

Teaching-learning process in mathematics: Scope and importance of previous knowledge

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Abstract—Learning constitutes a weapon provided by nature, from our birth to use it during the course of life in the development of the human species, this process is nourished with knowledge of daily work; the more knowledge is incorporated, the better the students' rational development will be. Currently there are difficulties with teachers, who do not give the required importance to the previous knowledge that students must have in the subject of mathematics, so the objective of the work is to investigate the teaching-learning process in mathematics, appreciating its scope and importance from previous knowledge in Higher Basic Education and Baccalaureate. In the present investigation, descriptive observation was used, the inductive deductive method to characterize the teaching-learning process, in addition, the quantitative-qualitative was used to evaluate the survey, which was applied to a population of 50 teachers who teach exact science, analysis-synthesis and historical-logic were also used. It was obtained as a result that the teachers are not busy, nor worried about the knowledge of the subject with which their students arrive; then most of them found the transmission of knowledge to the students of exact science complex.

Keywords---Teaching-learning, mathematics, previous knowledge, significant learning, exact sciences.

I. Introduction

The responsibility in acquiring the knowledge used by students daily and obtaining it, has its origin from the time the child is born, who begins to crawl, reach for objects, as well as walk and speak, being one of the elementary attributes of learning, useful for development, verbal communication, skill development, as well as relative growth and personal training.

Most of the learning is acquired during growth, being the result of the practice and experimentation of multiple positions, which is permissible to understand and learn during the growth of various activities, to name a few: reading and writing, therefore they are conceived as acquired and interrelated with the known phonological representations (Ríos & Cardona, 2016). Being able to reach this position, it is outlined that the acquisition of mathematical knowledge from philosophy and psychology, focuses and describes the action from the perspective of the individual who reasons and learns.

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In the field of mathematics, the aforementioned is not distinguished from a mere exception, being an important teaching-learning process, resulting in one of the topics to be dealt with constantly in the manifestations that damage education in general, notably in these moments you want to achieve that the teacher can show and teach their knowledge, abilities, skills; but also the attitudes, the values provided by competition in a wide and suitable environment.

The students have been able to previously and personally build their knowledge before starting the teaching process directly with the teachers, so they must continue with what they have learned, in addition to building a new meaning, which is why in the educational environment the individual characteristics of the students and representations of previous thoughts.

Teachers must encourage students to promote motivations related to learning, research activities that allow them to face challenges. The student plays a leading role in the educational process and not the educator; reason why the teacher must need a careful capacity for observation, exploration, so that the various reactions manifested in the students, so that the process of knowledge construction is not altered (Morales, 2009).

Beginning in the 2000s, mathematics education in the world has been marked by the constructivist paradigm. The key ideas of this paradigm come from or have their roots in the research of many authors, among which stand out: Piaget, Wallon, Vygotsky, Bruner, Dewey, Gagné, Ausubel, Novak and Hennessey, among others. All of them have agreed that learning any school content supposes, from the constructivist conception, to attribute a meaning and to construct the meanings implied in said content, and this is not carried out from scratch.

Outstanding research presents statistical data on the high rate of failure in mathematics, which is not specifically restricted to one institution; the situation is complex, resulting in a problem that generally harms each and every country in the world, as well as students at all levels, causing the majority of students to delay and drop out of significant numbers of students. (Morales, 2009).

In Ecuador, in the educational context, competences in mathematics have acquired an important importance motivated by the increase in the level of demands on students and citizens in general and the need to apply training throughout life, where it is decisive for professionals of these times the ability to apply knowledge in order to solve specific professional situations and problems that arise in the exercise of the profession. (Beltrón, Hernández, & Carrasco, 2019)

Considering the aforementioned, the objective of the work is to: investigate the teaching-learning process in mathematics, appreciating its scope and importance from previous knowledge.

II. Materials and methods

In order to safely direct this research and provide conscious responses to the unknowns mentioned, a detailed observational-descriptive-cross-sectional study was carried out to characterize the essential teaching-learning process of mathematics, taking into account the importance and scope and impact of previous knowledge, a population of 50 teachers was taken who impart exact science in the Educational Units of the Chone canton.

The analysis-synthesis method, the inductive-deductive method was used to make an evaluation of generalizations; the historical-logical, for the determination of the historical antecedents of the development of the teaching-learning process in the area of mathematics, for the logic of the investigative process developed. The documentary analysis was used to achieve the objectives and to know the goals to be fulfilled at the end of the study plan. Observation allowed knowing the reality through direct perception of the teaching-learning process of the subject in question.

III. Analysis and discussion of the results

Successful studies referring to the exact sciences project that historians and researchers in their references have promulgated that the men of the prehistoric in addition to counting physical objects calculated abstract quantities such as (time, days, seasons, years and others) positions that gave way to the beginning of the mastery of Elementary Arithmetic that would include mathematical operations.

Making a detailed analysis of the historical background of Mathematics studies, mentioning in them the most outstanding scholars and their contributions as a valuable recognition and at the same time the benefit of the same to the teaching-learning process shown in figure 1.

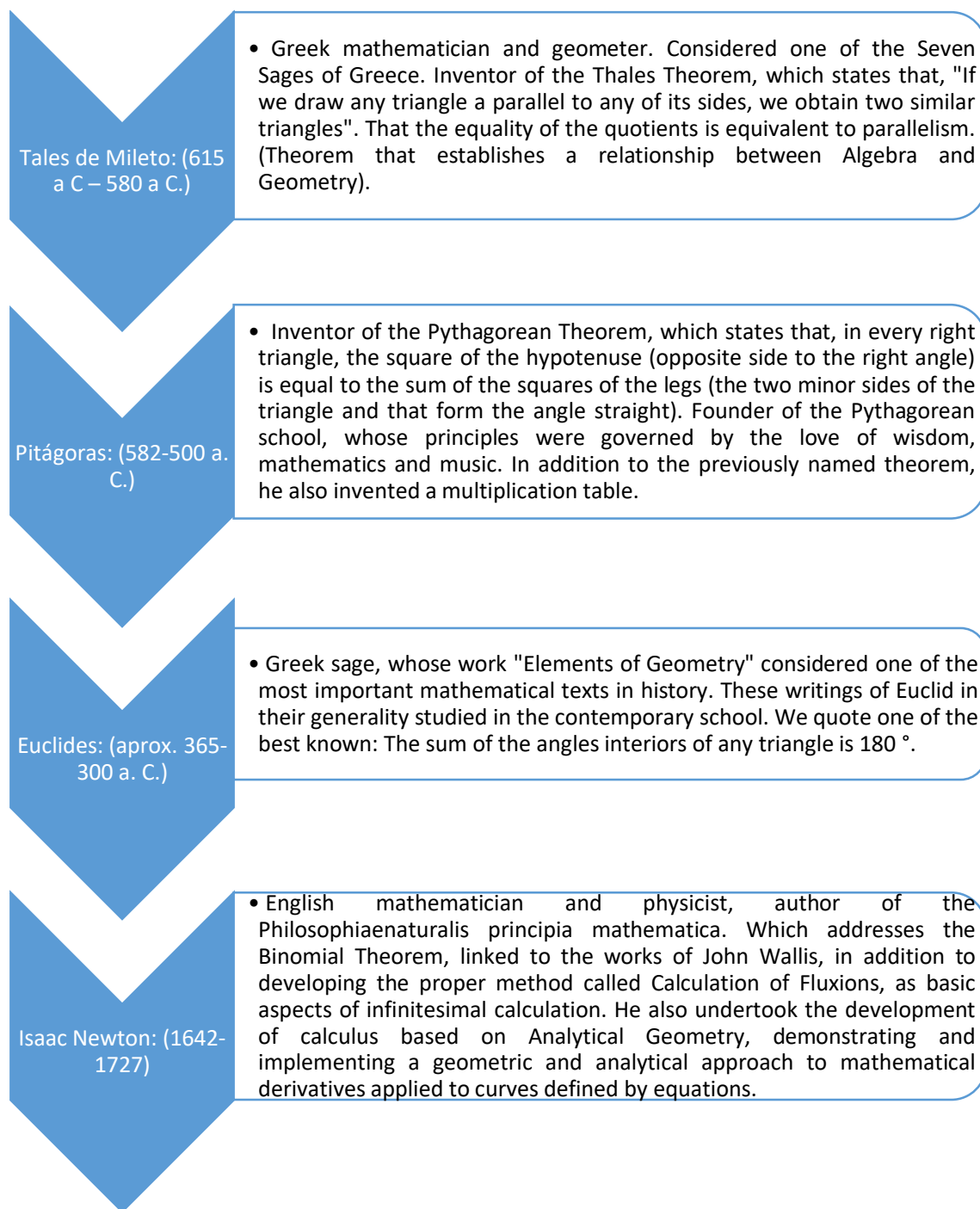


Figure 1. Scientists studying mathematics and their contributions

IV. Teaching-learning processes in Mathematics

Individuals located in the 21st century transit present the need to learn to identify and solve problems (Arteaga, Armada, & Del Sol, 2016), in learning the thought processes of the highest hierarchical degree; as well as the adaptation to the continuous changes of the sciences, the wide development of cultures and societies; where the great and new space destined to the accumulation of the imminent knowledge and contents, must obligatorily have to be replaced in a

very urgent way by the critical, behavioral, evaluative thoughts, capacities and abilities of planning execution, controlling the own knowledge; In addition to this provoked urgency we have to learn to apprehend and hold on to valued ethical codes; how the management of affective and motivational states; guaranteeing the achievement of overcoming conflicts as well as working under pressure, making use of leadership skills and abilities; the critical and creative spirit, taking interest in the confrontation with solid principles; modification of human and ethical values, assuming clear criteria, real and flexible (Arteaga, Navy, & From the Sun, 2016)

According Paramo (2019) refers to it is highly imperative that learning is planted and flourishes in the school itself ; prestigious institution that highlights and assumes the important social charge that has as its mission the preparation of man for life; it contributes to these individuals from their early ages and to other ages their positions and the esteemed role that will be necessary for the imminent confrontation with the contemporary world that is increasingly sensitive to changes and complexities at a given moment, being of knowledge that all the subjects of the curriculum have a high claim and request for responsibility, as it is the teaching of science, it is not exempt from these requirements.

The use and development of science knowledge becomes increasingly relevant, because it does not escape the general existence of any other human activity, in which the integration of these elements of knowledge is not observed in daily practice, as well as application and implementation in interdisciplinary, multidisciplinary or transdisciplinary impacts.

For this reason, it is significant that one of the subjects for the student, which demands renewal, not only for its meaning and the claim it acquires, for the broad contributions and approaches to the formation of logical thinking and to the area of proximal development of the students , is mathematics; for the evident importance highlighted and granted in the broad solutions of the problems in the modern world; This expands manifesting itself in the theoretical world of other disciplines and the learning of the multiple citizen competences.

Mathematics has earned a place in the university curriculum as part of universal culture, highlighting its evident and relevant value in the formation and development of personality; expressed above all, by the possibilities that it obtains for the stimulation of cognitive and affective-motivational growth; endowing the learner with an affective system of content, knowledge, abilities, habits, skills and ethical modes of action for their actions in the society in which they always coexist, in tune with the current context that imposed and accelerated scientific-technical development (Páramo, 2019).

Which according to what is stated (Friz, Panes, Salcedo, & Sanhueza, 2018) the knowledge of the mathematical discipline reveals an essential role in the successful task of the students in the subject; in addition to the existence of factors, conceptions; emotions, beliefs, attitudes and values in the development itself that explain this interrelation.

According to (Devia & Pinilla, 2016), it joins other universal criteria and reaffirms that in order for the student to assume a mathematically competent role, it is mandatory for the educator to maintain a wide and sufficient command of the dimensions; the conceptual; procedural skills; strategic thinking permissible to formulation and representation, as well as problem solving; in the communicative procedures through a mathematical language as well as the offering of essential evaluative attitudes of this science, combining it with the environment. Obvious positions that constitute a

large part of university academic training, thus favoring results with academic success from the laborious role of the teacher.

He also believes that in recent years this teaching-learning process of mathematics in the different educational settings has been identified, as a broadly complex and extremely fundamental activity, thus the Didactics of this science stated that mathematics has considerations in which the Students assume multiple forms of knowledge, which requires deepening and systematic dedication in the use of successful learning methods that guarantee the particular, the development of appropriate techniques that contributes to the quality of education, which emerges within the process. teaching and learning.

For (Coello & Páez, 2017), there are various forms and ways for teaching mathematics, supported by various means and procedures that are supposed to work; one more suitable than others being used in mediate and immediate teaching in natural language.

In other times modern technology, made known the computer with its respective programs; becoming the substitute medium for natural language and the most widely used word for the treatment and resolution of important and varied topics for mathematicians, ranging from games and activities to the use of elementary mathematical education, moving to highly complex theories and conceptions of mathematics; relieving, in the wide field of applications, means and procedures to support and help teachers performance, for the evident development of the teaching and learning process. Managing to characterize teaching as an active process, which not only requires mastery of the discipline, of the elements of basic mathematical knowledge, as well as those that argue, support or explain conceptual terminologies of high rigor and essentiality for the understanding of the widest world of mathematical science, in addition to a sustained domain of a set of essential skills for the collaboration of good work as a teacher of this subject.

The revelation of an increase in the professional training of teachers of the mathematical subject becomes observable, which causes concern and is the space that exists between the knowledge acquired by the student and what is really necessary to know for the presentation in the different action scenarios. Therefore, there is a worrying consideration of previous knowledge that has already been broadly and powerfully fundamental for the acquisition of new knowledge for several decades (Mota & Pereira, 2015).

There are generalized multiple criteria about the stressed and consecutive role of prior knowledge in the different learning processes and its transcendental participation in the broad construction of new conceptions, meanings, the definitions of greater meanings assume that it is more highly significant, how many Older consensual relationships is capable of building the student; between what is already conceived it is capable of building its previous knowledge and new content; very frequent interrelationships that come to promote and promote meaningful learning, which consider factual, conceptual, and attitudinal knowledge; as well as procedural and the connection with the new information understood by the students through suitable learning materials or the explanations provided by the teacher; Explaining that the previous knowledge of the students as favorable elements, important to the extreme of the constructivist conception, highlighting that it is not a static angle that happens from a dynamic perspective with retention to the assessment of its incidence on teaching processes (Spanish, Stefos, Sánchez, Torres, & Reiban, 2018).

Education has a truly fascinating aspect: it is an active, dynamic process in constant construction and highly contextualized. This feature allows the introduction of changes and contributions that ensure its permanent renewal.

From this perspective, research is directed as an activity inherent in the educational process; as a rigorous or less rigorous scientific investigation, always oriented towards the search for answers to the real needs and problems that in a certain field of science that the world and today's society face.

Research activity in the field of mathematics education has been favored by the rise of "research in education"; Consolidating itself as a broad field of study, which has suddenly evolved and solidified in order to position itself with a more scientific than a philosophical perspective.

Mathematics education is going through a degree of solidity, according to (Castro, 2017) such that it has allowed it; signify with an identification in the field of social sciences; In addition, it has been possible to broaden and delimit the space of the problems inherent to them; in addition to being taxed; for the investigation of problems, in a widely multi-paradigmatic position. It is to be associated that the generalizing existence of outstanding notes of the role that conjugate it.

It is also worth noting what it raises (Morales, 2009), the widespread existence of criteria on the prominent role that prior knowledge constitutes in the various learning processes and their outstanding participation in the great elaboration of new conceptions, which assume that meaning, "is more significant the more meaningful relationships, the student is able to build, between what he already knows, his previous knowledge and new content".

Currently, the concern of teachers in the study of mathematics is broader due to the distance between the knowledge that the students acquired in high school and what they really need to know to face the content in the year of university start, calling it the level zero or pre-university, whose interest is the preparation of the students, who have considered the entrance to the universities, that the multiple educational entities, regardless of the fact that they teach mathematical content at all levels and modalities, there is training for the student to study the university mathematical contents.

V. Type of Learning

The relevance of mentioning the type of learning in the mathematical sciences continues to be held in opinion; The same happens many times for the same motivation that the student achieves, plus what the teacher can generate so that he can develop meaningful learning. Learning in the teaching task has complexity, which implies the selection process, evidencing what the student has learned, as well as the challenges that lead to evaluating the knowledge acquired, highlighting three necessary aspects in integrative, self-evaluative and coevaluation (Salazar, 2018).

Meaningful learning is a process of acquiring knowledge, through the development of skills, attitudes and dexterity in which the main protagonist is the student, who builds learning by making it part of the cognitive, dynamic and self-critical framework. Therefore, it is necessary to apply pedagogical strategies that help improve educational praxis in order to use innovative teaching tools to improve academic performance (Morales, 2009).

People learn meaningfully, when they find meaning in experiences that impact them, such as new innovative learning models, using pedagogical didactic tools such as formative teaching strategies, which lead to education for new changes and transformation, in which the Teacher must provide fundamental information to the student, to strengthen

skills through the use of teaching and learning methods, which support the self-realization of knowledge (Bautista, 2016).

By using innovative tools, it allows the teacher to establish new knowledge, improving The academic quality of an obsolete educational system in an autonomous way, when using didactic applications in the classroom, aims to take a look at the trends that lead to think, analyze and reflect on the modalities that they plan to give answers, evidencing the significant learning from of the implementation and application of teaching tools, in which classroom learning is more dynamic and meaningful.

According to (Vivas, 2015), the University of the Balearic Islands, Balearic Islands, Spain reports that countries such as Mexico, Venezuela, Argentina, England, Norway, Scotland, Romania, the Philippines, China, Japan, among others, currently in educational centers They apply practices based on the Theory of Multiple Intelligence (TIM), applied to the reality of educational policies themselves and to the intellectual diversity that the reality of each institution lives.

TIM's theories of (Delgado, 2017) have influenced the philosophy of education, as didactic methods improving educational quality, it is also said that multiple intelligences is a model of thought that analyzes information in a neutral way in the process of teaching and learning, respecting diversity and facilitating educational inclusion; In addition, they facilitate access to information and future performance of the teaching activity and an integral intellectual development of the contents through the different procedures that are necessary for the acquisition of critical thinking of the student and at the same time have tools to facilitate said learning (López, Moreira, Mero, & Rodríguez, 2019).

Critical thinking, both teacher and student, is part of the educational processes, allowing the human being to analyze, understand and evaluate. Critical pedagogy favors application in the classroom, improving activities and turning them into innovative methods, seeking educational models focused on students, transforming everyday life and solving problems by complementing their desire to improve (López, Moreira, Mero, & Rodríguez, 2019). With this, it is necessary to approach an essential position, which is based on the vision of a paradigm of the times with a highly developing essence.

VI. Constructivism

As Morales states (2009), for the last 20 years, research in mathematics education has been marked by the constructivist paradigm. The key ideas of this paradigm come from or have their roots in the research of many authors, among which stand out: Piaget, Wallon, Vygotsky, Bruner, Dewey, Gagné, Ausubel, Novak and Henesian. All of them have agreed that learning any school content supposes, from the constructivist conception, to attribute a meaning and to construct the meanings implied in said content, and that this construction is not carried out from scratch.

Similarly, at present the teaching-learning process is developed under a construction process, in which the student does not limit himself to acquiring knowledge, which allows him to be the protagonists themselves, appropriating the contents Adequate, capable of contributing and giving creative solutions to the problems they face, based on educational experiences (Moreira, 2019).

According to (Morales, 2009), the conceptual essentiality of the constructivist of learning is supported by the idea of the purpose that is represented in the education provided in the educational institution, which is to promote the processes of personalized growth of the student, framed in the culture of group of belonging, attending to this conception the. learning occurs only if a group of circumstances are satisfied that the student is able to refer from a non-arbitrary and substantial position the new preceded information with the knowledge, previous and family experiences that he has in his structure of knowledge, having the disposition to learn significantly; as well as the learning contents have potential or logical meaning.

One of the referents of this theory is Piaget, who stated that learning focuses through two thoughts, assimilation and accommodation, the same one that allows the individual to adapt to the environment and transform their own structure; Likewise, it has more expectations in the field of pedagogy and in the educational field. The constructivist theory refers that learning in individuals influences cognitive development, in addition, thought processes are related to the product of mental construction (Saldarriaga, Bravo, & Llor, 2016).

Taking this indication by the hand, it is precise to frame that in the educational environment it is an essential observation, that, if the students have individual processes and graphics of previous thoughts, the teachers must promote learning areas where the exploration activities, challenging and discovery for the student are perceived as more important than the teaching itself. So that he is the protagonist of learning and not the teacher. Position is in which the teacher maintains and maintains a great capacity for observation and exploration of the multiple reactions that students obtain in their learning experiences so as not to modify the individual construction process.

VII. The Importance of previous knowledge in the mathematical subject

It is worth highlighting the essentiality and relevance of the existence of prior knowledge for the real acquisition of new knowledge, in the teaching-learning process in the area of mathematical science in universities, making it essential for students to obtain consistent mathematical knowledge of the baccalaureate level that allows him to learn to apprehend, since this knowledge is basic; that they provide a device in it for the assimilation of the new university mathematical knowledge, since this is knowledge that is considered the link for the new knowledge; Becoming imperative and brewingly imperative that the educator reveals and executes his broad concern so that the university student enters the first year of the University, sets in motion the basic mathematical knowledge; in addition to taking into account how this student is capable of correlating and appropriating with security and skill those knowledge that he has progressively acquired and that, until that moment, were unknown; For them, it must happen that the knowledge that they are going to assume at that educational level must have been clearly solid and significant, keeping in their long-term memory so that they can use them in a timely manner.

VIII. Information and communication technologies in mathematics

The use of information and communication technologies (ICT) in education has had an important evolution over the last forty years, taking different theoretical and pedagogical references such as behavioral, cognitive, constructivist and recent theory. sociocultural (López, 2017).

ICTs have increased considerably in different areas of development, be they economic, social, political, and therefore in the educational field, since it can contribute to equality in instruction for the exercise of the teaching process- quality learning (San Andrés, Pazmiño, Mero, & Pinargote, 2019).

However, mathematics has been one of the fields of knowledge that has taken the longest to incorporate these strategies and to take an important leap towards the use of ICT as support for learning processes, with the use of traditional methodologies still being frequent and performing mechanical processes, decontextualized and that do not generate important reflections in students about the usefulness of the concepts studied in their academic training and in their daily life (Vega, Niño, & Cárdena, 2015).

In the teaching-learning processes, the new trends in ICT go hand in hand in education, it is gaining more and more space in the different academic environments, serving as support for the subject plans, from the use of didactic tools, transversal projects and teaching strategies, creating new methods and structures that involve the student in the construction and consolidation of knowledge, allowing analysis of aspects of society, developing cognitive abilities that allow analysis and reflection, giving solutions to problems (Baños, Lezcano, & Casado, 2018).

ICTs, as a teaching strategy, facilitate the development of the capabilities of an individual, in order to adequately perform a task, having multiple reasons to take advantage of the possibilities of the new educational paradigm, keeping the student activities in a personalized way, improving the Productivity aimed at developing competencies and the transformations of innovation that determine the dynamics and participation of multiple intelligences (Delgado, 2017).

In learning mathematics, the use of structured and sequential curricula has been the basis for acquiring procedural skills, essential in approaching mathematical concepts. However, this cannot be the main purpose of the training process, since on the other hand the need arises for the development of reflection and discussion skills around the topics studied and that go beyond the rote and mechanical. This establishes an essential starting point for the development of interactive resources to support the teaching and learning of mathematics (Triana, Ceballo, & Villa, 2016).

According to (Ortega, Maldonado, & Moreno, 2016), they state that these aspects allow establishing an important foundation in the process of design and use of ICT in mathematics. On the one hand, the need has been created to generate technological resources that provide a real learning experience for the student, who through “mathematical experimentation” becomes the protagonist of his learning process, being autonomous in the variation of the parameters associated with the concept that studies and in the transformations that it wants to give to said object, which is achieved with simulation tools and online calculators that are constituted as versatile resources to allow the student to “play” with the object of study. On the other hand, there is the time you want and can dedicate to the exercise of learning outside the classroom, openly accessing a large amount of content and creating learning communities that allow you to learn about the experiences of other students and solve set the doubts that may arise in the development of these exercises.

The latter has been the basis for the creation of virtual courses, a strategy that has taken a great boom today and whose evolution will be described later. Virtual Learning Environments (EVA) and Virtual Learning Sites (VLS), appear as effective strategies to transform traditional conceptions of what it means to teach and learn mathematics; The

key concept is collaborative work, through which the student links his new learning with previous knowledge experiences and bases his learning on problems that reflect his reality (Moreno & Montoya, 2015).

A survey was applied to teachers, to know the criteria and opinions about the importance of the elements of previous knowledge in the teaching-learning process of Mathematics. To guarantee the information; Questions were asked to each of the teachers surveyed; simple, concrete and legible answers questions with the goal of obtaining a quick grouping of the information and not to cause fatigue or discomfort to the respondent. For this, 50 teachers from the Educational Units of the Canton Chone, Province of Manabí were selected.

It was based on the knowledge that all the respondents coincide in recognizing that there are difficulties with the previous contents that the students have on the subject of mathematics.

In the graph of figure 1, it is observed what is related to the importance of previous knowledge regarding mathematics in the teaching-learning process taught in the Higher Basic and Baccalaureate (HSB).

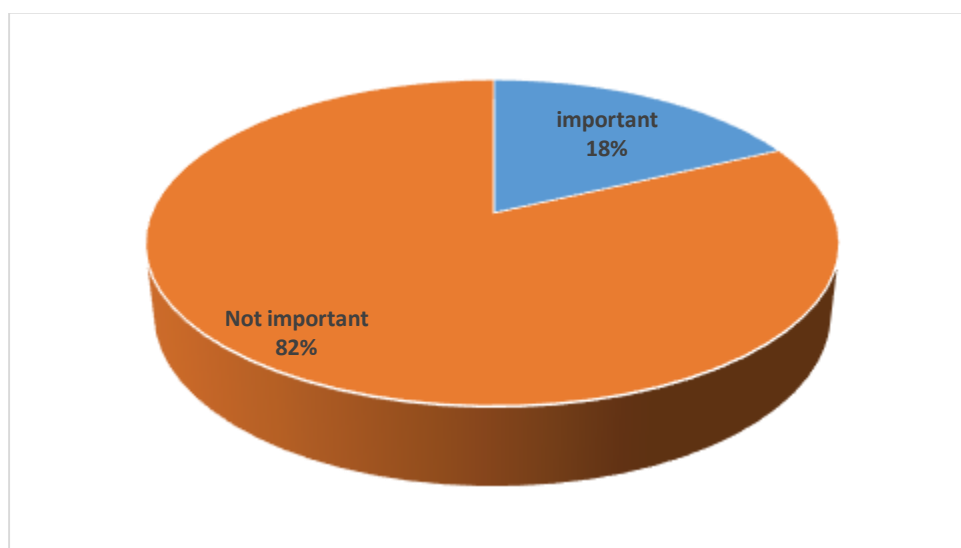


Figure 1. Graph of the importance of prior knowledge

Source: Survey of teachers from the Educational Unit of the Canton Chone

As can be seen, 82% of the respondents do not give importance to the previous knowledge of the subject in teaching and learning in mathematics, the vast majority of which refer to the fact that these teachings have different objectives in curricula as well as the knowledge that the Basic Higher Education and baccalaureate have, like her, lagged behind, so that the minority, 18% give importance to prior knowledge.

In the graph in figure 2, you can see the interest of the teachers for the level of previous knowledge of the students on mathematics when arriving at the Higher Basic Education and Baccalaureate.

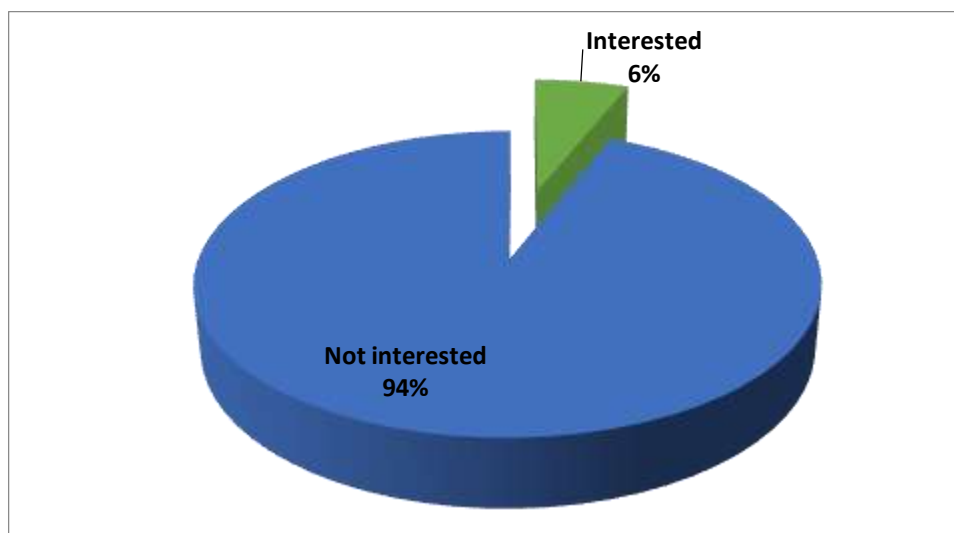


Figure 2. Interest of the teachers by the level of previous knowledge of the students

Source: Survey of teachers from the Educational Unit of the Canton Chone

As is evident, the majority (94%) disregards the importance of previous knowledge about mathematics; expressions reflected by the disinterest, to know the degree of knowledge tell their students, forgetting that each of them is an individual entity unable to grasp; process and understand the information like any other; being more noticeable in mathematics, which turns out to be such a complex science for learners; valuations based on the effort and sacrifice on the part of the students, in addition to the instructive development in the subjects, first of all of the subject depending much more on the effort, for them than the demand for the differentiated attention of the teachers. Figure 3 shows the complex teaching-learning process of the subject studied.

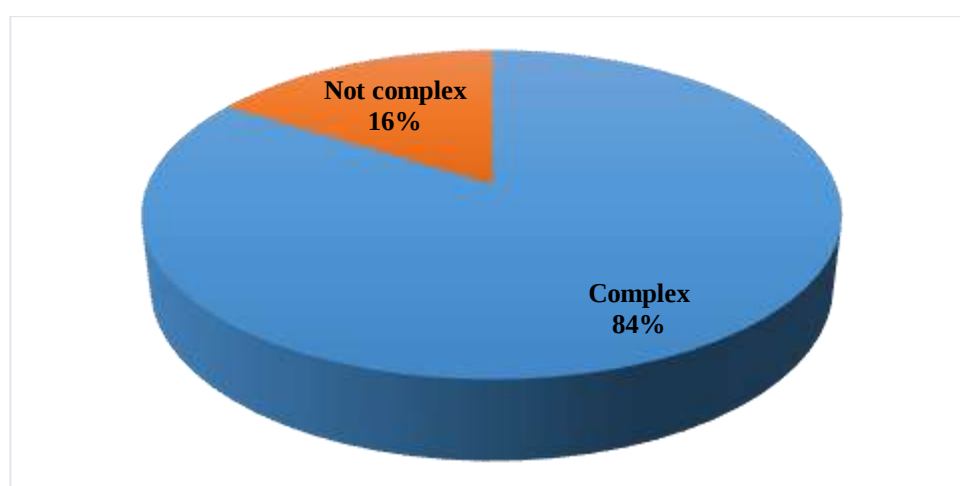


Figure 3. Complexity of the mathematics course

Source: Survey of teachers from the Educational Unit of the Canton Chone

It is observed that 42 teachers state that sometimes the teaching-learning process becomes complex; prevailing on difficult subject summaries; Because students generally understand that it has been explained to them. It is observable that this figure is undoubtedly due to the poor relationship established between mathematical knowledge at the levels of upper basic and high school; Although there is the presence of a minority in which they agree that the process is not complex, there being disagreement where some refer that an interrelation between the contents of the previous year and the current one is really necessary; very few others limit that their students have a different level of knowledge, that they do not need other techniques to achieve their learning.

Es un amplio y riguroso análisis en las explicaciones de los resultados de la encuesta efectuadas, donde la mayoría de docentes ponen de manifiesto consideraciones de que: los conocimientos previos o antecedentes de la asignatura matemática no fueron satisfactorio para responder a las demandas exigencias de la proyección y complejidad de los contenidos y conocimientos matemáticos.

IX. Conclusions

Teachers of Higher Basic Education and Baccalaureate have mastery of the subjects taught as well as the objectives to be achieved referred to mathematics by students in previous teachings, but do not attribute the required importance to these in the teaching-learning process of which they are protagonists, they reflect not being busy and concerned about the knowledge of the subject with which their students arrive; then most of them will find greater complexity the transmission of knowledge to students of the most important exact sciences such as mathematics.

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