

# ***ANTHROPOLOGICAL THEORY OF DIDACTICS AND DIDACTIC TRANSPOSITION: ANALYSING THE OBJECT-SUBJECT-INSTITUTIONS RELATIONS INTO OF THE THOUGHTS COLLECTIVES AND STYLES UNDER THE FLECKIAN REFLECTIVE***

**Luciano Pontes da Silva** [[lucianopontes.sf2022@professor.educ.gov.br](mailto:lucianopontes.sf2022@professor.educ.gov.br)] - *Secretaria de Educação de Alagoas (SEDUC - AL)*

**Laerte da Silva Fonseca** [[laerte.fonseca@uol.com.br](mailto:laerte.fonseca@uol.com.br)] - *Instituto Federal de Sergipe (IFS)*

## **RESUMO**

Este presente trabalho comenta uma análise sobre as Transposições Didáticas (TD) e Teoria Antropológica da Didática (ATD), de Yves Chevallard, na perspectiva da epistemologia de Fleck. Em primeiro lugar, é mostrado sobre Fleck e sua história, obras e conceitos dentro de sua epistemologia como um coletivo de pensamento e estilo de pensamento. Depois, discutiremos o que são a ATD e a DT, além de falar sobre Chevallard e seu trabalho. Na terceira parte, será feita a análise das duas teorias sob reflexão fleckiana, a qual é o principal objetivo deste artigo. Por fim, será discutida a pesquisa no campo empírico, aonde serão discutidas dados quantitativos sobre artigos publicados no BDTD - CAPES sobre a tônica dos círculos de pensamento, usando essas mesmas como referência de pesquisa no referido banco, e do estilo de pensamento. Nos resultados percebeu-se que o coletivo de pensamento mudou, dado que o estilo de pensamento também mudou.

**PALAVRAS-CHAVE:** Coletivos de Pensamento; Estilos de Pensamento; Didática; Ensino; Epistemologia

## **ABSTRACT**

This present aim brings an analysis about Didactic Transpositions (DT) and Anthropological Theory of Didactics (ATD), from Yves Chevallard, within the perspective of Fleck's epistemology. Firstly, it is showed about Fleck and your history, works and concepts inside of your epistemology like a thought collectives and thought styles. Then we'll discuss what ATD and DT are, as well as talk about Chevallard and his work. In the third part, the two theories will be made under Fleckian reflection, which is the main objective of this article. Finally, we will discuss the research in the empirical field, where tables will be discussed on articles published in BDTD - CAPES on the tonic of thought circles and style of thought, using these same as a research reference in that bank, where in the results it was noticed that the style of thought has changed, given that the style of thought has also changed.

**KEYWORDS:** *Thought Collectives; Styles Collectives; Didactic; Teaching; Epistemology*

## INTRODUCTION

Since the Greeks and your philosophy that object-subject relationships appear with core of the discussions. Plato, in mathematics terms of object, thought within a place outside reality where the objects were. The math's stuffs, by Plato, constitute a domain objective independent and self-sufficient which we have access for understanding. Plato is clear in your discourse: The Math's idea and forms not admit sensitive examples (SADY, 2012).

Aristotle, Plato's disciple, thought the math's stuffs like a parasitic existence of the real objects, once this objects only exist incarnate in real objects (SILVA 2007). Against your master, Aristotle shows your ideas about math's nature in the books XIII and XIV of *Metaphysics*. He does not doubt that the math's stuffs exist, but he discording that them exist separate of the real objects (SADY, 2012).

Many others philosophers after Plato and Aristotle thought about objects and relationships with subjects, with Leibniz, Kant, Descartes, Poincare, Frege, Wittgenstein, Russell. Each other's, your way, theorized this relation. Indeed, none of these philosophers explain about learning or how the object-subject relationships help/facilitate the learning.

It was in the 70's that the didactics of mathematics arose thinking about teacher's practices and, precisely, about learning, like Michéle Artigue, Guy Brosseau, etc.. Among these, Yves Chevallard was the didactic that theorized first **The Didactic Transpositions** and after, increasing this, **The Anthropological Theory of Didactics**, where brought concepts with objects, institutions and person, inside of the relations between person and object and institutions and object.

From these accusations, is necessary to understand the science not only as a scientist product, but to figure out about science community and research processes (Pfuetzenreiter, 2002).

The goal of this aim is showing the two theories inside the Fleck's epistemology, most precisely the **esoteric** and **exoteric circles** and ideas circulations, besides the concepts with **thought collectives** and **thought style**, which is the first part of this work. After, it will be necessary explain about Chevallard's theories and yours concepts. In the third part, it shows the intersections between two stuffs: Fleck's reflective and Chevallard's theories, which is the central goal of this essay that will try to answer the issues: What the thought collectives inside of the "Transpositions Didactics"? When Chevallard pass to the Anthropological Theory of Didactics, these collectives pass or change yours thought style yet? Appear new collectives inside this thought style?

To better understand this work, there was a division into two parts. The first is about revisiting the theories in question; discussing the two theorists who illustrate this exercise. The second part concerns the research in the Bank of Thesis and Dissertations of Capes, analyzing how it was not accepted the model proposed by the ATD in some collective of thought, starting from the assumption of TD.

## PART ONE – REVISITING THE THEORIES: THE FLECK'S EPISTEMOLOGY AND CHEVALLARD'S ANTHROPOLOGICAL THEORY OF DIDACTICS

Ludwik Fleck (1896 – 1961) was been a Polish-Jewish medical and microbiologist that lived during the Austro-Hungarian Empire, being influenced to multidisciplinary weather in this time (ALVETTI and CUTULO, 2005). He was born in Lvov (now Lviv), growing up under of the craftsman family. He studies at the John Casimir University, when interrupted studies him by military service. Fleck graduated in 1922, and your town already belonged the reborn Poland

(SADY, 2012). At the end of his studies, began to work within Rudolf Weigl, famous typhus specialist.

Despite not having or having a bit environment with the academic, Fleck conducted researches about philosophy of medicine, in approximate 40 papers, in the Polish and Germany. "Some Specific Features of the Medical Way of Thinking" (1927) and "On the Crisis of 'Reality'" (1929) inspired mostly by the quantum revolution in the Physics. Both this articles already showed terms like "Thought style" and "incommensurability".

Fleck wrote and sent yours manuscripts of this book *Die Analyse einer wissenschaftlichen Tatsache* to Moritz Schilick in September 1933, a founder of the Vienna's Circle. Schilick spoke with the willingness to the publication if his agree within the specialist on the Medicine's history would also review it (SADY, 2012). Brenno Schwabe has published in 1934 *Entstehung und Entwicklung einer wissenschaftlichen Tatsache: Einführung in die Lehre vom Denkstil und Denkkollektiv* (The Genesis and Development of a Scientific Fact: An Introduction to the Theory of Thought Style and Thought Collective).

During the World War II, Fleck was been arrested in the Auschwitz and the Buchenwald, both the Nazi concentrations camps, where worked in anti-typhus vaccine to the tifo, even led to the scientifically illiterate German doctor. In 1948, he testified against the German's doctors in the Nuremberg Trials of Nazi-Germans Doctors, who conducted criminal experiments on the prisoners of the concentration's camps. After this, he emigrated with his wife to Israel in 1957, where has been difficulties with cancer and hearts troubles. He died in July 5, 1961, of a second heart attack.

Fleck, in his epistemological works, considered four ideas: 1 – experience of a scientist; 2 – reflections on the history of medicine; 3 – philosophical ideas and 4 – sociological ideas (SADY, 2012). About 1, we can say that while working in the private laboratory and hospital, he conducted some medical researches, despite your researches was outside of the Academics. 2) In the interwar period Poland was probably the only country where faculties of medicine had chairs for the philosophy and history of medicine (Löwy 1990). (3) Before World War II, Lvov had a "philosophical branch" of a distinguished mathematical-philosophical school—the Lvov-Warsaw School. And 4) In 1935, Fleck devotes only a few pages to the sociology of knowledge, and, moreover, he refers exclusively to the German translation of Lucien Levy-Bruhl's book *Das Denken der Naturvölker*, 1921 and to Wilhelm Jerusalem's paper of 1929 (SADY, 2012).

### Thought Collectives and Thought Style

When Fleck developed yours concepts, he criticized the Vienna's Circle ideas, which were linked within the Logical Positivism/Empiricism, considering the non-neutrality both of the subject and object, thinking in a kind of "constructivist true" (DELIZOICOV et al, 2002), where the knowledge act is allow above the social, historical, anthropological and cultural facts.

In your studies, Fleck theorized concepts such as **Thought Collective** and **Thought Style**. The first could be classified as "individual communities that shared practices, traditions, conceptions and norms" (LEITE et al, 2001, translate our). It would be as a community of persons mutually exchanging ideas or maintaining intellectual interactions (FLECK, 1986). The members of this collective not adopt just kind of think and perceive, but they change it. This change not be occurred in your minds, but is such as their interpersonal space. They start speak about some important stuff. This, not cross your minds if they were isolates and not say this stuff if they were in another group. So, we have a thought style, characteristic of this collective.

Thinking in **esoteric circles**, we consider a thought style entering in small group, becomes sufficiently sophisticated (SADY, 2012; BABICH, 2003). This thought is articulated and employed in the collective, for specialists who "have know-how". The **exoteric circles** concept is linked within a lot of people that don't make the "idea", but they are influenced to the thought style. Those people do not play active role in the thought style in formation.

Fleck categorizes those circles in three subgroups:

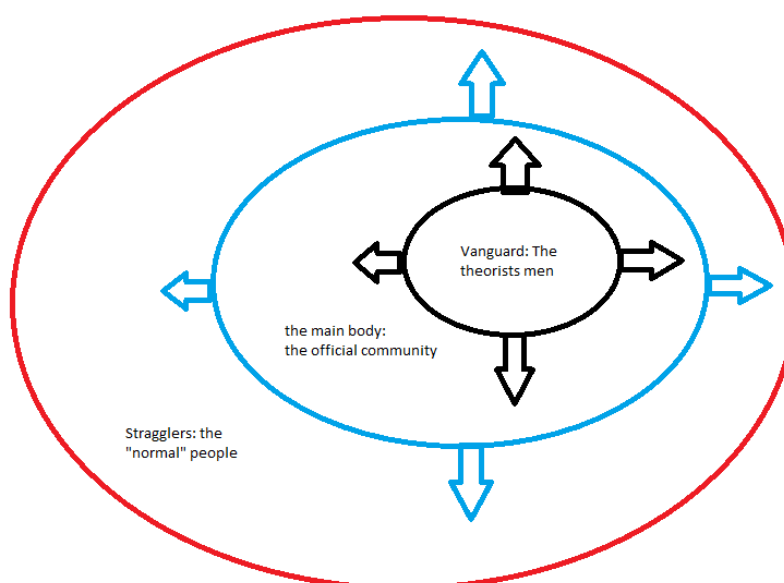
1 – Vanguard: could be understanding such as the scientist to the science, the priests and theologians to religions, artists to the art. They are the "initiated" (SADY, 2012) and "are known and they know".

2 – The main body: Those are people that to complete the esoteric circle, most precisely the "official community", what spread the thought style in the academic journals, books and congresses in the circle.

3 – Stragglers: the "normal" person, that receive the idea in the form mostly easy-letters (FLECK, 1986). Sometimes the stragglers in his work appear like a more general specialist, but we are omitted this approach because we are speaking that students and people that not participate of the circle, therefore they don't specialists.

The following scheme (Figure 1) show how happen the circulations ideas in the esoteric and exoteric circles, as well as the categories in this groups. We can see that, for example, a scientist could to pertain a one group the artists, within different thought styles or a priest, which he's in the religion collective, can be a scientist, pertaining to different thought style that yours. That is, a person inside thought collective with specific thought style can be in other collective, with other thought style, since won't have conflicts between them.

Some thought doesn't during many times (SADY, 2012). Although an individual's conversation lasts, only when social forces connecting people and ideas work for a long time, arise thought collectives that stay for many generations. Those social forces operating such as religious movements, folk traditions, artist's concerts and science congress. This collective creates the "institutions" which enable and regulate the method, the way that your added can spread your ideas. Educational systems, teachers, priest, artists, besides social rituals them make a "new member".



**Figure 1:** The idea's circulations in the three circles

Font: Making by Authors (2021)

In the next session, we'll speak about the Anthropological Theory of Didactics and Didactic Transposition, as well as the principals' concepts in this thought.

### **Anthropological Theory of Didactics and Didactic Transpositions**

Yves Chevallard (1946 - ) is a French mathematic and writer that theorized, within Math's Didactic, the notion of Didactic Transpositions (DT) and Anthropological Theory of Didactics (ATD). This first one was been expanded with the second one, where concepts are create and somebodies are more explain.

Teaching today in the *Institut Universitaire de Formation des Maîtres de l'Académie d'Aix-Marseille*, working with teacher's graduates and PhD theses. In your book *La transposition Didactique* (The didactic transposition), translated to the Spanish, gathered some notes to a Summer Course, in 1980. In 1991, his text *Pourquoi la transposition didactique* (Why the didactic transposition), showed in Seminary of the Didactic and Pedagogy of Maths in the Grenoble Scientific and Medical University he answer the critics, showed in the same Course.

In the second edition of this book, Chevallard updates this text, after adding a case study about "distance" in the mathematics, since Fréchet, in the middle of 1906 until today in the French elementary school teaching, entitled *un exemple de transposition didactique* (An example of didactic transposition), showing the "theory evolution" when linked with the empiric study (CHEVALLARD, 2002).

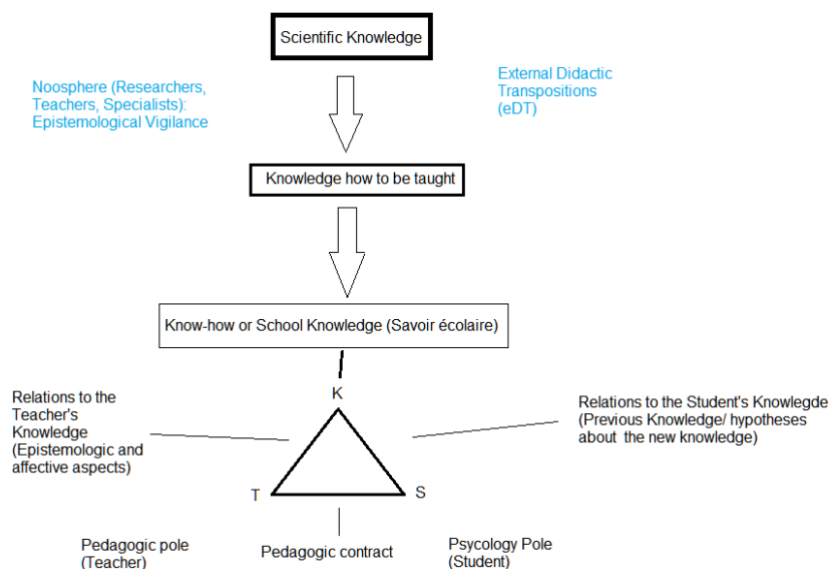
The ATD is found in texts such as *L'analyse des pratiques enseignantes en théorie anthropologique du didactique* (The analyses of teaching practices in anthropological theory of didactics) from 1999 and *Organiser l'étude 3: Écologie & regulation*, 2002; the first is in an important magazine "Recherches en Didactique des Mathématiques" (Researches in Math's Didactic) and second in the seminary within didactics. Both spoke about ATD, bringing terms as "praxeology" and "ecology", important concepts within ATD.

Chevallard think your theory departing of the traditional errors in the pedagogic reflections: The seconding of the know-how school discoursing. Make so, the triangular representation of the didactic system (figure 2), where explaining what is these relations and your complexity in this system: (K) the know-how; those that teaching, the teacher (T) and those that learning, the student (S)<sup>1</sup>. For him, the psychological approaches domain this system (PUC 2004), taking only two dimensions of this representation: Teacher and Student.

This way, the school know-how doesn't problematize and yes naturalize. The Didactic Transpositions is, this way, made to "invisible" Institution (MATOS FILHO, MENEZES, SILVA and QUEIRÓS, 2008), that him called "Noosphere". Analogously, thinking in Fleck's epistemology, the Noosphere is the place where living the "theorist man", the Vanguard. Between this and the Didactic System, is found the "Knowledge how to be taught" (idem, 2008), that Chevallard called *Savoir à Enseigner*, being this the curriculum, the norms and rules, references, etc.

It's arriving into the Didactic System, the knowledge change to "know-how" or "School knowledge", where Chevallard take the term *Savoir écolaire*. In the figure 2, we can see the knowledge way, since the Noosphere and the scientific knowledge until the triangular representation in the didactic system. However, this schema doesn't show the several stages between the Noosphere and Didactic System.

<sup>1</sup> Chevallard doesn't use this terms "Teacher" and "Student", but the terms "teaching one" and "learning one" (in French: "enseignant" and "enseigné") to expand this understanding inside of didactics system.



**Figure 2:** Didactic Transposition Schema

Font: Adapted from Matos Filho, Menezes, Silva and Queirós (2008).

In this process (internal transposition), the teacher change the knowledge for children in the school, within the pedagogic and didactic contract, for what this knowledge can be teaching and learning. Indeed, the Teacher show a “new face” of the knowledge, change in school knowledge.

Chevallard, feeling the necessary to apply your theory about Didactics Transpositions, inserted the Anthropological approach inside this (ALMOULOU, 2007). The Anthropological Theory of Didactics (ATD) was important for the Math's Didactics because directing this study in the **praxeology organizations**. This way, the ATD is considered with Didactic transpositions' evolution.

The Anthropological approach is referring the human activities in the mathematics; this is, about mathematics contained in the human and social institutions activities (CHEVALLARD, 1999 apud ALMOULOU, 2007). The ATD studies, so, the men and your math's knowledge relationship and math's situations.

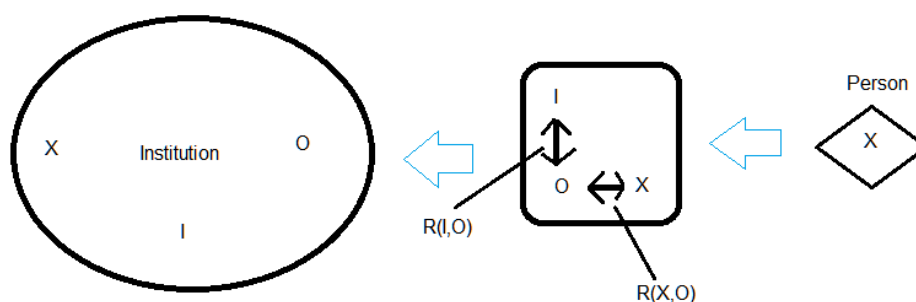
In ATD, the concepts like (kind of) Tasks, (kind of) Technical, Technology and Theory are necessities for the modelling of the social practices, most precisely, the math's activities, basing in three postulations: 1 – Every practices can be analyses above different viewpoints and different ways, in a task systems relatively well delineated; 2 – the Task greetings depend of the development of a Technical; 3 – The Task Ecology, I mean, the conditions and restrictions that allow your production and use inside of institutions (ALMOULOU, 2007).

Chevallard and Bosch (1999 apud ALMOULOU 2007) also classified the objects in two types: Ostensive and Non-Ostensive. The first one refers to every object that contains materialness, inside of the sensibility and reality that can be perceived for subject, I mean, every manipulate object in mathematical. The second one has absent-minded character, by having example the ideas, the notions and the concepts. This it only can glimpse through of ostensive objects associate them, such as a phrase, a discourse, as equation, etc.

To Chevallard (1998), an institutional relation is established between institution *I* (Teacher, Student, etc.) and an object *O*, depending of the positions occupied in the Institution and the Task Sets that the people must comply using determinates technical. The object only

exists if a person  $X$  or the institution  $I$  recognize it, by having the relation between person and object  $R(X, O)$  and institution and object  $R(I, O)$

The first bloc, called "Technical bloc"  $[T/\tau]$  is formed for a kind of Task ( $T$ ) that contained at least a Task ( $t$ ) and a Technical ( $\tau$ ), way of know-how-make the Task. The other bloc is called "Logical bloc"  $[\theta/\theta]$ , formed for a Technology( $\theta$ ), a rational discourse (justifying the Technical) and the Theory ( $\theta$ ) that justify rationality the Technology. The figure 3 showed the model between primitive elements in institutional relations. The Praxeology is the sum between these two concepts.



**Figure 3:** Primitive elements in institutional relations

Font: Adapted from Henriques, Nagamine and Nagamine (2012)

### ATD and DT: Analysing the two Theories under Fleck's epistemology

In this session, we show an analysis about two theories, inside the Fleck perspective if the esoteric and exoteric circles, as well as thought collectives and thought styles.

Firstly, when we think about DT, already we are thinking the Fleck Epistemology, where the ideas going to exoteric circles need of a transposition, can this to be didactic. The Chevallard's model can be a particularism of Fleck's Epistemology.

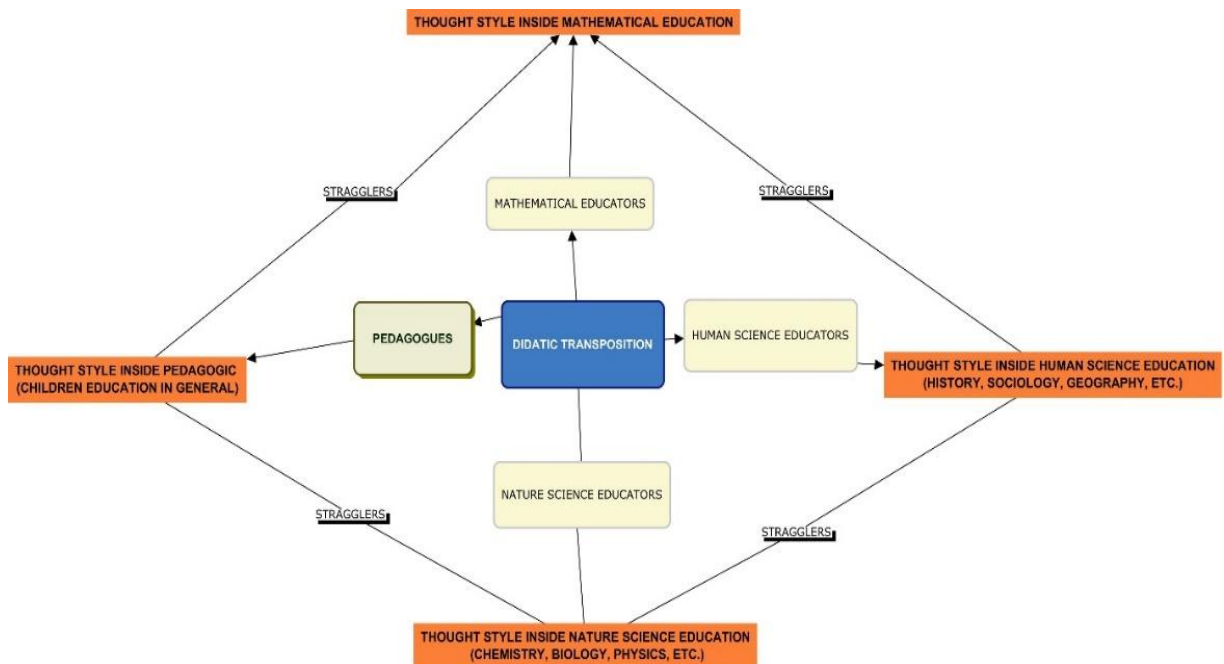
After him has published about DT in 1980 with *La transposition didactique* and in 1991 with *Porqu i la Transposition Didactique*, many thought collectives adhered this idea, not only the mathematical educators, but also nature science and human science educators, pedagogues, educators in general. The figure 4 show the schema, where the different main bodies (official communities) appropriate this, forming own thought styles.

Inside this, some of these styles are linked each other, because share common practices, beyond that an individual can to participate of two or more different circles, in the Fleck approach about ideas circulation.

We can see that these circles are interconnected, because many they change information each other. But each one has thought styles into your thought collectives (for example, in Mathematical Educations, DT can be associate inside of some trend, like Ethnomathematics', Math's Plays, Math's model, etc.).

Now, Chevallard change DT to ATD, expanding your theory and take with him many others conceptions. The ATD has its origin in the math's terms (like relationship between person  $X$  and object  $O$ , or institution  $I$ ) that are so complicated for others thought collectives. Chevallard still use some others terms like "ecology", that him explain borrowed from biology, but this concept showed others finalities. Physics teaching and Chemistry Education could think

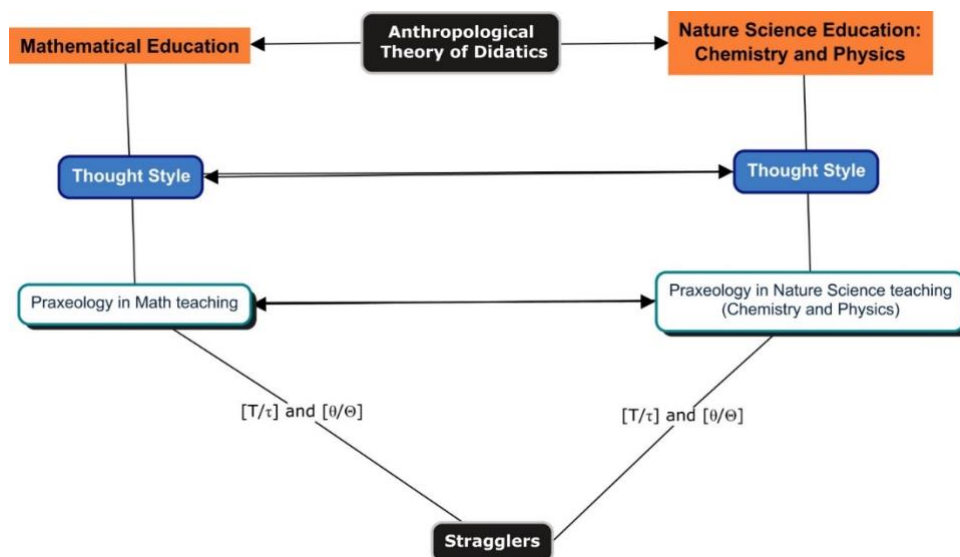
yours works in the ATD in your practices, what is natural by language’s proximity between two collectives.



**Figure 4:** DT's ideas circulations in the Fleck's perspective

Font: Making by Authors (2021)

Starting from this, the Figure 5 show only two thought collectives, in comparison with Figure 4. The possible motives to the others collectives: 1 – Change the relationship between object-subject-institution; 2 – Terms more specifics for other circles and 3 – Anthropological approaches, that are specifics from this collective.



**Figure 5:** ATD idea's circulations in the Fleck's perspective

Font: Making by Authors (2021)



We emphasize here that others collectives can added to ATD, but the collectives like the show in Figure 5 are more propitious because the two points previous. This added, maybe, can be most slowly, depend the necessities of the collectives and your problematics or never happen.

## **PART TWO – THE RESEARCH ABOUT WORKS IN THE THOUGHT COLLECTIVES AND THOUGHT STYLES IN THE BDTD – CAPES**

In this part that follows will be explained the data taken from the Bank of Dissertations and Theses (BDTD) of the Center for the Improvement of Higher Education Personnel (CAPES). This research still has an introductory character, so the results presented in it are only in loco. It is worth mentioning that this bank is fed by universities all over Brazil, so it is justified to choose this focus.

Table 01 shows the data referring to the number of works that bring in their keywords the drivers "Anthropological Theory of Didactics" and "Didactic Transposition", over 21 years:

**Frame 1:** Amount of work on ATD and DT for 21 years

<b>YEAR</b>	<b>DT</b>	<b>ATD</b>
1996	4	1
1997	3	1
1998	2	1
1999	4	1
2000	5	1
2001	11	2
2002	10	0
2003	14	6
2004	14	5
2005	13	1
2006	17	3
2007	34	13
2008	30	16
2009	30	18
2010	38	23
2011	49	22

2012	35	23
2013	50	29
2014	56	30
2015	70	41
2016	65	33
2017	6	4

Font: BDTD – CAPES (2021)

It is noted that the amount of work on DT is always higher than that of ATD. This shows that even as Chevallard extended the original idea about DT to ATD, the thought collectives continued to use the previous theory in their work. The rising appearance, having its peak in 2015, for both theories also induces this assertion. Table 1 shows in number of papers by academic level in this time:

**Table 1:** Amount of work on degree's level

TYPE	DT	ATD
Doctorate degree	118	67
Master's degree	350	166
Professional Master's Degree	68	24
Professional	24	16
TOTAL	450	261

Font: BDTD – CAPES (2021)

This further picture shows that the number of theses on DT exceeds by almost double the number of theses that bring with it the theoretical assumptions of ATD. It is emphasized that this table has the same time interval searched. The other levels have the same tendency in relation to the doctorate. The method utilized in this moment was the comparison between the works. The next frame brings with it the amount per thought collective:

**Frame 2:** Amount per thought collective about DT and ATD

DT	ATD	INTERSECTION
7	4	4

Font: BDTD – CAPES (2021)

This frame, in a summary character, shows that 03 collectives of thought did not follow the idea of ATD and, therefore, stopped producing works in this style of thought, which corroborates with the previous pictures. Table 4 shows in summary the amount of work on ATD and DT according to areas of thought:

**Frame 2:** Amount per thought collective about DT and ATD

DT	ATD
38	14

Font: BDTD – CAPES (2021)

This frame presents the expected scenario in hypothesis: some collective of thought left the style of thought. The causes can be diverse, varying from the complexity of the new style even the non-applicability of this in the areas that used the previous one. An example that illustrates this is the amount of work on ATD and DT in the biological sciences, according to BDTD. There is no record of any work in this area about the Anthropological Theory of the Didactics; in contrast, many works in this bank on Didactic Transposition appear even in areas of knowledge outside the natural scope of the theories under study.

Of course, collectives of thought who are unfamiliar with constructs derived from mathematics or didactics of French mathematics have abandoned the style of thought, but have not abandoned the previous style, which shows that there is no complete adherence to theory after the Vanguard to expand.

## SOME CONSIDERATIONS

The Fleck epistemology it seems important to explain the idea's circulations inside of esoteric circles to the exoteric circles, in any science. Understand this means of doing analysis about science's development, beyond of your origins. How the Didactic of Mathematics is a science, it is only natural that its theories.

Though the DT has been, to some extent, extend by its creator, Chevallard, this idea (that derivate from Fleck's epistemology) still is enough used for many educations and researchers in the Science and Math's Education, because it is easily understood. The ATD is a more specific analysis inside knowledge institutions and brings with it the anthropological approach, being more complete of what DT. However, ATD has many possibilities and ways to be apply in the many other circles.

These causes, by analyzing the tables taken from the BDTD, can be varied, as already mentioned. However, the research points to the suppression of this style of thinking, in hypothesis, by the fact that DT is better understood and less "mathematized" than ATD, where collectives of thought that have an aversion to mathematics, cannot manipulate.

We made it clear that this article, like the name suggest, has an introductory character, bringing just propose of how the thought collectives and your thought styles can behave with the change the theory inside of the esoteric circle.

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