

ON THE CONCEPTS OF KNOWLEDGE AND LEARNING, PRESENTED IN A DIALECTICAL FRAMEWORK

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ABSTRACT

This paper initiates a research project about the diversity of concepts of learning and knowledge and the variety of ideas about definitions. It studies the meaning of Socratic methods in the knowledge society and analyses some examples of knowledge creation from Plato and Dewey. With these examples and the notion of knowledge as proven true beliefs, the paper justifies an approach on learning and knowledge creation, based on reflection, reasoning and judgement. With this purpose, further research will focus on seven arts of reasoning and rhetoric of inquiry from the point of view of learning and knowledge.

INTRODUCTION

Management studies, especially on organizational learning, knowledge creation, knowledge management and information systems, propose different definitions of knowledge and learning. When we compare them, we realise that some of them focus on complementary aspects of knowledge and that they can be integrated. But we are also aware that other definitions clash between them, with incompatible claims. This situation constitutes an important challenge, and produces many debates.

Joining these debates, this paper will try to introduce a framework in which we could compare and discuss concepts of knowledge and learning. With this purpose, it will comment basic ontological, epistemological and methodological criteria that intervene in the formation of divergent theories. The paper will also focus on productive instruments that researchers and managers can use for learning and creating knowledge. Finally it will relate the main theories on organizational learning with different schools of thought.

In discussions on definitions of knowledge and learning, we find more basic points of disagreement. In the academic world there are many views about definitions. The questions of what is to define a concept and what are the requirements, functions and aims of this operation have conflicting answers. It is necessary to discuss this subject if we try to compare definitions of knowledge and learning. With this aim, the paper will introduce some of the most relevant classical and modern conceptions about

definitions. They are important in our scientific and philosophical tradition and influence the approaches of contemporary research.

In order to be more explicit about the subjects, research aims and views of the paper, we proceed to introduce a brief presentation of some examples. They diverge on the concepts of knowledge and learning and on the requirements of definitions. For instance, some theories define personal knowledge as cognitive mental states and learning as modifications of these states. Other theories introduce learning as changes of patterns of behaviour. It seems that these definitions focus on complementary aspects of learning and that they can be integrated. Nevertheless, there is an epistemological clash between them. Many scientists accept the notion of mental states in their theories, but others only work with concepts that are related to directly observable events. The positivist schools reject the first approach and introduce the second.

Definitions of learning in terms of behaviour have some problems that are not usually commented. It is a common experience that many times people acquire or possess knowledge for doing certain kinds of things, but they do not do them. Action, besides knowledge, involves feelings, requires motivations, purposes and will and agents have ethical principles. Theories of learning that equate this concept with changes of behaviour simplify important subjects and underemphasize basic questions.

In a second example we will compare another couple of definitions. On the one hand, many leading researchers on knowledge creation and knowledge management define knowledge as beliefs that are formulated, true and proven. This approach constitutes a foundation of the western philosophical and scientific tradition. Nevertheless, it requires some precisions. A definition of this type is complete if it specifies the kinds of evidence and arguments that are admissible for proving beliefs. These specifications are usually implicit and we are not always aware of them. We take them for granted, but without them the notions of proof, knowledge and science are ambiguous. When they change, the concept of knowledge also changes. For instance, in the scientific revolution from the Aristotelian to the Galilean physics both contending parties claimed that their theories were proven because they had different criteria about proofs. We can look at the history of epistemology as a long inquiry on that subject. Many present claims that knowledge is proven beliefs are quite empty.

On the other hand, in contrast with the idea of proven beliefs, there are other approaches to knowledge. Now, many researchers define it in terms of means of production, intangible assets and competitive advantages. These definitions focus on the meanings, functions and uses of knowledge, but do not state what it is and what are its requirements. In other words, they do not care for its ontological and epistemological properties. If we compare definitions of knowledge based on proofs with those that focus on economic values, we realise that they involve different ideas about what a definition is.

The way this paper will approach the research questions suggested in these introductory comments will follow some stages. The first part will investigate basic forms of learning and definition of concepts that were introduced and discussed by some classic Greek philosophers. We will emphasize that they constitute useful instruments in present contexts. The second part will analyse some contemporary contributions in these subjects, that are relevant in our quest.

These elements will constitute the conceptual framework in which we will discuss concepts of knowledge creation and learning. Finally, as we have already pointed out, we will relate the main theories of organizational learning with different schools of

thought. This research programme emerged in the development of a training project on organizational learning, knowledge creation and rhetoric of inquiry for PhD students at ESADE-EUDOKMA (European Doctoral School on Knowledge and Management).

SOCRATIC METHODS AS INSTRUMENTS FOR LEARNING, KNOWLEDGE CREATION AND DEFINING CONCEPTS

Socratic Methods in the Knowledge Society

The knowledge society vindicates the Socratic forms of inquiry, with a renewed interest. It recognizes that the ways of search that Socrates (469-399 B.C) introduced, in his quest for truth and moral principles, involved methods of learning, knowledge creation and research. Moreover, it points out that they are appropriate in many present contexts. Management studies, especially those related to knowledge creation, mention them; many managerial practices based on organizational learning use Socratic procedures; and information systems researchers claim that web chats can be very productive in knowledge creation and learning if they are developed as Socratic dialogues.

We will try to unveil many Socratic research techniques and will apply them to the subjects of learning and knowledge. Our analysis will distinguish two levels of the present Socratic influence. At a basic level, we will examine general ideas about Socrates' philosophy that are diffused in our society. At a technical level, we can learn from his scientific contributions to the subjects of definition, induction and analogy.

Basic ideas about research attitudes, forms and meanings of the Socratic methods

At a basic level, the following aspects of Socrates' life, search and methods belong to the common intellectual background of the Western culture. He developed his philosophical inquiries in long dialogues with his country fellows, while walking, sitting in public places or, sometimes, celebrating symposia, which, by the way, were dinner parties with entertainment and discussions.

Whoever was interested in the search of truth could participate in the conversations. Dialogues usually involved a small group of people, and, in them, Socrates had a principal interlocutor. The subject was stated in precise terms, which were discussed through short critical questions and answers. This way of inquiry, based on explicit and implicit rules, has been very influential. On the one hand, it led to the forms of dialectical debates, both in philosophical schools and in public contests, which were intellectual games. On the other hand it constitutes a component of any kinds of discussion and dialogues in modern scientific research.

Socrates thought that, in basic matters, people believe that they know the truth, but many times they are wrong. In his dialogues he tried to make his interlocutors become aware of their misconceptions and make them advance towards truth. Usually he did not know in advance the right answers to his questions, and many conversations did not arrive to a final conclusion but, even in these cases, they led to an important understanding of the subjects that were considered.

Socrates claimed that he only helped people to get the truth out of themselves. Being his mother a midwife, he called his method *majeutics*, term that referred to the active

help that midwives give to mothers in childbirth. This analogy points out the role of people in learning and knowledge creation; but, as we will comment, it led Plato to extreme interpretations. A reason why the knowledge society looks back to Socratic ideas is that, besides objective knowledge and information, it has a renewed interest on knowers, knowing processes, and dialogical forms of knowledge creation.

Socrates brought philosophy from heavens to earth. This classical saying meant that with him philosophy went from natural to social subjects. As a moral philosopher, he was interested in the right forms of social behaviour. He associated these issues to knowledge because he defended the following idea: People who know what is just, act in a just way. This view involves a deterministic relationship between some kinds of knowledge and some kinds of action. Aristotle refuted it, invoking as evidence the common experience of people. Now almost nobody would accept this Socratic view. However, we think, as we have pointed out, that, in the knowledge society, some definitions of personal learning, based on changes of patterns of behaviour, involve the same kinds of problems.

As a summary of this Socratic legacy, we can point out the present interest of these kinds of dialogues. They follow some patterns of discussion that obey implicit rules of research and ethical principles. They involve a specific subject, collaborative attitudes of people, the introduction of many points of view, criticism of ideas, persuasion by arguments and, among other elements, processes of learning, unlearning and relearning. A large number of present research situations, like management innovative activities, work teams, task forces, and academic discussions can benefit of these Socratic patterns.

Technical Aspects of Socratic Methods

At a technical level, Socratic methods involve many conceptual instruments, like procedures of definition, induction and analogy. W. Guthrie mentions ("A history of Greek Philosophy", vol. 3, chapter 14, part 2) that Aristotle claimed ("Metaphysics" 1078, b27) that "there are two things that can be recognized to Socrates with justice, inductive argument and universal definition". In fact Socrates frequently used them and, many years later, Aristotle studied their logical properties.

Socrates discussed the main social, ethical and educational issues of his time. They appeared in the context of a historical crisis of values and the rise of sophistry and rhetorical training for public careers. An important feature of his conversations is that, in most of his subjects, he organized the arguments around the definition of a concept. In fact, many Socratic dialogues constitute a long search of concepts like prudence, courage, justice, virtue, rhetoric, knowledge and learning.

In this paper we will choose some fragments of Plato's dialogues "Gorgias" and "Meno" that clearly reflect Socratic procedures. We will present simplified parts of the texts in order to unveil and conceptualise some instruments that are important in any kind of research.

Analysis of some models of learning and definition in "Gorgias"

The dialogue "Gorgias" is an inquiry on the ethical aspects of rhetoric. In the first part Socrates discusses with Gorgias, who was an eminent rhetorician, the concept of rhetoric. After some preliminary issues, Socrates asks him to engage in the conversation, not with long speeches, but with short and precise questions and answers. This distinction reflects the difference between rhetoric, which was practiced by Gorgias, and dialectics, which was introduced by Socrates.

Socrates – What is the object of rhetoric
Gorgias – Speeches

The answer is right in the sense that rhetoric is about speeches; but it does not characterize rhetoric and, therefore, it does not constitute a definition of it. When we define a concept by a property, we must check if the sets to which the property and the concept apply are the same. In this operation we will not look for examples of the concept that fulfil the property, but for examples of the concept that do not fulfil the property, and for examples that fulfil the property but do not correspond to the concept. With these methodological ideas in mind, Socrates will lead Gorgias to realize that the previous definition is not acceptable.

Socrates – On what kinds of speeches? Those that reveal to the sick what treatment will restore their health?
Gorgias – No
Socrates – So rhetoric is not concerned with every kinds of speech?
Gorgias – No

At this point, it is necessary to precise what kinds of speeches are the object of rhetoric. Before focussing on this subject Socrates relates speech with other properties of rhetoric, in order to extend his objection.

Socrates – Rhetoric makes men able to speech?
Gorgias – Yes
Socrates – And able to think about the matter of their discourse?
Gorgias – Of course
Socrates – Now, does not the science of medicine make men able to think and speak about their patients?

In discussions for defining a concept, we must look if there are contradictions and, in this case, avoid them. In this dialogue, on the one hand, it is clear that medicine is not considered a part of rhetoric. On the other hand, accordingly with Gorgias' definition, it is so. Gorgias, after claiming that his first answer is right, takes some time to realize that he contradicts himself. When he is aware of it he reworks his definition and proposes a second one.

Gorgias – Many arts, like medicine, to achieve their aims require not only works but manual crafts. Rhetoric is the art that achieves its aims only by words.

Many times, like in this case, the work of definition progresses with the introduction of a second possible definition. However, it has also to be submitted to criticism. The circle from a candidate definition to another, through comparisons of the concept with suggested properties for its definition, usually is repeated many times. Socrates finds out that the second definition has some problems.

Socrates – Arithmetic, calculus and geometry are arts that achieve their aims mainly with words, without manual crafts. It is to the arts based on words, I believe, that you assign to rhetoric.
Gorgias – You are right.
Socrates – But, I do not imagine that you intent to call these arts (like arithmetic) rhetoric.

Gorgias contradicts himself again. The idea of kinds of speeches now becomes problematic for the definition of rhetoric. In the research process to define a concept sometimes we have to think on other properties and ask new questions. We do not progress always in a straight line, but there are breaking points.

Socrates – What is the object of the speeches employed by rhetoric?
Gorgias – The greatest and noblest of human affairs.

This answer is not acceptable. It is subjective. Socrates points out that it is ambiguous, and shows that it is so through an string of questions and answers, which we will summarise in the following conclusions.

The doctor will claim that the greatest blessing of mankind is health and that, therefore, medicine is the noblest art.
The physical trainer will present similar claims with the strength and beauty of the body.
The businessman will take wealth as the noblest aim.

This is a pattern of reasoning that Socrates uses in almost every discussion. The argument presents three particular examples that are similar in reference to a specific matter. It is a case of reasoning by analogy. In other dialogues, Socrates tries, from particular cases to discover and justify a general property. So, as Aristotle pointed out, this last kind of reasoning is a naive form of induction, which we will comment. For the moment we will listen to Gorgia's claims.

Gorgias – (For the greatest and nobler blessing) I mean the power to convince by speeches the judges in Court, the senators in Council, the people in the Assembly, or in any other gatherings of a citizen body.
Socrates – You have revealed most precisely, it seems to me, what art you consider rhetoric to be. Rhetoric is a creator of persuasion, and all its activity is concerned with this and this is its substance.

So Gorgias states the third definition, which is based on persuasion. The quest has made an important progress. At the beginning Gorgias thought rhetoric as the art to produce speeches and now he accepts that it is the art of persuasion through speeches. Socrates, who is aiming to ethical subjects, goes on asking more questions. We will summarize again some points.

There are other arts that produce persuasion. Teachers, for instance, when they teach arithmetic, persuade students. Besides rhetoric, there are other arts that involve persuasion.
Socrates – Rhetoric is the art of what kind of persuasion? And what is its domain?

With this question Socrates, in order to discuss the moral character of rhetoricians, is aiming to the difference between ways of persuasion that prove knowledge and ways based on not proven beliefs. We will not comment the continuation of the dialogue. Instead of it, we will introduce, in a nutshell, the main Aristotelian ideas about rhetoric.

Analysis of some models of learning and definition in “Meno”

In Plato's dialogue “Meno” we find more explicit ideas about what a definition is, which come from Socrates. It starts, without the normal kinds of greetings that open a conversation. The first sentence of the text asks a central question.

Meno – Can tell me, Socrates, is virtue something that can be taught?, or does it comes from experience? Or is it given to a man by natural attitudes or something else?

The classical Greek notion of virtue, which they named *areté*, was very close to the present conception of excellence in a specific activity. It is interesting to point out that we preserve this view in some contexts. For instance, an outstanding classic music interpreter or singer is called a *virtuoso*. So, these questions, which seem to be far away from the interest of the knowledge society, can be restated, for instance, in the following terms:

Is management excellence something that can be taught? Or does it comes from practice? Or it is given to a man or a woman by natural attitudes or something else?

These are serious questions for management schools, which are re-stated in forms such as what is a right philosophy for MBA programmes? We will emphasise that the ancient conception of virtue is related to the present models of excellence and excellent performances, which are presented, for instance, in Brown and Duguid *Organizing Knowledge* (1998) and St. Clair *Knowledge services: your company's key to performance excellence* (2001).

Playing an ironical game, Socrates seriously claims that he does not know what is virtue and that the inquiry must start with the definition of this concept. In our context a discussion about what is excellence, or management excellence will be very interesting.

Meno – The virtue of man consists in managing capably the city affairs. The virtue of a woman is to be a good housewife. There is another virtue for a child, an old man, an slave and many more kinds of virtues.
Socrates – I wanted one virtue and I find that you have a whole swarm of them to offer. But seriously, to carry on the metaphor of the swarm, suppose that I asked you what is a bee and what is its essential nature and that you replied that there are many kinds of bees and they differ in many aspects. What I want you to tell me is the character in respect to which they do not differ at all, but are all the same. So the same with virtue. If we have some examples of virtue they all have a common character that makes them virtue. That is what might to be kept in view by anyone who answers the question what is virtue.

When we try to define a concept, we usually start with some examples of it. In common life situations, we can close the subject with them. But in theoretical research, a set of examples is a starting point, from where to develop our inquiry about a concept. So Meno is doing a good approach, but the problem is that he things that the subject is already set.

Socrates uses the metaphor “swarm” for “many of them” or “a large number of them”. In the present society, we use other metaphors with this meaning. But in the text we find the idea to develop them. A metaphor always involves an implicit analogy or similarity and Socrates, in this case, exploits it in order to compare definitions of bees with definitions of virtue. We can learn how to use this device. Analogy and comparisons by similarity constitute an important instrument in knowledge creation, and learning. In this example, as in many Socratic dialogues, it has a didactical function.

This part of the dialogue wants to clarify what a definition of a concept is. Socrates answers this question with the examples of bees and virtues. He explains the notions of definitions in terms of “the essential nature”, “common character in respect to which they do not differ but are all the same”, “what makes them to be virtues”. Meno has some difficulties to follow this part of the arguments. This fact shows this is not an easy subject and that the idea of precise definitions, based on the nature of things, was not popular at his time.

In the conversation we find other useful patterns of thought, that we can also follow when working on the definition of a concept. The search begins with the introduction of some examples and it follows with the investigation of their common properties. So, this process is not the same that we have analysed in “Gorgias”.

Socrates – Well then, did you say that a man’s virtue lay in directing the city well, and a woman’s virtue in directing her household well?

Meno – Yes

Socrates – And, it is possible to direct anything well without justice and temperance?

Meno – Certainly not

Socrates – Then, both man and woman need the same qualities, justice and temperance, if they are going to be good

Meno – It looks like it.

In the search for a quality that covers all the instances Meno proposes the capacity to govern men. Socrates refutes this view pointing out that it does not apply to children and slaves. Moreover, the capacity to govern men must be specified.

Socrates – You speak of “capacity to govern”. Shall we not add, “just but not otherwise”?

Meno – I think we should, for justice is virtue.

Socrates – Virtue, do you say, or a virtue.

The difference, emphasized with the example “virtue” and “a virtue”, is very important in concepts. For instance, many definitions of knowledge and learning only characterize some kinds of these concepts. At this point, the conversation between Socrates and Meno is only at its beginning.

Socratic Methods revisited

Classic and modern criticism has submitted the Socratic ideas to a deep analysis which covers both his form of conversation and his ontological and epistemological principles. These philosophical studies can help us to rethink and readapt Socratic methods to the present conditions of inquiry because their critical views have relevant implications in learning and knowledge creation. In this part of the paper we will especially have in mind the situations of innovative managerial activities, web quests and scientific research.

In a short technical excursus, we will comment that Socrates did not write any philosophical paper. Our knowledge of his methods comes from many sources, including some remarks by Aristotle. The main reference for us is constituted by Plato’s dialogues, in which Socrates has always the main role. Nevertheless, we have some problems with the interpretation of these texts. Sometimes they state Socratic ideas

and other times they express Platonic views. Researchers on history of philosophy have succeeded to separate many of these mixed contributions.

In Plato's dialogues, Socrates has no opponents of his intellectual level, even if the most distinguished people of his time, like Gorgias, were supposed to participate in them. The leading role of Socrates is absolute and his interlocutors many times look like apprentices who follow him. He always tries to educate people. For these reasons, we consider that his model of conversation, even if it introduced dialectics, reflects a hidden situation of teaching and training. We can develop the Socratic methods in many directions with different requirements, for instance, in participative forms of teaching and training or in collaborative research teams.

Beyond organizational learning practices, scientific research and web chats we can find Socratic dialogues in the most unexpected contexts. For instance, Harold Bloom documents the influence of Socrates in the personality that Shakespeare built for the famous tavern character Sir John Falstaff. We will introduce a quotation in which the Fat Falstaff uses the pattern of induction from examples that we have commented.

Falstaff – Can honour set to a leg? No, or an arm? No; or take away the grief of a wound? No – Honour hath not skill in surgery then? No ... Honour is a mere scutcheon – And so ends my catechism.
“Shakespeare, Henry the IV, part one”.

This example can demythologise many prejudices and has important values in itself. Falstaff opposes life to the war programmes of his society and the royal family of his time. In the technical aspect, this fragment is more a piece of rhetoric, based on irony, than a serious dialectical argument. He plays both parts of the dialogue. From this last observation we can learn something. Socratic dialogues can be carried out only in the mind of a single person, without external interlocutors. This is an important pattern of knowledge creation, which we must improve.

In the field of collaborative inquiry and research, we know that patronising interactions inhibit many processes of knowledge creation. So modern Socratic dialogues must be developed in more participative forms. In them, everybody can contribute to their subjects in equal rights without distinction of ranks. Dominance upon the others must be excluded in order to establish a creative group dynamic. Organizational learning studies how to create these conditions in the frames of the structure and culture of organizations. Some authors claim that learning organizations must be flat organizations. In contrast, the USA Navy, one of the most hierarchical institutions based on a strict chain of commandment, is developing important programmes of organizational learning and knowledge management.

Socrates is not impartial in his inquiries, and he is lead by his ideas about ethics and society. For instance, in “Gorgias”, as we have commented, he is not satisfied with the neutral definition of rhetoric as the art of persuasion by words. He continues the discussion in order to include in this concept his moral principles. In his dialogues, he does not aim to know and describe the conceptions of his society in basic matters, but only to change them. This criticism is interesting for modern discussions. We know that we are not aware of all our pre-judices and wrong ideas involved in our conceptual frames. In a correct attitude, we must be ready to reject them and accept convincing arguments of other people.

Plato's texts about Socratic dialogues have a high literary value which comes from a previous interest of their author to be a playwright. To understand them, it is necessary to take in account their historical and ideological context, which is presented in many

modern editions. Even with this information we can find them difficult and boring. Socrates repeated again and again some ideas which seem easy for us, and accumulated many similar examples in order to clarify a single subject. We think that these repetitions are related to some purposes.

First, Socrates' ideas and methods were new in his society. In fact, many dialogues pointed out that the interlocutors had difficulties for understanding them. Second, he tried to make explicit every inference involved in his arguments. These kinds of meticulous formulations of inferences can produce overloaded texts. In this line of criticism Aristotle claimed that logic or dialectics can be boring and that rhetoric can maintain the interest of people. In the modern context of organizational learning, it is important to maintain a balance between clear explicit arguments and the interest of conversations.

Socratic dialogues are mainly based on the knowledge of experience, which constituted the cultural background of his society. They usually do not discuss observations and experiments carried out with a scientific mentality. These characteristics require some comments. On the one hand, we will point out that many dialogues start from common knowledge, submitted to meticulous reflections that finally produce precise definitions of concepts. These Socratic pattern of inquiry, for common ideas to philosophy and science, constitute an intellectual masterpiece. We must learn how and in what conditions can we use this model of knowledge creation.

On the other hand, Socrates, in his dialogues, many times contrasted the claims of his interlocutors with common knowledge, which was generated by experience. This procedure involves a weak form of empirical test, but the method was almost exclusively constituted by pure reflections. For that reason, one of its dangers was that it could degenerate, ignoring reality and becoming an isolate intellectual game. In the medieval tradition, for instance, we find long debates about the number of angels that can set in the head of a needle. So when we update Socratic methods in the knowledge society, we must be prudent and develop them in the frame of modern scientific and philosophical thought. It is important that their arguments take in account the research methods accepted in each discipline and incorporate, whenever would be possible, the empirical evidence produced by rigorous observations and experiments.

Socrates tried to define concepts, like virtue, by common properties of its instances. This idea was latter formulated in the notions of necessary and sufficient conditions, which we work in many sciences, such as geometry. Nevertheless, the inquiry conducted by Socrates has some problems. In practice, he was looking for common properties associated with the meanings of names, like "virtue". Now, we know that the relationships between definitions of concepts and meanings of words are complex. Wittgenstein pointed out that the name "game" is applied to so many activities that they do not share common properties for the definition of the concept. We will take in account these findings in the study of the actual meanings of the names "knowledge" and "learning".

Socrates did not conceive these dialogues as situations for negotiating knowledge and definitions of concepts; even if he talked about agreements. For instance, in "Meno" (72,d) he claimed "I believe we rejected the type of answer that employs terms which are still in question and not yet agreed upon". He meant that in the definition of a concept, like virtue, we cannot use concepts that are not already defined from primitive notions. This attitude of Socrates had very deep reasons. His intellectual fight was against the sophistic claims that everything could be defended and become true. In his strive, he was looking for solid ideas whose truth would impose itself to everybody. He thought that he could find these kinds of principles in the definition of concepts, which,

in his view, do not depend on our opinions. This is a key point for understanding his methods and his almost obsessive interests in definition.

The ontological and epistemological status of concepts proposed by Socrates has nothing to do with most of the modern conceptions. Though we update his dialogical methods, we do not follow his ontology. In this paper we will not study it, because it was developed in a deeper philosophical level by Plato. So we will directly re-examine the Platonic ideas about learning and knowledge. Our study will point out what we can get from them for knowledge creation and learning in the knowledge society. To say goodbye to Socrates, we can remember that he was especially interested in knowledge of oneself. When the Oracle said that he was the wisest man, he commented that “I know that I do not know nothing”.

PLATO’S THEORY OF LEARNING AND KNOWLEDGE

Learning in Plato’s philosophy

Metaphors are not innocent. They work representing an object or a process by another process that stands for the first. In this way, they attract our attention towards some properties and distract us from others. Therefore, they constitute a powerful instrument, that stimulates the study of some aspects of our object and inhibits other paths of thought. Socrates’ metaphor of *majeutics*, which presents him helping people to get the truth out of themselves, is not an exception to these rules. As it presupposes that knowledge is already inside people, we can ask how did it inter our minds or our souls?

Maybe we are not aware of it but modern views present new metaphors that involve implicit answers to that question. For instance when we talk about seminal ideas or works, we mean a form of mental fertilization. Instead of these views, Plato (428-347 B.C) proposed a radical ontological and epistemological system. He claimed that knowledge is inside us because we possess innate knowledge of Pure Ideas. Pure Ideas or Forms, like the forms of geometry, constitute the essence of everything and are perfect, immutable, eternal and independent of us. What we call learning is reminiscence or, in other words, a process of recollection.

In the knowledge society, though many mathematicians and linguistics, among other scientists, accept some Platonic principles in their theories and research methods, this is not the general case. Usually we are amazed by the model that learning is remembering and we do not admit this explanatory theory. Far away from the current mentality, it implies that knowledge is not acquired, produced or created, but only discovered inside us. However we must point out, as a positive aspect, that Plato tried to solve with this doctrine some problems that are important for us. The questions, why is it possible to learn? and, how do we learn? deserve our attention.

Moreover, we can learn from the arguments that Plato introduced to sustain his theory. In them he even presented an empirical experiment, which is reported in the dialogue “Meno”. He proposed it as a proof of the principle that learning is recollecting. We will comment the experiment in a form that will confront the Platonic interpretations with our study of the functions of reasoning in knowledge creation. We think that this example constitutes an important model of the ways in which we learn.

Plato's learning experiment reported in the dialogue "Meno"

We have already commented from "Meno" some Socratic views about virtues and the definition of concepts. Now we must point out that the main core of this dialogue is Platonic. In it Plato states, using the character of Socrates, many important ideas of his philosophy. The conversation links the following subjects: the possibility of teaching virtue, the concept of virtue, the relationships between virtue and knowledge and the possibility of teaching knowledge. On this last theme Plato claims, always through Socrates, that learning is to remember. He tries to convince Meno with his famous experiment, which sometimes is separate from the other parts of the text, and presented with the name *The Reminiscence*. We will summarise it in some conventional stages, introduced only for clarity, without theoretical purposes.

First stage: Setting up the experiment. Socrates addresses a Meno's slave boy, who is intelligent but has only a very elementary knowledge of geometry. With his initial questions and the drawing of figure 1 (we will avoid to name the relevant points with letters, as it is usual in geometry), Socrates makes sure that the boy knows that a square has four equal sides, and that a square with sides two-foot long contains four squares of one foot. After this preparation, the dialogue, which we will simplify, sets up the experiment

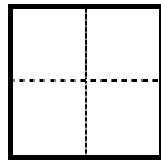


Fig. 1

Socrates (to the boy) – Now, could one draw another square whose area is the double of this one?

Boy – Yes.

Socrates – How many feet (square) will be its area?

Boy – Eight.

Socrates – Now then, try to tell me how long each of its sides will be?

Boy – Will be the double, Socrates, obviously.

Socrates (to Meno) – You see Meno, that I am not teaching him anything, only asking. Now he thinks that he knows the solution, but he is wrong.

Meno – Yes.

Socrates – Now watch how he recollects things in order – the proper way to recollect.

At this point, Socrates addresses again the boy and draws the squares of figure 2. With them he will make the boy realize that the second one is not the right solution.

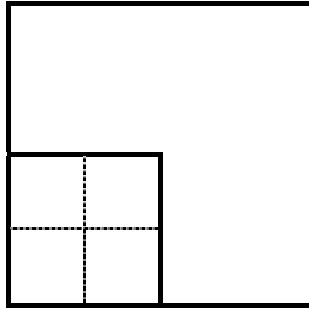


Figure 2

Out of Platonic views, we can comment this learning process as a knowledge creation situation, which takes the form of a problem solving. We will focus on its heuristics, or forms of reasoning involved in discovery. In them we will distinguish three elements: First, the creative ideas and the creative conjectural or candidate solutions. Second, the hints that points out some properties. Third, the chains of deductions that start with creative ideas or with proven properties. These conceptual instruments combine themselves in reasoning processes that try to prove that a candidate solution is incorrect or correct. With this theoretical frame, we can start our analysis of the dialogue.

Socrates is not directly teaching the answer to the boy, in the sense to tell it to him, but his questions, all along the dialogue, constitute a form of active teaching that guides the slave towards the relevant properties. Also he draws the figures that facilitate the process of research. For Socrates, this is the way in which he helps the boy only to recollect. In that setting created by him, at the moment there is a single but important contribution of the boy: He proposes as its first conjectural solution the second square, whose sides are the double of the first. It is wrong but it facilitates the full process.

Second stage: Criticising the first conjectural solution. Socrates introduces the main creative idea of this stage, drawing the additional lines that appear in figure 3.

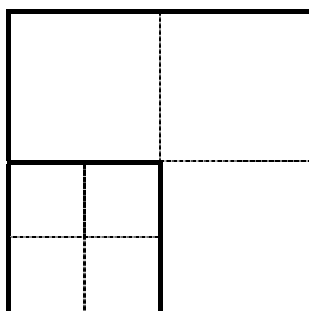


Figure 3

From this picture, a deductive process will prove that the second square is formed by four squares that are equal to the first, and therefore its area is sixteen feed square. Socrates produces the necessary deductions, in a meticulous sequence of questions, which convinces the boy. We can quote one of these steps.

Socrates – So doubling the side has given us not a double but a fourfold figure.

Boy – True.

In this part Socrates questions', like the last one, explicitly point out properties that are important and the boy realizes that they are true and accepts them. We consider that he is teaching the boy. The deductive process ends when it proves that the second square is sixteen feet square. So the first conjectural solution is disqualified. In the language of proves and refutations, we can say that it is falsified and in the terms of trial and error elimination, we can claim that it is eliminated. In the next step, Socrates makes explicit that the solution that the boy is looking for is in a square larger than the first and smaller than the second. After this remark he asks him to propose a third square, which will be the second creative conjectural solution.

Third stage: Proposing a second creative conjectural solution and rejecting it.

Socrates – Try to say how long you think the side of the double square is.

Boy – Three feet.

Again the creative contribution of the boy is the side of the square, which this time he proposes as the second conjectural solution. It is wrong and the following process, which leads to its rejection, is similar to the previous one. Socrates draws the figure 4.

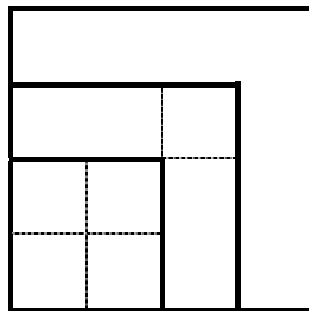


Figure 4

Working with it, it will be easy to realize (we mean to learn) and to prove that the third square is nine feet square. In the dialogue, Socrates explicitly introduces all the logical steps that prove that conclusion.

When the boy realises that his solution is wrong, Socrates starts another learning circle.

Socrates – Then, what length will you give to the sides of the double square?

Boy – It is not use, Socrates, I just do not know.

At this point, Socrates addresses Meno, and explains to him his interpretation of the process.

Socrates – Observe, Meno, the stage he has reached in the path of recollection. At the beginning he did not know the side of the square of

eight feet. Nor indeed does he know it now, but then he thought he know it and answered baldly, as was appropriate – he felt nor perplexity. Now, however, he does feel perplexity.

Meno – Quite true.

Socrates – In perplexing him, have we done him any harm?

Meno – I think not.

Socrates – We have helped him to some extent towards finding out the right answer, for now he is not only ignorant of it but he will be quite glad to look for it. Up to now, he thought that he could speak well on the subject of a square double the size of a given square.

Meno – No doubt.

Socrates – Now notice what, starting from this state of perplexity, he will discover by seeking the truth in company with me, though simply I ask him questions without teaching him. Be ready to catch me if I give him any instruction or explanation instead of simply interrogate him on his own opinions.

It is clear that Socrates is aware not only of the cognitive aspects of the inquiry but also of the attitudes and motivations of people. For him, a turning point of the dialogue is the moment of perplexity, from which the boy is eager to look for the solution. It is an important subject which involves persuasion. Many organizational learning theories approach it focussing on the motivations for and the commitment to the research for solving a problem. In another line of thought, we will comment it in relation to an epistemological problem, which has important consequences in our vision of science: at what point does research and the construction of theories start?

At the beginning of modern science, Galileo claimed that the new physics started with observations. That view has been accepted by many generations of scientists. In the twentieth century many philosophers opposed to it and emphasised that research starts with questions or problems, as we can appreciate in the following examples. John Dewey used precisely the term *perplexity*, the same that we find in Socrates, and completed it with the expression "*felt difficulty*". With them he named the initial stage of research. Karl Popper claimed, in an objective conceptual frame, that research starts with the falsation of previous theories or explanations. Thomas Kuhn emphasized the change of views or paradigms in producing new theories.

We can point out that the Socratic views are very close to these modern conceptions. Socrates claims that people engage in active search because of their perplexity on some subject. In the initial steps of *majeutic* processes, he arises perplexity in his interlocutors, making them realise that they do not know what they think they know. In the reported conversation with the boy, Socrates completes this view with the idea that he only asks questions, without teaching him.

Fourth stage: Discovering and proving the right solution

Socrates erases the previous figures and starts again. He draws the initial square and asks the boy, in three sequential questions, if they can add to it three other squares, equal to the first, and form in this way another square, which he displays in figure 5. It is the second square that has appeared in the previous part of the dialogue. The boy assents to each of these operations.

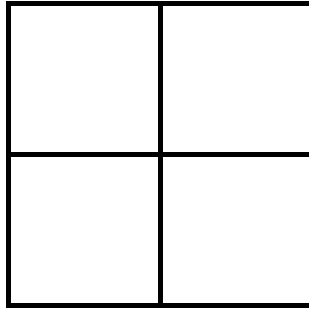


Figure 5

This drawing, with the arguments developed around it, constitutes an important hint for the discovery of the solution. In that frame Socrates, but not the boy, introduces the creative conjecture that will solve the problem. He draws the square whose sides joint the middle points of the sides of the second square. In other words, to facilitate the development of the inquiry, he draws the final square, which appears in figure 6 formed by a diagonal of each of the four squares of the preceding figure.

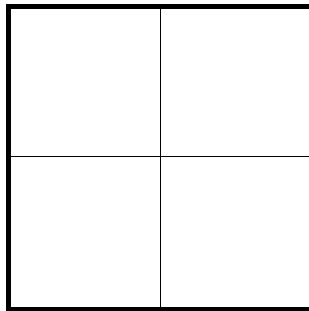
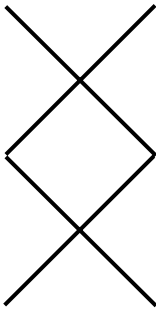


Figure 6

Socrates – Now does this line (a diagonal) going from corner to corner (in each of the four squares) cut each of these squares in half?

Boy – Yes

Socrates – And these are four equal lines enclosing this (central square) area?

Boy – I do not understand.

Socrates – Here are four squares. Has not each line cut off the outer half of each of them?

Boy – Yes.

Socrates – And how many such halves are there (in the central figure)?

Boy – Four

With some few more questions the conversation with the boy arrives to its end, with the right solution.

Socrates – It is your personal opinion, that the square whose side is the diagonal of the original square doubles it in his area?

Boy – That is so, Socrates

In this final stage it is clear that Socrates introduces the hints that will facilitate the solution, the square that solves the problem and the arguments that prove that it is the right solution. We claim that Socrates teaches the boy asking him questions that convey knowledge. The slave, at the final part, does not make any creative contribution

to the solution and even, sometimes, requires more explanations to follow the argument. However, he displays an important mental activity in order to judge the steps of the reasoning process and to assimilate them. We will comment this personal dimension of learning and knowledge creation. Socrates' analysis is another, and insists on his interpretation that he only asked questions.

Socrates – Has the boy answered with any opinion that were not his own?

Meno – No, they were all his.

Socrates – Yet, he did not know.

Meno – True.

Socrates – But these opinions were somewhere in him, were they not?

Meno – Yes.

Socrates – So a man who does not know has in him true opinions on a subject without having knowledge?

Meno – Yes.

Socrates – And the spontaneous recovery of knowledge that is in him is recollection, is not it?

Meno – Yes.

From this final part we will point out that, in the Socratic interpretation, the boy answers with his own opinions, which he has firmly grounded all along the experience. This is an important property of personal knowledge, which we will comment in the following part.

Plato's theory of learning revisited

The Platonic theory of innate knowledge has been reformulated many times in the history of philosophy. In this line, the most important contribution is Descartes' claim that we possess some kind of innate knowledge in which we include logic. In the twentieth century, Chomsky, inspired by Cartesian views, stated that we have innate knowledge, in the form of linguistic competence. Although we point out these Platonic revivals, we must emphasise that Plato built upon his ideas of knowledge and learning an impressive philosophical system. We cannot reinterpret it in the modern views of the knowledge society without betraying it and preventing the right understanding of its consequences. With these cautions, we will reanalyse Meno's dialogue in terms of the functions of reasoning in knowledge creation and learning.

Leaving aside Plato's philosophy, we can consider the boy's learning process in the conceptual frame that we possess innate capacities. The dialogue involves the abilities associated with the generation of conjectural solutions and the development of logical reasoning, which are innate. A stone does not learn. From this point of view, we find in "Meno" an excellent case study of knowledge creation and learning, which presents very carefully every step of the process. This characteristic makes it an interesting model to study. Moreover, it deals with a problem that is not trivial but does not require sophisticated geometrical properties. Its solution is mainly a reasoning experience.

We consider this dialogue as an example of participative teaching and training, which asks for the collaboration of the students. The solution is already known by Socrates, but he motivates the boy to rediscover it. We also see it as a model that, with some modifications, allows to write a guiding text for the activity, popular in some periods and

disciplines, called self-training, in the style of do-it-yourself, or learn-it-yourself. Its name is misleading because without the analysis, the separation of difficulties and the order of questions elaborate by the professor, the student would not rediscover the solution.

We can ask a non-naïve question: could the boy solve the problem without Socrates' guidance and with more personal reflection? We think that it is possible and even normal in some contexts. The main creative idea is to introduce the diagonals, and it occurs to many people. These kinds of witty contributions were called in mathematics *happy ideas*. Although this terminology expresses their unexpected character, they are facilitated by experience and association of ideas. For instance, the boy could have seen, in tiled walls and floors, geometrical patterns of squares built on the diagonals of other squares, and he could transfer this knowledge to his inquiry. In some levels of mathematical training, students were asked to solve problems looking for happy ideas, in more sophisticated subjects.

Plato's description of the process for solving the problem is similar to many present developments. G. Polya, in his book *How to solve it*, published in the forties, introduced an art of solving problems, which he named *Heuristics*. He tried to formulate many recommendations that we can apply in any situations. His work is based on many microcase studies on solving geometrical problems, in the line of the example that we are revisiting, but with more complex techniques. He influenced Allen Newell and Herbert Simon in their research on artificial intelligence and cognitive sciences. They proposed an heuristic theory, completed with a computer programme, for solving problems in their book *Human Problem Solving* (1972). Heuristic methods do not guarantee that we will find a solution nor that we will prove that it exists, but they are usually very useful.

We can ask another interesting question: Was the learning experiment really performed or was it a conceptual construction created by Plato in his writings? Internal and external evidence on this subject makes us almost sure that it was actually not performed. We cannot take it as empirical evidence, but this property does not completely disqualify it. In modern conceptions it could be called a "thought experiment" and compared with others that have been introduced in scientific arguments. Galileo, for instance, created many of them.

Finally, when Socrates insists that the boy has answered with his own opinion, we will emphasise the Socratic idea that the boy's opinion is grounded in the process of thinking and judgement that the slave displays all along the dialogue. We will relate this fact with two views of the knowledge society. First, it is usually recognized that knowledge is information plus judgement, or information submitted to judgement and accepted. Second, knowledge is proven true beliefs. Joining these two principles we can conclude that, in personal knowledge, the knower creates knowledge submitting his information and beliefs to rigorous proofs that require judgement.

Many present theories on knowledge management equate the mental operation of judgement with the concept of internalization of knowledge. We think that they do not analyse how judgement is performed and that they hide important aspects of knowledge creation. Judgement, reflection, and reasoning are central subjects of our research programme on the concepts of knowledge and learning.

Plato's arguments for his philosophy: From geometry to the myth of the cave

Plato, as we have already commented, related the theory of innate knowledge and recollection to his ontology. He claimed that concepts, Pure Ideas, or Forms, constitute

the essence of things. Pure Ideas are perfect, eternal, immutable and independent from us. We do not know the mental path that he followed to arrive to this system; but we can present some elements for its conceptual reconstruction. First of all, Plato's philosophy is an ontological development of some naïve Socratic ideas. In front of the sophistic opinions that we can prove everything and make it true, Socrates tried to found knowledge in the definition of concepts, which, for him, are independent of us.

In this background, Plato's ontology was strongly influenced by geometrical objects. When we draw a straight line with a sharpened draughtsman pencil, we can never achieve a perfect representation. The impossibility is not only due to our lack of personal skills, but to the differences between real and ideal objects. A perfect straight line has only a dimension; therefore, it is physically invisible and cannot be drawn with three-dimensional elements. Plato extended these relationships between real and ideal geometrical forms to all kinds of objects and properties. With this case in mind, he claimed that the things that we take as real are only rough imitations or replicas of Pure Ideas.

Plato explained this abstract and difficult system through the metaphor known as the myth of the cave: we live in a dark cave, penetrated by a dim light coming from a bright external world. The real things are in that world, which we cannot see directly. But we perceive their shadows projected on the cave walls and, confused, we take the shadows for the reality. We do or do not subscribe this ontology but its mathematical roots are clear and with them we understand the meaning of the inscription that was written on the frontispiece of Plato's Academy, "Nobody may enter here if he does not know geometry".

DEWEY'S PRAGMATIC PHILOSOPHY ON LEARNING AND KNOWLEDGE

Dewey and the Pragmatic Philosophy

John Dewey (1859-1952) is the most known philosopher of the American pragmatism, in which we situate him. This philosophical school started in the last decades of the nineteenth century and became a main reference in the first decades of the twentieth century. It sustains a form of empirism, based on the conception that experience is orientated towards the future and guides our activities offering rules of action. Charles Peirce introduced the name "pragmatism" for his theories and William James launched pragmatism as a philosophy.

Charles Peirce (1839-1914) was a philosopher, a mathematician, an astronomer and a surveyor. He always adopted a logical point of view and considered that knowledge is a never-ending quest motivated by doubt. He introduced semiotics, or the general theory of signs, which includes any kinds of signs, like language, icons and symbols and tried to classify them in categories. For Peirce a sign not only involves a dyadic relationship with the object that it signifies, but constitutes a triadic relationship, because we must take in account the people for whom a sign refers to an object. In this line of thought, he also introduced the concept of abduction, or the form of reasoning that explores signs: When an event is surprising, but becomes natural when another event is produced, the observation of the first is a motive for guessing that the second has happened. Peirce claimed, in a radical pragmatism, that the meaning of a concept is what we do with it.

William James (1842-1940) related pragmatics with psychology, and developed it in the field of ethics. He sustained an instrumental conception of truth and claimed that an

idea is true if it allows us to advance. With this background, John Dewey joined the logical, psychological and ethical aspects of pragmatism. He devoted important efforts to the subject of education and transformed the curricula of the American training schools. For him the world is a risky stage. Knowledge and Science allow us to understand and control it, and instruments, machines and technology make possible to create an environment more adapted to our needs, which constitutes a safer place.

Dewey's ideas on the functions of reflection in knowledge creation

Dewey analysed the functions of thought and reflection in knowledge creation and learning in his book "*How we Think*", published the first time in 1910, whose subject he retook in many other writings. His approach is based on the study of beliefs and how do we accept them. In many cases we do it with a slight, or almost not attempt, to state the grounds that support a belief. In other cases we critically examine the basis for a belief. This last process is what we call *reflexive thought*. As knowledge is proven beliefs, reflection becomes the central instrument for knowledge creation.

In his pragmatic philosophy, Dewey introduced a definition of thinking that he explicitly related to the purpose of his inquiry. With our interest on the ideas about definitions, we will point out that, in this view, definitions of concepts can change with the subjects of research. For Dewey, "thinking is the operation in which present facts suggest other facts (or truths) in such a way as to induce beliefs in the latter on the ground or warrant of the former". Reflection, beyond the forms of thought of silly people and dullards, is structured. It involves not only a sequence but a consequence of ideas, in which each of them determines the next as its proper outcome. Reflexive thinking is triggered by a question or a problem to be solved, or a difficulty to be surmounted. "The problem fixes the end of thought, and the end controls the process of thinking".

We can emphasise that Dewey's theory of knowledge creation and learning involves a constellation of concepts related to mental processes and logic. It includes thinking, reasoning, drawing inferences, reflection, judgement and inquiry. Dewey's appeal to judgement was criticised by other philosophers, who consider that it is subjective. They opposed to it the model of formal logic. Finally, in Dewey's view, inquiry requires doubts, dissatisfaction, perplexity, curiosity, and commitment. The concepts of dissatisfaction and perplexity were also objects of criticism because they are not properties of cognitive states. In the knowledge society, which focuses on personal knowledge, these objections are losing its force.

Study of an example of learning and knowledge creation

Dewey was interested in what he called *complete acts of thought* and we can conceptualise as complete processes of knowledge creation. In the second part of the book that we have mentioned, he presented three examples, written by his students, which he selected from about one hundred of them. We will offer a simplified version of the second story and will comment it.

In the ferryboat on which I daily cross the river, there is a long white pole, projecting nearly horizontally from the upper deck and bearing a gilded ball at its tip. When I first saw it, I thought that it was a flagpole. Its shape, colour and gilded ball agreed with this idea, and these reasons seemed to justify my belief. But soon, difficulties presented themselves. The pole was nearly horizontal, an unusual position for a flagpole, it had nor pulley, ring or cord to attach a flag, finally there were two vertical

staffs, with occasionally flags. It seemed probable that the pole was not there for flags.

Observing the pole is not in itself the starting point of the inquiry. Possibly hundreds of people have observed it without asking themselves for its functions. Our student did it and considered that it was a flagpole. When he was aware of many serious objections to this explanation, and realized that it was problematic, he could have lost his interest in the subject, as it happens many times. Instead of it, he felt perplexity and his curiosity pushed him to engage in a research process.

I, then tried to imagine all possible purposes of such a pole, and consider for which of these it was best suited: (a) Possibly it was an ornament. But as all ferryboats carried like poles, the hypothesis was rejected. (b) Possibly it was a terminal of a wireless telegraph. But the position of the pole was not the best for this purpose. (c) Its purpose might be to point out the direction in which the boat is moving.

When our expectations, theories or hypothesis fail and our perplexity and curiosity motivate us to look for an explanation, we must propose some new conjectures and submit them to reflexive criticism. Sometimes we introduce a single hypothesis, and, afterwards, if it is rejected, we introduce a new one. In this way we initiate a sequence of research cycles. Sometimes, as it seems in this example, we simultaneously consider two or more conjectures and try to choose the right one. In this case we look for "crucial evidence", like when we are in a crossroads point, that will fit with one of them and will reject the others. The student reasoning, however, is more sequential than crucial.

In support of the conclusion about orientation, I discovered that the pole was lower than the pilothouse, so that the steersman could easily see it. Moreover the tip, from the pilot's position, must appear to project far out in front of the boat. Moreover, the pilot would need some such guide as to its direction. Tugboats and ferryboats would need poles for such purpose. My hypothesis was much more probable than the others, so I accepted it.

The student states his conclusion not as an absolute proven truth, but in terms of a highly probable belief. This complete act of thought reminds us Popper's epistemology of conjectures and refutations, which he presented in the books *"Logic of Scientific Discovery"*, *"Conjectures and Refutations"* and *"A Never-Ending Quest: An Intellectual Autobiography"*. Nevertheless, beyond similarities, we will point out some differences. Popper worked on the problem of induction and the foundation of empirical sciences. For this reason, he focussed on how to contrast universal laws with scientific experiments. Instead of it, in the present example, the student falsifies or corroborates conjectures about the functions of the pole, which correspond to an individual case and not to a general law. The rejection or acceptance of a hypothesis is not the result of a classical experiment, but involves a form of reasoning based on experience, observations and reflections.

We can analyse the ferryboat pole case as a typical example of the trial and error elimination model of learning, which was also studied by Popper. In another line of thought, Dewey commented this complete process of thought emphasising that it is motivated by curiosity and not by the pressure of immediate action, as it happens in the first example that he presented. It involves common knowledge and not scientific

theories nor empirical proves, as in his third example. Nevertheless, it requires a good scientific mentality which many people spontaneously possess.

Dewey's theory of inquiry, as a learning and knowledge creation model

The narrative presented by the student, on the one hand, thoroughly describes or reconstructs his personal experience, and, on the other hand, it is strongly influenced by Dewey. It uses terms that come from his philosophy and perfectly fit with his theory. Even with these limitations it constitutes an excellent example of learning and knowledge creation.

Dewey analysed the structure of complete acts of thought as a process that is developed in five logical steps. First, there is an state of perplexity or felt difficulty, in relation with some matters or events. Second, we try to locate and define this perplexity, usually in the form of a well-formulated problem. Third, we suggest a possible solution. Fourth, we develop the arguments of the bearings of this suggestion. Fifth, we observe and perform experiments that lead to the acceptance or rejection of the suggestion; that is, we conclude believing or disbelieving the suggestion.

In his further publications, Dewey studied this model again and again, and finally he presented it with the name *The Logic of Inquiry*. He mentioned that in many cases the progress from perplexity to a defined problem requires a hard work. This happens frequently when doctoral students prepare the research questions of their project for the dissertation. In other cases perplexity comes out from a defined problem, and the first and second steps cannot be separated. For instance, the search about the functions of the front pole starts with a precise problem.

CONCLUSIONS AND FURTHER DEVELOPMENTS

Conclusions and further developments from the examples

The critical views of Socratic methods in the knowledge society have emphasised many aspects of learning and knowledge creation. Also, we have learnt many things from the examples that we have commented. At a first level, we realised that they follow some patterns, and we have conceptualised them. At a second level, we exerted our skill for interpreting texts and developed some models of analysis. Our examples emphasise the functions of reflection, reasoning and judgement that are involved in learning and knowledge creation. They include the formulation of problems; the proposal of conjectures that can solve them; the operations of drawing conclusions; and the contrast of conjectures and their consequences with further information, observations and experiments.

A remarkable point of our search are the differences and similarities that we find in the examples. Plato's idealism, expressed in his writings by the character of Socrates, and Dewey's pragmatism are opposed ontological and epistemological poles. Their interpretations of learning and knowledge are radically different. Nevertheless, the cases that they present, exhibit similar patterns of the process of learning, and emphasise similar forms of reflection. In our analysis, we will separate the actual experiences of learning from their ontological meanings and interpretations.

This paper will be extended with the study of more examples of learning and knowledge creation. We will present in our research programme complete acts of

thought in the contexts of common life, managerial innovative activities, natural sciences research and organizational learning. We already are preparing some cases, which include Hitchcock's movie "*The Rear Window*", and Lakato's studies on mathematical creativity. In all of them we will emphasise the functions of reflection and the influence of the contexts. We will be especially interested in comparing the forms of reflection that are associated to or separate from immediate action.

Conclusions and further developments from the conceptions of knowledge as proven beliefs, or reasonably proven beliefs

Not only the examples but also the conceptions of knowledge that define it as proven beliefs or as judged, criticised and accepted information, emphasise the functions of reflection and judgement in learning and knowledge creation. In this subject we will introduce two basic distinctions.

First, many leading authors do not care to separate the categories of proven beliefs and reasonably proven beliefs. Many debates discuss if it is possible or not to have beliefs that are absolutely proven. So, against the philosophical and scientific tradition, for some people the first category could be empty. At any case, the distinction is very important. The Greek philosophy introduced two kinds of knowledge: episteme, whose name produced the term *epistemology*, for proven beliefs, and doxa, whose terminology now is associated with the expression *PhD*, for reasonably proven beliefs. In this first class, knowledge is based in principles that are necessary and evident, and is developed by valid logical forms of reasoning. In the second class, knowledge involves reasonable opinions or beliefs and rhetorical arguments.

Second, a very long tradition distinguishes personal knowledge, which is in the mind of people and makes possible their activities, and objective knowledge, which is formulated in theories and, in a certain way, becomes independent of individual people. Both of them involve reflection but with different forms and standards. Personal knowledge is created by judgement and persuasion. Objective knowledge is subject to formal rules of logic and methodology.

For a systematic discussion of the present diversity of concepts of learning and knowledge, and the variety of ideas about definitions, which we find in literature reviews, the present paper has clarified some points. Nevertheless, we need to develop a conceptual frame which will include more basic views and theories on these subjects. This is an aim of the continuation of the research project.

An approach to learning and knowledge creation based on arts of reasoning and rhetoric of inquiry

We think that the arguments of this paper justify an approach to learning and knowledge creation based on reflection, reasoning and judgement. To clarify that view we will point out that it can seem problematic in some contexts and trivial in others. On the one side, when we learn how to swim or drive a car, or we acquire tacit knowledge or develop our skills, we apparently do these activities without reflection and reasoning. This is for us a problematic subject and, in our research project, we introduce the hypothesis that these kinds of learning involve reasoning and loose forms of judgement, which allow us to discriminate states and situations.

On the other side, when we create knowledge in a process of problem solving, we are ready to recognize that it requires reasoning. Nevertheless, we consider that this remark is trivial. For instance, among many other publications, Nonaka and Takeuchi's

book “*The Knowledge Creation Company*” states that “knowledge is justified true beliefs” and that “(learning and) knowledge creation is a dynamic human process of justifying personal beliefs towards the truth”. These concepts allow them to study transformations of knowledge. They focus on the subject of innovation but take for granted the functions of reasoning, which they do not analyse.

Research advances on reflexive practitioners pay more attention to the forms of inquiry involved in different kinds of practices. This is an important step towards the subject of reflection and judgement. Beyond these contributions, in our research project we will introduce a systematic view on these issues. We think that, in practical knowledge production, to be aware of our forms of thinking is very productive. We also believe that in scientific research, to analyse the kinds of arguments accepted in different conceptions of science is a basic guide because we work with new forms of knowledge production, and we transgress the disciplinary division of science. Moreover, we claim that focussing on reasoning and judgement we potentiate our mental capacities.

Seven arts of reasoning. In further developments of this research project, we will re-examine some classical and modern instruments for thinking from the prospect of learning and knowledge creation. In this line, we will consider the following arts of reasoning:

Logic, or the art of valid reasoning, with which we prove beliefs. Its models are syllogism and the proofs of geometrical theorems.

Rhetoric, or the art of persuasion through reasonable arguments, which we can illustrate with the discussion in the Courts of Law.

Dialectics, or the art of inquiry carried on through precise questions and answers, which we have commented in Plato’s examples.

Heuristics, or the art of solving problems, which we have used in our examples.

Linguistic Pragmatics, or the art of drawing inferences based on communicational principles and developed in conversations.

Hermeneutics, or the art of interpreting texts and human actions. Finally,

Writing or the art of formulating theories and framing knowledge in stories.

Dialectics and Rhetoric of Inquiry. The diversity of arts of reasoning, which sometimes are complementary and sometimes overlap, with their collaborations and tensions, and their ambition to impose themselves over the others, makes interesting to integrate them in a single field of study. In the analysis of their tensions, we will use the concept of dialectics, and in the subjects that integrate them we will follow the discipline of rhetoric of inquiry.

Deirdre McCloskey created the views and the mane of the rhetoric of inquiry. Her approach emerged from the influence of many lines of thought: Aristotle’s conception of classical rhetoric, modern developments of rhetoric related to communication, and new views on scientific research. This discipline is a basic part of epistemology and it focus on the forms of reasoning involved in metaphors and narratives.

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