Turkish Journal of Computer and Mathematics Education Vol.12 No. 7 (2021), 3133-3139

Research Article

Methodology To Improve The Teaching Of Mathematical Theories In Schoolchildren, Through The Use Of Programming Techniques

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Article History: Received: 11 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 16 April 2021

Abstract: The science courses are and will be the basis of the students' knowledge, in this sense the mathematics course is considered the most important course because in its content it presents topics related to calculus, making their learning of vital importance in the design of educational processes. Finance a review of the state of the art we find a series of works dedicated to being able to enhance the mechanisms used for teaching, from the use of scientific calculators to reaching certain computer programs of common use, in this work a methodology is developed to be able to enhance the programming skills that teachers have in a specific area of programming, where we can consider any programming language but also any computer tool such as Excel spreadsheets. The methodology proposes the organization of topics as specific theories, such as algebra, arithmetic, trigonometry, geometry, where specific functions are developed for each specific topic, with the intention that they can be understood more easily and in turn not complicated. to the teacher in his process of adaptation of the materials and in the development of the classes. The intention is to enhance the knowledge that teachers have instead of presenting a new programming language and that they can learn in order to teach. The results show that by using the knowledge they have regarding some computer tool, we managed to organize the study materials so that it is more understandable at the time of the classes. As a conclusion we can indicate that in these times of the COVID-19 product pandemic, the methodology that is presented becomes more important because the classes are online and can help the learning of mathematics with the help of these mechanisms to organize the study materials and improve the learning processes of the math course.

Keywords: Mathematics, programming, theories, algorithms, libraries, learning.

1. Introduction

For students in educational centers. The mathematics course is considered the most important, due to the number of hours they study per week, as well as the dependence for understanding of other courses that require their knowledge, as is the case of the Physics course. For this reason the importance of their learning, in this context to be able to improve learning in schoolchildren, many ideas and solutions arise capable of providing a better teaching experience, with the use of technology many of these solutions are being presented, as we can mention the use of programming languages such as PYTHON where they try to strengthen the knowledge of mathematics accompanied with the teaching of programming (Auccahuasi et al., 2019) (Palma et al., 2015) (Trigo et al., 2008).

One of the classic tools when performing calculation exercises is the calculator, in the market we find many types of calculators, ranging from those that perform basic exercises to the more complex ones that perform advanced calculation and graph the results for a better understanding , works are presented where the use of these calculators as well as graphing programs are presented in order to strengthen the teaching of mathematics (Araya et al., 2007) (Diaz et al., 2005).

When we refer to the teaching of mathematics in university careers, the challenge increases, one of the key courses in this stage of studies is related to the linear Algebra course, performing a quick statistics, we can indicate that the course has the highest number of disapproved students and who require more than one cycle of studies to be able to approve it, in this context, there are jobs where students who have been undergoing a course in a public university in Argentina with the intention of being evaluated for an average of 5 years In order to evaluate and recommend certain criteria to be able to improve the number of approved students, for this objective we resorted to the use of programs dedicated to the calculation of Linear Algebra, with which the performance of the students was improved (Craveri et al., 2009) (Vergara et al., 2016).

We also find works where computational tools are applied to demonstrate the exercises developed, in this aspect the use of the Excel tool is used as a learning mechanism and verification of exercises (Santos et al.,

2011). In the use of available computer tools, we cannot ignore social networks, in this sense there are many methodologies that are being presented to be able to use these applications in the teaching of certain topics related to mathematics (Salas-Rueda et al. ., 2018). The use of social networks and with more emphasis the applications related to the visualization of videos, are used more frequently, in history courses, managing to increase the knowledge of certain facts, managing to integrate these applications into the educational process (Salat et al., 2013).

In this search for alternatives to be able to use computational tools in the mathematics learning process, we must not neglect the point of view of the teachers, who are in charge of having the necessary skills to be able to teach, there are jobs where they are presents to teachers the different tools available with the intention of being able to strengthen these skills in favor of improving their performance in classes, (Villarraga et al., 2012). In this context, the present methodology that is presented is focused on enhancing these skills that teachers have with respect to the knowledge of some programming language, recommending organizing the information and the way in which it can be presented to students related to specific topics of mathematics , the intention is not to teach the teacher a new programming language, but on the contrary, to be able to strengthen the language that has knowledge.

2. Materials and Methods

In the development of the methodology, it is presented in figure 1, the block diagram of the methodology, where the 3 main processes are defined, each of them is developed with the intention of being able to apply the methodology, in each of them they are presented the activities to be carried out for the benefit of being able to put together their class material.

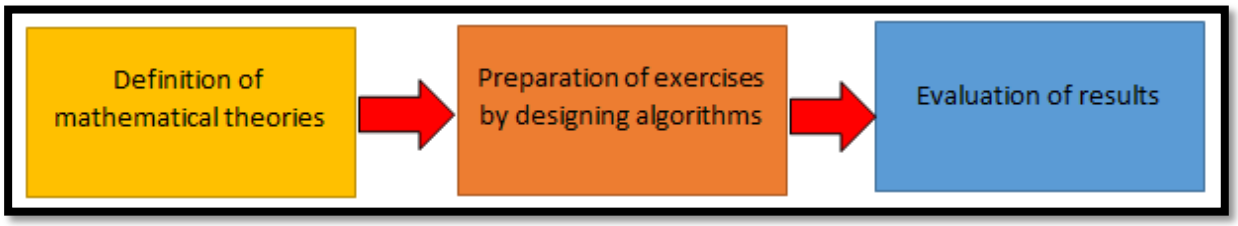

Figure 1. Description of the methodology.

2.1. Definition of mathematical theories

The first stage is dedicated to being able to design the structure of the material, it will depend on each one of the topics to be designed, the intention is to have defined the topics to be able to develop, for the purpose of being able to demonstrate the methodology the area of geometry is developed with the following Topics to be developed:

Study area: Geometry

Topics to be developed:

- Calculation of perimeters of the square
- Calculation of perimeter of the rectangle
- Calculation of perimeter of the circumference
- Calculation of the area of the square
- Calculation of the area of the rectangle
- Calculation of the area of the circumference

With each of these topics to be developed, the intention of creating a file, a spreadsheet or a function for each topic, which would lead us to later develop our own mathematical library and thus be able to increase new topics and with it grow our library.

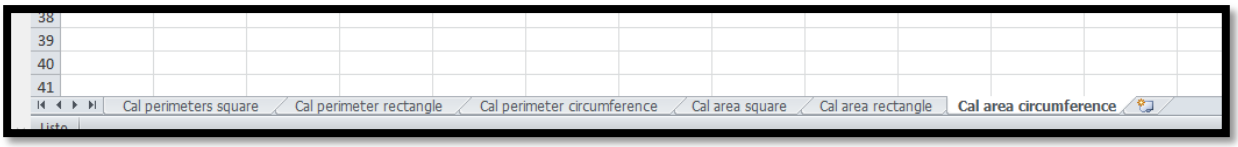

Figure 2. Organization of topics in a file in Excel.

Figure 2 shows as an example of the first stage of the methodology, the organization of the first 6 topics to be developed, in this case each of the topics, corresponds to a calculation hour in excel.

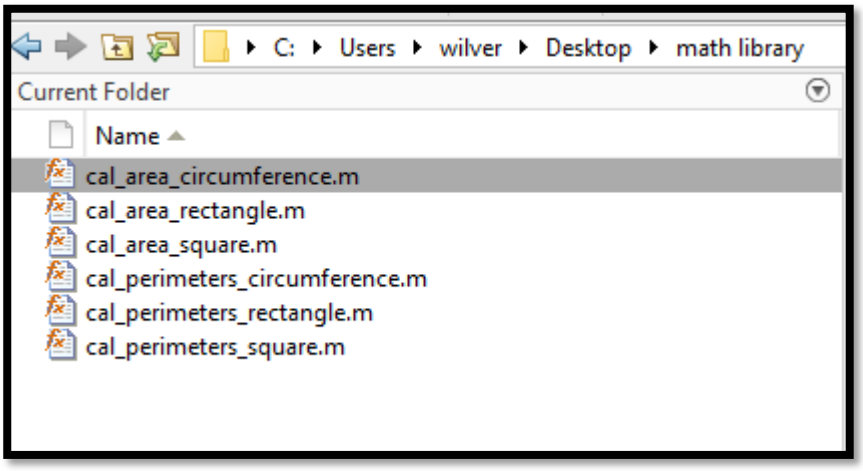

Figure 3. Organization of topics in the Matlab tool.

In figure 3, the organization of the topics is presented using the Matlab programming tool, where each of the 6 topics will be represented by a function, in the demonstration of the methodology, each of the steps and tasks will be indicated in Excel and Matlab.

2.2. Preparation of exercises by designing algorithms

With the intention of preparing the exercises, the methodology proposes the preparation of the exercises for each of the topics developed in the previous stage. It must be considered that for each of the exercises the Excel spreadsheets will be used and in the case of Matlab the previously created functions will be used.

In this second stage, it is recommended to develop the theory with an explanation, as well as the exercises that can be presented as an example and some as a challenge and as tasks, depending on the teacher who lists his material, he will define the exercises according to the complexity that you deem appropriate and will depend on the level of your students.

Figure 4. Development of the first exercise to calculate the area of a square in Excel.

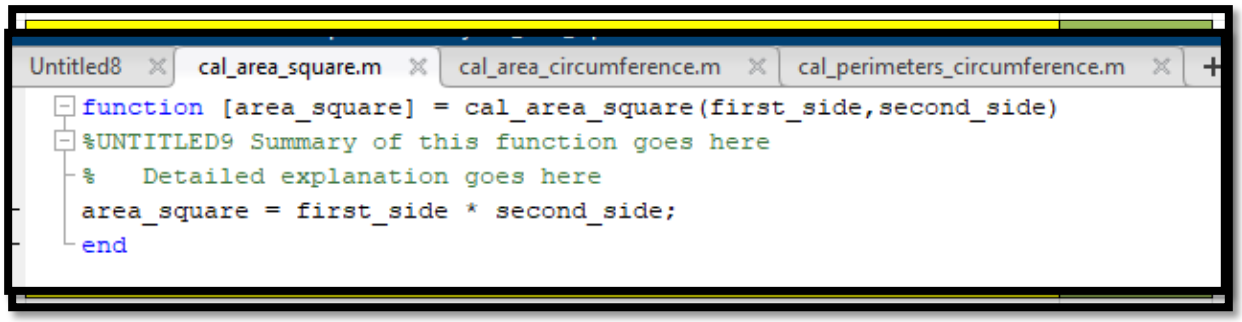

Figure 5. Development of the first exercise to calculate the area of a square in Matlab.

In figure 4, you can see the development of the exercise of calculating the area of the square using the Excel tool, in the form of completing the fields, as well as the verification of the result, in figure 5, it is presented in the same exercise using the tool matlan, where the development of the function calculation of the area of the square is presented, it is presented as a code, to verify the result, you have to make the call of the function in the command line. The results of the function and the way it will be executed is explained in the next stage of the methodology.

2.3. Evaluation of results The third stage proposed by the methodology is the execution of the exercises and the evaluation of the results. For the fulfillment of this stage, you have to complete the exercises and topics in each of the spreadsheets in the case of the Excel tool and in the case of the Matlab tool you have to finish programming each of the functions.

Calculating the area of the square	data
first side	7.5
second side	3.9
area	29.25
description of the exercise =C4*C5	

Figure 6. Result of the execution of the exercises in Excel.

```
>> result= cal_area_square(7.5, 3.9)

result =

   29.2500
```

Figure 7. Result of the execution of the exercises in Matlab.

In this figure 6, the results of the evaluation of the exercises are presented using the Excel tool, to improve the evaluation it is necessary for the students to send the file so that the teacher can evaluate the activities. In figure 7, the results are presented after evaluating the exercises with the Matlab tool, where the final result and the way in which the calculation of the area of the square function is presented is presented, in this case for evaluation purposes, the student you can send a similar image to figure 7.
In the evaluation of the exercises that can be presented to the students, figure 8 is presented, where the evaluation flow diagram of the proposed exercise is described, indicating each of the steps to be developed if each of the areas is carried out with success proceeds to the next topic, you cannot go to the next topic until the exercise is done.

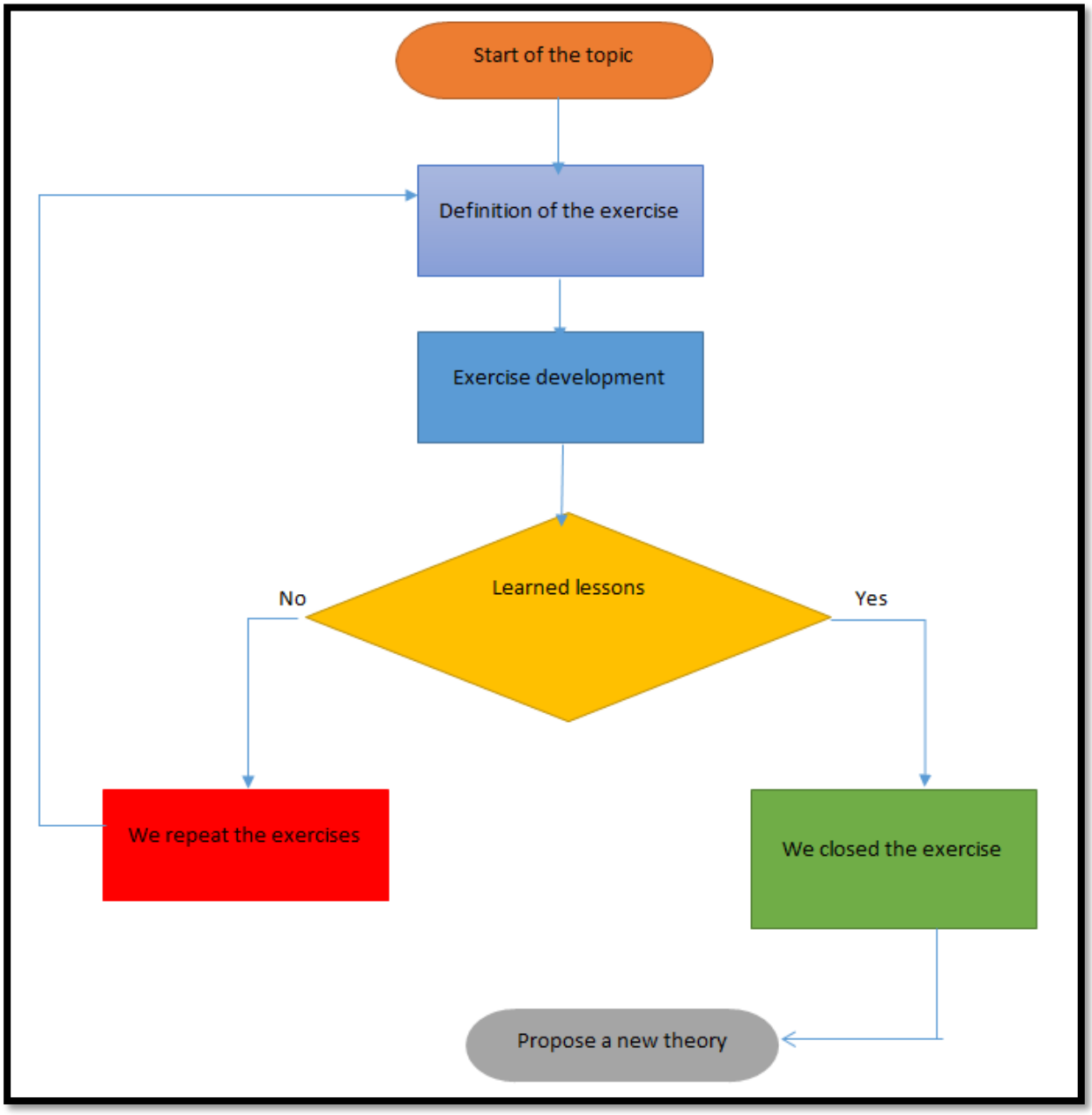

Figure 8. Exercise evaluation flow chart.

3. Results

Finishing the description of the methodology, we proceed to indicate the results obtained by referring to the two tools used to describe and apply the methodology. Each of them with its particularity, keeping in mind in both cases the good predisposition of the teacher, so that the methodology can be put into practice.

- For the Excel tool, the minimum knowledge to use the tool must be considered, therefore it is important that the teacher can know the tool. The results show that it is possible to have an Excel file for areas of knowledge such as Artirmetics, Algebra, Trigonometry and Geometry. In each of the files you can have as many spreadsheets as topics we want to carry out. In this way, students can open their excel file for each study area and can carry out the activities contained in each of the spreadsheets, in this case the activities can be designed to be able to corroborate the results obtained manually. Thus the student begins to handle the mathematical functions that are available in the Excel tool.

- In the case of the Matlab tool, a function was performed for each topic, in this way it is organized in the form of a mathematical library, so that the student begins to practice the exercises, the first thing

to do is find the function to work. and then you can call it from the command window or by making a programming file, containing the programming lines.

To finish we can describe that the computer tools, which we normally use in our daily tasks, we can give them an application in the teaching of mathematics, in this way we can enhance and take advantage of this availability, what would remain pending is to prepare the material, the methodology described It can be scaled and can be complemented with other courses such as physics among others.

4. Conclusions

It is concluded that the agreement of the theories that govern mathematics are important as knowledge of the basic sciences and serves as a support to demonstrate and verify certain laws in other subjects, such as physics, in this context their learning must be considered As a fundamental strategy, therefore, to achieve the educational objectives, with respect to the learning and teaching of mathematics, we can make use of the computational tools that we can have for the benefit of this work. The methodology presented is practical in its use and implementation, being scalable and depends on the teacher's ability to design the practical material..

The results show that the methodology can be implemented through the use of the excel tool and through the use of a programming language such as Matlab, these two tools were used for their simplicity in handling and familiarization in their use. Each of them adapts to how to assemble and organize the contents. The methodology can be applied using other tools such as programming languages, we can use the programming language Python, C, C ++, Java, among others.

It can also be scaled to levels of complexity and it depends on the level of difficulty that can be presented in the exercises, this task is fundamental and depends on the teacher. In most cases, the process is finalized, resulting in the design and implementation of a library of mathematical functions, which can solve different types of exercises, with which it is possible to improve the skills in the programming area by the teacher. As the students, and as a consequence of the use and application of them, the students can understand the importance and the direct relationship that mathematics has with programming, if this synergy is achieved, consider the students are candidates to be able to improve these skills and may be inclined towards studying undergraduate degrees related to engineering, computer science, informatics, and systems design.

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