OTHER THEMES

# Learning, Intelligence and Social Environment: epistemological conceptions

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**ABSTRACT – Learning, Intelligence and Social Environment: epistemological conceptions.** The text analyses questions 12-14 of the 24 included in the research entitled *Epistemology of the Mathematics Teacher* (Becker, 2012b), based on interviews with 17 teachers from Peru, Chile and Uruguay. The general aim is to identify the epistemological conceptions underlying mathematics teaching, specifically to learn how teachers explain the learning abilities of students from different social backgrounds and if they think intelligence is inherited. Teachers: display empiricist or aprioristic, rather than constructivist epistemologies; believe intellectual abilities are inherited and differentiated by the environment; and undervalue the action of the subject. The theoretical reference is Genetic Epistemology.
Keywords: **Epistemology of the Mathematics Teacher. Learning Ability. The Role of Social Environment. Inherited Intelligence. Constructivist Interactionism.**

**RESUMO – Aprendizagem, Inteligência e Meio Social: concepções epistemológicas.** O texto relata a análise das questões 12-14, dentre as 24 da pesquisa *Epistemologia do Professor de Matemática* (Becker, 2012b), cujos dados provêm de entrevistas a 17 docentes de Matemática do Peru, Chile e Uruguai. O objetivo geral é o de identificar as concepções epistemológicas que fundam o ensino de Matemática; o específico é saber como os docentes explicam as capacidades de aprendizagem de alunos de diferentes meios sociais e se pensam que inteligência é herdada. Os docentes revelam epistemologias empiristas ou aprioristas, não construtivistas; creem que nascemos com capacidades inteligentes e o meio as diferencia; sua concepção de aprendizagem não valoriza a ação do sujeito. A referência teórica é a Epistemologia Genética.
Palavras-chave: **Epistemologia do Professor de Matemática. Capacidade de Aprendizagem. Função do Meio Social. Inteligência Herdada. Interacionismo Construtivista.**

## Introduction

The research project, in its data analysis phase, is entitled: *The Epistemology Underlying Teaching; Mathematics teaching*. Its overall objective is to identify whether the epistemological problems widely found in Brazilian mathematics teaching, namely the predominance of a form of empiricism largely underpinned by apriorism, and only the occasional sporadic interactionist or constructivist insights that lack the necessary theoretical base to support active pedagogies, are also seen in neighboring countries. These problems were raised in two previous studies carried out in Brazil and published in book form (Becker, 2022; 2012b). The data for this research were collected during semi-structured, face-to-face interviews held with 17 teachers that lasted approximately one hour and involved 24 expansive questions. Recorded in Spanish, the interviews were transcribed into Portuguese by two Spanish speaking research assistants, one a graduate, who transcribed the interviews, and the other majoring in languages, who reviewed the complete transcription. The interviewees will be referred to by numbers, based on the alphabetical order of their names, preceded by T (Teacher) with: ten from university (U), five from high school (H) and three from elementary school (E), with one teaching at both the H and E levels. The sample consists of five Uruguayan, five Chilean and seven Peruvian teachers working in public (9 teachers) and private (8 teachers) educational institutions that serve different social strata, from schools located in the urban periphery to university centers that predominantly serve the middle class (One or another teacher may not appear in one or another part of the analysis because he or she did not answer the question or exaggerated/fantasized about the subject). Although this mode of research has been carried out for a considerable amount of time, it continues to be considered exploratory research. The interviewees were selected based on the following requirements: teachers from at least two countries; the widest diversity of teaching levels; and teachers from institutions serving students from different social strata. With the last two requirements being minimally achieved.

The analysis presented in this text seeks to discover the epistemological conceptions underlying the answers given by the interviewees to questions 12-14, of the 24 in the survey. The first two analyses (answers to questions 1-3 and 4-8) were published by BOLEMA – Bulletin of Mathematics Education (Becker, 2019; 2021); and the third (answers to questions 9-11) has been submitted to another mathematics education journal.

The text analyses the interviewees' responses to the questions:

a) does the child who is born and grows up in the urban periphery or in a slum, learn mathematics in the same way as a middle or upper class child?

b) Do children from a rural environment learn mathematics in the same way as those from an urban environment?

c) If the parents are intelligent, will the child be intelligent too?

The analysis was based on Genetic Epistemology, in particular: learning theory (Piaget; Gréco, 1974a), the genesis of intelligence and the epistemological criticism (Piaget, 1978), the relationship between action and understanding (Piaget, 1977b), and the interpretation of the development of cognitive abilities through the process of reflective abstraction (Piaget, 1995). The analysis begins with the teachers' answers to each question, which provide wealth of details that shed light on the underlying epistemological conceptions; secondly, those conceptions are grouped according to epistemological tendencies (we understand that, as an exploratory research, the reader needs to know from where the interpretations in this analysis were extracted); thirdly, these tendencies are interpreted in the light of Genetic Epistemology and its critique of the classical epistemologies – empiricism and apriorism; fourth, a general critique of the analyzed speeches is undertaken; and finally, there is an epistemological interpretation and critical analysis of the complete findings. In this text, the teachers' answers have been "cleaned" of the repetitions, linguistic failings, lack of grammatical or syntactic agreement, etc., that are common in speech, but ungainly in writing, while maximum care has been taken to maintain the original meanings. We use square brackets containing three points to exclude passages of speeches that do not contribute to the research, to add a word or expression to complete the meaning or, even, to signal inaudible or incomprehensible speech fragments in the recordings.

Genetic Epistemology, based on research into more than 100 different topics (object, space, time, causality, identity, chance, movement and speed, force, number, physical quantities, logical structures, logical-arithmetic relationships, symbolic function - imitation and toy, representation, mental image, etc.), carried out or coordinated by Jean Piaget (1896-1980), attributes the genesis and development of knowledge or cognitive ability to the subject's action. By contrast, empiricism attributes their occurrence to the action of the environment, of stimuli, a thesis widely developed in behaviorism, while apriorism suggests they are part of the human genetic inheritance, a thesis proposed by *Gestalt* theory. For example, Genetic Epistemology shows how the acquisition of each small or micro advancement in the constitution of the cognitive abilities depends on what the subject does; that is, how the subject assimilates the environment and how they remake themselves based on that assimilation. At this level, nothing happens independently of assimilation (internalizing any external reality into the subject), which leads to accommodation (modification of the subject, by the subject themselves, as a function of what they have assimilated); in other words, something in the environment is only able to determine the subject if it is assimilated by the subject. This theory of adaptation, in which the human subject exists as an organism that either assimilates or dies, was "translated", in one of Piaget's last books, as a process of reflective abstraction (Piaget, 1995): Piaget's epigenetic theory of cognitive functions "translated" into the world of human symbolic exchanges.

In the first place, remembering that in humans, biological assimilation is differentiated into psychological and cognitive or logical-

mathematical assimilation, without ceasing to be biological; this, in turn, differentiates into numerous forms of symbolic assimilation. Secondly, that "apriorism", although not in the Kantian sense, refers to the teacher's assertions that we biologically inherit the conditions for all knowledge, that is, the logical structures necessary for cognition – it is in this sense that the term "apriorism", or an "innatist-type apriorism", will be used in this text. For Piaget, we inherit the organic conditions to build cognitive structures but not the structures themselves, which are built; then, we have apriorism in the Piagetian sense; in which the "forms" or cognitive structures "[...] are conceived as something that sinks its roots into the nervous system or, more generally, in the preformed structure of the organism" (Piaget, 1978, p. 352).

Grounded on 18 studies into different topics (logical-arithmetic or algebraic abstractions, spatial relations and order of spatial relations), Piaget asserts the insufficiency, rather than the lack of importance, of empirical abstraction. He explains how reflective abstraction shapes the cognitive process to the extent that it uses, as the "raw material" for the construction of cognitive structures or capacities, not the data of empirical experience, but rather the qualities of the coordination of actions or operations, exercised on the empirical world or on previous instances of coordination. With them, the subject builds new cognitive abilities that, indeed, organize the data from the empirical experience, attributing meaning to them and highlighting their importance and indispensability.

Piaget refutes the genetic inheritance of cognitive or logical abilities, and affirms the inheritance of the capacity to build them – which differentiates us from other mammals. Cognitively, everything depends on what the subject does; and what they do with what they have done. If the sensorimotor action generates schemes or patterns of action, which are consolidated around four to five months of age, babies can extract qualities from these schemes that, at around 9-10 months of age, lead them to remove obstacles in order to reach objectives, configuring the first notion of objective space or permanent object; and, around the age of one and a half, to use means to achieve ends that are not directly attainable, such as pulling the tablecloth to access an object that his outstretched arm could not reach. These abilities did not exist in the first weeks after birth. Each new ability was enabled by the previous one and enables the next. The evolution of these abilities, always generated by the subject's actions, which progressively differentiate, leads to the emergence, at around one and a half to two years, of the symbolic function that enables the indefinite expansion of the capacity to assimilate: of the ambient language, the social meanings of language, the construction of mental images, the distinction between signified and signifier, the creation of signifiers; and, finally, the constitution of thought. These abilities enable the beginning of counting that the child will exercise in play and imitation; therefore, strictly dependent on the assimilation of the social environment.

Even so, this evolution will require another five years, approximately, to build the notion of number and extend the notion of quan-

tity, thus paving the way for arithmetic operations. A few more years are needed to carry out algebraic operations that will only be possible with the construction of formal operations – cognitive ability to operate with forms applicable to any content, to plan the future, to create theories (true or false), to place oneself in place of the other, grouping oneself with one's peers; these cognitive skills related to adolescence qualify the individual to enter adult life. "Especially since logic is not alien to life; it is just the expression of the operational coordination necessary for action" (Inhelder; Piaget, 1976, p. 254).

Empiricism reduces this whole process to the pressure from the environment while apriorism attributes it to what comes before, that is genetic inheritance.

For Piaget and Gréco (1974a), as in several other works by Piaget on learning (not cited herein), this step-by-step construction of cognitive abilities is what enables ever more complex learning. Without it, human learning would not surpass that of mammals such as cats, rats, dogs, horses. Such learning would be reduced to perceptive abilities, determined by the maturation process. On the contrary, it is the process of building cognitive abilities, achieved through the subject's action, and by what the subject does with what they have done, which constitutes the human ability to reason. This capacity is not determined by the environment (empiricism) or by genetic inheritance (apriorism), but rather it is constituted by the subject who dialectizes their genetic heritage and environment, through the processes of assimilation and accommodation; or, better, by the mutually complementary processes of reflecting and reflection (Piaget, 1995), which make up the process of reflective abstraction. Human intelligence is constructed by a radically interactive process.

> [...] the relations between the subject and his/her environment consist of a radical interaction, in such a way that consciousness does not begin with knowledge of objects or the subject's activity, but with an undifferentiated state; and it is from this state that two complementary movements derive, one of assimilating things into the subject, the other of accommodation to the things themselves (Piaget, 1978, p. 386).

Finally, one might ask, why is it important to know the epistemological conceptions held by teachers? The teachers' epistemological conceptions determine their psychological conception regarding how students learn, how they know, about what prior conditions a student must have to learn what he/she is going to teach. An empiricist-based pedagogy overestimates the teaching function; the student is seen a blank slate in the face of each new piece of knowledge, thus legitimizing a teacher-centered pedagogy. An aprioristic-based pedagogy underestimates the teaching function; it suggests the student, having inherited logical abilities, can learn by themselves, legitimizing a spontaneous, student-centered pedagogy. An interactionist-constructivist pedagogical approach holds that, on being challenged by the teaching, students will learn if they manage to mobilize their cognitive apparatus, synthe-

sized in the cognitive abilities available to the student at that moment. In this conception, the teacher and student must both be fully involved in the pedagogical process because, if one or the other is absent or the activity of either one is diminished, the interaction will be unsatisfactory, resulting in a loss of quality in the pedagogical process.

## Learning and the Social Environment: epistemological conceptions

We start by reporting the teachers' answers to the first two questions: "Does a child who is born and grows up in the urban periphery or in a slum learn mathematics in the same way as a middle or upper class child?" and "Do children from rural environments learn math in the same way as those from urban environments?". What epistemological conceptions underlie the teachers' responses?

### *What do the Teachers say?*

T5, a university teacher, thinks that differences in learning ability arise from living in different environments. "I believe that [children] could learn the same", regardless of social background. As an example, she points to the shortcomings of public schools: "in a middle or upper class school, the children have laboratories, equipment, games […]. This is the only difference". Children from rural areas, on the other hand, "learn from what is around them…".

T7, a teacher at an elementary school located in the urban periphery, says: "[…] slum children […] have fewer possibilities than middle-class children. First, because they won't have the materials. Secondly, due to the economic situation […]"; that is, the parents cannot ensure the conditions necessary for learning, such as: buying books, accessing information. When asked, "How do they manage, despite the difficulties?", he answers "[…] I repeat, there are few children who are born with this gift, with this capacity to learn, who like to study. If they have the support and encouragement of adults, basically the family, then they will develop more". Children in rural areas, on the other hand, "do not have the same opportunities to develop as children in urban areas". When asked "Do all children have the same ability to learn?", he responds, "All children are born with the same ability […], but these abilities must be nurtured and developed with adult encouragement. Because if there is no such support, the child will not develop".

T11, a university teacher, asserts there are different social and cultural contexts. "The child born in a place with scarce economic resources does not have many opportunities. Not only [in] mathematics". She thinks that "[…] there is a genetic pre-disposition […] that is transmitted, sometimes from the father. In the genes there is a predisposition, but it also depends a little on the environment […]" which should be stimulated so that "this capacity the student has continues to develop". When asked "Is this genetics, or lack of stimulation?", she answers without hesitation, "Lack of stimulation". When asked, "Is stimulation

alone sufficient to promote learning?". She continues, "I think so. That if a student or a person has rich experience they could learn mathematics in a natural way". When asked, "Is the stimulation enough or is something more needed?". She answers "Stimuli are necessary, but are not enough, because one would have to organize [...] experiences [...]". In rural areas, there is less information circulating; therefore, the children perform less well than those in the city. "But there are also exceptions. There are children who, while coming from rural areas, stand out in mathematics, because sometimes they are self-taught, they like to read, alone [they] make connections or identify relations that allow them to learn".

T12, a university teacher, says that children "from the upper class have more stimulation" than those "from the periphery". There, "The schools, the teachers don't demand much. So if you want to continue, it's by your own effort. [...] Those from the periphery have to sell sweets. [...]. On the other hand, those who come from the upper class have technology"; they are stimulated. While in rural areas there is no parental control, as in urban areas; then, the teachers may not teach everything they should.

T13, a university teacher, answers: "Yes, I come from a very low class and most of the Olympic mathematicians (those who go on to represent [their country] and win medals) [...] are generally from the lower class. I don't see any [...] 'white kid' who went on to represent [their country]". She discusses the South American countries best represented in an international mathematics event and concludes: "It doesn't matter where you study, in the most expensive school or in the poorest. It doesn't matter. It's the desire." She thinks that teachers at private schools are better prepared than those at the "schools far from the city" or "poor schools".

T9, a high school teacher, says that the in terms of learning, the difference between the children on the margins and upper-middle-class children, is that the former will only learn mathematics if they respond to their personal needs or those of their surroundings. He thinks access to a variety of objects, like toys, is important for development because "the brain will [be able] to imagine many things [...]". "It's easier to learn" in the middle class. If the father and mother work all day, the mother is a washerwoman, a delinquent or a drug user, the child will live in a limited world; the child who has good parents, good guidance, "can conquer the world". If the teaching is in accordance with the child's surroundings, their wants and needs, they will learn. If the child thinks that by learning mathematics they will survive, they will learn. If the child thinks that learning mathematics will not help their life, they will not learn. Children from rural areas will more quickly learn operations related to what they are practicing; if they are ploughing the land, they can imagine lines to represent the ploughed furrows. He says: "So, teaching in the countryside has an advantage in relation to the urban area. The urban area is a little closed, [...] you can't see much of the world [...]. In the countryside it's not. Teaching takes place more in the open air, in nature. [...]".

T15, a university teacher, says "First of all, I believe that 50% is the teacher [who must guarantee it], because the capacities are the same, in the city as in the mountains. […] social issues, such as the socioeconomic context, influence a little". There are limitations to learning that need to be managed, such as inadequate nutrition, tiredness, because Mathematics, like any science, is mentally constructed. About students from rural areas, "There are studies that show they don't learn equally. Because in mathematics the texts, the books are made for the city, [where] the cultural context is different". She gives an example, saying that in her city, on the coast, everybody knows the sea, but children from the Andes, who have never been to the sea, [reading in the book] "bathed in the sea" won't understand, because they don't know the sea. Hence the delay among children from rural areas in relation to those from urban areas.

T2, university teacher, thinks children from the periphery have the same capacity as those from the middle or upper classes. He says it doesn't matter where the child is born, who the father or mother is, the ability is the same. When asked, "So, is this ability born with the child?" he answers with conviction "Yes. Maybe the child has a complicated situation. […], but they certainly have the capacity". As an example, he says he saw, in the field, a 3-year-old genius whose father was a ranch hand. She played that memory game – a game in which all the cards are placed face down. "So, you have to match the pairs […], pick one, pick another, if you get the pair, you keep it, if you didn't, it goes back; and it's another player's turn. An incredible genius!". So, "Is it your understanding that we are born mathematicians?". "Yes of course".

T3, a university teacher, says: "No" they learn the same way. "Why?" "There are many reasons, one is the family environment." He explains by saying the experience of children who study under adverse conditions is different from those who have help from their parents. What happens is "in the lower classes" this responsibility is placed almost entirely on the teachers and the school, because they have little support at home: "[…] it seems much more difficult for someone from a lower class to learn than for someone from a higher class".

T4, a university teacher, says they do not learn the same way "[…] because the experiences children have in rural areas or in the slums are quite different; and not just the experiences"; also "[…] the whole environment, that is, the affective support and language use […]". Mastering the language is important for Mathematics. That is why he thinks learning in a slum or in the rural environment is not the same as learning in the middle class or in the urban environment.

T6, university teacher, answers: "I don't know, but I don't think so" they learn the same way. Due to several factors. One, psychological, "[…] it has to do with family mistreatment. If there is no family mistreatment, but the child lives in a slum, they are mistreated by the world that made them live there". And he continues:

> In the same way that such a child cannot run […] like a great runner, because they don't have strength and have not developed, they cannot exercise their neurons and learn like a middle-class child either. […] It is

> much more difficult for those who live in the slums [...] to reach the same level as those from the middle class.

Due to these factors (poor diet, psychological distress, lack of motivation, low self-esteem, lack of goals), students from the periphery are unable to learn in the same way as those from the middle or upper classes. He says he met a teacher in his country who worked in a school located an environment similar to that of the Brazilian *favelas*. While basic mathematical concepts were being taught to middle-class children, the slum children of the same age were taught how to behave in everyday life, such as brushing their teeth, respecting schedules, such as recess. People's goals reflect the social circumstances in which they live. "One of the children from the slum told this teacher: 'I have my life arranged in the future, because my father has a cart,'" a horse-drawn cart. In her world, "having a wagon is like being powerful".

T14, a university teacher, says that "Here [in my country], it has happened that a genius child leaves a marginal neighbourhood and goes on to have regular education". But, for that child, the learning conditions are worse than for ordinary school children: a more hostile environment, less quality food, siblings to take care of, and less time to study. For rural children, however, things are somewhat different. But there are no homogeneous rural environments; "[...] there are isolated and hostile rural environments and others that are very connected, with virtual libraries and the internet". Regarding the possibilities of learning mathematics, he would say there is less difference between rural and urban areas than there between the slums and middle or high social classes. "I don't have an answer, but I'm sure that, on average, conditions [in rural areas] are a little more advantageous" than those in urban areas.

T16, an elementary school teacher, says: "The capacity is the same [in the slum and in the middle and upper classes]; now, [...] how they learn is different. For example, this school is small compared to others, we have fewer resources [...]"; despite these differences, what is taught is the same for "the rich child, the child who has another social universe". The same happens with children from the rural environment, in relation to those from the urban environment. "The content will be the same, but the examples will be different because the reality is different". It is necessary to talk about the reality in the countryside, about the animals the child knows. It is important that the children are stimulated, receive the attention they deserve, the support they need.

T17, a teacher at a municipal school located on the outskirts of an urban area who also works with children from rural areas, says that "If a child [from the slum] wants to learn and has a good teacher, they will learn exactly the same [as one from urban centre]". "The desire to learn comes from the person's intrinsic motivation, that is; it is not because the child is poor that they will be unmotivated. They are more likely to be motivated." That is, in terms of probability, "because there are motivated children in all school sectors". But, about the way rural children learn, she says: "I would say no" they learn in the same way as children

in urban environments. "[It is] because in the countryside people have less means, children go out to work during the day and only come back at night. It harms them. [Besides that], the father's level of education is very low and the hope of continuing to study as well…". When asked, "Is there a difference in the ability of indigenous children[1] to learn in relation to the others?", she replies with conviction: "There is no difference. […] Here in eighth grade, my best student is an Indian[2]. Everything depends on the environment, on the circumstance; but genetically there is no difference. And they have to be treated like all the others."

T1, a university teacher says the upper class learn better, not because they have different abilities, but because, from the beginning, they receive more attention from their parents; while in poor families the same would not happen. When she is asked: "Do you think this is the reason?" She insists: "Yes, but not because of the child's ability." She reaffirms that everyone is equal in terms of ability. But, "[in] the rural environment, […] there is not so much mathematical stimulus, perhaps because people do not use it so much. The city demands more familiarity with mathematics and the people must familiarize themselves with it".

She is asked, then, "[…] if we switched positions, children from the rural environment going to live in the urban environment and those from the urban environment going to live in the rural environment, would the same thing happen because the ability is the same?" She promptly answers: "Yes, but the environment is not the same". The interviewer insists: "In mathematics and music things are similar. Does the person already have the ability and then dedicate him/herself, or is it different?" She answers: "There are people who have the innate ability, or mathematical intuition, it makes it easier [to do mathematics]; or for the language/literature. Just like in music…". When asked, "So, are there children that are born with greater facility for mathematics in the same way as for music?", she replies: "They are born with something".

T10, a teacher of seventh and eighth grades and high school, from a middle-class school, says: "Often, it depends; for me anyone can learn, regardless of the [social] class they come from. For me money does not make the person".

> I feel privileged [at the school where I work] because, you saw it yourself[3], there is a good level of discipline among the children, so I can advance and cover a lot of content and make the student think a lot. It's very demanding, but I know that the demand will benefit the students themselves.

The school with more resources, that works with quality education and a small number of students per class, achieves better results. Students from a school in a poor neighbourhood, in classes of 45 students and with students who do not want to study, are unable to advance. And he reaffirms what he just said about the differences in the learning of children from different social backgrounds:

> As education currently is, in the countryside it is different from the city, because in the countryside education is less demanding. […] [And the student] has to walk miles to get to school, they have to walk in the rain

> to get to school. [...]. There is a lot of difference between rural and urban establishments; but for me, people are the same. Everyone can learn equally.

## *Epistemological Tendencies*

Below, we select and condense the teachers' answers and gather them under the epistemological criteria: empiricism, apriorism, constructivism.

## *Empiricist Tendency*

Rather than pure empiricism, we understand the teachers reveal an empiricist tendency underpinned by an innatist-type apriorism, while they remain unaware of the contradiction implied therein. As if to say (and some say it explicitly): humans are born with logical-mathematical structures, but the environment, including teaching, determines their precise nature. Whereas, what the subject does is not taken into account. Let's look at the evidence.

The subject, the student, is determined by the stimuli. "It all depends on the environment, on the circumstances" (T17), but, genetically, there is no difference; the child from the periphery "has potential like any human being" (T15). The "*upper class children* have more stimulation" than those from the "periphery"; they "have technology" (T12). "*Children from the slums* [...] have fewer opportunities than middle-class children" (T7), they "have to overcome many more obstacles" (T6) and the teachers demand little; there is, there, "family mistreatment", a hostile "family environment" (T3); if that is not so, they are "mistreated by the world that made them live there" (T6), "if they want to continue, it is by their own effort" (T7). *Middle or upper class* students, on the other hand, "have laboratories, equipment, games" (T5). While those in *rural areas* are disadvantaged because, in their environment, they have to work all day and "the father's level of education is very low"; they do not expect to continue studying; there, there is little use of mathematics (T17) and little "mathematical stimulation" and "education is not so demanding"; besides that, to get to school they have to travel long distances and, sometimes, bad weather (T10); in addition, "the texts, the books are made for the city, [where] the cultural context is different" (T15). All this indicates that "[...] it seems much more difficult for someone from a lower class to learn than for someone from a higher class" (T3). After all, "[...] social issues, such as the socioeconomic context, influence a little" (T15).

Nonetheless, there are those who suggest the rural environment has advantages over the urban environment or, even that new technologies have reduced the learning differences of students from this environment. In the urban area, one lives in a "closed" environment, while in the countryside "it is more open air, in nature" (T9); "[...] I am sure that, on average, the conditions [in the rural environment] are a little more advantageous" in its interconnections with the urban environment, than the conditions in the slum in relation to the middle or upper classes (T14). Moreover, those who

represent their country, "in Mathematics Olympiads", "are generally from the lower class" (T13). In addition, with the advent of the internet and virtual courses, "children from the countryside and those from the city" (T6) learn in a more similar way.

Why do we think that these manifestations denote an empiricist tendency? Because 11 of the 17 teachers, while not denying that intelligence is inherited, attribute its determination and development to the action of the environment, the social, school or family environment. The others, despite attributing more weight to genetic inheritance, also assert the determinant role of the environment, even when they think the rural environment and being lower class would offer an advantage over the urban environment and the middle or upper classes, respectively. As they think everyone is born with equal abilities, the difference between individuals would come about due to the influence of the environment, from stimulation, sometimes in a very subtle and precocious way. As can be seen, it is an empiricism without a 'tabula rasa' - unlike Locke's radical empiricism, it admits the innate origin of logical or mathematical structures. However, there are no statements suggesting the subject's action – what the subject does with what is made available in the environment – plays any role in successful learning, that value the interaction between the environment and the genomic possibilities. Empiricism erases the subject from the learning process; hence the preference for a pedagogy based on copying followed by repetition, where creation and invention are not appreciated. Rather that repeating *because* something is understood, repetition is used *in an attempt to* promote understanding.

## *Aprioristic Tendency*

Here, we classify those statements that suggest there are intellectual abilities that are independent of the environment and pre-exist experience, in such a way they are unchanged under the pressure from the social environment, as indicating an aprioristic tendency. They differ, therefore, from an empiricist tendency, which affirms such abilities are determined by the environment, and from constructivist interactionism, which affirms that the subject, upon assimilating the environment, produces transformations in their own cognitive abilities. Let's see what the teachers say.

The teachers claim that "[...] few children are born with this gift [for Mathematics], with this ability to learn, who like to study" (T7); therefore, it does not matter that the child might be living in a "a complicated situation. [...] the child has the ability, for sure". "Yes, of course", we are born mathematicians (T2). "There are people who have the innate ability, or mathematical intuition, it makes[mathematics] easier; they are "born with something" (T1). Children of any social class, "[...] the ability is the same; [...] genetically, there is no difference" (T17); "All children are born with the same capacity..." (T7). "[...] anyone can learn, regardless of the [social] class they come from", "there is no dif-

ference between students from the countryside and those from the city. […] those from the countryside and those from the city will learn equally […]. Everyone can learn equally" (T10). "[…] there is a genetic predisposition […] that is transmitted, sometimes from the father" (T11). The child from the slum "will learn exactly the same" as the child from the urban centre (T11). The proof is that "we know stories of people who were very poor and who, however, were born with certain skills, managed to become good at Mathematics" (T11); and "a genius child that comes from a marginal neighbourhood" (T14); "The determination to learn comes from the person's intrinsic motivation, so that; it is not because the child is poor that they will be unmotivated" (T17). "It doesn't matter where they study, in the most expensive school or in the poorest. It doesn't matter. It is the desire" (T13).

Why do we think that these manifestations denote an innatist-type aprioristic tendency? Because, although they do not deny the influence of the environment, they relativize it. These eight teachers suggest the origin of mathematical knowledge lies in the genome, not as a possibility, but as an ability. They assert there are genius children, who are born with a gift or talent, distinguishing themselves from common children by solving complex problems on their own, sometimes so precociously that it is doubtful the family could have exerted any influence; genius children who can reach Olympic results (Mathematics Olympics). They believe intelligence is innate and that everyone is born intelligent, but to different degrees; some exceptionally different. The inheritance of exceptional ability, of learning certain things more easily than others, is genetic. Everyone is born with cognitive abilities and learning capacities, albeit different. While maintaining an innatist discourse, since they believe everyone is born intelligent, two interviewees deviate a little from this innatist-type apriorism to affirm the importance of willpower, desire: it is a fact there are students who learn quickly, who can learn something in two hours while their colleagues take four. They attribute this situation to the child's willpower or willingness to learn, qualities that, according to the teachers, are also part of the genetic inheritance, rather than to the influence of the environment.

## *A Tenuous Constructivist Tendency*

Although necessary, stimulation is not enough to ensure learning, "because one would have to organize […] experiences" (T11); provide access to a variety of objects, toys, so that the brain can "imagine many things […]" (T9); in addition, it is necessary to ensure that the pedagogical experiences are equivalent in terms of quality with those of the middle or upper class, so that they are meaningful for students from the slum or the rural environment: not only the experiences, but also "[…] the whole environment, that is, affective support and language management" to heighten learning (T4). The teaching provides the same content, "[…] but the examples [offered when teaching] will be different because the reality is different" (T16). The content must be contextualized within the reality experienced by the child, because the children

from the countryside and the city are equally intelligent. Of these four teachers, three displayed both empiricist and aprioristic tendencies.

We found these few statements that point to the need for the subject's action in the learning process. Nonetheless, they denote intuitions, arising from pedagogical practice, rather than theoretically elaborated convictions. Therefore, such statements do not come to form a constructivist tendency since they fail to dialectize or considerer the interaction between the genome and environment.

### *Attempting an Epistemological Interpretation*

While varying in terms of the emphasis they give, all the teachers affirm that children learn differently due to the physical and, above all, social environment.

The evidence seems to indicate the teachers think humans are born cognitively equal, that is, with the same ability to learn and retain knowledge. Nevertheless, individuals only achieve their potential due to the presence or absence of environmental pressures, particularly stimulation. We have summarized the interviewees' other statements to see if they confirm this provisional conclusion. They claim that middle or upper class students receive more stimulation, have more technology, qualified teachers with small classes in academically demanding schools; they have the support of the family environment that facilitates and values the kind of learning that enables advances; they have, if necessary, private lessons and ample access to the internet; such children have a variety of objects and toys.

Students from the periphery receive less stimulation to learn, schools with large classes, undemanding teachers, complicated school environments, where the learning is not valued; there, you don't learn math or language, but just how to survive. They have all kinds of difficulties because they have negative experiences in their daily lives, a hostile environment, psychological problems generated by family mistreatment, they live in a precarious linguistic environment, their father and mother are absent because they work all day, and they live in the midst of delinquency and drug addiction. Instead of cognitive content, schools teach behaviour, such as good manners, instead of technical or scientific knowledge. Their nutrition is often poor and from an early age they have responsibilities, such as taking care of younger siblings. They dedicate little time to study; if they want to advance, they can only do so through their own efforts and by overcoming numerous obstacles. Many of them are highly socially vulnerable and few of them want to study. Those who do cannot advance; they rely on self-effort and will need to make much greater efforts than those from the middle or upper classes to achieve the same levels; their dreams for the future are modest they will only take advantage of education if it responds to their needs and those of the people around them. They have fewer opportunities due to the difficult economic situation, lack of materials and precarious availability of food. If there is no support from an adult, they will not develop.

Those from rural areas, where less information circulates, have the same potential as any human being and will be able to learn the same contents as the others; but they will only learn if the teaching content deals with topics, products or animals from the place where they live and that are related to their tasks. Today, they have new opportunities due to the internet. On the other hand, they are at a disadvantage due to lack of time because their parents, who generally have had little access to education themselves, require them to work, as well as because the texts and books are designed for the city, where the cultural context is different. They receive little mathematical stimulation. In relation to the urban environment, the rural environment would have an advantage because the student is in contact with nature, and is able to imagine their needs will be met in those circumstances.

Even those teachers who claim that children or adolescents from rural areas and the urban periphery learn differently from those from urban areas or from the middle and upper classes, attribute this difference to environmental pressures, especially social pressure, rather than to the construction of abilities. Even when they affirm the existence of a genetic predisposition ("genetically, there is no difference") to learn mathematics, or to the obstruction of brain activity, preventing learning math, they end up attributing deficient mathematical learning to the environment ("everything depends on the environment"), to the lack of stimulation, to the lack of rich learning experiences (Piaget, 1974b). This also happens when an interviewee expresses the role of voluntarism, stating "It doesn't matter where you study, in the most expensive school or in the poorest. It doesn't matter. It is the desire"; or when others explicitly indicate innateness like this: "There are people who have the innate capacity, or mathematical intuition" and "there are few children who are born with this gift, with this quality of learning, who like to study"; or when a third describes a type of motivation: "The desire to learn comes from the person's intrinsic motivation, so that, it's not because the child is poor that they will be unmotivated"; or when a fourth claims the existence of children who, naturally, "are very fast". In all these cases, the teachers attribute the responsibility for precarious learning or non-learning to the environment, or the lack of a suitable environment.

The idea of building knowledge, or the cognitive abilities responsible for opening up possibilities for progressively complex learning, is not aired. It boils down to the belief that humans are born with logical, even mathematical, abilities with which they can learn anything at any age; whether they actually learn or not will depend on the environment, the teaching. Not forgetting it is claimed that some people are born with more capacity than others. Hence, in the name of an epistemological belief, a discrimination that has caused more than a little damage becomes commonplace and is reflected in low self-esteem among students who say they are not cut out for mathematics, they are thick headed, they are no good at math, that are angry or who hate it; including those who opt for university courses that do not include mathematics in their curriculum, etc. If they do not learn, it is because they have not yet ma-

tured – biological maturation is confused with cognitive development – or a lack of prerequisites. There is no mention of the hypothesis that it is due to a lack of the construction of structures or differentiated cognitive abilities - conditions for learning more complex contents – while recognizing the role of maturation and the prerequisites.

## Intelligence and Genetic Inheritance

Answers to the question: "If the parents are intelligent, will the child be intelligent too?"

### *What the Teachers say*

T5, a university teacher, thinks there is not necessarily a link between the parents' intelligence and that of their children. "There is a genetic component […], but there are cases in which the parents are brilliant and the child is not. So, I think it depends a lot on the environment, the stimulus […]". "But only those with talent learn mathematics, and the person is born with talent. What do you think of that?"

> Well, I think both. There are children who are born with a gift, or talent, and manage to resolve complicated problems alone […] and there are children who need support to develop. I think that's the difference [between an ordinary child] and a genius – a child who is born with a lot of talent for mathematics, who arrives at the result very easily. They reach Olympic results.

She thinks there are people who cannot even develop the mathematics they need or acquire or develop the necessary basic knowledge.

T7, an elementary school teacher working in the urban periphery, asserts that intelligence depends on hereditary factors; but adds a non-genetic rationale by claiming that it depends on the support they receive because "[…] smart parents will always be concerned that their child learns more."

T11, a university teacher, says people are "[…] born with a certain predisposition; but along the way they have experiences, which also determine whether they will develop more intelligence or not".

T12, a university teacher, states it is "very likely to be so" due to the stimulation, because what the child listens to at home will stimulate him/her to want the same thing.

T13, who teaches calculus at a university, thinks there is no link between the parent's intelligence and that of their children. "I think it has nothing to do with it". "It is a fact that there are students who 'learn more quickly'", who respond quickly, who plan, who can learn something in two hours while others take four. But this is not due to them having intelligent parents. The truth is: "they learn if they want to learn. […]. Everyone can learn". And she says with conviction: "What is the value of a parent buying the best book? What's the point of a parent hiring the best private teacher if their child doesn't want to learn?".

T9, a high school teacher, says that his parents "[.] were just workers, but they gave me the opportunity to become a professional. [...] and my children [...] their world will be different [from that of my parents]".

T15, a university teacher trainer, answers assuredly: "Intelligence is innate, everyone is intelligent". And she goes on to theorize: "Because intelligence is a basic cognitive process, just like attention, memory, thinking." She thinks a child's intelligence has nothing to do with that of the parents: "[...] the parents' intelligence has nothing to do with it". And she makes a caveat: intelligent parents "[...] can, perhaps, transmit something in their genes; but it is very small [the possibility]".

T2, university professor of pure mathematics, is categorical: "Certainly, yes". But then he relativizes: "It depends on the parents, I don't know. Genetics has a lot to do with it, of course, for sure." Then, he talks about different abilities: "[...] some people are able to learn some things more than other things. That [...] I think", it is genetic. "You can be very smart at math and dumb at life. Be very smart at life and dumb at math." He finally confirms that intelligence and mathematical ability are transmitted genetically; but, again, he relativizes: "A father who is a good soccer player is likely to have a son who is also a good soccer player".

T3, also a teacher of pure mathematics at university, starts by saying he doesn't know. And then presents his hypothesis: "If there is a part of intelligence that is genetic, they might be better able to develop that part; but I would say it is very unlikely."

T4, a teacher of pure mathematics at a university, states: "If the parents are intelligent, they take care of their child [...], encourage him/her, I think there is a good chance that their child will be intelligent". He bets it has more to do with the child's development and the construction of intelligence: "I believe that almost all of them are built and developed". But he's not completely sure: "On the other hand, there are examples that show there is [...], very early on, a predilection for mathematical subjects [...]; [and] a subtle influence [of the environment] that arouses this interest, this pre-disposition".

T6, a teacher of pure mathematics at a university, says: "Not necessarily". And adds: "Because there is a genetic component and bad luck [...] I believe [...] intelligent parents are more likely to have an intelligent child". When asked, "What abilities is a child born with?" he answers, "I have no idea. I don't know. The brain is very elementary at birth. It has far fewer neurons. When a child is born, for me, it is like a plant; [but] ends up, in time, as a human being with infinite complexities". And he insists on the idea that "The child is very primitive when it is born. When I took my daughter in my arms, as a newborn, she seemed to be barely distinguishable from an animal [...]".

T14, a teacher of pure mathematics, says that "[...] it is known that, to some extent, intelligence is a component of the brain". And he continues: this "[...] is not determinant. There is a probability, because intelligence is linked to a complex set of genes. Complex in such a way that there is interaction with the environment". And he provides an ex-

ample: "Rich, intelligent and beautiful parents are more likely to have rich, intelligent and beautiful children, but it is a probability, because they can also have a problem child". And he concludes by saying that the subject "is too complex to give an answer".

T16, an eighth grade elementary school teacher, says that if the mother "[…] can't read, she can't help her child no matter how hard she tries […]". Although the child continues to develop, they will face more difficulties than most children. She believes the support, the help, the mother's encouraging words, saying "You can", is what determines the child's intelligence; "the parents have to provide more stimulation".

T17, a high school teacher, thinks that intelligent parents can produce smarter children, but this is only a "probability", not a certainty. There are "conditions" and "circumstances", in addition to "emotional factors", that interfere in this game of probabilities. She is asked, "What if the parents are intellectually disabled?". She says that genetics is like "Russian roulette", because: "the intellectually disabled might be very likely to produce children like them, [or] they might produce normal, or super intelligent children".

T1, a university teacher answers "there are probabilities" they might be intelligent. When asked "What if the parents are intellectually disabled?", she thinks there is no direct relationship because "[…] if the parents are bad [at Mathematics], it has to do with the stimuli they received since they were little. If the parents are good at Mathematics, […] they encourage the child, unlike parents who don't know [mathematics]. She refutes the idea that intelligent children are that way because their parents are intelligent.

T10, a primary and secondary school teacher at a private school, says: "In general, children who have intelligent parents are also intelligent" because "[…] they are parents capable of caring about their child sufficiently to ensure they also learn and, in general, when both [father and mother] are intelligent, they tend to have intelligent children". When asked "What about intellectually disabled parents?", he replies that if there is support and respect, they will always learn; but one must work with them at their cognitive level.

## *Epistemological Conceptions*

Our interest lies not so much in the teachers' positive or negative responses to the question, but rather in the epistemological conceptions underlying those responses.

As we do not have the responses from T8, we will work with the responses from 16 teachers. Their statements can be classified as follows: seven display an empiricist tendency; seven an aprioristic tendency; nine refer to the role played by genetics (being of greater or lesser importance) in intelligence; one highlights willpower; and two attribute intelligence to experience and its construction. This total of 26 means the same teacher can display different epistemological conceptions, while being unaware of the contradiction this implies.

### *Empiricist Tendency*

We gathered the statements from seven teachers. They say intelligence depends very much on the environment, on stimulation, on experiences, on the parents' education and on the support the child receives from them. Intelligent parents care about their children's learning; when a child is born, it is not very different from a plant or an animal, but the environment can transform the child into an infinitely complex human being; even when the genetic input is considered crucial, subtle environmental influences can awaken an interest or predisposition towards mathematics – parents who are good at math encourage their kids to be good at math too. But the opposite is also true, if the parents no little about mathematics or if the mother does not know how to read, it is difficult for her to encourage her child to learn to read. Parents are also products of stimulation, so if the father and mother are intelligent and therefore stimulate the child, he/she is more likely to be intelligent as well. Even intellectually disabled people, with sufficient support and respect, can learn Mathematics.

### *Aprioristic Tendency*

Here, we also collected statements from seven teachers. They say there are children who are born with a gift or talent and manage to deal with complicated problems alone; they differ from other children because they reach the results very quickly and rapidly respond to the problems put to them; in two hours they solve problems where other children take 4 hours; they are the ones who can achieve Olympic results. Genetics ensures everyone can learn because intelligence is innate; it is a basic cognitive process, like memory and thinking, that everyone inherits. But this inheritance is not the same for everyone; some people inherit greater abilities to learn certain things, and lesser abilities to learn other things; we can be very good at solving math problems but not at everyday problems, or good at everyday issues but not at math.

Three teachers take divergent positions. Two of them claim that there is no relationship between the intelligence of the parents and their children: "*it has nothing to do with it*", they say. Two refer to the will to learn. They claim that students learn if they want to learn. What's the point of a parent buying the best book or hiring the best private teacher if their child doesn't want to learn? These statements, it seems to us, do not escape a certain degree of apriorism.

### *The Probability or Tendency towards overcoming Empiricism and Apriorism*

Nine professors, without necessarily denying the influence of the environment or the role of genetic inheritance, assume a more cautious attitude, using probabilistic reasoning. Children are merely *likely* to be intelligent due to stimulation; intelligent parents will *probably* produce

intelligent kids; parents *probably* transmit something to their children through their genes; intelligence depends on a complex group of genes, to the point of suggesting a role for interaction; it is merely *probable* that beauty and intelligence are transmitted genetically; stimulation, emotional factors, and circumstances are *likely* to interfere with intelligence; intellectually disabled parents are very *likely* to produce children with the same condition; but they are also produce normal or even super-intelligent children. Therefore, what these teachers refute is the existence of a direct relationship: if the parents are intelligent, then, by genetic determination, their children will be intelligent.

## *Attempting an epistemological interpretation*

Unlike in section 1.0 above, here we are faced with a tie between the empiricist and aprioristic tendencies, together with numerous signs these tendencies may be overcome with the introduction of probabilistic reasoning, as displayed by nine teachers. Together with weak signs of a commitment to experience and construction, which would require the student's creative and inventive activity.

On the one hand, seven out of 16 teachers claim the environment's impact on the subject determines their intelligence. Adults, like intelligent, well-educated parents, encourage and support their children; but if they are not intelligent, they can inhibit them. Only one teacher displayed an empiricism close to Locke's *tabula rasa*, when stating that a new-born infant seems like a plant or an animal and the environment transforms him/her into a human being with infinite complexities; even the intellectually disabled, with adequate support and respect, evolve cognitively. On the other hand, seven out of 16 professors also affirm the determinant role genetics. A child is intelligent because they are born with sufficient talent to solve problems alone, and relatively quickly, while ordinary children cannot. Genetics ensures that everyone can learn, but this inheritance is differentiated in two different ways: some children manage to learn better than most and some learn certain things better, like Science instead of Mathematics, while others learn other things better, like Mathematics instead of History. Three teachers affirm there is no relationship between the parents' intelligence and that of their children, and suggest willpower, the desire to learn, drives intelligence.

What was surprising in this analysis, compared to the previous ones, was the appearance of signs of the weakening of the belief that a child's intelligence is determined by either by environment/stimulation or by genetic inheritance. A significant number of the teachers introduce, while also affirming the importance of the environment and genetic inheritance, the idea of *probability*, relativizing the role played by the environment and the genome – but they do not go so far as to propose interaction between these two poles.

I think that probabilistic reasoning brings them closer to constructivism, although there is no clear theoretical transition to constructivist interactionism through the dialectization of genetic inheri-

tance and environment. For this reason, here we include two teachers who come a little closer to constructivism, without, however, criticizing apriorism. They claim that children, who receive parental care and have a certain genetic predisposition, will be intelligent because along the way they have experiences that determine the greater or lesser development of the intelligence that is developed or constructed. They are one step away from constructivism; however, they lack the theoretical foundation.

## Final Remarks

In this research, we seek to identify the epistemological tendencies of teachers or, in other words, their epistemological conceptions. Remembering we speak of "tendencies" because none of the teachers displays a pure epistemological conception. The teachers cannot be classified as: either empiricists or apriorists, nor as constructivists. They can, in the answers to one question, display an empiricist conception, while when answering another question, display an innatist-type apriorism.

The predominant interpretation can be formulated as follows: teachers believe the ability to think logically, a condition for all knowledge, and mathematics are innate and that the environment differentiates them. So that, at birth, humans would already have these abilities. On the other hand, they think mathematical truths are self-evident, there is no need for experience. However, while it is evident that (2+3) +7 = 2+(3+7), humans require at least 11/12 years to achieve the necessary cognitive conditions to recognize this evidence, during which time they undergo periods of intense empiricism and symbolic construction (Nunes; Bryant, 1997; Piaget; Szeminska, 1975; Piaget, 1995).).

When teachers attribute success or failure in learning to the contingencies of the environment (Becker, 1912a) they are not mistaken, as the environment exerts a powerful influence on the evolution of the cognitive processes (Piaget, 1973). The problem is in conceiving that humans are all born with the cognitive (logical) abilities to learn in general, and, in particular, to learn Mathematics, and that the responsibility for the success or failure in this endeavor lies solely with the environment. The exceptions being a few statements that attribute it to talent – for a child born with a talent for Mathematics the environment does not seem to be an obstacle. In thinking like this, the teachers are professing an empiricism, sustained by an innatist-type apriorism.

If our interpretations are correct, these manifestations denote empiricism, but a *sui generis* empiricism, since the cognitive abilities, on which the environment acts, are seen as being inherited. More explicitly, our interpretation is that the teachers' manifestations reveal an underlying empiricism, which, however, differs from the empiricism of Locke's *tabula rasa* – "there is nothing in intelligence that has not first gone through the senses". The conceptions we collected from the interviews are different because they do not simply attribute the origin of

learning opportunities to the environment ("*Everything depends on the environment [...] genetically there is no difference*"), but to the environment acting on inherited cognitive abilities. Epistemologically then, we have an empiricism underpinned by apriorism, which is, therefore, very different from constructivism. At the same time, a very different conception from the interaction proposed in Genetic Epistemology, according to which cognitive abilities are generated by the subject's action on the environment, extracting qualities from objects, but, above all, from the coordination of the subject's actions with which they build new abilities (Piaget, 1995; Becker, 2017; 2019; 2021); and that, prior to this interaction, there is no knowledge, much less awareness (Piaget, 1977a; 1977b; 1995; Becker, 2016) – *sine qua non* conditions of learning, especially of formal contents. Hence, according to Genetic Epistemology, humans are not born with cognitive structures, but with the ability to build them; their construction depends entirely on the assimilation of the environment (Piaget, 1978) and on the consequences of that assimilation. Therefore, we can see empiricism and apriorism have not been overcome, since the teachers' statements reflect both these epistemologies at the same time, showing almost no sign of overcoming these two determinant conceptions. As we have demonstrated elsewhere (Becker, 2012a; 2019, 2021), this determines the quality of teaching.

It is surprising that changing the question changes the epistemological conceptions. The answers to the first two questions were overwhelmingly empiricist, with few instances of aprioristic attitudes. In the answers to the third question, empiricism and apriorism were tied, and the sparse occurrence of both opened a small space for probabilistic thinking, which relativizes those conceptions. Our hypothesis is that this situation leaves ample margin, in the teaching of Mathematics, for the application of common sense, empiricist or apriorist. And that moving on from these epistemological conceptions towards interactionist constructivism will be facilitated by establishing a broad epistemological discussion in teacher education. Otherwise, scientific knowledge, such as mathematics, will continue to be taught based on common sense epistemologies – which is a contradiction.

When compared with results found in Brazil, the epistemological conceptions, extracted from the answers to the first two questions, coincide in terms of the strong empiricist presence, underpinned by an innatist-type apriorism, with no apparent awareness of the contradiction; are distinguished by a greater presence of apriorism in the answers to the third question; and are novel in that the answers reflect greater probabilistic thinking, which, in our opinion, paves the way for constructivist interactionism; but still in an intuitive form rather than as expression of theoretical construction; which is therefore, insufficient to modify teaching practices.

From an epistemological point of view, the key generalization gleaned from the teachers' responses, seems to be this: all human beings are born with abilities for Mathematics (apriorism); it is the environment that differentiates these qualities (empiricism). We have,

therefore, an empiricist epistemology that differs from Locke's *tabula rasa*, which is based on an innatist-type apriorism; which is far from constructivist interactionism, with only fleeting intuitive exceptions, such as probabilistic thinking and statements that postulate the active participation of the student, their experience, in the learning process.

At a time when, perhaps more than any other, emphasis is placed on active pedagogical practices, it is necessary to overcome empiricism and apriorism. It makes no sense to found an active pedagogy on such epistemological conceptions.

Finally, there are two remarks. First, several contributions from the teachers on the role of affectivity in learning, some precious ones like this one: "*what's the point in a parent hiring the best private teacher if their child doesn't want to learn*?", have not been explored in this analysis. Second, this research aimed to identify the epistemological conceptions underlying the teachers' responses. However, the analyzed responses provide a lot of interesting information for a sociological analysis, which may be the objective of future research.

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## Notes

1 In the question, the name of the indigenous tribe whose descendants are numerous in that region was used, including the city where the school is located; the teacher also responded using the name of this indigenous group. We have replaced the name with the adjective "indigenous" to preserve the teacher's anonymity.

2 "Indian" instead of the name of the indigenous group is used to preserve anonymity.

3 I attended the teacher's class, days before the interview.

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