ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 15, Issue, 01, pp.23338-23344, January, 2023
DOI: https://doi.org/10.24941/ijcr.44607.01.2023

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

METHODOLOGICAL PROPOSAL FOR THE TEACHING-LEARNING PROCESS OF SOLVING PROBLEMS RELATED TO THE THEORY OF DIVISIBILITY IN HIGHER EDUCATION IN CABINDA

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ARTICLE INFO

Article History:
Received 26th October, 2022
Received in revised form
20th November, 2022
Accepted 19th December, 2022
Published online 30th January, 2023

Key words:
Teaching of Mathematics;
Divisibility Theory;
Applications and Mathematical Problem Solving.

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ABSTRACT

This article aims to develop the teaching-learning methodology for solving problems related to the Theory of Divisibility at the Higher Education in Cabinda. The study involved three Institutes, namely of Educational Sciences, Polytechnic Institute and Lusíadas Polytechnic Institute. This research arises as our experience as Mathematics teacher and the result of observation in the pedagogical practice of teachers, which contradicts the recommendations expressed in official documents of the Angolan Ministry of Education and Higher Education. Based on Polya's theory of solving problems, were elaborated a methodological proposal for teaching how to solve problems related to the Divisibility Theory in an investigative perspective. A questionnaire was applied in the classrooms, with students aged between eighteen and over twenty-six years old who were not used to working with problems related to the Theory of Divisibility. We chose to work with a quali-quantitative research methodology to understand how students relate to problems and identify the strategies used to solve them in their daily lives.

Citation: ***Geremias Luis Gomes and Alcides Romualdo Neto Simbo.*** **2022.** "Methodological proposal for the teaching-learning process of solving problems related to the theory of divisibility in higher education in cabinda*". International Journal of Current Research*, 15, (01), 23338-23344.

INTRODUCTION

The investigation emerges as a result of the researcher's experiences as a mathematics teachers, for 12 years working in several public and private schools from primary to second cycle, namely in Tali-beca primary school, Barão Puna first cycle school, new school of Chiweca and at the Chengnene Private School Complex in Cabinda. At the same time as a student at the Higher Institute of Educational Sciences of Cabinda (ISCED-CABINDA), during4 years of degree and 2 years of Master degree in Mathematics teaching course. While this trajectory was taking place, in dialogue, and witnessing classes of teachers who work with the subject of Mathematics, in these educational establishments, he was able to understand that the teachers were particularly interested in expose the contents, develop a mechanism to memorize formulas, exercise calculation skills, demonstrate some formulas, etc. Most teachers who work with the subject of Mathematics in the first cycle, even in Higher Education in general, occupy most of their time, exposing the contents and solving exercises such as: calculate, solve, demonstrate, determine etc, without worrying about solving challenging problems related to the divisibility theory. This situation result in Learning difficulties, problems with Didactic means use, Teaching methods, and Academic achievement in the Educational Sciences Institute (ISCED-Cabinda), Polytechnic Institute (ISPCAB) and Lusíadas Polytechnic Institute (ISPLC). There do not have the appropriate Measures to overcome. We understood that the teacher is the protagonist of the class, being considered the person who knows and who should teach others as said (Duli, 2014). From the perspective of traditional teaching, the teacher, according to Freire cited by (Recalcati, 2020) is the subject who leads the student to an automatic memorization of the content and the student is a vat, a container to be filled by the teacher, realizing the contents regardless. Therefore, *Haw to favour the teaching learning process of solving problems related to the theory of divisibility in higher education in Cabinda?* This research aims to develop a methodological proposal for solving problems related to the theory of divisibility in higher education in cabinda.

MATERIALS AND METHODS

Basic Concepts

Numbers theory: It is the part of Discrete Mathematics that studies integer numbers and their properties.

Theory of divisibility: Set of definitions, axioms, theorems, properties and laws that serve as a basis for dividing numbers, usually integers, or mathematical expressions. For our research of numbers, we consider the Euclid's theory for solving number divisibility problems and Polya theory for its teaching.

Euclid's theory of numbers: Set of procedures that consist of calculating the greatest common divisor between two positive integers a and b, represented by. For example, obtaining the greatest common divisor between 414 and 662 follows the following procedure or algorithm:

$662 = 414 \times 1 + 243$
$414 = 248 \times 1 + 166$
$248 = 166 \times 1 + 82$
$166 = 82 \times 2 + 2$
$82 = 2 \times 41 + 0$

$\therefore mdc(414{,}662) = 2$since 2 isthelast non-zero remainder
Euclid's algorithm: According to (Rosen, 2004) it consists of a sequence of instructions for calculating the greatest common divisor between two positive integers, represented in the following pseudo code:

Procedure$mdc(a, b$: positive integer)

$x := a$

$y := b$

while $y \neq 0$

begin

$r := x\,\boldsymbol{mod}\,y$

$x := y$

$y := r$

end [the$mdc(a,b)$is$x$]

***Number divisibility problem*: the main problems related to the number divisibility are the following**

- Mathematical induction problems
- Problems dividing two positive integers
- Maximum common divisor problems
- Minimum common multiple problems
- Linear congruence problems

Mathematical induction problems: is an extremely important technique that can be used to demonstrate statements of this type. Mathematical induction can only be applied to the demonstration of results that have been obtained in some other way. It is not a tool for discovering formulas or theorems. They are also applied in the development of algorithms. The Principle of Finite Induction is the basis for demonstrating the truth of propositions.

Theorem1 (Principle of Finite Induction-1st Form): Let $P(n)$be a sentence in $\{n \in \mathbb{Z}: n \geq n_0\}$, where $n_0 \in \mathbb{Z}$. Then$P(n)$ is true for all $n \geq n_0$, providedthat$P(n)$ satisfies the following conditions:

1) $P(n_0)$ is true

2) If$P(n)$ is true for $n \geq n_0$, then $P(n+1)$isalsotrue.

Proof: Let us analyze the set $X = \{n \in \mathbb{Z}: n \geq n_0 \text{and} P(n) \text{false}\}$. Weint end to show that$X = \emptyset$. Let us suppose for absurdity that $X = \emptyset$.

As X is inferiorly bound (by n_0, for example), then by the Well-Ordering Principle, there is $m_0 \in X$, minimum element of X, such that: $m_0 \leq n, \forall n \in X$. With$m_0 \in X, m_0 \geq n_0andP(m_0)$is false then $m_0 \neq n_0$, because, by hypothesis, $P(n_0)$is true. Thus, $m_0 > n_0$and, consequently, $m_0 - 1 \geq n_0$. There is $m_0 = minX$, it follows that $m_0 - 1 \notin X$. Therefore, $P(m_0 - 1)$istrue, sothat, bycondition (2), $P(m_0 - 1 + 1) = P(m_0)$. It is true and so is $m_0 \notin X$, which is a contradiction. Hence, $X = \emptyset$andtherefore$P(n)$istrue for all$n \geq n_0$.

Problems dividing two positive integers: is every problem in which$a$ and b being two integers, $a \neq 0$, wesay that a divides b if there is an integer $c$suchth at $b = ac$. When a divides b we say that a is a factor (or divisor) of b, and that b is a multiple of a. The notation $a \mid b$indicatesthat$a$ divides b. Wewritethat$a \nmid b$when$a$ does not divide b.

Theorem 2: Rosen (2004) says that, let a, b a nd c beintegers. Then:

1. If$a \mid b$and$a \mid c$, then$a \mid (b+c)$;
2. If$a \mid b$ then $a \mid bc$for everyinteger c;
3. If$a \mid b$and$b \mid c$then$a \mid c$.

Proof:

1) Suppose that and Then, by definition of divisibility, it follows that there are two integers and such that and Therefore,

$b + c = ak_1 + ak_2 = a(k_1 + k_2) \Rightarrow a \mid (b + c)$

2) Suppose that and is an integer. Then, by definition of divisibility, it follows that there is an integer such that. Therefore,

$bc = (ak)c = a(kc) \Rightarrow a \mid bc$

3) Suppose that and Then, by definition of divisibility, it follows that there are two integers and such that and Therefore,

$c = bk_2 = (ak_1)k_2 = a(k_1k_2) \Rightarrow a \mid c$

Maximum common divisor problems: Problem in which and are non-zero integers that consists of finding the greatest integer such that and is called the greatest common divisor of and The greatest common divisor of and is denoted as , (Rosen, 2004).

Minimum common multiple problem: Problem in which being two positive integers and consists of finding the smallest positive integer that is divisible by both and The minimum common multiple of and is denoted by , (Rosen, 2004).

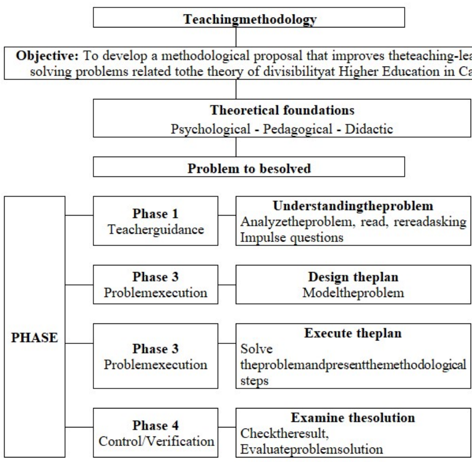
Linear congruence problems: It is a problem in which it consists of finding the values of a variable through the relation ≡ mod , where is positive integer representing the remainder of the division of by , and are integers and a variable that represents the division's quotient of by (Rosen, 2004).

$2 \times 11 = 7 \times 3 + 1$
$2 \times 11 = 21 + 1 \Leftrightarrow 2 \times 11 \equiv 21 mod\ (1)$
$a = 2;\ x = 11;\ b = 21\ ;\ m = 1$

METHODOLOGY

The present work, is of a quali-quantitative nature, whose research instrument was a questionnaire composed of several questions, a questionnaire applied to teachers and another questionnaire applied to students. *Population, Sample and Data collection:* In order to carry out the research, information and data was collected. With Simple random samples, two hundred and sixty-five (265) corresponding students from the three institutions under study were chosen, of which

67 were female and 198 were male and Fifteen (15) Mathematics teachers, of which 2 were female and 13 were male, making a total of 280 individuals surveyed, which corresponds to 27% of the population. The questionnaires were elaborated according to seven main dimensions (*Learning difficulties*, *Teaching methods*, *Didactic Means*, *Evaluation system*, *Academic achievement* and *Measures to overcome*) with their respective questions as nominal or ordinal variables, using the Likert scale. *Data analysis and Model construction:* Conceptual model was designed using IBM-SPSS software after the treatment of questionnaires data of professors and students, with the reliability of 66.3% and 79% respectively of Cronbach's alpha, thus being within the admissibility range, with reasonable internal data consistency. In the diagnosis, the respondents' opinions were extracted based on the analysis of data normality and of the main components.



Source: Prepared by the author

Figure 1. General scheme of the methodological proposal based on Polya's model

The variables did not have a normal behavior, they had distributions around their median because the p-values were below 0.05 and the answers stood very often on the extremes. For the extraction of the variables with the highest weight, that becomes the variables we includes in the dimensions in the Conceptual Model, we based on the admissible values of the Kaiser–Meyer–Olkin sample adequacy coefficient and the Bartlett sphericity test. In the case of studants, this measure was 71.2% with a p-value of 0.0 for the Bartlett test. For the teachers, this measure was 77,7% with a p-value of 0.0 for the Bartlett test. *Validation of the methodological proposal:* For the methodological proposal validation, we selected 3 experts in total, 1 professor from ISCED-Cabinda, 1 professor from ISPCAB, and 1 professor from ISPL-cabinda with an academic degree of Doctorate, who teach the subjects of Mathematics and have skills and experience in the use of Information Technologies. The questions formulated in the questionnaire to experts in the field, based on the following scale and its indicators: Bad (M); Sufficient (S); Good (B); Very Good (MB) and Excellent (E). Figure 1 is the graph of the results obtained in the pre-test and post-test applied to students. The post-test results showed us significant improvements in terms of students' academic performance after the implementation of this methodological proposal for solving problems related to the theory of divisibility in these institutions in Cabinda.

Background to the teaching of solving problems related to the theory of divisibility in Cabinda: What is expected to be done in the classroom, at the ISCED, ISPCAB and ISPL Higher Institutes in Cabinda, is the development of Mathematics classes, so that students understand the content and not just memorize and memorize formulas, exercise skills in calculations (Gomes, 2014). Considering this claim as an inherent premise of the teacher, higher education that emphasizes problem solving collaborates in teaching and education, as the curricular norms of higher education defend that teaching should occur based on problem solving (Silveira, 2020). According to (Silveira, 2020), the term problem is everyday, both for students and for teachers. In Cabinda Higher Institutes, it is present in the usual textbooks in schools, but this term has addressed some obstacles to students when they are found in a manual. Many teachers have a different point of view of what is a problem in math, and what is the difference between a problem in math and an exercise. When dealing with problem solving, it is important to define what we consider a problem, as (Proença, 2020) already pointed out that the word problem has multiple meanings. That said, we agree with (Polya, 1994) definition, by emphasizing that we have a problem whenever we look for the means to achieve an objective. We can emphasize that a problem is a situation that does not have any method or rule, or does it have any way of solving it, but that seeks to achieve a goal or an end and reproduce another problem. For (González, 2020), problem is an obstacle. According to (Figueiredo, 2020), a problem is a situation that the individual or group wants or needs to solve and for which they do not have a fast and direct path that leads to a solution. For (Zanon, 2020) a problem is a task for which the person wants or needs to find a solution (Leivas, 2020), define a problem as a certain situation that requires reflection, good interpretation, basic knowledge, and that understands the curiosity in which it is faced, while it is ready to solve it. For (Mendes & Proença, 2020), a problem is any situation in which the individual confronting is not guaranteed to obtain a solution with the use of an algorithm, and all relevant knowledge of this person must be combined in a new way to resolve the issue. solving a problem involves a thought process, based on four stages of problem solving, called: representation, planning, execution and control. We agree with (Pólya, 1973) who organized the problem solving process into four phases, as described in the Figure 1. For more details, the methodological proposal we present help to solve mathematical problems considering four steps: Understanding the Problem, Elaborating a Plan, Executing the Plan and Verification or Retrospect. Referring to the first action in the figure, the choice of the problem is considered as the superior preparation carried out by the teacher before carrying out his class, in which the problem (possible problem) to be worked on with the students will be chosen/planned, aims to introduce new content. In this sense(Proença, 2020)highlights three relevant aspects for this choice: The main thing is to direct students to use Mathematical concepts, principles and procedures previously learned during schooling; The second is precisely to lead them to build the content/concept/subject to beintroduced; The third comes from the previous ones and seeks to provide conditions for students to establish relationships between Mathematical knowledge and new knowledge. Understand, therefore, the relevance of working with the students' previous knowledge, making them remember contents that were worked on in previous years, in order to use this knowledge in the construction of new knowledge, arising from the Mathematical content that will be worked on.

Conceptual Model for Improving teaching/learning in solving problems related to Divisibility Theory: Conceptual model aims to identify and explain the significant concepts in a problem domain, identifying the attributes and associations that exist between them. This model is the result of the questionnaire applied to teachers and students via SPSS software. The initial mention is the result of a given approximate research on the positioning that they assume about the methodology as a scientific result of the pedagogical investigation, based on the different existing opinions about the conceptualization of the specialties of its presentation. Based on the revised information, it is assumed as a proposal at the most specific level: One of the ways of proceeding to achieve certain objectives, which are awe-inspiring in the theoretical body that is organized as a logical process consisting of steps sequence, elaborated, steps of conditioning and mutually dependent procedures, which, arranged in a particular and flexible way, allow for the achievement of proposed knowledge in which the investigation presented is assumed.

Theoretical foundations of the proposal

***Psychological*:** Is based on cultural-historical theory of Vygotsky (1994) and other authors of a Soviet school. The author also pointed out that development is the result of the interaction of the internal constituted environment, which in order to understand any learning phenomenon must take into account the level of development achieved on the basis of experience and that this level of development reached is dynamic with a wide and flexible range.

Pedagogical: the subject of knowledge is considered interactive, regulated by both internal and external forces. In practice, it is necessary for the teacher to accompany the teaching-learning process and occupy his position in this process. In the application of problems involving the divisibility theory, it is very important to know how to choose the problems to be proposed: The problems must be interesting and compatible with the students' level of knowledge, easy to interpret, in simple and familiar language and that allow extrapolations of way to challenge the students' "appetite", so that they can experience sensations, such as the tension of solving and developing a problem that involves the theory of divisibility and the glory of discovery.

***Didactic*:** every teaching-learning process is characterized by the dialectical relationship that is established between the didactic categories (objectives, contents, methods, means, forms of organization, evaluation and the teacher-group-student relationship), where play a fundamental role, the student learns to learn, the teacher is an agent of change who participates from their knowledge in the enrichment of the most appreciated knowledge and values of culture and society, assumes the creative direction of the teaching-learning process, planning and organizing the learning situation, guiding the students and evaluating the process and the result, coordinates groups of students offering them elements of analysis that come from the theoretical-methodological references systematized in science and culture, with the purpose of helping them to overcome the barriers of the learning task and contribute to their growth as a human being. On the other hand, the teacher must be attentive, helping the students during the resolution, being configured as the third action. It is worth emphasizing that the teacher should in no way be solving the problem for the students, delivering it to them ready and finished. To solve the following problems, the foundation of the methodological proposal by the heuristic method must be taken into account, in order to stimulate the students' mental process that is, taking into account the characteristics of the classes and the problems. The continuation of exercises is developed with the support given based on questions, to motivate reflection and analysis, and with that, the preparation of the students is obtained. These procedures must be developed systematically taking into account the characteristics of the contents and the students. Problems and their respective solutions are presented below, describing situations of a more representative didactic nature.

Analysis of the results obtained through pre-test and post-test: Graph 1 shows the difference in the pre-test and post-test results of students who participated in solving problems related to the theory of divisibility where the results obtained.

The results obtained in the post-test exceeded those of the pre-test, where 6% of students obtained a Good result, 24% with a Very Good result and 70% of students obtained excellent, while previously 90% of students had poor results in the pre-test. Thus, it was found that solving problems related to the theory of divisibility in teaching-learning contributed to reducing students' difficulties and increasing their motivation and interest in their learning.

Validation or proof of the methodological proposal in solving Mathematical problems

We selected 3 experts in total, 1 for each institution under studywith skills and experience in teaching Mathematic and Technologies of Information. The questions formulated in the above-mentioned questionnaire to experts in the field, based on the following scale: Bad (M); Sufficient (S); Good (B); Very Good (MB) and Excellent (E).

RESULTS

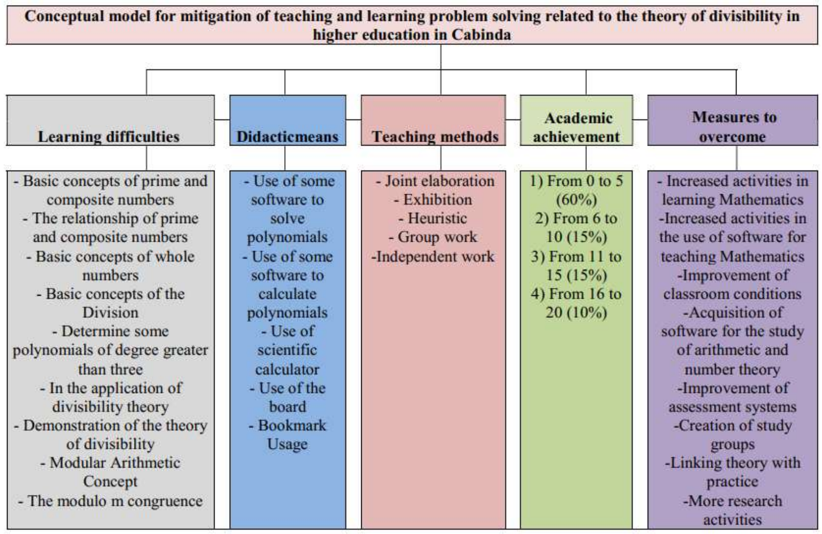
In validating this methodological proposal, the following results were obtained:

- With regard to the first indicator referring to teacher training in the use of software for teaching Mathematics of this methodological proposal, one teacher validated the proposal as excellent, one teacher as good, and another as very good.
- Taking into account the improvement of working conditions in the methodological proposal, two professors validated it as excellent and one professor validated the phases of the methodological alternative as very good.
- Regarding the acquisition of software for solving polynomials with n variables, the professors validated one professor validated the proposal as excellent, one professor validated the proposal as good, and one professor evaluated it as very good.
- Regarding the pertinence of the use of software in teaching arithmetic and number theory at ISCED-Cabinda, ISPCAB and ISPL-Cabinda, teachers had equal opinions taking into account the current context, so one teacher validated the proposal as excellent, one teacher validated as good and another rated it as very good.

Table 1. Problem Solving Related Theory of Divisibility

Problem Solving Process According to George Polya		
1.Understand the Problem		
First	It is necessary to understand the problem	It is the first phase or process inherent in problem solving. An adequate understanding involves not only realizing the meaning of the terminology and symbols used, but it is also necessary, at this first moment, an appropriation of the task or problem. This step allows you to clearly understand what the problem is, thus being able to build schemes to organize the proposed situation. It is necessary for the student to understand the problem, describing the relationships between dados e incógnitas, podendousar graphs, diagrams or adopt a notation that you deem appropriate.
2.Design the plan		
Second	Make the relationship between the data and the unknown.	The elaboration of the plan It is mentioned that after understanding the problem, the solver must concentrate on designing a plan that allows for unravelling the distance between the current situation and the goal to be achieved. Based on already acquired knowledge or considering auxiliary problems, the student should seek to find an immediate connection to a correct problem. After reading and identifying what the problem is, students will try to relate the scientific knowledge they have, seen in the classroom, with cognitive knowledge, that is, possible ways to get answers to the problems.
3.Plan execution		
Third	Execute your plan	Problem solving step, that is, implementing the plan made and transforming the problem through the rules known. This can be the easiest part of the process once the previous phases are done correctly. Because executing your plan correctly, the student will see the need for corrections from the previous steps. It is the moment in which the student will confirm their learning.
4.Validate the solution		
Fourth	Check the obtained solution	Examine the solution The step in completing the problem resolution process that occurs when the goal is reached and the solution obtained has been reviewed or analysed. At this stage, you can review the process and see if there is a different way for the problem to be resolved.

Source: prepared by the Author, 2020



Source: Prepared by the author

Diagram 3. Conceptual model for mitigating improving teaching/Learning

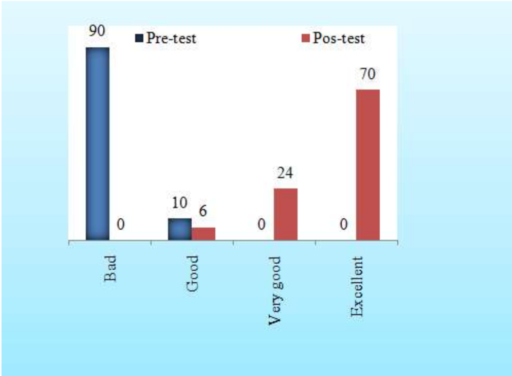
Table 2. Improvement of the proposal for solving problems related to the theory of divisibility

Problem solving process according to Polya		
The number of cases per covid-19 estimated by the World Health Organization in Angola is 23,732 and an average of 180 cases are registered daily. What is the death toll we can find daily?		
Understand the problem		
First It is necessary to understand the problem	1. What should you do first when going to solve a problem? 2.What does the problem say?	1.Understand the problem, read, reread, formulate and extract the data from the problem. 2.What is the number of deaths per covid that we can find daily?
Design the plan		
Second Make the relationship between the data and the unknown. It is necessary to come up with a plan for the resolution	3.Have you seen this type of problem before? Or have you ever seen the same problem presented a little differently? 4. When does not a fact occur periodically, what is it about? 5. Is this a reasonable problem? Are the conditions that figure in the problem sufficient to determine the Greatest Common Divisor? 6. Is there unnecessary data in the problem? 7. What will you do now?	3. No 4. it is the Maximum Common Divisor (mcd) 5. Yes it is reasonable and the conditions that figure in the problem are sufficient to determine the Maximum Common Divisor 6. There is no unnecessary data in the problem. 7. It will divide 23732 by 180 until it finds the Maximum Common Divisor.
Plan execution		
Third Execute your Plan and examine each step	8. How is the problem solved? 9. Is there no other way to explain it better?	8.Let's calculate $mcd(23732,180)$. Based on Euclid's algorithm, this calculation will be solved as follows. $\begin{array}{c\|c\|c\|c\|c\|c\|c} & 131 & 1 & 5 & 2 & 3 & \\ \hline 23732 & 180 & 152 & 28 & 12 & 4 & \\ \hline 152 & 28 & 12 & 4 & 0 & & \end{array}$ 9. The other way to explain better $23732 = 180 \times 131 + 152$ $180 = 152 \times 1 + 28$ $152 = 28 \times 5 + 12$ $28 = 12 \times 2 + 4$ $12 = 4 \times 3 + 0$
Validate the solution		
Fourth Check the obtained solution	10. Finished calculating what explanation is needed? 11. What is the answer?	10. Using this mechanism, mcd(23732, 180)=4. Will be the last non-null remainder. In this case it is the number 4. Through this method the calculation of the mcd of integer numbers is easier. 11. Every day we can find that in Angola, the number of deaths per covid-19 is 4 elements.

Table 3. Indicators evaluated

Indicators	M	S	B	MB	E	Total
Teacher training in the use of software for teaching Mathematics				1	2	3
Improvement of working conditions			1	1	1	3
Software acquisition for solving polynomials with n variables				1	2	3
Use of software in teaching arithmetic and number theory			1	1	1	3
Improving the teaching methods of arithmetic and number theory				1	2	3
Improvement of the evaluation system including the use of software			1	1	1	3
Application of the scientific theories of teaching and learning by Polya.					3	3

Source: field research (2020)



Source: field research (2020)

Graph 1. Analysis of pre-test and post-test results

- Taking into account the indicator referring to the improvement of teaching methods in arithmetic and number theory two professors validated the proposal as excellent and one professor as very good.
- With regard to the application of scientific theories of teaching and learning by various authors such as Polya and others, the professors validated the three as excellent.

DISCUSSION

The importance of problem solving throughout human history and the relationship that this has had since its beginning with people's daily problems is perceived. (Bicudo, 2018), cites three different ways of approaching Problem Solving according to (Schroeder &Lester, 2019) related to the above proposal, that is, a more significant mathematics education, bringing three methods for teacher reflection, which are:

- Teach about problem solving,
- Teach problem solving
- Teach math through problem solving.

It is up to the teacher to dose each form mentioned to balance the approaches to problems. The author also refers to (Walle, 2017) who suggests that teaching mathematics through problem solving requires the teacher to create a motivating and stimulating mathematical environment. Polya's model with four phases show impressionant results in teaching divisibility theory of numbers. Therefore, each class must comprise three phases: in the first, it is necessary to understand the problem, clarifying the objectives, in the second, make the relationship between the data and the unknown. It is necessary to come up with a plan for the resolution. In the third, execute your plan and examine each step. Finally, in the fourth phase, check the obtained solution.

CONCLUSION

The revised theoretical foundations lead us to understand that the current teaching-learning process in solving problems related to divisibility theory in the higher institutes in question has not taken into account the essential arguments that help and stimulate learning and achievement student motivation, thus creating a negative impact on the quality of teaching. The heuristic method creates in the student a capacity for reasoning, and develops Mathematical thinking so that it passes through all the fundamental stages that characterize it. The presented methodological proposal based on Polya's theory is characterized by the heuristic method and the way to value the practice to contribute to improve the teaching-learning process. Because to solve a problem, it needs to go through orientation stages, execution, control and verification by the heuristic method to activate the teaching-learning process in solving problems related to divisibility theory and improving learning, which are important

The subject of Mathematics has a preponderant role as a modeler of reasoning, development of skills to formulate and solve problems, to communicate, to develop a critical spirit and a sense of rigor in the teaching-learning process. The revised theoretical foundations lead us to understand that the current teaching-learning process in solving problems related to the theory of number divisibility in the Higher Institutes concerned, has not taken into account the essential arguments that help and stimulate learning and obtaining student motivation, thus creating a negative impact on the quality of teaching. Problem solving is the essence of the development of Mathematics, it has an extremely important role in the teaching process - learning at all levels (André, 2017);

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