

# MENDIVE

REVISTA DE EDUCACIÓN

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## The overcoming of mathematics teachers: a challenge for secondary school education

### La superación de profesores de Matemática: un reto para la educación secundaria básica

### A melhoria dos professores de Matemática: um desafio para o ensino secundário básico

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#### ABSTRACT

The knowledge society has caused profound transformations in all spheres, including education. This requires new ways of thinking and acting to develop an educational practice that responds to social demands. However, the increasing attention of teachers that is not satisfied

with the graduations of universities and pedagogical schools constitutes a challenge. Another element to take into account is that many teachers only have comprehensive training without specialization in the subject. All these have as a result that teachers do not satisfy the needs of the school either quantitatively or qualitatively. Hence the importance of implementing processes of improvement that elevates the quality of their preparation so that teachers self-value their work in a positive sense and are appreciated by society. The work aims to characterize the improvement that teachers need based on their experience and opinions. To do this, a course is designed in a flexible way in which the teachers themselves identify their needs for improvement and reflection on its relevance.

**Keywords:** pedagogical improvement; continuous education; mathematical education.

#### RESUMEN

La sociedad del conocimiento ha provocado profundas transformaciones en todas las esferas, incluida la educación. Esto exige nuevas formas de pensar y actuar para desarrollar una práctica educativa que responda a las exigencias sociales. Sin embargo, constituye un reto la creciente carencia de profesores que no se satisface con las graduaciones de las universidades y escuelas pedagógicas. Otro elemento a tener en cuenta es que muchos profesores solo cuentan con una formación integral sin especialización en la asignatura. Todo trae como resultado que los docentes no satisfacen ni cuantitativamente ni cualitativamente las necesidades de la escuela. De ahí la importancia de implementar procesos de superación que eleven la calidad de su preparación para que los docentes autovaloren su labor y sean debidamente apreciados por la sociedad. El trabajo se propone caracterizar la superación que necesitan los docentes a partir de su propia

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experiencia y opiniones. Para ello se diseña un curso de forma flexible, en el cual los propios profesores identifiquen sus necesidades de superación y reflexionen acerca de la pertinencia del mismo.

**Palabras clave:** superación pedagógica; formación continua; educación matemática.

### RESUMO

A sociedade do conhecimento trouxe transformações profundas em todas as esferas, incluindo a educação. Isto exige novas formas de pensar e agir a fim de desenvolver uma prática educativa que responda às exigências sociais. No entanto, a crescente falta de professores é um desafio que não é satisfeito com a graduação nas universidades e escolas pedagógicas. Outro elemento a ter em conta é que muitos professores só têm uma formação abrangente sem especialização de disciplinas. Como resultado, os professores não satisfazem as necessidades da escola, nem quantitativa nem qualitativamente. Daí a importância de implementar processos de melhoria que elevem a qualidade da sua preparação para que os professores possam valorizar o seu trabalho e ser devidamente apreciados pela sociedade. Este documento visa caracterizar a melhoria necessária para os professores com base na sua própria experiência e opiniões. Para este fim, um curso é concebido de uma forma flexível, em que os próprios professores identificam as suas próprias necessidades de melhoria e reflectem sobre a sua relevância.

**Palavras-chave:** melhoria pedagógica; educação contínua; educação matemática.

## INTRODUCTION

The emergence of the society of knowledge and information has led to changes in society and profound changes in education, which collects a new education, starting from a change of perspective on teachers and education professionals (Gil, 2018). The advances in knowledge and information required teachers an attitude of openness, assimilation of new technologies for incorporation into the process of Teaching - learning.

The novelty of these processes requires to re considering the education of this times where concepts of teaching and learning are combined with new technology to acquire knowledge and information, which requires projecting the future with forms of development pending of study.

In this social context, from a perspective of equity, quality and social relevance, teaching has become a key and dynamic profession to satisfy the needs of individual and collective transformation. The teacher's work is essential in the development of the desired education, for which he also has to change, modify his ways of thinking and acting, in correspondence with the demands of the society in which he lives (García, Addine & Castro, 2010).

All of this constitutes a challenge for present and future education, both in the medium and long term. The reasons are diverse and cut across the psychology of the teacher for the acceptance of the new and the changing dynamics of the student - teacher relationship. This is mediated by the new resources that are incorporated into the teaching - education process and lead to the improvements in the quality of the teaching - learning (Lalangui, Ramon & Espinoza, 2017).

For this reason, the reality demands from teachers ,the insertion in educational

research and in the knowledge imparted, reflection on the way you teach your subjects in the new conditions of the teaching - learning.

A major challenge for current education is the growing shortage of teachers, which is not satisfied with graduations from universities and pedagogical schools. This situation often entails the need to employ an emerging human capital, which has a particular training focused on professional pedagogical practice without a specialization in particular didactics (Miranda *et al.*, 2010).

On the other hand, teachers perceive that they are not valued enough and their professionalization is questioned (Nieva & Martínez, 2016). In this situation, factors of diverse nature influence: in the first place, the sociocultural, where the estimation of the quality of the teaching - educational process carried out by the school and the teachers is valued by society; and the other is the pedagogical, related to the preparation of the teacher to carry out a quality professional performance.

A positive self-assessment of teachers about the quality of their work motivates them and guarantees its success. Conversely, fact can be conducted to indifference to their teaching practice and, in many cases, may be the reason for the abandonment of the profession.

A significant number of teachers carry out their professional work without complete training in the area in which they work a reality. For this reason, it corresponds to the educational system to attend to the development of this human capital that leads the teaching - learning process, both in the completion of their initial training and in the updating of their knowledge to a dynamic and changing reality (Camacho, 2016).

Undertake this task will allow for better teachers prepared for the subject they teach, able to understand with critical attitude the transformations that scientific technology revolution of knowledge imposes to the substantive processes of the school and to the quality of teaching. In addition, it favors the estimation by society of the figure of the teacher and the educational institution.

The conditions indicated demand from the teachers a pertinent preparation to face the continuous transformations that occur in the school and to do so without interrupting their professional activity (García, Addine & Castro, 2010). However, generally, it is difficult for a practicing teacher in an independent way to plan and carry out self-improvement activities to constantly enrich their knowledge of the subject they teach and raise their professional preparation.

An important sector and needed of care are teachers of mathematics, by the peculiarities of this subject, one of the areas of knowledge with more failure school and cause of frustration among students.

It is a fact that in educational Cuban reality at present, the teaching of Mathematics and covering teaching of this subject are in a critical period, being deficient in terms of the number of available teachers, those found in training and even those who aspire to study the career.

An aspect to take into account is the need to raise the interest for Mathematics, both in those who aspire to train as a teacher and in those who teach the subject. The role of the Mathematics teacher is complex and dynamic, because multiple factors derived from the sociocultural environment in which it operates (Hernández & Lezama, 2019) influence their work. More pressure is felt when teaching a subject traditionally considered difficult, where school failure

and demands from superiors for results are great.

For this reason, the search for spaces to offer these teachers a quality professional improvement is still a necessity, which combines preparation in updated knowledge, a critical attitude towards social events, the knowledge of the men who have enriched this science and subject of learning with the didactic-methodological preparation at the updating level.

The solution to the problem implies an analysis of the objective and subjective factors that can affect the teaching updating process, determining what type of improvement to offer and what content should make up the proposal. We contextualize the work at the secondary level, as it is the preamble to higher education and a starting point to deal with the problems stated.

Pre university school is the level that prepares students to continue their studies at university or in vocational and technical education and includes basic secondary education and high school. It is the main stage where the preparation bases for insertion into the labor market are created, which requires a minimum domain of knowledge and mathematical skills to assimilate new technologies.

At this level, the need to improve has peculiarities: a large number of practicing mathematics teachers were trained as comprehensive general teachers of basic secondary school and they need spaces to increase their preparation. For this reason, the work aims to theoretically establish a proposal for improvement for teachers of Mathematics at this level from the postgraduate level and permanent preparation.

## MATERIALS AND METHODS

The materials used proposed as educational resources included in the digital presentations and the discussion of the audiovisual material *Why are children bored at school*. (Road To Freedom, 2015), with the purpose of introducing the debate on the reality of the classroom and analyze from the experience of Mathematics causal factors and effects on the teaching - learning level junior high school, a selection of updated documents on the teaching of Mathematics and on the development of interest and motivation in the school.

Other materials created were the observation record, the diagnostic instrument and the PN I technique (Positive, Negative, Interesting) of lateral thinking, valid for the collection of reliable information, as a final diagnosis of practical experience.

The selected methods have been the diagnosis of the teachers, to know the main concerns, aspirations and interests with professional performance; the constant comparison applied to the study of the particularities of the students belonging to the centers selected for the study, their interests with the subject, theoretical sampling applied to the analysis of tasks, discussion workshops, forums content worked in the proposal and overcoming participant observation, applied in the process of overcoming developed and that support the theoretical basis of the proposed improvement and preparation of practicing teachers.

The participant observation was developed during a semester of the 2016-2017 academic years to teachers of the basic secondary schools of the Old Havana municipality. 38 practicing mathematics teachers participated, of them 27 males representing 71.1 % and 11 females, for 28.9 %, of which 34 were trained as comprehensive general teachers, for

89.5 % and four with specialized training, for 10.5 %.

## RESULTS

The rise of information technology and communications has influenced all spheres of society and are influencing mathematic education students need. In this situation, mathematics education should equip students with skills that underpin the mastery of new technologies, capacity building for communication and problem solving.

The role of mathematics in secondary education is widely recognized, its position in the curriculum is essential and basic content are essential to appropriate other skills that prepare students, both daily life and to acquire and play a profession.

To teach mathematical content, the teacher should be able to organize and plan it properly because of a thorough analysis of the same and a thorough understanding of all its aspects. However, secondary level teachers are not satisfied with the preparation received in their initial professional training; they consider that their preparation requires a deepening of the subject they teach, which supports the existence of an interest in broadening and deepening their knowledge.

Mathematics teachers must necessarily be identified with their role in society, based on extensive information on the subject, not only on its specific content, but also on cultural information about it, taking into account the level at which it is performed. (Hernández & Lezama, 2019).

Every teacher who teaches Mathematics must reflect on their activity in the classroom, know what to do, how to do it and why to do it. It is a link between action and

reflection, it is the expression of his mastery over the content taught, and can stimulate students love for the subject.

Their training must be oriented towards the organization and development of a quality teaching - learning process, based on solid moral and patriotic convictions, mastery of mathematical content, a comprehensive general culture and methodological didactic elements of the teaching of Mathematics.

The proposal presented aims to contribute to the solution of the problem, to the address an important factor: the deepening in mathematic preparation and mathematics education by teachers working in their teaching secondary level or, particularly for those trained as emerging teachers, who received general pedagogical and didactic training in the area of knowledge, but without the specialization that the theoretical, methodological and practical depth provides to the subject, which was pending for the overcoming of postgraduate studies.

In dealing with the subject, it is essential to take into account the preparation and improvement categories, taken from different sources, whether they are authors or regulations established by higher education.

To teachers were concerned update their knowledge and skills, educational authorities and the organization of the professional activity of these, so that the former are motivated to perfect their professional preparation (Delors, 1996). To do this, the teacher should be given facilities to update in the most advanced aspects of science and technology, deepen the subject he teaches, to be creative and capable of appropriating the most advanced in the teaching of his subject.

The raising of quality of education starts from providing teachers with initial training and a pertinent update according to the paradigm of permanent education. This update takes place through pedagogical improvement, a continuous training process throughout the professional, systemic, deep and creative life, which continues and complements undergraduate training.

One of the challenges facing the training, both initial and continuous, of professionals is the vertiginous obsolescence of knowledge, which affects all spheres of knowledge. If before it was an aspiration to train a professional with encyclopedic knowledge, now up-to-date professionals are needed. At this time, more than having encyclopedias, the availability and accessibility of relevant databases is required.

Continuous training is necessary for any professional, but essential in the professional education, because their daily activity is to transmit knowledge and if knowledge is constantly enriched, transformed and modified, then the teacher must, in principle be updated.

Every pedagogical training process today must satisfy the needs of society: teachers committed to their social mission, who make the training objectives their own and who are involved as subjects in their own personal development.

To achieve the training of an active teacher in the face of the changes that are occurring in society, it is necessary that they be protagonists in their training and not simply subjects of change. They need spaces for self - preparation and permanent improvement, to enrich their general culture and appropriate updated knowledge to impact in raising the quality of the teaching learning process.

According to a report presented to the Institute for Research about University and Education (2016), continuing initiative training is low in the region of the Americas, which realizes the need to improve the professional training of teachers through diversity of instances of improvement.

The teacher, as the vanguard of knowledge, must be permanently updated, both in their subject and in the way they develop skills, habits and capacities in their students. These aspects in their preparation specify in a more direct way the achievement of the goals or objectives of the school and impact on the integral formation of the personality of their students.

The pedagogical improvement raises an apparent contradiction between the general nature of their management and the individual character, both of participation and the effect of their results, mediated by the responsibility of the teacher with their efficient professional performance.

However, when facing the daily reality of the classroom, the teacher always discovers deficiencies to face these teaching situations, he realizes the distance between the theory of the subject and the concrete professional practice carried out every day in the classroom.

Moreover, Facing the teacher responsibility in the classroom warns about the need for time and space to overcome gaps in knowledge and skills of the subject they teach, as well as a mathematics education which should lead carried out as his own and inherent to his profession. This includes cultural education in the history of science and important figures in their development, as well as the values that bring this subject to the preparation for the social life of students.

The pedagogical improvement thus becomes a space for the attention to three dimensions in which it is organized and planned: the knowledge of the subject, the didactic knowledge and the evaluative didactic experience on the teaching- learning process and education in the instruction. Thus, combines knowledge, skills, experiences and applications to social needs from mathematic culture.

In the above, it adds the opportunity to exchange experiences among teachers with more time on the work with new teachers, providing them with knowledge and strategies to teach their subjects.

This opportunity, expressed in the relations of exchange, solidarity and cooperation in the space of improvement, make it a technical tool that complements and humanizes the collective need for improvement, while providing the teacher with greater security in their performance.

The complexity of the pedagogical professional exercise is that the theory that is mastered or known is not enough to ensure success, as it happens in other professions, its essence is much more complex. In addition, it requires pedagogical theory and methodology to develop the preparation process for the life of students in unique settings, which force the teacher to seek new ways in unforeseen situations, impossible to foresee in initial training.

It is important to take into account the preparation for the subject, as a form of methodological work carried out by the teachers who make up the group in a center or municipality, to guarantee, prior to teaching, the planning and organization of the main elements that guarantee the efficiency and efficacy of the teaching process of education (Ministry of Higher Education, 2018). Its content is oriented towards the construction of the didactics of the subject, relying on the experiences

that are accumulating because of the systematic methodological work that is developed and the achievements that are achieved in the pedagogical research carried out for this purpose.

This means that the teacher receives an initial general theory of science that he is going to teach professionally and also the general theory of the field of professional specialization, in this case pedagogical; When operating with this knowledge, he finds two essential problems to be solved: first, that of the application of the theory learned to the process of instruction and education, and secondly, the teacher has to create a specific didactics for the grade he works, and the circumstances of the classroom will require creative and innovative adaptation in front of learning situations in class generated unexpectedly.

The teacher, in the classroom must face challenges that demonstrate the demands of specialized professional activity. A first challenge is the responsibility of teaching their subject with the required quality, with proper work education from instruction. This way, he rigorously contribute to the education of their students and achieving adequate levels of efficiency in this process (Ministry of Education, 2018).

A second challenge is the domain of content and learning resources for teaching subject, the ability to guide, monitor and evaluate students, providing support continuously. All in line with the general objectives of the subject and the ones formulated for the corresponding academic year.

A third challenge is to possess adequate political, ideological, pedagogical, methodological, professional and cultural preparation for the best performance of their functions, establishing appropriate relationships and interactions with the

rest of the participants in the educational teaching process.

Due to the complexity of his pedagogical training, the professional preparation for teaching and the application of the knowledge of the subject he teaches, the teacher faces the complexity of his social task. This requires not only a deep preparation, but also a comprehensive general culture and the projection of a social image with deep human values.

The combination of cognitive and human factors, professional, socio-cultural, psychological, make the image of the professor something that goes beyond the educator as a person. Therefore, society values teachers as one example of citizen, with high culture and professional competition confiding the formation over from society, men and women of the future.

These challenges allow understanding why society is so critical to education, school and teacher. They explain why the first person interested in safeguarding the cultural and historical stereotype of the figure of the teacher and education is the teacher himself.

This expresses the dialectic between the ideal model of teacher that society has and the reality that education develops, essential in the articulation between society and education. For this reason, it is so important to attend to improvement as a basis for improving the quality of teacher training and their continuous development.

Without any doubt, the preparation and teaching are ways to overcome it through. The professional development teaching can be organized given as: self-improvement, improvement courses professional training, job training or diploma.

There is also a wide range of modalities: workshops, seminars, specialized conferences, scientific and technical debates, meetings for the exchange of experiences, and all those that enable the study and dissemination of advances in science, technology and art.

The purpose of pedagogical professional improvement is the systematic preparation of the teacher for the performance of their functions and the enrichment of their general culture by facilitating the acquisition, complementation, expansion and continuous improvement of their knowledge and basic skills (Salgado, Juan & Mederos, 2014).

The organization of the improvement of teachers depends on multiple factors of varied nature, but the primary thing is the existence of the will on the part of the educational authorities for it. This because it is aimed at adult subjects, with some experience in their work and responsibilities in their work groups, has a special character and requires certain requirements in its design and execution.

According to the Ministry of Education (2019) to overcome post degree responds to the demands of training for professionals working in institutions and the constant improvement of university graduates.

In the overcoming of graduate are implicit, specialization, the research and innovation among others, harmonically articulated in an educational proposal relevant and supported by principles:

- The participation of students in social development through processes of creation, dissemination, transfer, adaptation and application of knowledge;
- favoring the access to the most advanced knowledge, both the country and the world;



- promoting the sustainable development of society through the training of professionals in close connection with practice;
- the attention to the demands of professional improvement in correspondence with the requirements of the society;
- promoting multidisciplinary, interdisciplinarity and transdisciplinarity.

Among its essential characteristics are the flexibility and rigor of the quality of the programs, in addition, it must guarantee:

- The elevation of the efficiency and quality of education;
- the acquisition of knowledge and skills of a general or specific nature not acquired in the career or acquired without the necessary depth;
- the systematic updating of professional knowledge and skills, in correspondence with scientific and technical advances and development;
- The deepening or broadening of knowledge in particular areas of knowledge, in correspondence with scientific and technical advances.

A concern of the teacher must be the quality of the education he develops and the ability to problematize reality to challenge the intelligence and will of his students. For that reason, and it is important, the interactive work with students in finding solutions to significant problems of reality.

In addition, the teacher should be committed with his time, be ready to learn permanently, adapt creatively to change and participate in the development of society enthusiastically.

For it, the pedagogic improvement should be an opportunity for teachers to

update their knowledge and skills in their specific area of knowledge, contact with advances in science education with new programs, content and innovative teaching and learning modalities (García *et al.*, 2019).

The entire system of planning, organization and development of pedagogical improvement must start from the determination and systematization of the problems that affect the teaching - learning process and that determine its objectives. These must specify the aspiration of society and the professional model capable of conducting an educational teaching process based on advances in science, technology and culture.

The pedagogical professional improvement, conceived and organized based on the problems present in society, must set precise objectives, starting from the real needs of the pedagogical group, a content to be developed that responds to the real and concrete deficiencies of the territory. In addition, one mode of action, structure or form of organization and resources necessary for their development and evaluation are added.

To find a response to the challenges imposed by society, pedagogical improvement must observe as requirements:

- Assume each subject of improvement and the group as a system in transformation ;
- propose consistent objectives with the characteristics and complexity of the tasks to be faced ;
- propose problems similar to those they must face in their teaching practice ;
- Promote a strong and intense group activity that promotes the exchange of experiences in solving problems.

The response to social and territorial needs makes pedagogical professional improvement a key element in social development. However, in addition to raising the teacher's preparation for their work, improvement should improve the self-assessment of their personal and professional development, their personal enrichment, as a unit of the cognitive and the affective one.

The pedagogical professional improvement is effective insofar as it seeks a solution to the problems of educational practice, both in general and in particular to each school or territory.

Unlike the training that constitutes an initial stage of preparation, the pedagogical professional improvement is a continuous, prolonged, permanent process and takes place in parallel with the teaching or managerial functions. Its purpose is the professional and human improvement of the teacher, with general objectives: to expand, improve, update, complement knowledge, skills, abilities, promote the development and consolidation of values.

To assume its social function, pedagogical professional improvement must be articulated around what constitutes the core of the teaching work planning, orientation, execution and control of the teaching-learning process.

In the opinion of García, Addine & Castro (2010), establishing a pedagogical improvement strategy, whether in the short, medium or long term, requires an adequate determination of the individual needs of each teacher or professor, as well as those of the pedagogical group. For this, it is necessary to start from a diagnosis of the state of the preparation of teachers, their insufficiencies and potentialities and the level of aspiration to be achieved.

The improvement of all teachers is a necessity, because of the rates of development of science and technology,

the problems that society faces and the increasing demands for quality professional performance.

It is necessary to clarify that in this reality, professional quality passes through the capacity for self-management to learn to learn in the new conditions of the knowledge society, the appropriation of general culture, employment and mastery of educational technology and its incorporation into teaching activity.

Therefore, enhance overcoming professional teaching should be a priority of the structures of administrative management of education in the territories, responsible for various design options and modalities for the improvement and development of teachers, beyond the usual ways, with a greater emphasis on the link with the territories and their problems.

It is necessary to systematically assess the results of professional pedagogical improvement reflected in scientific activity, measure the effectiveness of the activity of improvement and propose increasing levels of demand in the preparation of teachers.

In the reality of Cuban education, where at various times it has been necessary to resort to variants that guarantee the quality of the educational teaching process, a requirement has been to ensure the preparation of teachers for the best performance of their work; for which it has considered the need to carry both, professional growth and human growth.

An important aspect of the processes of improvement is to favor communities with multiple points of view that from common problems generate common solutions to problems that affect learning.

This interaction facilitates the use of reflection as a strategy for professional development and the improvement of the quality of the education that is imparted. This allows knowing and internalizing diversity of modes of action, to critically take the most effective educational practices.

The conception of pedagogical improvement should be considered as an important step for the continuous training of the teacher, but its objective should not focus on providing the teacher with knowledge and skills, but on the transformation of their attitudes, in their vision of teaching practice, questioning and self-questioning the work conceptions of their professional activity.

The pedagogical professional improvement must:

- Be planned, so that starting from the current development of the teacher is oriented towards their potential development;
- promote the development of the personality and the professional identity of the teacher, activating the appropriation of knowledge and professional skills closely related to the formation of feelings, motivations and positive attitudes towards himself and the profession;
- promote the ability of the teacher to know, control and transform their own performance, stimulating his metacognitive reflection;
- Propitiate the development of skills and strategies to learn to learn and to teach to learn.

For this, a pedagogical professional improvement course must be based on principles such as:

- Flexible planning based on learning: it starts from an initial planning in which only the most

general lines of action are established, organizing each phase or step in the course of the development of the process itself, taking care of the particularities of the group, so that all the moments involve learning about each training himself and about the profession and its modes of action.

- The correspondence with the logic of the teaching profession: the way the process is organized must correspond to the logic of the profession, establishing permanent relationship between psychological content and problems of the teaching profession they face and must solve students in their way of acting as teachers.
- The agreed intentionality: During the process, all participants learn and teach, establishing a relationship between equals reflecting based on their personal and professional experiences. In this relationship, the intentions in the development of the course are agreed, based on the felt needs, the previous notions and the personal commitment of each participant.
- The dialogic communication: it must be established through the whole process a flexible and empathetic climate focused on exchange and dialogue, horizontal communication, which promotes the authentic expression of the participants and promote the inter subjective- relationships as a basis for attitudes of solidarity and help.
- The significance: should reveal links between contents and preconceptions, applications and utility in teaching activity, leading to the construction and reconstruction of knowledge and approval of the process.
- Metacognitive reflection: both individually and in groups.

- Progressive socialization: individual and group exercises should be alternated at different times of the course, so that reflection on knowledge develops progressively, promote explicitness in the exchange and stimulate collective awareness.
- The necessary synergy and co-responsibility between the institutions and the actors in charge of the improvement process

The improvement of Mathematics teachers should be organized from an exchange between teachers, which stimulates reflection on the way in which the subject is taught, be a complement to the methodological work in order to achieve the comprehensiveness of the educational teaching process as a whole (Ministry of Education, 2014).

- The methodological work cover essentially:
- The cultural and ideological orientation of the content, revealing its educational potential for the comprehensive training of students.
- The domain of the content of the programs, methods and procedures for effective management of learning, skill development and the work-study link

The experience developed by the authors was a contribution of Higher Education professors to the educational improvement of the municipalities of the City of Havana during the 2016-2017 academic year, aimed at raising the systematic methodological preparation from a novel conceptual strategy of articulation of centralized preparation (Municipal Overcoming Center), with the specialized one by subject and specific of the centers.

In this course the reflective activity of the Mathematics professor was directed to

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the identification of what you need and what manages to overcome them, evaluate the horizon of possibilities it brings, deriving implications for mathematic education they teach.

For the development of this work, participant observation was used, so the teachers in the course were active protagonists providing information about it. It was based on a direct relationship between the observer and the subjects of observation, which allowed the direct collection of information, without the mediation of other agents.

The principle of the investigation was the existence of an open attitude, free of judgments, allowing the direct exchange of information between the agents and the awareness of the need to seek solutions to problems from a diversity of opinions.

The first moment was the selection and definition of the problem and the identification of the essential categories. As a problem, the need for planning, organization and development of the improvement of high school mathematics teachers without initial specialized training in the subject was raised, in order to raise the quality of their professional training.

In the pedagogical improvement for teachers of Mathematics in secondary school, the main categories are identified: mathematics education, pedagogical improvement and motivation for pedagogical improvement.

The importance of experimentation at this level and subject is justified by its peculiarities: the predominance of teachers who were prepared with a comprehensive general training, without specialization in the teaching of Mathematics. Despite this, it is necessary to point how they carry out the teaching of the subject successfully, overcoming the challenge

of the lack of depth in preparation for the course.

The course was developed in phases:

1. Planning and approval.
2. Disclosure of the course and announcement.
3. First meeting of the course and agreement on the content to be developed.
4. Development of the meetings.
5. Course Evaluation.

After the course has been planned and approved by the municipality's Center for the Improvement of Teachers, enrollment is called, informing the teachers of the objectives of the course and its duration. The course was planned for a semester with a fortnightly frequency.

The course aims to provide teachers of Mathematics, of the basic intermediate level, with cultural knowledge of the subject they teach, in the knowledge of their subject and in didactic aspects; This gives them greater professionalism as an advanced of knowledge and knowledge in their subject. It gives them security in their work teaching and thus the quality of mathematics education rises.

In the first meeting, the objective, needs for pedagogical improvement and the municipality and the form of evaluation of the course are discussed. Then, the professional needs are asked to shape the course program; this is flexible, it can be modified or enriched during its course, always with the consent and approval of the professor who directs the course and the students. From the discussion among the group of professors participating in the course, a consensus is reached on dealing with the topics in which it is desired to deepen:

1. Descriptive statistics.
2. Numerical domains.
3. Plane geometry.
4. Solving mathematical problems.

The meetings take place naturally, as planned, except for some interesting content additions. The Geometry theme was the least favored in time due to unforeseen difficulties.

An important moment in the research is the identification of the motivation shown by the teachers of mathematics for their improvement in the subject and what their interests of improvement are.

To collect the information, a record of the observer is used, where the opinions expressed by the teachers during each day of the course are recorded. The evaluation of the course is performed with a group technical interview and PNI (Positive, Negative interesting).

After processing the information collected, a meeting is done with students teachers, officials and teacher who teaches the course. In this way, some interpretations of the data that could be erroneous are clarified. Finally, the essential ideas are drafted definitively.

Among the main ideas, the teachers propose:

- The need to improve the preparation to teach the classes with an improvement that breaks the molds of routine methodological preparation.
- It is essential to deepen, first, in the knowledge of the content that is taught and, secondly, in the methodological treatment that must be given to the content.
- It is necessary, in addition, to provide courses to raise the math culture and give attention to how

to develop the student's logical knowledge.

- The teachers consider that the content of the course must devote a considerable part of the time to geometry as the area of knowledge that most urgent deal.
- The needs to deal with topics that deepen mathematics education, according to new approaches and not insist on those that are traditionally applied.
- The need for learning teaching strategies for mathematical content in later editions of the course.

## DISCUSSION

The permanent education is an urgent need in care and for attending; within it, pedagogical improvement courses play an important role, to which more attention is paid every day with the intention of professionalizing more in the graduate. Its organization must have an impact on the quality of education provided and on student learning.

The pedagogical improvement of Mathematics teachers should promote teaching in an institutional and social framework, combined with the interests of the territory and of the teachers, which updates the latter, in terms of novel approaches, advanced methodologies, the latest research on mathematic education and general culture.

The objectives to be achieved with the pedagogical improvement must specify contents, skills and the objectives of the subject in basic secondary school. In addition, ethical and moral values that express full awareness for the solution of cultural, environmental and social problems with mathematical knowledge.

A pertinent pedagogical improvement must promote the creativity of the

teacher, the ability to deepen, systematize and integrate professional content. It is important that pedagogical improvement is contextualized in the peculiarities, potentialities and limitations of each school, in the aspirations and requirements of the territory, elements that make the acquired knowledge significant, through the activity.

Placing the teaching improvement in the school or territory allows making this an instrument or an opportunity to innovate, improve teaching practice and transform basic secondary school.

Continuous training in a pedagogical improvement course should favor collaborative learning and confrontation between the experiences of teachers for the transmission and socialization of positive teaching experiences.

The experience developed in the 2016-2017 academic year and its continuity in 2017-2018 showed acceptance and satisfaction in the participants, both teachers and students -teachers; it was clearly stated that:

- The overcoming of mathematics teachers must be independent of systematic methodological work; but it must complement it. First, aimed at ensuring compliance with curricula and programs, and secondly to empower and reassure the teacher and advanced on not only knowledge in the content that imparts but, in addition, in cultural aspects of their subject.
- The pedagogical improvement must be flexible, dynamic and participatory, the program must be designed in common agreement between the teacher who leads the improvement and the attending teachers and be susceptible to modification during it.

- At the end of each stage, teachers must evaluate the quality of the course and the relevance of the topics covered to consider them when planning and organizing future pedagogical improvement courses.

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#### **Conflict of interest:**

Authors declare not to have any conflicts of interest.

#### **Authors' Contribution:**

*Jorge Antonio Díaz Lozada:* Conception of the idea, authorship coordinator, literature search and review, translation of terms or information obtained application of instruments, compilation of information resulting from the instruments applied, writing of the original (first version), review of the applied bibliographic standard, review and final version of the article, correction of the article.

*Luisa Manuela Martínez O'Farrill:* general advice on the topic addressed, literature search and review, translation of terms or information obtained, preparation of instruments, application of instruments, compilation of information resulting from the instruments applied, statistical analysis, writing of the original (first version), review of the applied bibliographic standard, review and final version of the article, correction of the article.



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