education, and Real Life Problem Solving, as well as an systemic educational that requires and prepares in hybrid thinking, as it is the case of inter-disciplinary communication. We suggest to use the cases studies at too levels: 1) as a research and educational method in scientific activities and 2) as a Meta-Case studies regarding the different cases studies in different disciplines in order to identify commonalities which might allow a) the design of a general methodology for integrating research, education and real life problem solving, consulting, and/or practice and b) for a more educational methodology that relates logical and analogical thinking into an *integrated cybernetic hybrid thinking*.

The Casuistic Approach. Another historical root of case studies or “Case Thinking” can be found in Moral and Practical Philosophy. A casuistic approach to morality is based in the concrete examination of cases and the respective decisions that might be made accordingly, via analogical thinking. According to a rigorist approach to morality the

existence of good and evil, right and wrong, does not depend on the circumstances of a specific case, but in general (absolute) rules and moral code. Ferrater-Mora, 1969, Vol. II, p. 648). This origin seems far from the actual meaning of “Case Studies”, “The Case Method” or “Case Methodologies” but it actually is not because of at least two reasons:

1. Case-Thinking, or thinking via specific cases, is common a) to the present meaning of “case studies” and 2) to the meaning of “casuistic” in Moral and Practical Philosophy, and in a modified version in jurisprudence-based legal argumentation.
2. Among the typology presented by several authors regarding the present notion of case studies, the type of “*decision case studies*” has the objective of producing a decision (or a set of decisions) in a given situation or case. As it is known many decisions have an ethical dimension (and even a legal impact), which might (or should) be addressed by means the respective “case study”, and via analogical or hybrid thinking. This dimension belongs to the domain of practical or moral philosophy and, possibly to legal domain. Managerial decisions are also frequently supported by implicit or explicit (written or non-written) case studies.

It is good to notice that ***the effectiveness of a case method, or methodology, might certainly depend on (organizational, disciplinary or national) cultures (and possibly the judicial system) in which it is immersed.*** Let us keep that in mind along this article, in order to see how plausible this initial hypothesis might be. Consequently, we think it is adequate to provide more information regarding what has been called “casuistic” in practical or moral philosophy, even knowing that “casuistic” has been *abused* by the use of biased analogies motivated by political and ideological struggles and biased and, consequently, completely ***discredited*** for a long time

Martin Stone (1998), providing a short description of the meaning of casuistry, affirms that this term:

“has been understood in three separate yet related senses. In its first sense casuistry is defined as a style of ethical *reasoning* associated closely with the tradition of practical philosophy influenced by Aristotle and Aquinas. In its second sense it is *reasoning* about “cases of conscience” (*casus conscientiae*). The third sense, moral laxism, arose out of Pascal’s famous critique of casuistry, which did much to diminish its influence. In recent years, however, renewed interest in the first and second senses of casuistry has been witnessed in the areas of *practical reasoning* and applied philosophy.” M. Stone (1998, p. 227) [italics added].

Consequently, casuistry was understood as a *way of reasoning* in the moral realm. This way of reasoning is used in present case studies but in the epistemological domain, specifically in theory testing cases, and even in theory building via case (or cases) study. Let us present an example of the affirmation we just made.

Many cases studies, especially those related to decisions and practice have necessarily an ethical component, which sometimes might not be relevant but it might be very important to be included in some cases. Ethical issues are everywhere in academic activities (research, education and real life problem solving) but they are not always considered either explicitly or implicitly. Research misconduct has frequently been reported but regrettably educational misconducts are not always reported and they are not even perceived as such. Educational ethics should not be limited to just following the rules of educational institutions. Educational responsibilities should also be considered regarding educational ethics. ***Is there an ethical problem when the students are supposed to receive Higher Education and they actually receive just Higher Instructions?*** Personally, I strongly believe that case studies should be more frequently made in the context of Academic Ethics. This kind of case studies should necessarily be given the respective academic merit in academic promotions. *Some case studies regarding the integration of research, education, and real life problem solving might require to analyze potential ethical components and possible synthesize some potential conclusions or recommendations.*

After what might have been perceived as a digression let us get back to the main purpose of this article.

Actual Conceptions of Case Studies. Gary Thomas (2011) affirms that a “case study must compromise *two elements*:

1. A “practical, historical unity, which I shall call the *subject* of the case study, and
2. An analytical or theoretical frame, which I shall call the *object* of the study” (p. 513) [emphasis and italics added]

Then he defines “case study” as follows:

“Case studies are analyses of persons, events, decisions, periods, projects, policies, institutions, or other systems that are studied holistically by *one or more methods*. The case that is the *subject* of the inquiry will be an instance of a class of phenomena that provides an analytical frame—an *object*—within which the study is conducted and which the case illuminates and explicates.” (p. 513) [Italics added]

[Please, notice the similarity with analog source and target domain in analogical thinking. But if we accept that abstractive processes required analogical thinking, then, there is no similarity but complete identification between subject/object and analogs (source analog and target domain)]

With regards to the purpose of this article we might apply this definition as follow: Case studies regarding specific instances of integrating research,

education academic activities include “persons, events, decisions, periods, projects, policies, institutions, or other systems that are studied holistically by one or more methods. The *specific* case study “will be an instance” of the *general* methodology being applied, designed and/or re-designed, which is, or would be, the object “within [or for] which the study is conducted and which the case illuminates and explicates” and potentially generates elements for continuously improving and re-designing the sought methodology

According Thomas’ definition (given above) “case studies” may provide a dialectical relation between the two mentioned elements: the *object* (analytical frame, theory, or methodology according the objective of this article) might be used to clarify or to explain the *subject* (a methodological instantiation according the purpose of this article), and the subject (the evolving methodology in our case) might provide knowledge which might modify (extend, adapt) the object (the general methodology), or the analytical frame or theory used to explain the subject, in the cases where the purpose is to understand rather than to effectively apply a methodology. Theory testing and theory building, as well as methodological testing and methodological building can be combined via a case study or several case studies in which the same theory or methodology (object analytical) and different cases (subjects, methodological instantiations) are used. In theory seeking case studies a theory is developed through the study or the studies. When seeking methodological case studies, a methodology is developed through the specific studies or studies, all of which required hybrid thinking as represented in figure 3 above.

This kind of dialectics (with potential cybernetic loops) in case studies has also been noted in, or can be inferred from, other authors of case studies. For example Michael Wieviorka (1992) affirms that

“For a ‘case’ to exist, we must be able to identify a characteristic unit. . . . This unit must be observed, but it has no meaning in itself. It is significant only if an observer . . . can refer it to an analytical category or theory. It does not suffice to observe a social phenomenon, historical event, or set of behaviors in order to declare them to be ‘cases.’ If you want to talk about a ‘case,’ you also need the means of interpreting it or placing it in a context.” (p. 160) [italics added; also cited by Thomas, 2011, p. 513]

Consequently, any case requires a theory or an analytical framework by means of which we can perceive and explain the ‘unit’ to be observed and examined. A case is defined by both the unit (the subject) and by the theory (or analytical framework, the object) with which it will be perceived and interpreted. This duality is what defines any ‘case’. The Subject/Object and Unit/Theory dualities are related to source analog/target domain and vice versa, via cybernetic loops between alternative analogies in one direction and in its opposite direction.

Mutadis Mutandis we can say that for a methodological case to exist we must be able to identify some methodical characteristics, but they would not have meaning by themselves. They are significant only if an observer can infer from it a potential initial synoptic methodology which will increase in its details as other methodological cases are observed. We can talk about a methodological specific case if and only if there are a general methodology no matter its level of abstraction or included details and/or the “if then” to be applied in a given sub-method or another alternative one, but always in the context of systemic (not systematic) methodology. A methodological case is defined by both the *specific* methodological case as well as by the *general* methodology that provides an interpretative context to the characteristics of the specific methodological instantiation. A methodolog in general and a methodological case are two faced Janus: the specific and the general require each other and might get into cybernetic relationships: negative co-regulative and positive co-amplificatory feedback.

Another example regarding this duality required to define a case is found in Wallace (1969). He emphasized in the importance (even the necessity) of distinguishing, in any social study, between 1) *what* is being explained and 2) the explanation framework. He used the terms *explanandum* to refer to what is being explained and *explanans* what is being used to make the explanation (Wallace 1969; p.3)

Consequently, with different names, and conceptual orientations, a case has been defined as a *conceptual duality*, *two faces of the same coin: subject/object, methodological instantiation and general methodology; characteristic unit/analytical category, explanandum/ explanandum, analog source/target domain*, etc. A similar situation is found in the historical origin of case studies, i.e. in casuistic. The difference it that casuistic is oriented to moral judgments or decisions, and case studies in the present days are oriented to epistemology, praxiology, and/or decision(s) required in the praxis. To illustrate this similitude with “casuistry” let us use the text with which Stone (1998) describe ‘casuistry’:

In its widest sense, casuistry can be described as a method of ethical reasoning which drawing on the tradition of practical philosophy of Aristotle and Aquinas, aims to construct a ‘*dialectic*’ between the facts of particular cases and the antecedent assumptions, evaluations and convictions which individual agents bring to bear in their considerations of such cases. *The purpose of the dialectic is to enable agents to arrive at informed decisions as to what is morally possible and impossible for them to do in particular cases.* In a narrower sense the term casuistry has been employed to characterize different systems of moral theology within the Christian, Jewish and Islamic traditions, in which *all inclusive norms are derived from judgments in particular cases*, instead of being laid out in advance by absolute moral codes.” (p. 227) [italics added]

Consequently, casuistry, in its general meaning, refers to the inference of particular instances (decisions, cases) from general conceptual frameworks and, in a narrower sense, casuistry refers to the inference of general rules or framework by means of considering and examining particular cases. Both senses in the meaning of casuistry suggest *opposite* approaches (or methodologies) that do not contradict each other but might complement each other as *polar opposites*. An analogous situation (possibly a qualitative isomorphism) is found in the present when using case studies as 1) an approach for *theory building* or 2) an approach for *theory testing*. It is evident the structural analogy between the *moral* opposite approaches in casuistry, in the past, and the *epistemological/praxiological* opposite approaches of case studies in the present. *Can we learn more from this analogy between casuistry and case study methodologies? Can we formulate methodological and meta-methodological hypothesis from this kind of qualitative isomorphism or analogical relation?* Is this kind of analogical thinking what originated present case studies in managements, decision making and problem-solving as *analogically* related to judicial thinking, decision making, and problem solving? A historical review, even a very short one, seems to indicate that analogical thinking based in the history that followed casuistry might probably be intellectually beneficial in the context of understanding and comprehending the notion of ‘case studies.’, as well as for conceiving the use of methodological case studies for the design of a general case study methodology which might be applied in implementing different cases for the integration of Research, Education, and Real life Problem Solving. On the other hand, this kind of brief historical review might also be helpful on conceiving a systemic (differentiated from systematic) methodology⁶ for the achievement of effective case studies in different disciplines and different cultures. We know by an extended experience, and by hard data, that information systems development methodologies that showed to be effective in a culture (the USA culture, for example) might not be effective in other cultures (a Latin American one for example, as it is the case of Venezuela) (Callaos, 1995; Callaos & Callaos, 2014). Mutadis Mutandis, case methods and methodologies that showed to be effective in a culture do not necessarily have the same level of effectiveness in other cultures. A similar situation might happen to methodologies of integrating research, education, and real life problem solving. This is why a *systemic* methodology is what is needed for cross disciplinary and cross-cultural applications. Systemic methodologies are more flexible and adaptable than *systematic* ones, which by definition are fixed and inflexible.

Figure 6 is a visual representation of the actual and the potential relationships that directly or implicitly exist or may exist if we make explicit and address these relationships among

⁶ A systemic methodology is an open set of related, or relatable, methods; which are post-ordered according to the situation. Systematic methodology is a closed set of related methods which order has been given a priori and theoretically independent of a given situation. This is why systemic methodologies are more adaptable than systematic ones and, hence, more effective though they might be less efficient.

- Analogical Thinking and logical Thinking
- Hybrid Thinking that systemically and cybernetically integrates analogical and logical thinking
- Inter-disciplinary Communication
- Case Studies and Methodologies of Case Studies
- Integrating Research, Education, and Consulting or Real life Problem Solving.

Notice, please, the double nature of the arrows in Figure 6. This is what potentiates the emergence of direct or indirect, implicit or explicit, cybernetic and synergic relationships among each of the items mentioned above and, consequently among several or all of them.

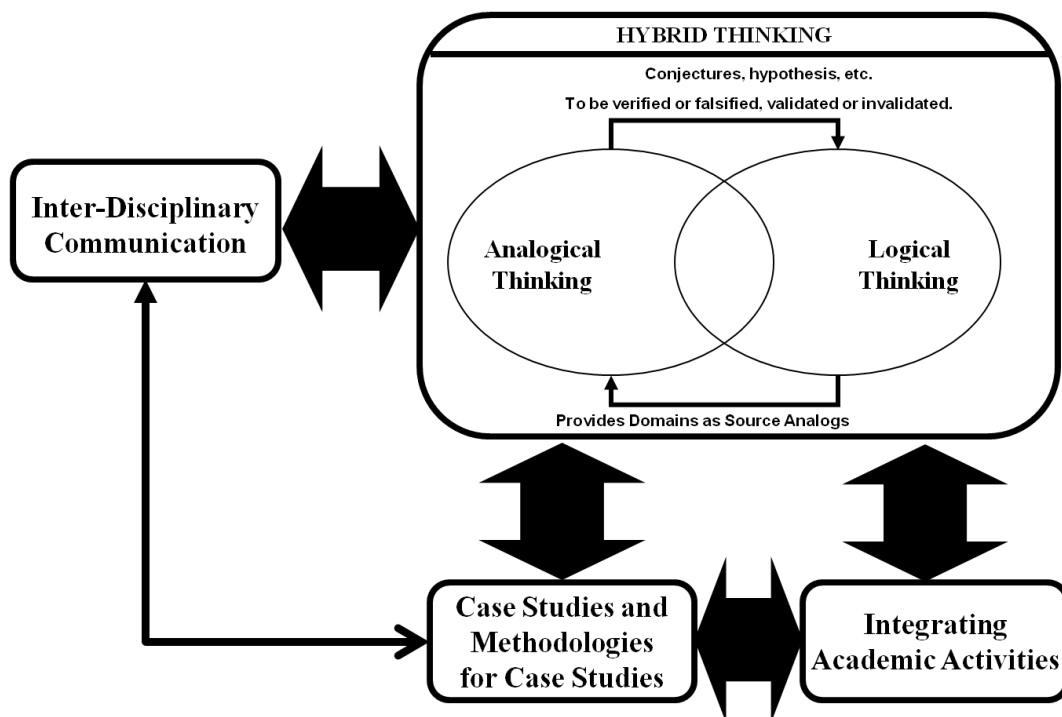


Figure 6

Next Steps

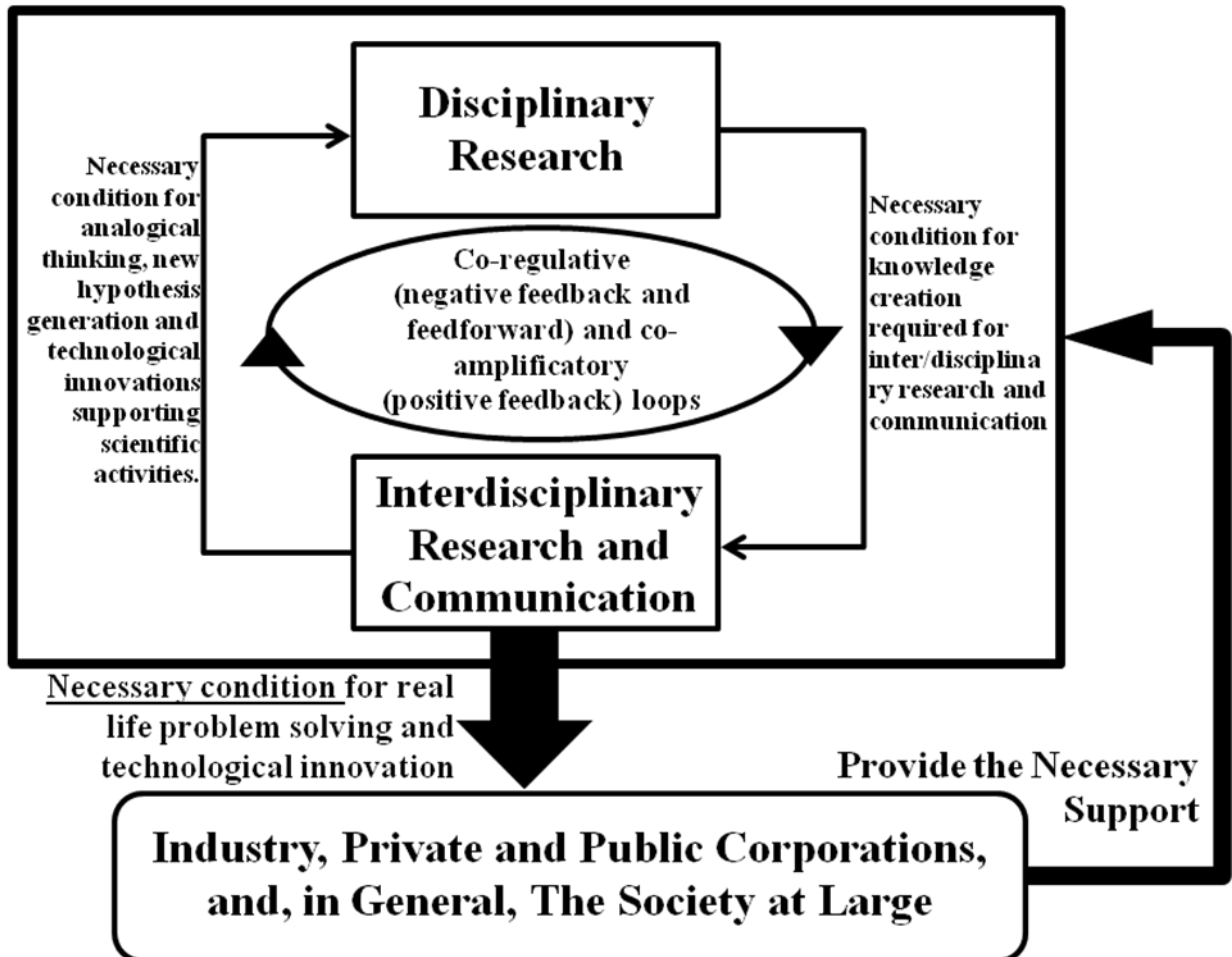
The next steps will be oriented to examine and analyze with more details each one of the double arrows included in Figure 6, in order to show more explicitly and clearly the systemic relationships and cybernetic loops that implicitly exist, potential may explicitly exist between or among them. The following are very short descriptions of an example of next steps

Relating systemically and cybernetically Intra-Disciplinary Research and Inter-Disciplinary Research and Communication: *“Disciplinary Research is a Necessary Condition for Science Advancement but it is not a Sufficient Condition for Real Life*

Problem Solving and Technological Innovations, because in these cases Interdisciplinary Research and Communication are also Necessary”

We will try to answer questions like the following

- Is the above affirmation right?
- If not, Why?
- If yes, Why?
- What are the implicit and/or explicit relationships between Science and Engineering, real life problem solving, and technological innovations?
- Do the following systemic-cybernetic relationships make any sense to you? If not why?
- Is there any association between Academic Ethos, Pathos, and Logos and relating explicitly disciplinary research and interdisciplinary communication and research?



Information, knowledge (episteme) and opinion (doxa) sharing would provide input to the attendees of this session so they feel enabled to write reflection-based or practice-based position “invited papers”, which will be included in the post-conference edition of

the conference proceedings with no additional costs for the respective authors. The best of these papers will also be published in the Journal with no additional cost for the respective author. These papers will be distinguished as “invited papers” or “position papers”.

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