

# Hermeneutics and Engineering Education

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**Abstract:** In this paper we intend to explain our point of view that a hermeneutics approach is adequate for Engineering teaching and learning. It may sound strange associating Hermeneutics with the Engineering Education because Hermeneutics is usually related to Humanities. But when we analyze this subject deep inside, we verify that its investigative and interpretative aspects are what makes the hermeneutics approach adequate to treat many different situations that we have in Engineering practice, including Engineering Education.

In this paper we intend to revisit Hermeneutics, accompanying the historical evolution of this knowledge area, explaining its investigative and interpretative character, with the objective of showing that an hermeneutics approach of the most different problems found in the practice of Engineering can aid the Engineer in its daily work as an educator, as a student or as a professional.

**Keywords:** Engineering learning, Hermeneutics.

## 1. What is Hermeneutics?

This question is the first that we must answer in this paper, once this subject, Hermeneutics, is not part of our daily work as Engineering educators and neither as Engineering professionals. Therefore, the subject still causes larger strangeness among our regular students of Engineering.

This question, for its time, is easy to be formulated, but difficult to be answered in a direct way, once it would imply in summarising in little words a knowledge area, a science, as we will see along this paper.

## 2. Hermeneutics, a historical approach

The first registration of the word appeared in the title of the book *Hermeneutica sacre sive methodus exponendarum sacrarum litterarum*, by J.C. Danhauer published in 1654.

While the word Hermeneutics just date of the 17<sup>th</sup> century, the interpretation theories - religious, literary or legal - are older, they repair to the Ancient Times. Therefore, the Theology, being a historical interpreter of the biblical message, had been always hermeneutic.

The oldest meaning, and perhaps the most diffused meaning, of the word Hermeneutics refers to the principles and methods used at the Middle Ages to interpret the Bible. The need of a procedure for this purpose was based in the difficulty that the priests and shepherds faced, in their daily work, to interpret the Writings. Because it was so difficult for them to communicate frequently with the higher authorities of the Church, there was a fear of not guaranteeing the same biblical interpretations for the most different subjects.

The development of the rationalism and the coming of the classic philology in the 18<sup>th</sup> century had a deep effect in the biblical hermeneutics. Then, it appeared the historical-critical method in the Theology. It became a challenge in the interpretation to make the Bible important for the rational man of Iluminism. The methods of the biblical hermeneutics became essentially a secular theory of interpretation, that is a Classic Philology. The word Hermeneutics became virtually identical to a philological methodology. The conception of a Hermeneutics strictly biblical gradually developed into a conception of a Hermeneutics considered as group of general rules of philological interpretation (Philological Hermeneutics), being the Bible an object among others of application of those rules.

Schleiermacher established the concept of Hermeneutics as "science" or "art" of the understanding. This hermeneutics conception implies a radical critic of the point of view of the Philology, because it tries to surpass the hermeneutic concept as a group of rules, becoming a science that describes the understanding conditions in any dialogue, resulting a general Hermeneutics, not simply a philological Hermeneutics, whose principles can serve as base to all the types of text interpretation.

### 3. Hermeneutics, a contemporary philosophical point of view

The philosophical contemporary point of view of Hermeneutics as research field and investigation process emerged from Martin Heidegger's *Sein und Zeit* [1] and they had continuation in Hans Georg Gadamer's *Wahrheit und Methode* [2].

#### 2.1 Hermeneutics of Heidegger

Martin Heidegger called the analysis presented in his *Sein und Zeit* (1927), a Hermeneutics of *Dasein*. In this context, Hermeneutics doesn't refer to the science or the rules of textual interpretation but to the phenomenological explanation of the human existence. The analysis of Heidegger sustains that the understanding and the interpretation are fundamental manners of the human existence. Understanding is a quality of the human being, but it is not a natural quality, it is built. The understanding is not reduced to the logical-semantic universe but it doesn't release this universe.

In his attempt to understand life starting from life itself, Heidegger developed a phenomenological type designated as Phenomenological Hermeneutics, that is Hermeneutics of *Dasein*. The philosophy in Heidegger, in opposition to the one of Husserl that is essentially scientific, becomes historical; it is a creative reconstruction of the past, it is a form of interpretation.

Heidegger re-defines Phenomenology, starting from the Greek roots of the word to obtain its original sense - *phainomenon* and *logos*. In this sense, the Phenomenology means to allow things to be shown as they are, without projecting in them our own categories. We do not indicate the things, the things that are revealed to us. Without considering any primitive animism, it is the statement that the Phenomenology is a way of being driven by the phenomenon, by a manner that genuinely belongs to it.

Under this point of view, the Phenomenological Hermeneutics implies that the interpretation is not based in the human conscience and in the human categories, but it is based in the manifestation of the things that come across us, of the reality that comes to our encounter. To sum up, Hermeneutics is still the theory of the understanding, but it is defined in a different way, in an ontological way (of the Greek *ontos*, entity and *logos*, word, reason).

For Heidegger, the understanding is the capability of capture the possibilities that each one has of being, in the context of the vital world in that each one of us exists. In that way, the understanding is conceived as a way of being in the world. It is the structure of the human being that makes possible the current exercise of the understanding at empiric level. The understanding is the basis of all the interpretation, it is present in every act of interpretation. In this context, the understanding operates inside a hermeneutic circle and not in a progressive order that goes from the most elementary aspect to the more complex of the whole.

The understanding, according to Heidegger, cannot be conceived as something metaphysical, above the man's sensitivity, but it is tied up to it.

The understanding acts in the construction of relationships, a process that is not limited to the pre-conscious operations of the mind as perceptions, but that involves the temporal and the historical dimensions of the human being, in a hermeneutic process.

The interpretation makes the understanding explicit. The foundation of the understanding is previous to all thematic statement. Still, the understanding becomes explicit as interpretation, through the language, spoken or written. According to Heidegger, "*the words and the language makes the things to be and to exist,... the language is the house of the human being..., the ontological-existential foundation of the language is the speech..., the understanding of the human being in the world is pronounced as speech..., the language is the pronouncement of the speech.*"

Heidegger affirms that "*the interpretation is never the reception of something previously given without presuppositions*", what takes us to infer that interpretation doesn't exist without presuppositions. In other words,

what appears in the object is what we allow to appear based on the structures that support our way to act, that is, in the concept of world that we have, while being an agent of the understanding process. In this conception, it is impossible to guarantee only one answer, only one truth, only one interpretation in the analysis of an investigated object, therefore nothing is intrinsically-evident and immune to the action of the investigator.

Hermeneutics as theory of the understanding is, consequently, a theory of an ontological revelation. The analysis of Heidegger reveals a Hermeneutics not only based on the subjectivity but also based on the factual world and in the historical dimension of the understanding.

## 2.2 Hermeneutics of Gadamer

Gadamer, in his *Wahrheit und Methode* (1960), describes the development of Hermeneutics from Schleiermacher to Dilthey and Heidegger, supplying the first adequate historical report on Hermeneutics. *Wahrheit und Methode*, however, is more than the history of Hermeneutics; it is an effort to relate Hermeneutics with the aesthetics and with the philosophy of the historical knowledge. The linguistic phase of the Hermeneutics develops in that Gadamer's work : "*a human being that can be understood is language*", meaning that Hermeneutics is the encounter with human being through the language.

It is important to note that Plato had already attributed to the language an highlighted importance in the search of the understanding of the things. Plato saw the language as the way to reach the essence of the things.

In Gadamer, the subject that understands is finite, that is, occupies a defined and limited place in the space and in the time. The subject that understands is a historical subject, that is, brings in himself/herself a series of pre-concepts that can be modified along his/her understanding process but that is never annulled completely.

This posture appears as a critic to the rationalism of the Illuminism because, according to Gadamer, the Illuminism doesn't recognise these contour conditions imposed by the previous concepts.

Pre-concepts don't necessarily mean false judgement or negative judgement. In the conception of Gadamer, they can be legitimate and, then, they can promote the understanding process.

Still, according to Gadamer, an immediate consequence when admitting the existence of pre-concepts is the rehabilitation of the Authority and of the Tradition. These are not necessarily untruthful sources; it is evident, however, that the Authority cannot be accepted without questioning, according to Gadamer ..."*accepting the authority of a person is neither a submission act nor an abdication of the reason, but at once it is the recognition that the other is of ownership of a superior judgement and understanding , resulting of there that its judgement should prevail...*" The same comment, according to Gadamer, is worth for the tradition.

Jürgen Habermas, when criticising Gadamer's Hermeneutics, affirms that assuming Authority reveals a philosophical conviction that doesn't have the guarantee of the Hermeneutics.

The understanding surpasses the knowledge obtained through the application, even if rigorous, of a method, affirms Gadamer.

Habermas opposes saying that Gadamer, in his *Wahrheit und Methode*, should not have opposed the hermeneutic's experience to the methodical knowledge. This is the basis of the hermeneutic's sciences, it is not possible to dissociate empirical analytical manners from the manners of hermeneutic's procedures.

According to Gadamer, the understanding process begins, necessarily, with a strangeness stage. To understand is to melt horizons, without which there is not dialogue.

In general, Gadamer criticises the Modern Science in that he calls its *alienating estrangement*, that is, the establishment of an objectivity approach that results from an instrumental rationality. He is opposed to that objectivity conception and he introduces a notion of objective sense that is established by the confront between subject and object, mediated by reflection. The hermeneutic process includes the subject inside of the knowledge process and promotes a process of understanding with limits not known *a priori* and without necessarily successful results; the understanding task, therefore, assumes an infinite dimension.

For Gadamer, the meaning is not a property of the object neither a projection of the subject on it. On the contrary, the meaning emerges in the relationship between the things themselves and the faiths and values of the interpreter placed in the history. In that way, it is not possible to admit an universally valid understanding; different cultures can attribute different meanings for the same object.

## 2.3 Hermeneutics in other contemporary authors' points of view

Richard Palmer defines Hermeneutics, in his book *Hermeneutica*, as the science of the interpretation [3].

Paul Ricoeur in his *De l'Interpretation* (1965) characterises Hermeneutics as a "theory of the rules that governs an exegesis, that means, the interpretation of a certain text or group of signs which may be considered as texts". In this context, Hermeneutics is presented as a decoding process that intend to discover a latent or hidden meaning. For instance, in the Psychoanalysis the interpretation of the dreams can be seen as one type of Hermeneutics. The studies of Ricoeur characterise the symbols in two categories: one consists of symbols that have unique meaning, with only one sense (it refers to the symbolic logic) and the other consists of misunderstandings that admit several meanings, that is proper of Hermeneutics.

Ernildo Stein [4] affirms: "before, the Hermeneutics was the understanding of texts, the understanding of cultural universes, it was interpretation. Now, understanding implies understanding a totality, because it means to understand the world... The world that is, at the same time, us and that we projected on everything that should be given."

#### 2.4 Hermeneutics in our point of view

In synthesis, we can say that in the tradition of the Logic, that comes from Aristotle, the man's speech was mathematical-deductive. In the field of the Theology, the man's speech was considered imperfect, because the perfect word was the divine word, the one of God. The Humanism of the Middle Ages brings us a new speech possibility, the hermeneutic speech, with no truths guaranteed by the application of the Logic. The absolute and perfect truths defended by the Theology don't exist anymore; consequently, no unique truth exists and no single way to reach this truth exists, anymore.

Returning to the initial question, perhaps it is more appropriate to characterise Hermeneutics than to define it; and this is what we will try to do in this conclusion, highlighting the following ideas:

A. Hermeneutics fights against the existence of only truth and also against the possibility of only one way to reach some truth. The hermeneutic interpretation shows that the reason cannot reach the truth in an absolute way.

B. Hermeneutics doesn't consist in a technique, a method; it consists in a group of concepts, part of an investigation process.

C. Hermeneutics seeks the "sense" of the things, through an interpretative process, using the language for that, considering the historicity, scientific, cultural and social aspects related to the studied subject and with the human being - agent of this study.

It is important to highlight the possibility of the existence of a hermeneutic procedure in order to reach a truth. This procedure has many properties which depend on the investigation field where it is applied, but that consists, essentially, of a going and coming process, that means, it consists in a dialectical process. It consists in discovering ways that take us to a conclusion of the investigation, which, if is not final and definitive, is satisfactory inside the context that is placed.

D. Hermeneutics, as a process, has a completely different dynamic from the Scientific Method, which is broadly used by the traditional Science in any investigation field.

The Scientific Method, as it is known, gives the Subject of the action (investigator) and the Object of investigation roles well demarcated (Subject acts on the Object). The process consists in applying empirical and logical-mathematical methods, simultaneously or alternately, in order to reach the truth. It is a process of certainties and of search of absolute and universal truths.

The hermeneutic process, on the other hand, is a process in that Subject and Object interact, sometimes being alternated in its roles. It is a process that is going on during its application, differently from the Scientific Method that presupposes a careful planning and an implementation according, strictly, to this planning.

The hermeneutic process is fundamentally dialogical. The hermeneutic interpretation transcends a logical-deductive interpretation.

#### 4. Hermeneutics and the teaching of Engineering

The hermeneutic teaching approach is adequate to be used as part of Engineering teaching procedures. This statement can cause impact, because Hermeneutics, as a way of investigating, a way of interpreting a situation or

simply as a researcher's philosophical posture, was always associated with the area of the Human Sciences, due to its genesis and due to its field of application.

Why we consider that approach proper to be used in Engineering teaching ? Because the formulation of hypothesis is part of Engineering procedures in general. Therefore, this characteristic makes Hermeneutics useful in Engineering practices, including Engineering teaching. In Engineering, we work, basically, with hypothesis that imply models and algorithms that allow the simulation and prediction of situations which permit to develop new technologies. So, the formulation of hypothesis is fundamental and the Hermeneutics can be useful, mainly because its dialogical aspect.

In this paper, when we revisited this knowledge area -Hermeneutics- analysing its evolution through the times, and when we explicit its investigative and interpretative character, we intent to become evident that, in our point of view, the use of an hermeneutic approach to face the most different problems found in the practice of the Engineering is adequate.

We considered that, besides the Scientific Method which, through the centuries, has been structuring ours to do in Engineering, it is possible to reach new aspects of the truth, or to permit that new truths can appear, by establishing a dialogue between researcher and object of such research, that is, by a dialogical or hermeneutic procedure.

The investigation procedure described by Flickinger[5] is an example of solution of a Engineering problem through a hermeneutic process. In this article, the author describes its experience during a research accomplished to solve an environmental problem: the contamination of the soil observed in a small German community. This place was considered a natural reservation and it was detected a strong contamination in its soil for heavy metals, this contamination didn't have any apparent cause. Only after the " researchers' immersion " in the community, the mystery can be unmasked. At the time of the war, there was in that area a factory of warlike goods, whose industrial process used heavy metals; with the lost of the war, this factory has been disabled, and it has been destroyed and " banished " of the conscious of the community's people. This has been the hidden " cause " of the observed contamination.

In what it concerns: the teaching of Engineering, the hermeneutic process appears, in a non conscious way, when the students are stimulated to do projects of different complexity levels. In this process, the " dialogue " between the theoretical project and the built prototype is constant and it finishes only when the prototype, in the technical jargon, becomes operational, that is, when it works.

Other activities like the job in a researcher group, as an academic monitor or, like a student, in professional world also permit the appearance of situations in that the use of Hermeneutics reveals.

## **5. Conclusions and propositions**

We conclude with the idea that the hermeneutic process, as a way to enlarge the horizons of knowledge in Engineering is adequate. These horizons which are traditionally established by the Scientific Method, applied in the analysis of the most different situations faced in the daily of the Engineering.

In that way, it seems to us quite appropriate to establish, in a conscious and reflected manner, the hermeneutic process as a possibility to deal with the several subjects that appears in our professional courses, stimulating our Educators to insert in its pedagogical practices the hermeneutic approach in order to interpret the studied phenomena and the used techniques.

The proposition of including Hermeneutics as a possibility in the treatment of the concerning subjects of the Engineering, doesn't include the suggestion of insert new philosophical disciplines in our grade courses. We are just proposing the discussion of this theme - Hermeneutics - to promote, in particular, a reflection about the adaptation and property of the inclusion of a new approach of the contents, that is, by the point of view of Hermeneutics. And, in general, to promote a broadly reflection about our teaching practices.

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