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Letter to the Editor

The Affective Domain in the Teaching-Learning Process of Mathematics

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Abstract: This article presents a general overview of a problem that arises in our daily teaching work, the Teaching-Learning Process of the exact sciences, especially Mathematics. In the first section, a historical context is presented about the origin of the area of Didactics of Mathematics called Affective Domain, and then in the second section we introduce ourselves to the Socio-Epistemological Theory of Mathematics, analyzing the feelings and states of mind on which The theory of the Affective Domain is founded as well as its relationship with Mathematics and in the third section, we finally propose some research problems that are still open that can be addressed during our presentations in the classroom and deserve to be the subject of future research..

Keywords: Didactics of Mathematics; Teaching-Learning Process; Affective Domain; Constructs.

El ámbito afectivo en el proceso de enseñanza-aprendizaje de las matemáticas

Resumen: En este artículo se presenta una visión general de un problema que se plantea en nuestra labor docente diaria, el Proceso de Enseñanza-Aprendizaje de las ciencias exactas, especialmente de las Matemáticas. En el primer apartado se presenta un contexto histórico sobre el origen del área de Didáctica de la Matemática denominada Dominio Afectivo, luego en el segundo apartado nos introducimos a la Teoría Socio-Epistemológica de la Matemática, analizando los sentimientos y estados de ánimo en los que se fundamenta La teoría del Dominio Afectivo así como su relación con la Matemática y en el tercer apartado, finalmente se proponen algunos problemas de investigación aún abiertos que pueden ser abordados durante nuestras presentaciones en el aula y merecen ser objeto de futuras investigaciones.

Palabras clave: Didáctica de las Matemáticas; Proceso de Enseñanza-Aprendizaje; Dominio Afectivo; Constructos.

1. Introduction

Origin of the Affective Domain

Since Greek times, attempts have been made to explain people's behavior. Empedocles (495 - 425 BC) begins to formulate a theory, which Hippocrates (460 - 336 BC) later completes, based on bodily humours. Empedocles believed that the human body was made up of four elements. He related these four elements to the four bodily humors. Changes in these moods were considered the cause of certain mood states and character predispositions (Carrillo García, 2006).

Empedocles established the foundations of what would later be known as the Theory of the Four Temperaments, which would be expanded during the pre-Renaissance period by Robert Burton with his work The Anatomy of Melancholy. He and his contemporaries maintained that the bodily humor and, consequently, people's emotional states were susceptible to external influences such as age, diet, and passions. For a long time, psychology was dedicated to the observation, measurement, classification, and therapy of human behavior, but in isolation from the physiological point of view and, in turn, from the neurological one. Despite this, there have been significant contributions to psychology with works such as that of the neurologist Antonio Damasio (1994), who, based on his research, proposes the idea that reason is not so pure, that emotions and feelings are not They are intruders in the bastion of reason: they can be found entangled in its networks (Carrillo García, 2006). For this reason, today, it is established that the historical origin of the Affective Domain Theory has its origin in psychology, which focuses on cases of anxiety and how these affects academic performance. However, it was not until the late 1980s that Mcleod (1989) referred to the Affective Domain as "an exten-

sive range of feelings and moods (mood states), which are generally considered to be something other than pure cognition, and include as specific components of this domain, attitudes, beliefs, and emotions," this definition being the most accepted and still valid to this day even though there have been new proposals for this definition to cite some authors: according to Bloom et al. (1977), appreciations, preferences, beliefs, emotions, attitudes, values and feelings, and according to Lafortune and Saint-Pierre (cited in Gómez Chacón, 2000) attitudes, values, moral and ethical behavior, emotions, feelings, attributions, motivation and personal development and social (Martínez Padrón, 2005). As is known, Mathematics has been present in almost all the tasks of humanity, and, according to Galileo (cited in Barrow, 1997), it is the language in which the book of nature seems to be written. Perhaps that is why finding any phenomenon capable of escaping its descriptive power is complex. As an area of study, Mathematics has been considered the formal foundation of most disciplines, being present in many of the curricular structures that outline the academic training of children, adolescents, and adults (Martínez Padrón, 2005).

This combination of the omnipresence of Mathematics in all areas of knowledge, in addition to its complexity and abstraction in conjunction with the feelings and emotions of human beings, has caused it to be stereotyped throughout history (only studied by "intelligent" people."), causing animosity in learning them by most people, including students.

Socio-Epistemological Theory of Mathematics

There are different definitions of Mathematics Didactics, among which we can mention:

• Discipline that studies different aspects that intervene in the Teaching-Learning Process. (Royal Spanish Academy, 2014).

• Scientific discipline whose object of study is the relationship between knowledge, teaching, and learning of the contents of mathematics (Baldor, 2004).

The Didactics of Mathematics, as such, then focuses on purely cognitive issues, to the point where its research has focused exclusively on Teaching - Teacher - Student Learning Processes. Suppose at this moment, we begin to analyze issues that go beyond the cognitive aspects. In that case, we must introduce ourselves to the epistemological factors, the Socio-Epistemological Theory of Mathematics. Cantoral (2013, 2014) defines this theory as the part of epistemology that deals with the study of didactic phenomena linked to mathematical knowledge, assuming the legitimacy of all forms of knowledge, whether popular, technical, or cultured, since he considers that they, in Together, they constitute human wisdom. From this context, the Socio-Epistemological Theory of Mathematics addresses the metacognition of Mathematics from two guidelines:

• Systematizes sociocultural positions of education.

• Theoretical lines that allow us to understand the influences that affect, and attitudes have on mathematical learning.

Therefore, according to Cantoral (2013):

• Mathematics is a social construction; analyzing the history of Mathematics, each civilization proposed its own Mathematics according to its needs, feelings, and, most importantly, its beliefs.

• When considered socially, elements of culture intervene, for example, the mathematical writings in cuneiform writing of the Babylonian Civilization or the Egyptian hieroglyphs found on papyrus papers. Both are examples of the elements specific to each culture: the clay from the Tigris and Euphrates rivers in Mesopotamia and the plants from which papyrus paper was obtained on the banks of the Nile River.

• As we mentioned in the previous section, the history of humanity tells us, from a psychological point of view, that affects dominate the sociocultural characteristics of human beings and, therefore, their understanding and construction of the Teaching-Learning Processes. of Mathematics.

Going deeper into the understanding and construction of the Teaching - Learning Processes of Mathematics, there is an inverse correlation between the age of human beings and the level of acceptance of Mathematics; again, we quote

Mcleod (1992), who establishes that students express a negative relationship as the years go by. In other words, as we advance from kindergarten to higher education, most human beings experience feelings of denial, stress, anxiety, and helplessness when studying subjects related to Mathematics, a series of emotions.

Gómez Chacón (2000) tells us that some of these effects are firmly rooted in the students, so they are not easily displaceable from the Teaching-Learning Processes. In this sense, effects are not only inherent to students but also to teachers; therefore, when, as teachers, we identify cases of blockage in Mathematics or any other exact science, it is advisable to channel the student to an appropriate instance, such as a specialist in the Affective Domain or psychological care. The Affective Domain Theory of Mathematics is based on three basic constructs (Mcleod, 1992), although currently, even more constructs that have not been fully defined have been proposed, such as resilience. Each of these three constructs is defined below (Marban Prieto, 2016):

• Emotions. Rapid changes of feelings and vigorous intensity. This leads students to a fear of Mathematics or a satisfaction in solving a problem.

• Beliefs. Cognitive domain about Mathematics and oneself about the teaching of Mathematics and the social context. Here, questions arise: Do I could solve a problem? Is Mathematics useful?

• Attitudes. Evaluative predisposition (positive or negative) that determines personal intentions. For example, a student may say, "I like Mathematics," or a teacher: "I like teaching Mathematics."

Leder and Grootenboer (2005) establish the following for these constructs:

• That their descriptors can be exchanged.

• Each of them is a hypothetical constructor.

• They are acquired through the socialization process.

• They are transferable.

• They play a triggering role in the acquisition of knowledge.

Finally, regarding attitudes, these are not defined in educational programs (curriculum frameworks) as defined by Marban Prieto (2016), but rather as a series of desirable qualities of any student considering only purely academic aspects, underestimating the Affective Domain. (Casis, 2021).

Areas of opportunity in the Affective Domain in Mathematics.

The European Society for Research in Educational Mathematics (CERME) established at the CERME 12 Congress the following lines of research that must be addressed in the classroom (Gargonza, 2021):

• Definitions and inclusion of affective constructs and their relationship, particularly resilience and self-efficacy.

• Development of instruments for measuring constructs such as rubrics, questionnaires, or scales, to name a few examples.

• Inquire into the role of emotions, attitudes, values, and beliefs in Teaching-Learning Processes when considering problem-solving, problem creation, theorem demonstration, creation of teaching materials, or the inclusion of information technologies.

It is essential to mention that the return to face-to-face modalities with students is very favorable for developing these investigations, which, practically with online models, is much more challenging.

2. Conclusions

In conclusion, among the factors that influence the appearance of affection towards Mathematics, the following can be mentioned:

- The abstract and impersonal character of mathematics.
- The attitude of teachers towards students, especially those with learning difficulties.
- The methodology used in teaching Mathematics subjects.
- The family and social environment influence the stereotypical image of Mathematics.
- The same society is responsible for promoting and disseminating that Mathematics is difficult, complicated, and intended for "intelligent" people.

Without a doubt, the study of the Affective Domain not only of Mathematics but of any area of scientific knowledge is an area of opportunity that should not be omitted since, if treated adequately by students and teachers, it would potentialize better academic performance, a lower index of failure, lower student dropout and an educational program with even greater recognition. Finally, it is important to provide follow-up in our teaching practice for those students who have learning problems and channel them to the corresponding instance. It is also important that teachers feel comfortable with the class they teach (that is, a pleasure in teaching it and a mastery of it) since, if this is not met, they can transmit stress to the group and, therefore, a drop in the academic performance of the students.

3. Conflicts of Interest

The authors declare no conflict of interest.

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