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Understanding the processes of problem-based learning

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Learning and Cognition: The Interplay Between the Subject and the Group Understanding the Processes of Problem-Based Learning

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ABSTRACT

The purpose of this article is to discuss the relationship between learning, epistemology, and intersubjectivity in the context of problem-based learning and project-oriented work at a university level. It aims to show how the collaboration of students in a group over a long period of time can put emphasis on the knowledge-practice discussion, and thereby on some of the values required to progress in science as a field and to develop knowledge. This article focuses on the ways in which the dialectical interplay between the individual's learning and the groups' learning process can be described through the development of a project in a field. This process of dialectical interplay is a matter of cognition and development of the self as well as the development of competencies and knowledge. Learning is a process based on the involvement of the self, engaging and interacting with a problem and with others. The process of learning during problem-based activities is described as the development of knowledge about something while simultaneously developing reflexivity and skills in order to understand oneself as a learning entity. In order to understand this learning process, we need a perspective on how to understand the human being and the consciousness – that learning is always about the individual and therefore requires an understanding of the ontology of the human being. This requires a discussion about the process of interacting with knowledge, and how to handle the processes of understanding, and the contradictions that appear in particular learning contexts. The grounds for the development of intersubjectivity, which is required for the engagement of interaction, thus appear to be an important component for learning. This article will examine these questions and themes from a broad phenomenological and dialectical perspective.

Keywords: Group learning, Subject, Intersubjectivity, Cognition, Epistemology, Problem-based learning, Project oriented work, Development of Knowledge and the Self, Context, Scientific values

INTRODUCTION

In order to further elaborate upon theoretical discussions regarding education and problem-based learning, this article draws on research from Aalborg University and the teaching of business economics as an empirical case. This approach allows for a practical illustration of the theoretical notions, in addition to contributing further criteria concerning which phenomena are central to learning at a university level. In order to understand the discussions on theory and the case presented in this article, a brief introduction to problem-based learning at Aalborg University is required.

Krogh et al. describe problem-based learning (PBL) as an orientation towards researching a problem (Krogh et al. 2004). Heidelbach describes the process of researching in this sense of PBL in the following way;

> "Project work is characterized by being a problem-oriented process of realization rather than being purely a knowledge acquisition. Usually, the process of realization consists of two parts. The first part takes its point of departure in a lack of knowl-

> edge in relation to one's surroundings, that is, one wonders about something, which is different from what one expected, or, which turns out to be different from what one would expect. This wondering may result in the formulation of a problem that is to be dealt with. The second part consists of thinking through the steps that are needed to take in order to investigate and potentially 'solve' the problem. The realization, then, occurs in the interplay between actions and thought, where one carefully considers one's actions and acts according to one's thought process" (Heidelbach et al. 2001:7).

At Aalborg University, the PBL approach is closely tied to the notion of writing and developing a project, which entails that the students work in groups for the duration of a semester. The project is typically 50-80 pages, centering on the discussion of a theoretical or empirical problem. The students enter these groups with the purpose of working on a specific problem, and during some semesters the problem is formulated in cooperation with a company. Additionally, each group has a supervisor. Each semester has a primary theme that the students must define through their own understanding and definition of the selected problem; subsequently, they carry out the research process aimed at answering that problem. These groups and projects comprise about half the activities of a semester. The majority of the other half consists of lectures that are relevant to the semester's main theme, and therefore the lectures usually support the students' work in groups (Krogh et. al 2004:14)

This way of organizing the students' work sets it apart from traditional cognitive learning (TCL) as presented by Fox (1997). Firstly, it situates the process of learning into a specific context, which Fox argues for with his notion of situated learning. The process of defining a problem, along with the process of researching that problem, requires the definition of the context as much as the definition of the problem itself. Secondly, the difference between TCL and PBL is the process referred to by Heidelbach as *realization*. In any learning situation, there is a process of realization in the sense that something is perceived in a different way. The process referred to by Heidelbach in PBL is significantly different in terms of the dialectical relationship between actions and thoughts. According to the students' unique definition of the problem, PBL calls for both the application and the development of knowledge from different settings as they explore the unique context that their definition of the problem has produced. Therefore, the development of the project is a creation produced through the interaction between the actions of students and their ability to self-reflect. Thirdly, due to the social nature of groups, the students implicitly develop the necessary competences to collaborate with other students and reach a mutual understanding. This social aspect of scientific work not only requires social competences but also creates a context wherein the effects of some social aspects of interactions clearly influence the students' learning processes. PBL from this perspective is therefore a process that the students enter into, which in turn emphasizes a dialectical interplay between self-reflexivity and scientific practice. The dialectic interplay between these two aspects is made possible by the intersubjective nature of humans and should therefore be viewed as the single individual's possible interplay within an inherently intersubjective context.

The discussions brought forth in the article so far have included an implicit discussion of the individual's ability to perceive reality, and one of the characteristics in this regard is known as *consciousness*. In order to start with the assumption that future assumptions are based on, it is necessary to discuss what consciousness is and the roles that it plays in our perception of reality. In the following, Kant describes two central elements in relation to the constitution of our consciousness.

> "Our nature is so constituted that our intuition can never be other than sensible; that is, it contains only the mode in which we are affected by objects. The faculty, on the other hand, which enables us to think the object of sensible intuition is the understanding. To neither of these powers may a preference be given over the other. Without sensibility no object would be given to us, without understanding no object would be thought. Thoughts without content are empty, intuitions without concepts are blind" (Kant 1929:93).

In this quotation, Kant distinguishes between *sensibility* and *understanding*—two human capacities through which interaction creates both the content of our thoughts and the appearance of objects. In the Kantian perspective, these two characteristics in turn relate to the *judgement* of an object, which is a synthesis of *intuitions* (the product of the faculty of sensibility) and *concepts* (the product of the faculty of understanding). The process, described by Kant when he links *judgement* with *intuitions* and *concepts*, is considered an essential part of any discussion on consciousness, since an inescapable part of consciousness is that its existence is only true when it is directed towards something. In other words, we can only be conscious when we are conscious of *something*, which entails that we have judged or interpreted to some extent that *something*. Such a definition assumes two central elements in regards to humans: 1 – as humans there is such a thing as not being conscious and 2 – that non-consciousness can inter-

pret objects (this must be possible if the *something* must appear to us before we can be conscious of it).

According to this discussion, consciousness can be described as a dialectical process that can only occur if it is preceded by a non-conscious interpretation of *something*. Another characteristic of consciousness is what Kant refers to as the *transcendental unity of apperception*. Searle discusses and exemplifies this notion in the below quotation:

> "First, at any given instant all of our experiences are unified into a single conscious field. Second, the organization of our consciousness extends over more than simple instants. So, for example, if I begin speaking a sentence, I have to maintain in some sense at least an iconic memory of the beginning of the sentence so that I know what I am saying by the time I get to the end of the sentence" (Searle 2015:4).

This idea of unifying *all of our experiences into a single conscious field* indicates that experiences relate to each other through our unification of them. Naturally, humans cannot consciously conceive of all their experiences in one single conscious field. It does seem entirely plausible, however, that the process of unification is a practice that enables consciousness through the relation of experiences to one another. Thus, consciousness becomes a product of unification and not of the process itself. Consciousness in relation to the latter part of the quotation from Searle assumes the ability to recall previous experiences, which is also an intricate part of the unification process. Due to the necessity of memory in the constitution of consciousness, the latter must contain a primary characteristic of memory, namely its unique constitution. Time and space force each individual's memory to be unique, since no two things can exist in the same space at the same time. Therefore, it is safe to assume that the memory of each individual is unique and, as a result, each unification process that forms consciousness is also unique. This is usually described as the *subjective* nature of consciousness.

Schütz has a similar view in his discussion, when he talks about replacing the objective analysis of the things in the world with a subjective analysis of the things in the consciousness. He does this by making a distinction between "the act of thinking" and "the object of thought" (Schütz 1973:102). Schütz attached great importance to a phenomenological analysis of meaning and searched for the underlying elements in that which he called "the stream of consciousness." This concept is decisive for his analysis, as it introduces the temporal dimension that supports the concept of "reflexivity." *Consciousness* is fundamentally an unbroken stream of lived-through experiences (*Erlebnisse*) that have no meaning in and of themselves. The meaning depends on *reflexivity*, or the process of turning into yourself and reflecting on the experience of the act. The conscious experience of meaning is only connected with actions in a retrospective way, and this process of giving meaning reflexively depends on the actor's identification of the aim or the goal that he or she is trying to reach.

From the discussions so far, consciousness can be described as a subjective, dialectical, unifying, and relational process that is only accessible through the memory of the individual and is preceded by a non-conscious process. The introduction of memory into the constitution of the individual enables another central aspect, which is usually termed *self-consciousness*. In relation to the scope of this article, self-consciousness or self-reflection is central to any PBL or project-oriented process. Self-consciousness in relation to epistemology and learning is closely connected to the notion of non-consciousness and language, especially with regard to the dialectical nature of the definitions of the problem and its context, as well as the performance of actions within those definitions. In terms of the individual's self-consciousness, it can be defined as the consciousness of oneself. Self-consciousness in other terms is the process of understanding oneself. From a phenomenological position, understanding oneself—as with all understanding—is a process directed towards understanding the essence of something. Alternatively, it can be described as synthesizing a transcendental judgment regarding an object. Eco further describes below which is essential to the process of self-consciousness:

> "The moment we enter the universe of essences, we enter the universe of definitions, that is to say the universe of language that defines" (Eco 2000:23)

In this quotation, the universe of essences is equated to the universe of language, which means that the process of self-consciousness can be understood as a process of defining oneself through language. Having language as the facilitator and content of any self-conscious process enables a description of language as encompassing both a limiting and expanding force in the individual's potential for learning. In other words, language is the medium through which humans can expand themselves as well as their surrounding world. This link between self-consciousness and language is central to the discussion regarding PBL and the practice of scientific actions, as it serves as the theoretical description for how the two are linked.

Before a discussion regarding PBL and project group work can take place, it is necessary to formulate the epistemology of the individual. Such a description can in no way be removed from the epistemology of the group, so this separation is merely intended to be a starting point for an epistemological discussion about both factors. In this article, elements such as *understanding, sensibility,* and

judgement have been introduced as a foundation for how the interpretational process can be described. Furthermore, this process has been described as taking place both non-consciously and consciously within the parameters of the individual's language. This process, just as with consciousness, must be related to *something* even if that *something* is only imaginative and fictive. If this were the finished result of the epistemological discussion, then it could be described as a primarily subjective perspective without accounting for any of the commonalities of our everyday lives or for the possibility of any perceived yet shared truth. Therefore, in order to understand learning or epistemology, it is necessary to introduce the intersubjective nature of humans. As has been discussed above, language, consciousness and, by association, thoughts are very closely connected when it comes to how individuals construct knowledge.

> "But only by taking the attitude of the generalized other toward himself, in one or another of these ways, can he think at all; for only thus can thinking – or the internalized conversation of gestures which constitutes thinking – occur" (Mead 1967: 156)

Mead introduces the idea of the *other* as a central element in thinking, thus placing it in a very central position in the epistemology of humans. The *other* becomes pivotal for the development of thinking and therefore of language, thus even in an action as solitary as thinking, the *other* is present as an enabler of that action. From a phenomenological perspective, the term *intersubjective* is utilized as a way to describe the result and parameters of the interaction among humans, and as such, the *generalized other* is a result thereof. The *generalized other* can function as an illustrator of the ways in which the dialectical relationship between the individual and the group can be understood. If the epistemological description is accepted to this point, then the *generalized other* can subsequently illustrate how the interaction with others is not only interpreted or judged by the individual's epistemological capabilities, but also how this interaction with others enables and constructs the individual's epistemological capabilities. This dialectical interplay between the group and the individual is therefore central to any understanding of learning and epistemology. When relating this discussion to learning, PBL, and project-group work, there are numerous concepts that have a clear influence on the learning of an individual, such as power, ethics, emotions, narratives, identity, and more. In this article, only a few these concepts will be discussed based on their empirical relevance and they will be introduced in a limited fashion due to the scope of the research. However, there are some general guidelines to consider: for example, due to the epistemologically constituting nature of intersubjectivity, there is a theoretical foundation for including such social aspects as power and ethics in the process of interpretation. This means that the interpretation of the individual contains elements that have a primarily social origin. As stated previously, intersubjectivity constitutes us as well as we constitute it.

From this perspective, consciousness, interpretation, and intersubjectivity become closely linked, and they are especially important to consider when discussing the dialectical process of actions and self-reflection in PBL. This dialectical process is a clear element in PBL when it comes to the requirement of defining the problem and the context in which it is to be researched. The typical process of implementing a project begins with the understanding and definition of the problem and its context, and as knowledge develops regarding the context, the problem will be redefined in order to match what was originally intended and what is deemed appropriate for the context of the problem.

An example of this is a project undertaken by students regarding management and communication. In the beginning, the two concepts were separated with no clear interactions. Communication was defined solely as a means of expressing management. As the project progressed, communication seemed to play a central role not only in expressing management but also in framing and limiting the possibilities of management. The project eventually concluded that the research originally performed regarding communication had been too limited in its scope and did not match the importance of communication when it came to management. In such a project, self-reflection regarding the students' original definition was required. It was their everyday assumptions and definitions that ultimately led to this methodological weakness, thus creating the possibility of reassessing not only the definition of communication but also the practice of insufficiently questioning the initial definitions and their correlations. In other words, the students felt it necessary to comment on their own scientific actions, based on a process of self-reflection. Although this case was described briefly and in a singular fashion, it is a common experience and hopefully demonstrates how the theoretical discussions so far can come to express the processes of everyday experience.

INTERSUBJECTIVITY: LEAVING THE NAÏVE ATTITUDE

The students being in the learning context is situated, which means that the learning context has a special meaning as well as structure of relevance for the students' living, thinking, and acting within it while creating the context. The students develop, and therefore select and

interpret this context prior to conducting their methodological research through a series of commonsense constructions originating from their everyday lives and their education. This learning context can be understood as "the common-sense world," the "world of daily life," or the "everyday world;" these are variant expressions for the intersubjective world experienced by the students within what Husserl (1995:152) terms "the natural attitude," deeming that daily practical living is naïve. It is an immersion in the already given world, whether it is through experiencing, thinking, valuing, or acting. They are naïve in the sense that they take things for granted both as a way of handling their education and to survive and obtain what they believe as important, namely good grades. This is in many ways a situation full of contradictions with regard to what education and *building*[1] could and should be at a university. On one hand, it is a matter of being able to exist within the process of education and learn the *doxa*, or how to behave. On the other hand, this is problematic in relation to the development of the self—the process of *building*. Therefore, the question is how to leave the naïve position and subsequently enter into a process of learning and reflection that is less limited by common-sense constructions and language.

The educational program has its history, and is presented to the students in an organized fashion by teachers, supervisors and administrative staff. The learning context is the primary setting for the students' actions, as it is what these by definition are (or should be) centered around. Therefore, this common-sense world is the main arena for their social action; within it, they enter into relationships and try to come in terms with one another as well as with themselves. All of this, however, including individual learning styles, perceptions of their own projects, theories and methods, is typically taken for granted, and this means that these structures of daily life are not themselves recognized or appreciated consciously and reflectively. The student sees the world, acts in the world, and interprets the world through these implicit typifications. That there is a social world related to education, that there are fellow human beings, that we can communicate meaningfully with others, that there are very broad and general principles true for daily life—these prime facts are woven through the texture of the natural attitude (see Schütz 1990:XXVII) in the learning context. The recognition that every learning context is constituted by the natural attitude is one of the primary arguments for why the process of problem definition and self-reflection is central to any scientific research or learning.

1 A German expression that has no parallel concept in English. It can be seen in relation to in ancient Greece, where the term *paideia* referred to the rearing and education of the ideal member of the community.

Learning as understanding and self-understanding is thus confronted with the fact that the learning context is not a private one, but is interwoven in an intersubjective world. This means that it is common to all, either directly given or potentially accessible to everyone, and this involves intercommunication and language. It is in and through this intersubjective world that learning and action can be understood. To learn in this intersubjective world means to be engaged and to act in and upon it, which also means that we must consider learning as a social action. *Social* is understood as behavioral interactions between two or more persons, acting toward one another and about something. Therefore, social action is understood in the light of the meaning that the action has to the actor (and to the *other*). To understand the social world is to understand the ways in which human beings define their different social learning situations, and the very definition is itself both a process and an action, and that interpreting the world is acting in the world (see Schütz 1972:XVII).

To learn and develop the self can be understood when we consider what happens when acting within a specific situation of experience—a new specific meaning rises in the interplay with previous experiences. The rising meaning is then capable of changing the meaning of the previous experiences. MerleauPonty discussed this, taking his point of departure from Heidegger's *"Dasein"* (see Heidegger 1992; cf. Bengtsson 1993:71). However, MerleauPonty emphasizes that the subject is one's own living body. It is therefore a psychophysical notion, where a human is both consciousness and a physical entity.2 One's own body is not a thing we move around in space in the same way as with chairs and tables. It is the subject that moves the thing. The individual body is the subject of all action. As a subject, the physical being does not exist in space and time, like trees and bushes, tables and chairs, but it *occupies* the space and the time. To one's own body, a lived space and a lived time arise through its beingintheworld, through its interaction and communication with the world (cf. Merleau-Ponty 1994:243-; Bengtsson 1993:74). Space and time ultimately manifest themselves to us through our activities. Thus, geometrical space and chronological time do not constitute the foundation of lived space and lived time. They constitute an attempt to imagine lived space and lived time, respectively, and to

2 As Merleau-Ponty (1994:XIX) says when he discusses the necessity of **not** looking upon the world from different isolated viewpoints, thus referring to Marx's statement on historical development: "It is true, as Marx says, that history does not walk on its head, but it is also true that it does not think with its feet. Or one should say rather that it is neither 'head' or 'feet' that we have to worry about, but its body."

control them by means of mathematical constructions. In this way, MerleauPonty argues that:

> "I am not in the space and the time, I do not think the space and the time; I am to the space and the time. My body embraces them" (cf. Bengtsson 1993:74).

In relation to the discussion of intersubjectivity, in the same way a human is to the world through his body, he also is to other human beings. In the same way that we have a fundamental belief in the world, we also have a fundamental faith in other people. However, this spontaneous belief and faith do not necessarily justify anything, as its justifications, as with all other rational activities, always presuppose both the world and other people. This does not, however, mean the learning context and intersubjectivity a solid foundation. It is, instead, a sensitive foundation.

Normally, we understand other people spontaneously; however, occasionally problems of misunderstanding arise. When this happens, the normal, functioning, practical behavior is replaced by theoretical behavior, whereby we attempt to enter into the spirit of the intentions of the other person. In this way, we can understand the conditions of our communication and interaction. Communication materializes when I allow my own understanding of the totheworldbeing of the other person to express itself in my own totheworldbeing. In other words, I take over and carry on the bodily meaning indicated by the action of the other person. By doing so, a dialogue may develop as a spontaneously functioning interaction, whereby I confirm the other person and the other person to me, and whereby I correct the other person and the other person corrects me, especially in the cases where both agreement and disagreement may arise. Understanding is never definitive, however, because it is never frozen in the moment. Through continuous action, one may change the first understanding or modify it. We live and interact with other people and we experience the world, and consequently intersubjective and social affairs are neither a notion, a thing, nor the sums of things. They are instead formed through a dimension of existence that we can never escape, above which we can never rise, and outside of which we can never stand.

The discussion around intersubjectivity can be further understood in relation to Schütz's (1978:121) discussion of intersubjectivity and how we achieve and construct understandings of one another. In this, he is interested in illustrating the ways in which we know the lived experiences of other people once we have postulated and taken for granted the general thesis of the alter ego. In the understanding of intersubjectivity, this is linked with the private world and with the world as an intersubjective cultural world, i.e. Schütz's discussion of the concept of the Lifeworld.

Among the elements of my experience of the outer world are physical objects and fellow humans, or *alter egos*. Encountering the body of another human being is qualitatively different from the experience of inert bodies, or bodies *as things*. First of all, the body of a fellow man is experienced as part of a psychophysical unity. This means that coeval with the recognition of the body is the awareness and appreciation of the ego that possesses, in addition to a body, a world of cognitive awareness generally similar to mine. Taking my body as the center point for the coordinates that map my world, I may say that the position of my body constitutes my *Here*, in relationship to which the body of a fellow human is *There*. I find that it is possible to alter my position and move from *Here* to *There*. Having moved, the *There* becomes a *Here*. But the body of my fellow human remains *There* for me as it remains still a *Here* for him. Although I cannot in fact stand directly in the perspective of the other's *Here*, I can as subjunctively attribute to him a reciprocity of perspectives. Thus, the objects and events of the world are common to both of us because I can perceive from *There* the same things I perceive from *Here*, despite the shift in perspective. Within the common-sense world it is simply taken for granted that the reciprocity of perspectives holds, that the objects and events of human experience are intersubjectively available and more or less the same for all "normal" perceivers. The concept of normalcy itself, it might be suggested, is derivative from the implicit assumptions common sense makes about the structure of sensory perception. The interchangeability of *Here* and *There* between two egos is the necessary condition for a shared reality (see Schütz 199Ø:XXXII-).

The students experience reality as a shared or common reality, as intersubjectivity is taken for granted as an obvious quality of their world. This structure of meaning arises in and is institutionalized through their actions. All objects of culture (i.e. tools, symbols, language systems, social institutions, etc.) point back, through their origin and meaning, to the students' activities. Intersubjectivity, in general and through group work, can therefore be seen as a common subjective state or as a dimension of consciousness that is common to the group that has a mutual impact on each other. In contrast, social connections are rendered possible through the intersubjective understanding of common rules which is inevitably experienced subjectively. Intersubjectivity refers to the fact that different groups may interpret and experience the world in the same way, which is necessary in some contexts due to the collective development of the project.

Through the description above, any field may be understood as containing objects of culture, which point back, through their origin and meaning, to previous actions and experiences of learning made by students. This appears to be true for all fields, but none more so than the professional scientific field. As noted earlier, intersubjectivity and actions inevitably contain social meanings and language. Therefore, the actions of a scientific field must also contain values, and due to the extreme complexity of the lived world, scientific values could rightfully be described as being far more central to the scientific field than any particular scientific theory, under the consideration that any theory is the result of numerous sets of scientific actions and the values therein, along with numerous judgments made by others and their scientific values. After establishing the importance of scientific values, the question becomes how to design a learning context in which not only are these values taught consciously but also encourages students to improve their abilities to perform actions in correspondence with certain scientific values. This is where the project supervisor becomes a central figure. At Aalborg University, it is naturally preferred that a supervisor is extensively familiar with the topic that the students have chosen, but it is not a requirement. This is because the supervisor can learn about the topic, but above all, it is because the supervisor should embody and exemplify a certain set of scientific values and encourage the students to do the same. The obvious question would be: *is knowledge regarding one's object of study not a central scientific value?* The short answer is no. Prior knowledge is not a requirement for scientific work, since knowledge itself is the aim of scientific work. This serves as an example of the differences between beneficial competencies and essential scientific values. As with any action, science contains far too many social values than can be described within the scope of this article. However, it is worth mentioning a few that are central to the practice and development of scientific work for students—and in turn, these are hopefully general characteristics of all scientific work. One of these values has already been established implicitly in the discussions regarding the inevitability of intersubjectivity in any learning situation, and thus is caused by the presence of others, namely ethical values. Another value stems from the notion of problem formulations and it is genuine and as far as it is possible, unhindered curiosity. Within the value of curiosity and the action of researching a problem formulation is, as discussed above, the need for a dialectical interaction between actions and self-reflection. Developing such skills as self-reflection is encouraged not only by the presence of a supervisor but also by the presence of the group. As described above regarding the dialectical interactions between problem definitions and research, reflexivity as a method becomes central to a self-development, which is then not only based on common-sense assumptions. By considering self-reflexivity, and reflexivity in general, as a scientific methodological necessity the understanding of PBL becomes more specific, and ideally the consequences of PBL work become more apparent. In more traditional scientific terms regarding self-reflexivity, the discipline of the philosophy of science, in as far as it functions as a method for reflection regarding one's own scientific work, becomes an essential part of any scientific endeavor.

CONCLUSION

A central component of any development is the direction in which it transpires. As such, the primary task of a supervisor is to exemplify the direction in which the development of students is intended to proceed. In other words, a supervisor is expected to exemplify the *doxa* of scientific work. This notion is not only founded upon normative assumptions regarding what science *should be*; indeed, it also serves as the conclusion to the first half of this article, regarding how human epistemology and learning *is*. Any learning is considered to be an action, at least an action of judgement, and in this way it contains—due to the epistemological considerations brought forth in this article—a set of values created throughout history in an intersubjective existence. Being aware of one's own development during PBL work not only depends on the learning of specific methodologies and theories but, more importantly, also depends on learning about oneself and about the expansion of one's own language and individual consciousness.

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