# Epistemological Beliefs in Relation to The Content, Teaching and Learning of Mathematics Teachers

## Creencias epistemológicas en relación al contenido, enseñanza y aprendizaje de profesores de matemáticas

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Artículo de investigación científica y tecnológica

***Abstract*— One result of the research is the paper "integral intervention of mathematics' teaching and learning processes" developed in a public university in Colombia, Latin America. The analysis of the epistemological beliefs of a group of academics from the Mathematics Department, who teach subjects to engineer and technology students is presented. We performed descriptive and quantitative cohort research. The objective was to identify the beliefs regarding mathematics' content, learning, and teaching. The 56 participants were included from a voluntary sample, in which the majority were engineers. A questionnaire adapted from Vizcaíno, with a specific domain of mathematical beliefs, approached from the multidimensional model de Schommer was used as a measuring instrument. The results showed that, in general, the teachers' system beliefs are naive or simple and in some specific topics sophisticated. It was observed a percentage of teachers who didn't assume a precise position in their beliefs when responding neutrally to the questionnaire, which could be interpreted as a lack of reflection on their teaching practice, which revealed the need to generate discussion spaces for promoting reflective practices that improve the mathematics' learning. Likewise, the need for training in mathematics' history, epistemological knowledge, and didactics was evidenced, which promotes better mathematics teaching practices.**

***Index Terms*— Epistemological beliefs, mathematical learning, mathematical knowledge, mathematical teaching**

***Resumen*— El artículo es uno de los resultados de la investigación "intervención integral en los procesos de enseñanza y aprendizaje de la matemática", desarrollado en una universidad pública en Colombia. Aquí se presenta el análisis de las creencias epistemológicas de un grupo de profesores del Departamento de Matemáticas de dicha universidad, que orientan asignaturas en la formación a estudiantes de ingenierías y tecnologías. La metodología de la investigación fue cuantitativa de corte descriptivo, la cual permitió identificar dichas creencias de los participantes con respecto al contenido de la matemática, su aprendizaje y enseñanza. El estudio se hizo con una muestra voluntaria de 56 sujetos, los cuales en su gran mayoría son ingenieros y se utilizó como instrumento un cuestionario adaptado de Vizcaíno, de dominio específico de las creencias matemáticas, abordado desde el modelo multidimensional de Schommer. Los resultados arrojaron que, en general el sistema de creencias de los docentes es ingenuo o simple y en algunos temas puntuales sofisticados. También se observó un porcentaje de docentes que no asumieron una postura precisa en sus creencias al responder neutral a las preguntas del cuestionario, lo que se pudo interpretar como falta de reflexión de su práctica docente; lo que mostró la necesidad de generar espacios de discusión que promuevan prácticas reflexivas que redunden en mejorar el aprendizaje de la matemática. Asimismo, se evidenció la necesidad de la formación en historia y didáctica de la matemática, así como en el conocimiento epistemológico de conceptos matemáticos que promuevan mejores prácticas de enseñanza de la matemática.**

***Palabras claves*— Aprendizaje de la matemática, conocimientos matemáticos, creencias epistemológicas, enseñanza de la matemática.**

## I. INTRODUCTION

THE conception of teaching has been changing , implying changes in the role of the student and the teacher; However, in most cases the teacher is still the center of the process, it is who transmits or communicates knowledge and the student is a passive being, sometimes forgetting the events and activities that arise within the classroom, which makes of it a complex space, in which the beliefs and actions of the teacher are not taken into account in the phenomenon of didactic transposition.

The classroom is a complex space, where events occur that allow the development of analysis, research and understanding of teaching and learning processes. This complexity can be approached from studies about the beliefs and conceptions that teachers have about the knowledge, learning and teaching of mathematics and its actions in the classroom, the relationship between saying and doing, which allows interventions in its task, to promote meaningful and productive learning,

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responding to the new educational paradigms and demands of the globalized world.

Education is not alien to these demands, for example, the standardization of national and international tests to which students are subjected, and that for Colombia the results are not the best, particularly in mathematics.

It is common for many university students not to pass different mathematics subjects, despite the efforts that are made to reduce this problem. It is known the dissatisfaction of many teachers and professionals in terms of the durability and use that students make of the knowledge they acquire. Some complaints concern that they forget what they learned or almost everything, or are uncapable to use knowledge, to recognize or apply [1], a few find the various features of a concept and its representations; most try to memorize, without being interested in knowing what it is, why it happens, how it is, or what it is for. In such learning conditions, the student finds it almost impossible to interpret, integrate and apply knowledge [1].

The accumulation of difficulties in the learning of mathematics generates the impossibility of developing logical, critical and mathematical thinking, which allows achieving the professional competences with which the university has committed. The solution that many teachers have adopted is the approach of tasks that require low level intellectual operations , which involve only rote knowledge , understand a meaning or apply a concept or a rule to solve a problem; forgetting the need to propose situations with students to develop high - level intellectual operations, enabling them to approach the construction of knowledge, apply it and make meaningful learning.

The previous problem has led to various studies and research, from teaching to learning mathematics. Although, for a couple of decades the problem has changed its purpose and this is how attention has been focused on knowing the beliefs and conceptions that teachers and students have about mathematics, its teaching and learning, because "The conception of what mathematics is affects the conception of how it should be presented. The way to present it is an indication of what the teacher believes it is essential... The matter then there’s or what is, what is the best way to teach? but what about what is really mathematics ...?

In Latin America, research has been carried out on teachers' beliefs about mathematics, including studies in Argentina by Dodera, Burroni, Lázaro and Piacentini, 2008, and in Peru by Moreano, Asmad, Cruz and Cuglievan, 2008. In Mexico Inguanzo - Arteaga, 2010 and in Cuba, Vizcaíno, 2015. These last two have in common an instrument built by the former guided by the central concepts of Schommer's multidimensional model that addresses them from epistemological beliefs, "A set of ideas dynamic and non-verifiable personal data that teachers can have about teaching, learning and the nature of knowledge “.

For Schommer, the epistemological beliefs are:

A multidimensional construct constituted by a belief system that the individual has about the nature of knowledge and learning, which are relatively independent of each other. It is a system because there is more than one belief, it can be considered more than one dimension of the themselves and is more or less independent because a person can have the at the same time some beliefs at a sophisticated level and others at a very high level simple, they possess an asynchronous.

Implicit in this definition and according to the findings, is the idea that each belief may or may not develop at a different pace. It cannot be assumed that if individuals are mature in a belief, then they are necessarily mature in all their epistemological beliefs. Vizcaíno, talks about the "irregular levels in the development of the system of epistemological beliefs about the mathematics of these teachers who tend to the poles of ingenuity and sophistication", referring to the results found in mathematics teachers’ high school.

The model multidimensional Schommer, Gomez and Silas, and -Arteaga Inguanzo, suggests that simple or naive beliefs are based on experience rather than on theoretical foundations that allow provide opportunities for productive learning and significant. Sophisticated beliefs are based on theoretical foundations, which imply reflective practice. Schommer, Calvert, Gariglietti, & Bajaj [2], point out that the conformation of "higher or sophisticated levels of epistemological beliefs, occurs as higher levels of schooling are acquired. This assumption highlights the value that is given to the influence of context on the development of beliefs “.

For Schommer [3] The teacher's beliefs are: A set of dynamic and unverifiable personal ideas that can be have teachers about teaching, learning and the nature of knowledge; these ideas can govern their behavior, decisions they take in the classroom and the way they relate to the students.

Originally model multidimensional raises five beliefs towards knowledge and learning. Towards knowledge: beliefs about (simple to complex) structure, stability around knowledge (certain and uncertain) and beliefs about the source of knowledge (authority - no authority). In learning, the learning speed (fast or gradual) and the ability to learn (fixed - improvable) are identified.

The contributions of Inguanzo-Arteaga to this model were in the construction of a questionnaire of beliefs for university professors where the category of beliefs in teaching is added, which includes beliefs about planning, class activities and the self-perception of skills. In its origin the questionnaire was conceived as an instrument of general domain to evaluate the teachers' beliefs. Later, Vizcaino adapted the same questionnaire for high school mathematics teachers, and in our research was validated with experts to suit university professors guiding mathematics engineering and technology programs.

## II.METHODOLOGY

It is a descriptive quantitative research court, which allowed identify and describe the beliefs of a group of teachers that guide the formation of mathematics or engineering at the Universidad Tecnológica de Pereira, a volunteer sample of 56 subjects. For which a questionnaire of specific domain of the mathematical beliefs was used, approached from the multidimensional model of Schommer, with an analysis of the proportions of the tendencies in the epistemological beliefs of the participants.

The instrument the selected one is a questionnaire that was adapted from the one proposed by Vizcaíno [2], an adaptation that consisted in suit the language according to our cultural context. Instrument that had been adapted from the one proposed by [3], which was inspired by Schommer's multidimensional model.

The questionnaire consists of 50 items or statements that correspond to three categories that correspond to the teachers' beliefs about knowledge, learning and teaching. Beliefs about mathematical knowledge have five variables: structure, stability, source, utility and nature of knowledge. The beliefs about learning expressed in the variables such as ability to learn, speed with which learning occurs, processing styles and evaluation of learning. Finally, beliefs about teaching were addressed from class planning, classroom activities and the self-perception of teaching skills.

To answer the questionnaire, we used a Likert scale with a rating of 1 to 5, where 1 is totally disagree and 5 is totally in agreement.

## III.RESULTS

The results of this research was focus to identify and describe the system of epistemological beliefs of teachers involved about mathematical knowledge, learning and teaching characterized by a system of simple or naive beliefs and sophistical or structured or the which is also called productive, which for Vizcaino is understood as "the conception of mathematical knowledge as abstract, structured, complex, applicable and transferable ".

## IV.BELIEFS ABOUT MATHEMATICAL KNOWLEDGE

From the perspective of model multidimensional of Schommer, updated in Latin America with the contributions of Inguanzo -Arteaga and Vizcaíno, for the analysis of the construct of epistemological beliefs about knowledge are considered those on the structure, stability, source, utility and nature of knowledge.

The following table shows the items on which the questions were centered for each one of the variables that allowed to describe the belief system of the professors participating in the research with respect to mathematical knowledge.

TABLE I
VARIABLES THAT ALLOWED TO DESCRIBE THE BELIEF SYSTEM OF THE PROFESSORS

| **Structure** | **Stability** | **Source** | **Utility** | **Nature** |
|---|---|---|---|---|
| Isolated - integrated | True - tentative | Authority - No authority | Transferable - Non-transferable | Abstract - concrete |
| | Static - dynamic | Questionable - Not questionable | Current vision - future vision | Scientific foundation - common sense |

In this article we will present answers to the assertions about stability and the nature of knowledge of mathematics.

## I.V. STABILITY

Beliefs about the stability of knowledge fluctuate between certainty and uncertainty. Schommer he sees it as a continuum that moves from a fixed perspective to a more fluid one and a progression is understood from believing that absolute truth exists with certainty until the position in which knowledge is tentative and can evolve.

The knowledge is not exact, what is elaborated to a certain point is a series of predictions, but the uncertainty always remains. Although the laws that dominate nature are accurate, not the knowledge that you have about them. In this sense, in this investigation, we investigated about beliefs about the stability of knowledge when it is true or tentative.

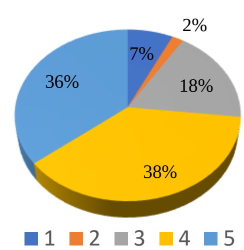


Fig. 1. The theoretical explanation that supports the contents of mathematics is true.

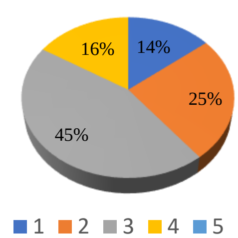


Fig. 2. The theoretical explanation that supports mathematics is intuitive and requires accumulating more evidence.

Fig. 1 shows that 36 and 38% of teachers surveyed strongly agree and agree with the theoretical explanation that supports the contents of mathematics is true. While the Fig. 2 shows that 45% of the sample is declared neutral regarding the belief about: the theoretical explanation that supports the mathematics is intuitive. It also draws attention in the distribution proportional to the positions of agreement or disagreement, which can be interpreted as a lack of knowledge about the topic or a difficulty in understanding l a question, which also generates questions such as: do we really know mathematics? do we know the mathematical objects that are taught?, are mathematical knowledge finished? The results show simple or naive beliefs about the stability of knowledge.

## V. NATURE

The nature dimension of knowledge is also addressed in the literature as "nature of science" (Acevedo-Díaz, Vázquez-Alonso, Acevedo-Romero, & Manassero -Mas, 2005) and taken up by Inguanzo -Arteaga (2010) from this perspective, is the one who proposes to evaluate the teacher's beliefs about the nature of scientific knowledge seeing its abstract component.

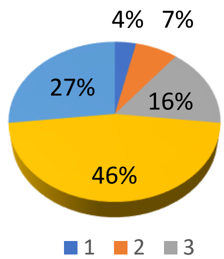


Fig. 3. Common sense complements the knowledge learned in the mathematic

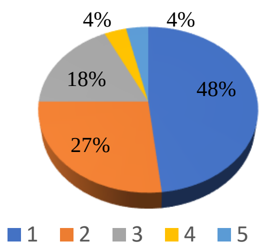


Fig. 4. To access the knowledge of the Mathematic I put side common sense.

Therefore, with respect to the nature of knowledge, it was investigated to know the beliefs about the scientific, abstract or concrete can be; for the analysis four questions were considered, which alluded to the scientific of mathematical knowledge.

Fig. 3 shows that 46% of teachers agree common sense to consider that complements the knowledge learned in mathematic. What is corroborated by the belief that to gain access to mathematical knowledge common sense must be set aside, 48% are in total disagreement, Fig.4, answers, which show a sophisticated belief system, considering the historical development of mathematical knowledge.

Continuing with the exploration of the beliefs of the nature of knowledge, if it is scientific or of common sense, it was found:

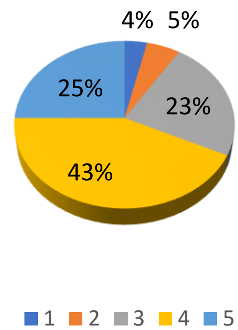


Fig. 5. Some knowledge of athematic m has been derived from common sense.

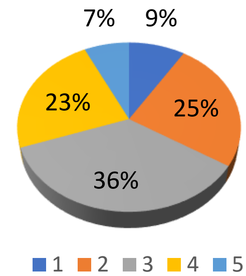


Fig. 6. Own contents of the athematic m have been derived from scientific research with strong empirical support.

Fig. 5 shows that 43% of respondents said they agreed and 25% agreed with, Mathematical knowledge has derived from common sense. Although it focuses attention on that 23% have a neutral position, which when added to those who disagree or strongly disagree account for 32% of respondents, generating doubts about their beliefs about the scientific nature of mathematical knowledge, or you might think that they did not understand the question? Likewise, from Fig. 6 it is observed that 36% have a neutral position in believing that the contents of mathematics have been derived from scientific research or have a strong empirical support. Answers that seem to be in contradiction with statements 8 and 13, Fig. 3 and 4. The dispersion in the answers leads one to think that historical, philosophical and epistemological of mathematics. Therefore, deduce and this is a system or simply naive beliefs.
In the same way, by continuing to inquire about beliefs about knowledge in this case, if abstract or common sense, it was observed that 43% show a neutral position with respect to the question whether the content of mathematics are abstract, which added 30% of those of agreement or complete agreement lead to infer that the belief system is naive, no theoretical framework that can endorse such a position, as shown in the following graph.

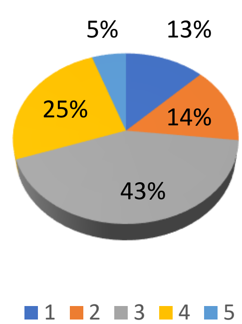


Fig. 7. Mathematical knowledge is abstract or common sense

The responses raise concerns about the pertinence of teaching mathematics is being offered for engineering and technology, what operations are thought to develop or strengthen privileging? Is the teaching only algorithmic and procedural? Is there no contextualization of concepts?

This allows you to highlight diversity in s response s and the tendency to ingenuity and simplicity of some of these, which could be setting aside the two aspects that involves the nature of knowledge: what is knowledge and how It acquires, which would have implications in teaching and therefore in learning, because when conceiving abstract mathematics, one might think that its teaching is limited to transmitting only formulas, equations and algorithms? Its abstract nature does not prevent its contextualization and modeling of reality and of different physical, scientific and engineering phenomena.

## VI. BELIEFS ABOUT LEARNING

According to recent cognitive theories, learning "is an active and constructive process that is influenced by the mentality, beliefs and preconceptions individuals"[3].

The variables that were considered to know the belief system of teachers with respect to student learning about mathematics were: skill, styles, speed and evaluation. The following table shows the items that were analyzed in the research, although this article considered the beliefs about the speed with which students learn.

TABLE II
VARIABLES BELIEFS ABOUT MATHEMATICAL LEARNING

| **Ability** | **Styles** | **Speed** | **Evaluation** |
|---|---|---|---|
| Effort – effortless<br>Innate ability - Not innate | Convergent - divergent | Fast - gradual - slow | Criterion - norm<br>Evaluation – qualification |

## VII.SPEED

"... learning ... slowly acquired through multiple exposures to information, continuous practice and distributed the required skills and reflection about the mental processes and procedures required for solving problems" [4], " The beliefs about learning are gradual and systematic " [5].

The beliefs of the participating teachers regarding the pace or speed with which students learn, whether it is fast, gradual or slow, is shown in the following graphs.

As, 43% totally disagree, 30% disagree with the statement regarding the student who is slow to learn the mathematic cannot change his pace of learning. Again, 20% neutral in its response leaves concerns such as: neutral is that the question is not understood? they do not want comptometer with an answer? it focuses on teaching the teacher or content and leaves aside the student and his learning? questions that are not unrelated to the answer to question 41 of Fig. 9, where the answer is 41% neutral. This leads one to think is there a lack of theoretical knowledge and scientific foundations about learning? Does it concern, from the teaching of mathematics, the learning of mathematics? Is teaching to communicate? Is teaching not conceived as a dialogical relationship with the learning process?

The previous results show that the beliefs of the participating teachers are not far from those revealed by the research of Azcarate and Moreno on the conceptions and beliefs of a group of 6 university mathematics professors on the teaching of structural equations, it was reflected that " the teachers aimed to conceive the apprentice as a mechanical executor, who learns by imitation, considering him a passive receiver of mathematical knowledge. Relying on these beliefs, the teachers to justify planning decisions, choice of content and tasks learning " [2].

The responses of the participating teachers show a naive or simple system as regards the belief about the speed with which students learn.

## VIII.BELIEFS ABOUT TEACHING

In relation to the beliefs of teachers about teaching and learning we also observe that the manifest variables that explain the construct show an explanatory relationship of significant type. This we refer once again to the approaches of Moreno, (2000), Usó (2007), Estebaranz (2008) and Pratt (2008) in the sense of the importance of contemplating Teachers' beliefs when explaining teaching processes and learning and the impact of these on what happens in the classroom [3].
The beliefs about the teaching of mathematics were made from three variables, planning, classroom activities and self-perception of skills, which are described from the items shown in the table, although this article focuses attention on class activities.

TABLE III
VARIABLE BELIEFS ABOUT THE MATHEMATICAL TEACHING

| **Planning** | **Class activities** | **Perception of skills** |
|---|---|---|
| I plan - I do not plan<br>Clarity in the objectives - without clarity in the objectives | Individual work - team work<br>Feedback - No feedback<br>Provides instructions - Encourages construction by the student<br>Expository teaching - participatory teaching | Needs updating - No update needed |

## IX.CLASS ACTIVITIES

The activities in class from promoting individual work or team work; provide constant feedback, it provides clear instructions, enabling participation, allow knowledge construction.

" Some classroom activities can contribute to developing a better-quality educational practice, such as beliefs about the importance of the teamwork method " [5].

Beliefs about classroom activities are shown from individual or team work.

## X.INDIVIDUAL WORK - TEAM WORK

Beliefs about individual or team work explored from the questions or statements: The good teacher must accept that students learn more mathematic working individually with others and good mathematics teacher should use teaching methods that maximize the interaction teacher - student and student - student.

Regarding the belief that teachers have surveyed about d e, students learn more by working individually with other, 30% say disagree, strongly disagree 27, showing a sophisticated belief. However, 25% neutral, as in other questions generates doubts, for example: neutral would you say that the teacher is not interested in knowing if the student learns or how he learns? or what do you plan? What activities do you propose in class? Do you have any intention, rather than fulfill a program? Does education enhance the integral development of the individual?

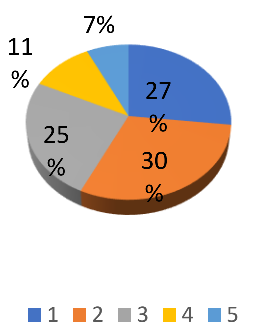


Fig. 10. The good teacher must accept that students learn more mathematic working individually with others teacher, to achieve better dynamic teaching mathematic.

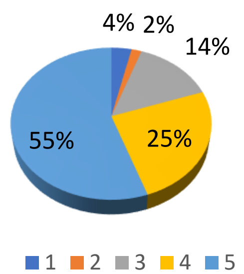


Fig. 11. Good teacher mathematic should use teaching methods that maximize the interaction teacher - student and student - student.

While Fig. 11 shows that most respondents, 80%, believe that the relationships that arise in the classroom are generated by the teachers, by expressing agreement and total agreement that the good teacher m athematic should use teaching methods that maximize teacher - student interaction and student - student. Again, there is a figure, 14% neutral in the answer and again generate doubts about the beliefs that are held about teaching, will it be that they conceive it beyond simply transmitting knowledge? Do they comply with some contents? Is there a lack of knowledge about the joint construction of meanings? Although the neutral percentage is low, approximately 8 teachers, it does not stop worrying, since , although each one only had a group of 30 students, it is talking about 240 life projects that are being denied the possibility of learning from Significantly, and what this implies in the development of thought, for example, use prior knowledge to approach the shared construction of knowledge, revise, modify, enrich, relate theories to establish connections and new relationships between them.

## XI.PARTICIPATORY TEACHING - EXPOSITORY TEACHING

" Each teacher has his own personal perspectives, which can be based on the knowledge he has acquired from his professional studies; This gives him the guidelines to make decisions about how to teach, and almost always he does this automatically and without a long reflection " [3].

The decision-making about the teaching, their beliefs, was analyzed from two questions, one related to the participation of the students and the encouragement for it and the other in the master class.

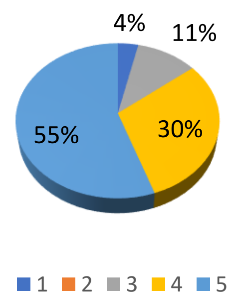


Fig. 12. In the classroom it is advisable to allow the participation of both students and teacher, to achieve better dynamic teaching mathematic.

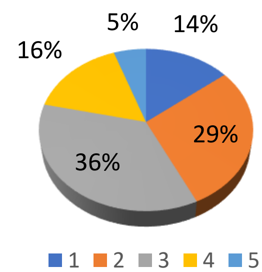


Fig. 13. The master class It is the most appropriate way to transmit knowledge to students mathematic.

It can be seen from Fig. 12, question 36, that 85% of the professors surveyed stated that they agreed or totally agreed that the intervention of both teachers and students achieved better teaching dynamics; which leads to a sophisticated belief system. Answers in apparent contradiction with those of teamwork, graph 10. However, it seems corroborates by 36% to manifest neutral response to the statement about: the master class is the most appropriate way to transmit knowledge. Percentage that returns to draw attention and generate questions about the belief system of the participants in relation to teaching. This neutral percentage in Fig. 13, could be interpreted: is there no interest in the teaching process? What are the theoretical referents that are held about teaching? In what theorists do they base the teaching that they lead to the classroom today? answers that again show a simple or naive belief system.

## XII.CONCLUSIONS

The description of the data obtained when inquiring about the beliefs held by professors of the Department of Mathematics about the knowledge, learning and teaching of mathematics allows us to reach the following conclusions:

In general, the system of epistemological beliefs is naive or simple in relation to beliefs in the three dimensions analyzed, which leads as theory says to think that teaching in most cases is done from experience, without theoretical foundations, which does not promote or offer significant learning opportunities and does not lead to reflections on teaching practice.

The neutral answers lead to the conclusion that the questionnaire was not taken responsibly, which can be interpreted as a lack of commitment both with the institution and with the guidelines given by the academic authorities. Also, they may show a lack of understanding in the questions, or of knowledge in the epistemology, history and didactics of mathematics; what generates concern because most of the respondents have a master's degree in mathematics education or doctor's degree. Also, it can be interpreted as lack of awareness regarding the need to reflect on the teaching practice and what it implies.

The results show the need for constant updating on topics such as philosophy, history and mathematics education and a permanent training in topics amateurs with teaching m athematic for the training of engineers and technologists.

Bearing in mind that teachers' beliefs regarding teaching affect their performance in the classroom, and therefore learning, the results show the need to reflect both pedagogical and teaching practice, since a better understanding of beliefs can allow teachers to be in constant learning and search for teaching strategies that contribute to improve the learning of mathematics.

There is a need to study the coherence between doing and saying, which allows progress towards a consolidation of didactic models for the teaching of mathematics at the Technological University of Pereira.

## REFERENCES


[1] M. Silvestre, "Learning, education and development". *Havana - Cuba: Editorial pueblo y educación*. 2001.

[2] A.Vizcaíno, "Epistemological beliefs about mathematics and academic performance". Santa Clara. Doctoral Tesis. Santa Clara: Central University "Marta Abreu de Las Villas". 2015.

[3] G. Inguanzo-Arteaga, "Beliefs of professors at the undergraduate level about the nature of knowledge and teaching and learning processes". *Doctoral thesis. Puebla: Instituto Tecnológico y de Estudios Superiores de Occidente.* 2010.

[4] L. Gómez-López and J. Silas-Casillas, "The epistemological beliefs of secondary school students and teachers". *Mexico: Instituto Tecnológico y de Estudios Superiores de Occidente*. 2012.

[5] AC. Vizcaíno Escobar, "Adaptation of a questionnaire to evaluate the epistemological beliefs about the mathematics of secondary school teachers". *Santa Clara: Central University "Marta Abreu de Las Villas"*, Universidad de la Habana. 2013.

[6] D. Chassapis, "Integrating the philosophy of mathematics in teacher training courses". *Editors, Karen François. Jean Paul Van Bendegem. Springer Science and Business Media*, LLC. pp. 62, 2007.



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Ha publicado artículos en revistas especializadas nacionales e internacionales, los últimos son: (1) La observación de la práctica pedagógica de estudiantes-practicantes desde las dimensiones disciplinar, ético-política y procedimental. (2) Cambios en la práctica docente en la enseñanza de las matemáticas aplicando la metodología de indagación. (3) Aprendizaje basado en problemas en didáctica de la matemática, caso: solución de ecuaciones cuadráticas por el método de aplicación de áreas, mediado por Cabri Geometre II plus. (4) Construcción y uso del concepto combinación lineal de vectores. (5) Algunas Concepciones de la Práctica Pedagógica en estudiantes practicantes de X semestre del programa Licenciatura en Matemáticas y Física de la Universidad Tecnológica de Pereira. (6) Algunas estrategias para mejorar la articulación de la educación media con la superior.

Autora de los libros: La indagación en la clase de matemáticas – investigación con base en la práctica (2018). Álgebra lineal desde un enfoque desarrollador (2015). Lecciones de Álgebra Lineal. Libro de trabajo del estudiante y guía didáctica para el docente (2010). Introducción a la programación orientada a objetos y el lenguaje Java (2004). Programando con Java – un recorrido rápido – (2000).

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