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## **Emotions in Mathematics Education: a view based on complex thought**

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**ABSTRACT – Emotions in Mathematics Education: a view based on complex thought.** This article aims to present a reflection on two theoretical notions for the study of emotions in mathematics education: experiential complexity and emotional configuration. Characteristics of complex thought are presented. This is to reflect and analyze how the rational is conceived from this perspective and how it is differentiated from complexity sciences. A synthesis of aspects related to diverse theoretical stands about research on emotions is exposed. In particular, characteristics of affective domain are synthesized to distinguish it from the approximation presented in this paper. This paper problematizes and argues on the inclusion of experiential complexity and emotional configuration notions. With these notions, this article addresses the succession of emotional configurations of a female student of pedagogy in mathematics, identifying crucial emotions in the student's vocational decision process at the end of high school.

**Keywords: Teacher Training. Mathematics Education. Complex Thought. Emotional Configuration. Emotions.**

**RESUMEN – Emociones en Educación Matemática: una mirada con base en el pensamiento complejo.** Este artículo tiene como objetivo presentar una reflexión sobre dos nociones teóricas para el estudio de las emociones en educación matemática: complejidad vivencial y configuración emocional. Se exponen características del pensamiento complejo, se reflexiona y analiza cómo se concibe a lo racional desde esta perspectiva y se le distingue de las ciencias de la complejidad. Sigue una síntesis de aspectos relacionados a posturas teóricas del estudio de las emociones; en particular, se sintetizan características del dominio afectivo, para diferenciarlo de la aproximación que aquí se presenta. Se problematiza y fundamenta la incorporación de las nociones de complejidad vivencial y configuración emocional. Con estas distinciones se aborda el suceder de configuraciones emocionales de una estudiante de pedagogía en matemáticas, identificando emociones cruciales en su proceso de decisión vocacional al cierre de enseñanza media.

**Palabras-clave: Formación de Profesorado. Educación Matemática. Pensamiento Complejo. Configuración Emocional. Emociones.**

## Introduction

During the 20<sup>th</sup> century there was a preponderance of conceptions of *the human* under a rationalistic classical view. The value given to reason prevailed over other instances such as perception, tradition, and feelings. The major characteristics of this view are the blind trust in reason, the universality of knowledge, the thoughtlessness on human sensibility as a mean of knowledge and the admiration and protection of mathematics under these perspectives (Ávila, 2016).

Rational behavior is usually perceived as the internal coherence behind the decisions made by someone while maximizing the personal interest, behavior derived from a mechanistic view of economic thought. This view emphasizes a rational decision prompted by the results of cost/benefit analyses. Cost/benefit analysis proposes that when someone encounters any situation requiring decision-making, cost and benefit are to be evaluated. If the benefit is greater, the person takes the decision and acts according to what emerges in the situation. However, if the cost is greater, the person does not act according to what the situation offers (Casassus, 2015).

On the other hand, in the last decades, diverse fields of knowledge have problematized the reduction of rationalistic views on behavior and human knowledge. Philosophy expands the conceptualization of rational being by considering the subject as a *polycognitive epistemic subject*, made of a pulse tissue found (Perafán, 2005). In the beginning of the 1990s, the human is not only thought as a *homo sapiens*, but a *homo complexus* (Morin, 1990).

Cognitive sciences show the inseparability of mind and body. The mind is no longer thought as an abstract entity; it is thought as embodied and distributed inside the body (Núñez, 2004; Varela, 1990; 1999; 2000; Najmanovich, 2001). Denise Najmanovich – epistemologist and biochemist – asserts that it is necessary to build a cognitive space in which body/mind, subject/object, matter/energy are to be acknowledged as correlated pairs, not as opposing independent concepts. Instead of the material body of modernity, that is objective and independent, she refers to an emotionally cognitive body of an embodied subject. This “[...] does not allude to an independent referent or objective reality, but it emerges when focusing on the embodied experiential multiplicity and it is traversed by the multiple territories built throughout our vital becoming” (Najmanovich, 2001, p. 21).

In modernity, a person was thought as an individual; human existence between two individuals was conceived as absolutely independent from each other. The individual was solely a particular case within a generic element: population. Nowadays, to think about the human as an embodied subject means to think about the human as a person. Different from the meaning of the term individual, the term person denotes a living human being, someone who thinks, worries, cries, anguishes, and rejoices (Najmanovich, 2012).

Thus, human knowing begins being understood as a broader and more complex form of knowing; opening the path to other aspects of human beings, such as emotions, complementarity, interdependence, and intersubjectivity. This article presents two notions aimed at approaching students' complexities that emerge and concur in the mathematics classroom. Firstly, it analyses distinctive ideas from Edgar Morin's complex thought, such as *homo complexus* and *rationality*. Secondly, it delineates the differences between complex thought and the field of knowledge known as complexity sciences. In doing so, a notion of experiential complexity is established to talk about the complexity that emerges intertwined with the person's own experience when under experiencing the human. Thirdly, it presents diverse perspectives on emotion studies, particularly concerning Affective Domain – *Dominio Afectivo*. This perspective has been placed, from the beginning of the 20<sup>th</sup> century, as a reference point in the field. Finally, a notion of emotional configuration is proposed to address the study of emotions in mathematics education, and to illustrate its use in the vocational decision of a female student of pedagogy in mathematics.

### **Complex Thought Perspective: from *homo sapiens* to *homo complexus***

Edgar Morin coins complex thought as a philosophical positioning which conceives the human being as *homo complexus*. Within this positioning, the human condition is constituted by both animality and humanity. The concept of man has a double entry (biophysical and psycho-sociocultural) referring to one another. The human is constituted through inseparable loops co-defined between each other: mind/brain/culture, reason/emotion/impulse, and individual/society/species (Morin, 1999). A truly human development requires the understanding of each individual as an ensemble of all these loops and of humanity as one and diverse.

The XXI century should abandon the unilateral vision that defines the human being by rationality (*homo sapiens*), by technology (*homo faber*), by utilitarian activities (*homo economicus*), by compulsory necessities (*homo prosaicus*). The human being is complex, and bears bipolarized antagonistic qualities [...] The man of rationality is also the man of emotion, of myth, and of dementia (*demens*). The man of work is also the man of play (*ludens*). The empirical man is also the imaginative man (*imaginarius*) [...] The human being does not solely live by rationality and technology [...] We are infantile, neurotic, frenzied beings, yet rational. [...] that is truly the fabric that human beings are made of (Morin, 1999, p. 27).

To understand this complexity through classical rationalism lacks sense, since the attention from complex thought is decentralized from what is characteristic and distinctive of the human condition, given its rationality and objectivity. The attention of complex thought displac-

es towards what is interrelated by a metaphor of complex interweaves formed to project themselves beyond its parts. Complexity is:

The fabric of events, actions, interactions, retroactions, determinations, and change that constitute our phenomenal world [...] It presents itself with the disturbing traits of the inextricable, of disorder, of ambiguity, of uncertainty (Morin, 1990, p. 32).

Contrary to classical rationalism, a main characteristic of complex thought is “[...] its constant aspiration to integrate or articulate dispersed knowledge” (Paiva, 2004, p. 240). Within complex thought, complexity does not eliminate simplicity and is not to be confused with completeness. Complex thought is positioned in a different starting point for a richer, less mutilating action (Grinberg, 2005).

### Rationality in Complex Thought

Teaching and learning of mathematics is often associated, within society, to selectivity and rationality, both for mathematics and for those who study it. However, Morin offers rationality a new meaning:

True rationality is by nature open and engaged in dialogue with the real, which resists it. It constantly goes back and forth between the logical instance and the empirical instance; it is the result of debate of ideas, and not the property of a system of ideas. Rationalism that ignores subjectivity, affectivity, life and beings, is irrational [...] True rationality knows the limits of logic, determinism, mechanics; it knows that the human mind cannot be omniscient, that mystery is part of reality [...] True rationality can be recognized by its capacity to recognize its own shortcomings (Morin, 1999, p. 27).

This dialogical and interrelated view of rationality encourages us to think differently – what does it mean to be rational? There is no doubt that in the *argued debate* there is room for constructs, ideologies, paradigms and previous points of view that help to argue, but the rational is not reduced exclusively to this apparatus of pre-given and validated argumentative constructs (closed and objective) with which one is able to discuss. On the contrary, with regard to the multidimensional nature of the human, rationality flourishes, it emerges dynamically, in a dialogical-argumentative relationship between diverse instances: logical, empirical and experiences of the human.

A similar phenomenon occurs with mathematics educators, when they dedicate themselves to understand the type of transformations that were generated in the historical-epistemological evolution of knowledge. In that work, there are senses, meanings and rationalities already hidden, which in the future are sought to be recovered through some didactic design for their teaching. In this becoming, emergence is part of the process of *conforming (configuring) of a mathematical knowledge* in what it currently is. It becomes paradoxical, then, that a teacher

places him/herself to teach from a pre-given rationality logic through a clean, objective, and finished mathematical discourse. When developing a mathematically impeccable task, the teacher appears unbeatable, rational, objective, and convincing. With this action, the student is presented with a false vision of what it means to be rational, reducing it to the objective, closed and clear argument with which it “gets a hold” on something. This understanding of rationality is problematized when it is argued that rationalism is irrational when it ignores beings, subjectivity, affectivity and life. In complex thought, the antagonistic characters are neither mutilated nor exiled in the emergence of rationality, but these are constitutive parts of it.

### **Complex Thought and Complexity Sciences**

Complex thought and complexity sciences correspond to different fields of knowledge. Complex thought, according to its main representative – the French philosopher Edgar Morin – places human condition at the center, in a sense of loops. Complexity sciences refer to a field of knowledge with diffuse limits, which encompass theories of complex systems in a broad sense, with multiple representatives in cybernetics, genetic epistemology, general systems theory, fractal geometry, theory of autopoiesis, theory of catastrophes, among others (Rodríguez; Aguirre, 2011).

Complexity in contemporary scientific thinking involves a new form of doing and understanding science, in order to include problems ignored by a modern scientific thinking anchored in mechanism, reductionism and determinism. These problems deal with issues related to disorder, chaos, non-linearity, non-equilibrium, uncertainty, and self-organization. Complexity sciences begin in the physical-natural sciences, the sciences of life and matter (physics, biology, thermodynamics, among others), and their development is linked to the development of modern computer science (Rodríguez; Aguirre, 2011).

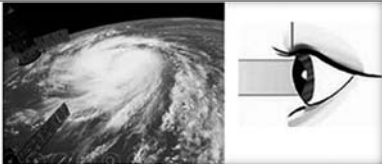


Therefore, complexity sciences are related with the intention (or action) of trying to understand, explain, or solve a complex phenomenon's aspect in which, whether or not the human being is present, he is not the center of attention. Complex thought, on the other hand, is related to a thought that understands the human being as a complex interweaving, constituted by inseparable loops, imbricated with what he lives and how he lives.

### **Experiential Complexity: the human being and feeling**

By using the phenomenon of the occurrence of a hurricane as a metaphor, we can state that complexity sciences aim at knowing the functioning or behavior of a hurricane, and that complex thought aims at recognizing human being immersed inside the hurricane (and the same human itself as another hurricane). The developments of complexity sciences mainly respond to what is quantitative, namely, they

digitalize, they graph, they model, and they address to a product and a goal. Complex thought responds to what is qualitative; namely, it acknowledges the human being itself as a complex phenomenon, able to experience. This is fundamental, in being the human immerse within a complex phenomenon and by having the capability of experiencing, it emerges another complex phenomenon or another type of complexity: *experiential complexity*. This is understood as a complexity that is intertwined with the encounter of the human experiencing the human, according to the particular complexity in which it is immersed. Experiential complexity is the complexity that “[...] happens precisely in the act of experiencing” (Ávila, 2018, p. 239).

**Figure 1 – From Understanding and Comprehending by Experiencing**

COMPLEXITY SCIENCES		Intentionality of comprehending (solve) a complex phenomenon.  <i>To understand the functioning of a hurricane.</i>
COMPLEX THOUGHT		To comprehend the human as complex.  <i>Involves the human experiencing the hurricane.</i>
EXPERIENTIAL COMPLEXITY		The human immerse within the complex.  <i>The human experiencing the hurricane.</i>

Source: Authors' elaboration.

In the sciences of complexity, the human is not necessarily part of the complexity picture that is configured. In complex thinking, the human is incorporated into the complexity picture that is configured, but it is still acting from outside that complex picture. In the experiential complexity, with the human being interlaced with the complexity picture that takes form, other complex pictures are configured for that human being who experiences.

The narrative of experiences shows an experiential complexity. It is configured there a complexity that brings together the subject who experiences and narrates his/her experiences. We are the narratives that we tell ourselves (Connelly; Clandinin, 1995). What is narrated-experienced is reconstructed in a continuous movement, mediated,

among others, by *interpersonal narratives with which articulates that experientiality*. As it leaves and enters the picture, in doing so, both dimensions are interwoven. We are the mammal articulated according to its story in first person. The person that is observed being, including past and present feelings, reflections and dreams.

Being a student or a teacher is an example of experiential complexity. Each student and teacher's experience is formed by interrelations, emotions, impulses and own understandings of what occurs and happens in their everyday lives.

### Emotions from the Perspective of Affective Domain

Theories on emotions can be traced back to the beginning of the history of philosophy and literature. In Greece, they were already part of Plato, Socrates and Aristotle's philosophical discussions, however, its scientific origins are placed in 19<sup>th</sup> century and its study suffered a lethargic moment until late 1980s (De Souza, 2011).

Emotions are recognized as a complex and multidimensional entity that can be studied from diverse perspectives. Table 1 shows some approaches and identifies major research interests and representative authors.

**Table 1 – Some Theoretical Approaches Concerning Emotions, Major Interests and Authors**

APPROACH	MAJOR INTERESTS	RELEVANT AUTHORS
Evolutionary-biological	<ul style="list-style-type: none"> <li>• Study of the expressions of emotions.</li> <li>• Differential and transcultural analysis of basic emotions.</li> <li>• Specific functions of what they represent.</li> </ul>	<ul style="list-style-type: none"> <li>- Charles Darwin</li> <li>- Silvan Tomkins</li> <li>- Robert Plutchik</li> <li>- Carroll Izard</li> <li>- Paul Ekman</li> </ul>
Neurosciences	<ul style="list-style-type: none"> <li>• Focus on, almost exclusively, the relationship between the functioning of the brain and emotions.</li> </ul>	<ul style="list-style-type: none"> <li>- Antonio Damasio</li> <li>- Joseph LeDoux</li> </ul>
Cognitive	<ul style="list-style-type: none"> <li>• Interaction between physiological and cognitive aspects that determine emotions.</li> <li>• Emotions are evaluated and valued through cognitive processes; cognition is previous to emotions.</li> </ul>	<ul style="list-style-type: none"> <li>- Magda Arnold</li> <li>- Stanley Schachter</li> <li>- George Mandler</li> <li>- Richard Lazarus</li> <li>- Andrew Ortony, Gerald Clore and Allan Collins</li> </ul>

Socio-cultural	<ul style="list-style-type: none"> <li>• Social component of emotions and the importance of cultural contexts for their embodiment and experiencing.</li> <li>• Influence from codes or behavior norms for experiencing and expressing emotions.</li> </ul>	<ul style="list-style-type: none"> <li>- Theodore Kemper</li> <li>- Thomas Scheff</li> <li>- Arlie Russell Hochschild</li> </ul>
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Source: Authors' elaboration.

Based on complex thought, the nature of emotions cannot be reduced only to cognition, physiological, sociocultural, or other. Our aim is to characterize emotions in relation to human beings' experiential complexity. This is done from two components linked to its occurrence: emergency and concurrence.

First of all, we have to refer to Affective Domain theoretical perspective, one of the most used perspectives since the late-1990s for studying emotions in mathematics education (Gómez-Chacón, 2000; Marlow, 2001; Hannula, 2002; Martínez-Padrón, 2005; Gil; Blanco; Guerrero, 2005; Caballero; Blanco; Guerrero, 2008; Caballero; Cárdenas; Gómez, 2014; Martínez-Sierra; García; Carrillo; Jiménez; Lemus; Lom; Villa; Valle; Canul; Miranda, 2015; Attard; Ingram; Forgasz; Leder; Grootenboer, 2016). Next, this perspective of approach from the emotions presented in this article.

Douglas McLeod was the first researcher to talk about the Affective Domain in the early-1990s. McLeod identifies three basic concepts of the Affective Domain: attitudes, beliefs, and emotions. Later, De Bellis and Goldin (1997) add a fourth concept: values. Based on cognitive psychology, particularly on Mandler's theory of emotions, McLeod directs his approach towards affect. According to McLeod, Mandler's theory allows to illustrate how affect can be included in cognitive studies in mathematics, by considering factors of beliefs, attitudes and emotions:

Any reconceptualization of the affective domain should attempt to be compatible with cognitive-processing models of the learner. In this context, the work of Mandler (1984) should provide a useful general guide. The theoretical analyses of Mandler (1984) and the practical analyses of mathematics classrooms suggest that beliefs, attitudes, and emotions should be important factor in research of the affective domain in mathematics education (McLeod, 1992, p. 578).

And so, the Affective Domain responds to a cognitive perspective. More precisely, it is defined as "[...] a wide range of beliefs, feelings, and moods that are beyond the domain of cognition, and includes as specific components of this domain attitudes, beliefs, and emotions (McLeod, 1989, p. 245 *apud* Gil; Blanco; Guerrero, 2005, p. 16). Beliefs are understood as the most cognitive, and emotions as the least cognitive. Beliefs are more stable and less intensive, and emotions are more intense and

less stable. Attitudes are an intermediate component between both dimensions.

Recently, Grootenboer y Marshman (2016) allude to these three components as inter-related. They claim to be aware about other facets that could be included, such as motivation and commitment. Their concern is in analyzing and discussing diverse aspects of the Affective Domain as a complex and inter-related whole. Besides this distinction of inter-relation, emotions, from an Affective Domain standpoint, rather than delving into their emergence, are considered already crystalized as *a part of something*. According to Gómez-Chacón (1997 *apud* Gil; Blanco; Guerrero, 2005, p. 23):

Emotions are organized responses beyond the frontier of psychological systems, including physiological, cognitive, motivational, and experiential system. Emotions emerge in response to a (internal or external) event that has a positive or negative significance for the individual. The value related to the emotional act comes after the occurrence of some perception and cognitive discrepancy with which the subject's experiences are infringed. These expectations are the expression of students' beliefs about the nature of school mathematics, about themselves, and about their role as students in classroom interactions. Students' beliefs, that seems to be a crucial aspect in the structuring of social reality in the classroom, within which it is taught and learned, deriving the meaning of emotional acts.

From this conceptualization, it is possible to assert that emotions are organized responses with a charge of positive and negative meaning. At the same time, these charges of meaning (valorizations) that ensue from emotional acts, are derived by students' beliefs. Thus, this approach focuses on the moment that follows the experiencing of emotions, is placed within its valorization, which happens as a subsequent cognitive act to the emergence of an emotion.

### **Distinction of Emotions by Emergence and Concurrence**

In order to address the emotional from an experiential perspective, we build on Ávila (2018, p. 240):

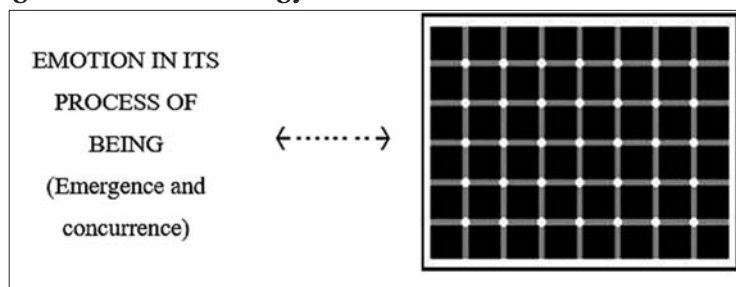
As understood, an emotion emerges in a person while in experiencing a situation that involves him/her, configurative aspects that characterize such emotion are shaped, mainly, regarding what is happening at that moment. On the other hand, we understand that an emotion concur in a person when in front to a situation that involves him/her, the emotion emerges, but this time it is more intertwined with the experiential.

It is interesting to explore within the moments in which an event-person relation is taking place in order to delve into the experiential

complexities that configure emotions and, also, into what is configured from those emotions.

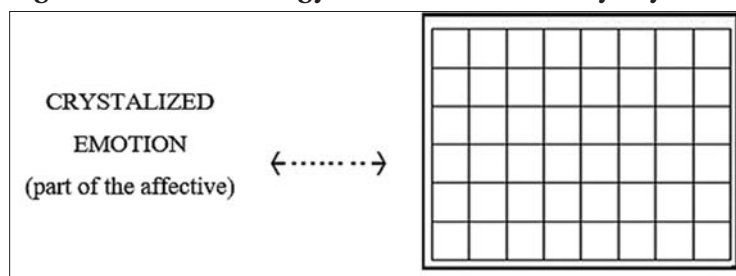
Rather than an exclusionary/deterministic typifying of emotions, the intention is to attend to the inter-related manner in which emotions can occur, in terms of emergence and concurrence. The interest is in highlighting the relational and dynamic aspects that triggers the emergence/concurrence of an emotion, distinguishing certain aspects that contribute to the understanding of its configuration, by addressing students' experiential complexity and the *now* of being (Toboso, 1996 apud Díaz, 2007) that accompanies any configuration process. To illustrate this perspective, we use the following analogies:

**Figure 2 – Visual Analogy of an Emotion in its Process of Being**



Source: Authors' elaboration.

**Figure 3 – Visual Analogy of an Emotion already Crystallized**



Source: Authors' elaboration.

Figure 2 illustrates emotions as a dynamic and active process, in their process of being, in their being configured. In looking Figure 2 closely, it seems that the white dots change color when these are not looked directly. The white dots turn black and even appear to shine. Figure 3 illustrates what occurs when dealing with emotions as something already crystallized, which occurs or has occurred in a particular area of the affective, but without deepening into its process of being.

## Emotional Configuration of Experiential Complexity

When searching for *configuration* in the *Diccionario de la Lengua Española*, one finds the meaning “[...] disposition of the parts composing a thing and give it its form and its properties” (Configuración, 2014, online). Such meaning can be read as static (photographic) or as more complex (relational, emergent, systemic). A photographic interpretation would be to, literally, focus on the contemplation of the parts, which are tied to the image of what has already been shaped. In the example of the streets of a city, it would be to focus on what is there – *streets distribution, the map, the plane, the image*. In this case, what is given, what is distributed, is the configuration. The disposition of the parts would allow referring to the shape and properties of the streets of the city (narrow, wide, parallels, confluents, the architecture involved, etc.).

But also, it is possible to question about the configuration of less visible things (in the literal meaning of *difficult access to sight*). For instance, a *musical piece* experienced in a theatre. In this case, there would not be many possibilities of maps or images. Musical scores can account (to musicians) for that disposition of parts for the piece being configured. However, it does not account for the musical piece in the *now* of the event, that is, in its process of being, when it is occurring. Configuration has to do, besides scores, with the spatial location of the performers, the intensity of sound of their instruments, history and internal experience of each performer. Not for being in the same spatial location (disposition of the parts) the sound will be the same. Sound intensity and the internal experience of each performer – that will make them play as they play at that particular moment and not in a different way –, regardless of their professionalism, are also part of the disposition of the part that shape, configurationally, that particular musical piece, in that time and with those performers. The relational, the systemic, the emergent are more present. Diverse musical pieces will emerge if the same performers, even placed in the same locations and with the same instruments, play in different experiential moments.

With this look, the notion of configuration becomes wider and dynamic, it focuses on *those parts that compose and shape a thing* as something involving trajectory and flow within the *being constituted* of things. By considering what is beyond of the already constituted, what colludes, concurs, emerges, flows, assists, intervenes for establishing, stabilizing or conforming (configure) something.

An example is this same section, there are sentences, paragraphs, internal organizations, links between sections. These (more or less concrete) components are parts of the configuration of the section. However, prior its final stage this section was neither elaborated as such nor was located in this place. This section was moving, emerging. Those *components* that intervened and contributed for the shaping of the section, are also parts – although invisible, existing in that moment – of the final configuration of this section. Moreover, they helped for the section to make sense.

Another example could be the reader's understanding of this section. Part of the *disposition of the parts* for the configuration of the section is the very same reader with his/her history, and biography, the moment he/she reads it, how he/she reads it and what for. In this case, the components of the configuration are more difficult of visualize. To capture them with clear and objective evidence, as the logic of classic rationalism aspires, would be an unapproachable ambition. It is about experiences, of episodes that are *configured* intertwined from each reader, consciously and unconsciously, rationally and emotionally, in a complex manner.

From this, we understand emotional configuration as “[...] a configuration that includes aspects related with concurrence and emergence of an emotion, focusing on itineraries that lead it to installed and uninstalled in the person” (Ávila, 2018, p. 240).

### The Arising of Emotional Configurations: Rebeca's case

As part of a doctoral research, the case of a student of pedagogy in mathematics, Rebeca, was studied. By building on this case, it was sought to unveil emotional configurations involved in her formative process. Certain aspects of experiential complexity that occur with her decision of studying that career are detected.

In her last year of school – fourth grade of high school –, Rebecca is one of the protagonists of a rivalry relationship with one of her classmates who boast of being the best of the class in mathematics and keeps her knowledge to herself. On the contrary, Rebeca likes to share what she knows, she does not perceive herself as the best in mathematics, but she positions herself as one of the best as a result of hard effort and study.

Rebeca: I was one of the best in mathematics at school, but at the same time 'I was one of the best', there was a dispute with the girl with the best grades of the class. She was someone who bragged about being good because her mother is a mathematics teacher, so she understood the situation like 'I'm the best!' For her! And I, from the little, or much, because in comparison with the rest of my classmates, it is not like I was *brainy* [the best], it was hard for me too, but if I learnt and I was sure of it, I was able to be in front of the class, with a marker and c'mon *chiquillas* [girls] this is the way to do it! That is how I did it! (...) this is when I started teaching, then I said: 'Yes! I like sharing the knowledge I have, not keeping it to myself'. I liked 'finding the way' because my best friend was *so bad* [poor-performer] in mathematics and [...] with me, she passed it, so with her I was also trying to find the way of teaching what, maybe, for me was obvious but not for her, and I started playing with this.

Her classmate, the one with the best grades of the class, was, arrogantly, selfish and proud, she boasted and felt superior to the rest; she was opposed to Rebeca's way of understanding the relational (in relation to knowledge and to the other). This enabled to emerge, within her, acts built towards courage and generosity of sharing her knowledge, even though she perceived herself as not being the best. These experiences,

and moved by the emotion of *disapproval* in relation to her classmate's behavior, activated in her a desire to help her friends that struggled the most with mathematics and it generated challenges and an initial practice for teaching. This emotion of disapproval – in that sense – is centered in the emergence; it emerges (enters into the configuration picture) because of her classmate's actions. It is possible to address *interest* and *enthusiasm* in a similar fashion; both emerge within her in order to help others. This emotional flow that shapes her experiential complexity, generates in Rebeca a sense of *I like sharing the knowledge I have, not only keep it to myself*.

Going more in depth into her experiential complexity, it is possible to elucidate that these emotions have also a component of concurrence.

Interviewer: Was there a comparative relationship between the two of you?

Rebeca: Of course, we were compared, because I was '*piola*' [simple and humble], my mom didn't study [...] everyone in the class said daughter of a teachers, who doesn't! It would be the last straw not knowing mathematics when you mother is a teacher. And it is not my case, my mom wasn't like that, my mom taught me the little she knew, so I have always learned the little I know I could convey it, so I do it.

Interviewer: And that relationship with her, what emotions did it generate in you?

Rebeca: I don't like this kind of people! [...] for me it was showing her that because she knows or because she is the best it doesn't mean that others have to remain under her, for her to feel, I don't know how to say it, I'd always say that she was *too big for one's britches* [a conceited person and with a superiority complex]. Since she was the best, and she didn't help us, she remained being the best. And I could not be one of the best, but I wanted that my classmates and my friends became better, so [...] for me was a leadership, it was about being a leader and being a supervisor, something like that, so me and friends if they didn't know, they weren't the best but to achieve some change in them. This girl wasn't, she was only worried about her own chance, not me, if I had to have a break less to study with my friends, I did, and she didn't. Then, she laughed at her friends because they performed poorly; on the contrary, I was happy because even though my friend had raised a tenth or pulled the four, but I knew how much that four had cost [four is the minimum grade of approval in Chile, in a scale from 1 to 7], but because I knew how much it cost to achieve that four, and she didn't, she looked at the grade and laugh at your face.

More than the quantity of knowledge she has, she experiences the sharing of knowledge with her mother. This vital development contributes, also, to prompt some emotions in her, such as *disapproval* and *anger* towards her classmate's way of being. Therefore, these emotions that have traits of emergence (come together by the behavior of her classmate) have also traits of concurrence because there was no harmony with the experiential experience – *experencialidad* – she previously had with her mother. This previous experience of sharing, moves her also to share with her classmates and friends, being part of the configurational picture that made interest and enthusiasm to emerge, in this case closer to concurrence.

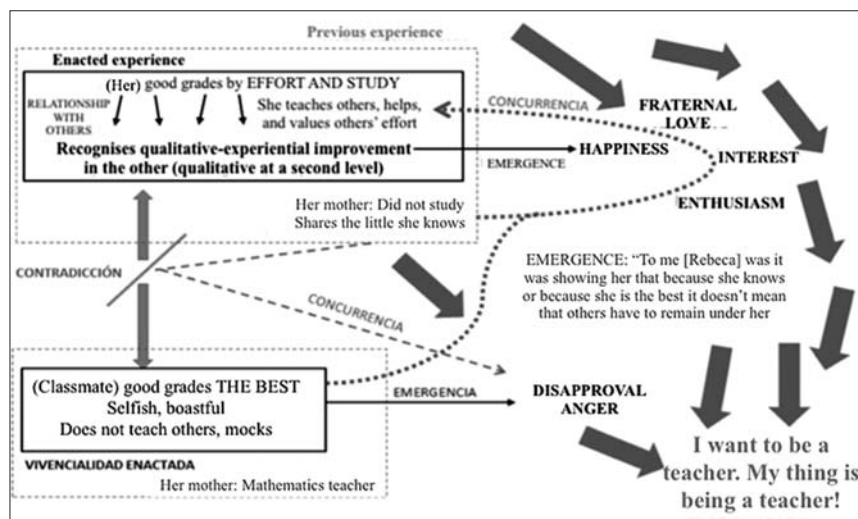
All of this generates in her an active role, of transformations of the contextual picture that emerges from that way of being of her classmate. She does not appeal to a change in her rival, she appeals to a change in the context, in the improvement of her friends with difficulties in mathematics. She assumes a role of leadership in order to change the situation. This indicates a fraternal love towards the other and happiness when the other progresses, by decentering herself from the attention picture. *Fraternal love* and *happiness* arise as emergent emotions that barge in Rebeca's experiential scene regarding the achieved change within her friends. As minor as this change is in terms of grades, she values the effort and the experience of her friends behind those small numerical shifts, in terms of grades (*I was happy because even though my friend had raised a tenth or pulled the four, but I knew how much that four had cost*). Beyond grades, there is the human and the favorable change, not in quantitative terms, but qualitative, more in accordance with complex thought than with classic rationalism.

With this experiential complexity described in her school experience, with what is being generated in her from her emotions, her decision of becoming a teacher has been taking shape.

Rebeca: when we took the PSU mock exam [PSU, *Prueba de Selección Universitaria* is a Chilean test for applying to University], she also competed with me, and I won, and I was not even competing with her, I won because I knew more, that's all, and I was the best score of the class, so then she started looking at me like this (she frowns)... and then at the end, the 'what do you want to be?' came up. And I was: 'I want to be a teacher; my thing is being a teacher'. And they ask me 'ok, but in what field?' And I've always been good at math; it was the only thing I considered myself good at school, and I said 'ok! In mathematics'.

Being the best score in PSU seems to be secondary. The *I want to be a teacher; my thing is being a teacher* emerges as a direct response to the question *what do you want to be?* There is no hesitation or analysis linked to the PSU score obtained. Her categorical answer connects to the accumulation of emotions carried throughout her life. She decides to be a teacher, with a strong relational posture, with experiential experience of happiness and joy to share what she knows, and that other improve by their own merit, with disapproving others that consider themselves better but that do not share with or mock others, with not considering herself at one of the best but with plenty conviction and perseverance. With emotions emerging and concurring are illustrated in Figure 4:

**Figure 4 – Diagram of Emotional Configuration towards being a Mathematics Teacher**



Source: Authors' elaboration.

This illustrative case elucidates emotional configurative elements that allow distinguishing emotions that emerge and concur in the mathematics classroom, co-helping the person choosing to become a teacher. In particular, this illustrative case leads to reflect on how the rationality that complex thought alludes, is actually part of Rebeca's configuration diagram, in the sense that her rationality is overlapped with intense feelings of love and disapproval, anger and generosity. A human being, who experiences, suffers and rejoices, impresses, defines and co-defines herself continually; emerging and concurring in her a sort of stabilization of rationality in the sense of complex thought that, in a configurative way, directs her to become a teacher. More than a choice representing a world or of variables analyzed externally from a picture that she *rationalizes objectively*, it is a picture that embraces and involves her, entering and leaving it constantly, in an experiential complexity.

## As Closing

This article deals with highlighting the experiential of the human immersed in a complex phenomenon. For this, notions of experiential complexity and of emotional configuration are embedded, to illustrate the emotional configurations of a student in her vocational process. Each subject is considered as an embodied, emotional and cognitive body; that emerges from the experiential diversity embodied and articulated with territories through which it transits in its vital evolution. With this subject concurs a rationality that incorporates life and, with this, its affectivities and subjectivities. A rationality that emerges

from dialogical-argumentative relationships between the logical, the empirical and the experienced. As the presence of the cognoscente and sentient person in his/her *experiential complexity*, who incorporates the complexity framing in which his/her being experiencing is, configuring new frames of complexity.

Unlike other theoretical positions, such as the effective domain, which analyze emotions from its crystallization, from the aforementioned perspective we are interested in placing ourselves on the dynamism of unfolding emotions. With this purpose, the attention has been centered on what emerges and concurs, retroactively, to unveil experiential complexities that shape an emotion and, also, in what is configured from those emotions.

*Emotional configuration* is conceived as the configuration involving aspects linked to concurrence and emergence of an emotion, attending to itineraries, which lead an emotion to be installed and uninstalled in an experiential now of the person. This notion focuses on those parts that configure and shape an entity, involving its trajectory and flow, when such entity is being constituted.

It is interesting to continue following the path towards understanding, each time in greater depth, implicit links, which configured the lived, and the experienced by the subjects throughout their processes of formation.

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