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Storydoing in the emotions of young university students during the process of learning calculus in engineering

Cuentos sobre las emociones de jóvenes universitarios durante el proceso de aprendizaje del cálculo en ingeniería

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	ABSTRACT
Keywords: Emotions, students, cognitive processes, conscious experience, Interview.	The study of emotions using storydoing, constituted as the main factor in the learning of calculus in engineering, constitutes the main objective of the research, executed under the qualitative approach and the phenomenological method in order to deepen in the answers expressed by the adolescents of an educational institution. The article, based on a quantitative study, analyzes how the process of learning calculus takes place in the emotional, thought and feeling responses from the perspective of the students, who are directly benefited or affected by this situation. The sample consists of 111 university students from the first to the fourth semester. Emerging conceptual categories were friendship, role, learning innovation, emotion, feeling, environment, family support. Emerging paradigms were synchronic behaviour, inter-agent epistemology, self-organizing dynamics, abstract symbolic representation.

	RESUMEN
Palabras clave: Emociones, estudiantes, procesos cognitivos, experiencia consciente, Entrevista.	El estudio de las emociones a través de los cuentos, constituido como el principal factor de aprendizaje del cálculo en ingeniería, constituye el principal objetivo de la investigación, realizada bajo el enfoque cualitativo y el método fenomenológico para profundizar en las respuestas expresadas por los adolescentes de una institución educativa. El artículo, basado en un estudio cuantitativo, analiza cómo se desarrolla el proceso de aprendizaje del cálculo en las respuestas emocionales, de pensamiento y de sentimiento desde la perspectiva de los estudiantes, que se ven directamente beneficiados o afectados por esta situación. La muestra consta de 111 estudiantes universitarios del primer al cuarto semestre. Las categorías conceptuales emergentes fueron amistad, rol, innovación en el aprendizaje, emoción, sentimiento, entorno, apoyo familiar. Los paradigmas emergentes fueron el comportamiento sincrónico, la epistemología interagente, la dinámica de autoorganización, la representación simbólica abstracta.

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Introduction

Stories are a fundamental part of the human being [1], they are a vehicle to transmit wisdom, to explain the world in which he lives. Stories give meaning and context to communication [2], so people are driven to share stories, not information. Today, the educational community is effectively incorporated into education, in which it converges in the university environment, giving young people the capacity to adapt and recover from entropy, which is the result of any situation, due to the resources that they have at an individual and collective level [3]. Therefore, describing how this process takes place in the emotional, thought and feeling responses from the students' perspective is a strong approach to reality [4]. The capacity to face each new reality depends on the members of the system, alluding to the fact that it will be difficult for them to adapt to the environment after a critical event. Human beings have the ability to interact with their environment through basic and complex cognitive processes where perception, communication, thinking, are manifested in different forms of behaviour [5], expression of feelings and socialization in different written or verbal channels with their peers, so knowing the emotional responses, thoughts and feelings of a population represents a focal point to investigate [6]. Feelings and actions are handled by the marks and symbols expressed in emoticons, drawings, characters, appropriated by the young people, thus, they are able to focus, in the emotional arc behind the story, this will help them to understand the type of learning to share and that generates satisfaction and well-being.

Materials and methods

The research follows a predominantly qualitative approach [7], supported by phenomenology [8] as a method, according to the research objectives, analysing emotional and sentimental responses reported by young people after experiencing a learning situation in which story doing is embedded. The phenomenological method was constituted in a tool that allows to describe the human experience to detailed explanations of the phenomenon to study (Emotions and thoughts reported by the adolescents, it looks for to analyse the speech from the 4 existential pillars of which it makes use (corporeality, temporality, spatiality, the relations; conceived like the interaction of the subject with other people) [9].

The research incorporates in-depth individual interviews and focus groups in conjunction with participant observation recorded from a field diary [10]. To achieve the necessary depth in describing why and how adolescents manifest these emotional responses, thoughts and feelings as the research process proceeds [11]. The focus group interview, used in a group of 18 young people, contrasts the group's opinion with the personal uniqueness found in the personal interview [12]. The study includes 17 to 23 year olds from higher education institutions in Cúcuta, from the first to fourth semester. The participants selected for the research were 111 first- to fourth-semester engineering students at a public university who met the criteria for inclusion in the research.

Results and Discussion

Field and conceptual journal analysis allows us to determine three clusters and seven emerging categories (Table 1) in which emerge from stories elaborated the cronyism as an important element in learning, the family as part of the historical context, development of thought as a value of learning from the emotion, the emotion where the comic is a means of expression, feelings associated with sensations, role in teamwork where skills are highlighted and correlated with the joint work to achieve a final comic; innovation of learning as a cognitive component of creativity.

The description of emotions and thoughts in inductive categories that emerged were: feelings of sadness, anger, loneliness, joy and guilt. At a cognitive level the positive or negative evaluation of the storydoing and the attribution of internal or external responsibility for it. Similarly, it was observed that the information related to those who provided emotional support was frequently induced, and this is called ecological environment.

Table I. Formatting sections, subsections and subsections.

	Concept	**Competitive association**
Classmate-Family - Cluster 1	The friend is the first and most important context of growth and socialization of 80% of young university students. For them, it is an omnipresent institution in which the friend is a fundamental figure in the learning process and in the generation of ideas for the elaboration of comics. The family within a socializing context, of expression, comics always incorporate him, in particular grandfather and mother, in it one learns the bases on which the human being is constructed. Graphics are associated with habits, customs, behaviors and personality	0.75
Roles in team work - cluster 1	It connotes the participation in work teams according to the skills of each member, drawing, art, mathematics, equation solving, text interpretation, writing, creativity, narratives, video games, the contribution allows them to measure their participation and evaluate consequences that would be expected from this possibility. The object of the research is to conceptualize how the adolescent's yearning to have a poster, book, or comic book creation in math subjects, due to what it represents for him or her.	0.81
Innovation of the learning cluster 1	Valuable or cognitive component of creativity and emotion The first one is in charge of evaluating the novelty of the cartoon, the acquired and applied learning, socialization through posters, the care of the product, the cause-effect analysis that analyzes the event. It depends on whether you consider it positive or negative for your life based on certain factors analyzed subjectively.	0.95
Emotion Cluster 2	The emotion as a factor immersed in the stories, triumph, winning, learning, after feelings of frustration for not knowing a subject or the resolution of a problem, are shown in each story in differential equations, as an episode of synchronized and interrelated changes of all or almost all the organic subsystems on which each component depends in response to the evaluation of an internal or external, relevant stimulus [13]. 13] Considered as the emotional manifestations present internally and externally, translated as the reaction patterns by the young person from facial and motor expression, to the physiological reaction ending with a subjective feeling.	0.95
Feelings Cluster 2	Conceptions focus on behavior, as well as cognition, in the manifestos of Shuman et al, [15], to verbally inform a qualitatively different multitude of sensations, encoded in a rich emotional vocabulary, can be internal, experience of consciousness.	0.89
Environment Cluster 3	Favouring a climate of work and affection, of permanence, of security, of exchange of values, of beliefs, and behaviours that allow the development of stability in children. The concept is understood as a set of patterns, activities, roles and interpersonal relationships that the person experiences during his or her evolutionary development through a given environment.	0.92
Family Support- cluster 3	It is conceived as the accompaniment, the interchange of affection, and the participation of members of the family nucleus. For the purpose of the research, this term is conceptualized as the influence of the members of the nuclear or extended family that accompany the student during his or her crisis stage, representing a relief to his or her discomfort [16].	0.75

The emotional area is directly influenced, it is more probable that due to their cognitive maturity they present feelings of frustration at the beginning of the process, of emotiveness when assigning the role of drawing if it is a skill, of need to be cohesive with the work group, they have the capacity to understand the causes and consequences). The methodological triangulation allows us to observe deductive and inductive categories (Table 2), they arise as deductive categories were emotions, conceptual memory for skills, emergent approach. The young people from a cognitive approach from storydoing reason symbolically about their own representations in order to achieve learning goals. It is frequently observed that the break in perception in the face of the cognitive act connected to skills to act with prospecting, emergent approaches, from the sensory data of each individual is transformed and leads him/her to act, to create and to shape stories that he/she then tells and reproduces, constituting a process that structures the external environment, represented according to the ability and capacity of each young person to a greater or lesser extent in isomorphic terms. The participants focus their learning on the hierarchical neuronal distribution of the visual cortex, which acts as a sensor and external effector. Through the ontogenetic system, the system operates in its environment, processing stimuli from the external environment and from its own internal environment associated with previous learning, belief, perceptions, in conscious observation and consequent sensory, varying according to the degree of cognitive complexity, of its phylogenetic and behavioural or neurobiological motor capacity; routes that mediate and manifest in feelings of

pleasure reflected in happiness referring to learning achievement and finished product, even if they valued it as something positive, but if they experienced feelings of euphoria, associated to later relationship and visibility with their peers. Each time products are shown and related to learning, young people had an affective approach that generated feelings of joy. Similarly, the people who were providing emotional and affective support during the process were a source of joy. For the participants being involved in this situation led them to discover skills in software game design (30%), drawing (50%), teaching (47%), critical reading and writing (90%), knowledge and dissemination of the history of mathematics and engineering (60%). Within the young stories they express, besides historical issues, lived situations. The structure of the family was permanent, its immersion allowed to observe that the young people, engineering students from first to fourth semester, feel supported facing challenges.

Table II. Deductive and inductive categories

Deductive category	Inductive category	Entrevista	Focus Group observation	Cognitive Paradigm-Emergency	Triangulation
Emotions	Feeling of satisfaction	90% expresses feelings of well-being, socializes with enthusiasm, emphasizes the design, around the calculation present type of equations, methods in a detailed way (45%), the remaining 65% emphasize solution and take advantage of all the themes.	Team work, socialization of all the members, taking pictures to remember, some show each skill by exposing	Synchronous behavior in real time Increased space for interaction	Cognitive maturity expresses feelings Ability to understand consequence, associated with satisfaction, emotionality
	Feeling of pleasure and joy	Taste for what has been done, for generating applications, games from comics, for design, for content, narrated history, were given at the time of delivery of each work and in their socialization. Similarly, these feelings were due to cognitive conflicts before solving problems, which turned into joy when solving them.	As in the interview, this is the category that was repeated in the participants. Body and facial expression (movements, gesticulation, tone of voice) Joy in socialization	Causal consequence of the manipulation of symbols Autonomy Inter-agent epistemology	Subsequent interactions, affective bonds Situation generates feelings and thoughts of pleasure.
	Feelings of impatience	It's were reported at the proposal of work and in the period close to delivery of the final product.	The emotional distance that assists the team in facing the challenge and design, selection of characters in two groups, is the main cause in the focus group.	Adaptation-new self-organizing dynamics	Impatience in the absence of a supportive relational context Difficult moments in cognitive development
Conceptual memory for skills	Creative attribution	In 95% of the young participants, a thought was reported that alluded to it as creative responsibility, openness to the generation of knowledge and artistic works.	Execution of active memory skills in problem solving	Responses to perturbations Abstract symbolic	Creative thinking in the generation of ideas Associated to the profile and degree of cognitive development
	Cognitive architecture	Personification, in terms of valuing there is a positive connotation, participants spoke of the tranquility that it took them to learn through storydoing, to form networks, work teams, especially by mastering preconceptions.	Positive connotation is associated to focal group. Empathy and later mutual support, are causes. Sensory data processed by cognitive mechanism.	Motivation Semantic baggage Concurrent self-organization of a network	Improved peer relations, coaching for learning achievement Cognition implies embodiment
Emerging approach	Ongoing guidance support in and out of the classroom	Interactions between the system and the environment. Participants reported teachers as a fundamental part in cognitive, creative, affective and psychological accompaniment. Moderation of mutual interactions. Operational identity, translating environmental signals.	Each time a question was asked concerning circumstances experienced, participants brought up the people who accompanied them in the process	Emotional category and mentoring in each expression Codetermination	A climate of affection, permanence, security, exchange of values, beliefs, and behaviors that develop stability.

The cognitive area reported by the participants is of great importance to analyze the effects of storydoing on their conceptual and argumentative development. Regarding the category of internal attribution of responsibility for absences from class, it was found that very few participants did not attend, two of them with illness or participation in sports olympics. The cognitive maturity allows them to correctly differentiate external causes, it was also found

that the participants make a correct attribution of the events that occurred. It was found that the participants reported more tranquility and calm in the evaluation dynamics after the support of proposals, likewise some reported that the relationship with peers and teacher is better compared to other subjects seen or previous, Affection factor is mentioned, associated to empathy with teacher. Constants referring to the period after the elaboration of products responded networks of support in the process are indispensable to be an emotional and affective support.

Emotions are constituted in episodes of synchronized and interrelated changes of the organic subsystems on which each component depends in response to the evaluation of an internal or external stimulus, but relevant, by the organism, characteristics associated to the verbal reporting of a qualitatively different multitude of feelings, codified in a rich emotional vocabulary, constitutes an important aspect of emotional episodes of many scholars in the field of emotion, internal sensations necessarily experience of the consciousness, unique to the emotional experience of a particular individual. Scherer, [15] with respect to thoughts, is a cognitive or evaluative component that is immersed in the interpretation of the emotion but whose execution and control is in the part of the thought that processes the information using the capacity to evaluate the importance of an event or the capacity to connote how pleasant or unpleasant the information is [16]. In addition, there is the evaluation of the causes of an event and the consequences related to such information. In these components, the capacity for self-analysis to make aware of the abilities to rationally solve an event is crucial. And the process of comparing internal norms of the subject with external rules as a mechanism of self-regulation.

Fixed components for observing and connecting the presentation of the spectrum of emotion to a particular event, cognitive or evaluative, relates to the way information is processed using thought, memory, attention, previous learning, which is based on the central nervous system [17], physiological activation, is responsible for triggering all the organic responses required to respond to the stimulus, such as changes in body temperature, increased respiratory cycle, acceleration or deceleration of heart rate, internal constriction of the organs, among others, delegated to the vegetative system [18]. Motivation, in charge of preparing and directing

the action, which makes use of a neural subsystem of execution, motor expression, presents the function of communicating the emotional reaction that is being felt during that instant [19]. This is done through the voice (tone), body posture, and facial gestures. Emotional feeling or experience coordinates the entire individual and responds to formation and values from within the family [20], which interacts based on the individual's appreciation or personal assessment of a specific event [21], and then regulates the form, intensity and duration of the emotional expression. This is achieved through the categorization made by the person experiencing the emotion, the young person manages to conceptualize the story into a complex system of symbols about emotions obtained from the conscious experience, unique or particular, a component that is called feeling.

Conclusions

Emerging conceptual categories resulting from implementing storydoing were friendship, role, learning innovation, emotion, feeling, environment, family support. Emerging paradigms were synchronic behavior, inter-agent epistemology, self-organizing dynamics, abstract symbolic representation, concurrent self-organization of a network. The evaluative and attributional process plays a fundamental role in processing the information received from a stress event, and is also a key factor in organizing individual resources that are part of the subject, used for the resolution of internal conflicts such as that which arose from this change in learning.

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