Training in Computational Thinking for Teachers of Educational Technologies in the Blended Learning

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ABSTRACT
Computational Thinking (CT) is present in business, education, health and other areas. Given its nature of practice and the increasing use of this type of methodology, there are countless opportunities for pedagogical teaching that can be used at school, regardless of the area/discipline. This research was developed from a hybrid training of teachers. The research technique was through form and observation. During the training, the teachers filled out the survey form. The results were analyzed according to categories, at the time of the data, standing out as plugged activities using the concepts of Computational Thinking in the different areas of knowledge.

Author Keywords
Computational Thinking; Teacher Training; Pedagogical Practice.

ACM Classification Keywords
K.3.1 [Computers and Education]: Computer Uses in Education

INTRODUCTION

Problem solving is a demand that arises daily in our lives. According to the World Economic Forum (WEF) the act of solving problems is one of the skills necessary for the professional of the future [10].

The National Curricular Common Base [1], highlights that the promotion of practices and activities involving CT concepts and fundamentals can collaborate so that students evolve and improve their ability to "understand, analyze, define, model, solve, compare and automate problems and their solutions, in a methodical and systematic way, through the development of algorithms" thus contributing to the integral development of the student in the educational process.

It is possible to apply this context at school, where students are challenged to systematize possible solutions, based on real problems that are present in society regardless of the area/discipline. As a strategy to solve problems, we resort to Computational Thinking (CT) that is present today in several areas, whether in business, education, health or other areas.

According [5], CT is composed of ideas and human knowledge to solve different types of problems, and leads the subject to question, think and solve problems, moving from theory to practice, using the teachings obtained in the classroom.

Using a CT in an interesting and attractive way, reconciling learning and problem solving, can be a differentiated strategy that enhances the students' learning process.

However, it is necessary to prepare the teacher for the countless possibilities of pedagogical practices involving the CT, given its insertion in the daily life of contemporary society, its interactive nature and the considerable increase in its application in education.

However, for this practice to be effective in the educational area, it is necessary to promote teacher training that contributes to the development and construction of new knowledge considering the CT for teaching in Basic Education, thus making it a reality in education, preparing students for life in the 21st century.

In this way, a pilot project of Training in Computational Thinking was carried out, with a group of teachers of educational technologies, linked to the Municipal Department of Education of Vila Velha [4][9].

This work aims to present a report on the experience of teacher trainees, carried out in a hybrid way in partnership with the Federal Institute of Espírito Santo (IFES) in the use of Lovelace's Massive Open Online Course (MOOC: Computational Thinking).

According to [2] reflection that "the continuing education of teachers favors research issues and theoretical and practical proposals that study the processes in which teachers are involved, and which allows them to intervene professionally in the development of teaching, curriculum and school".

METHODOLOGY

The strengthening of Computing in Basic Education demands, among other elements, the training of teachers. Considering this need, the training was designed to

encourage the continued training of teachers for the use and application of CT in the pedagogical context [3].

The research was applied between August and December 2021, aiming to meet the training of teachers of educational technologies using CT in their pedagogical practices.

The public selected for this research were teachers and pedagogues of Basic Education of Elementary School in a public school in the municipality of Vila Velha in Espírito Santo/Brazil, considering the importance of this theme and its educational practice.

The universe of professors with interest in participating in the training was attended by a total of twenty and seven registered.

Twenty-two will start training and respond to the questionnaire for initial diagnosis, not which was possible to trace or profile two professors participating in the research.

Among the characteristics observed, we found that 40.9% of participants were between 31 and 40 years of age, that 4.5% were older than 60 years of age and that 54.4% were between 41 and 60 years of age.

Regarding the training of these teachers, it was possible to verify the existence of a diversity regarding the initial training for acting in education, as shown in Figure 1.

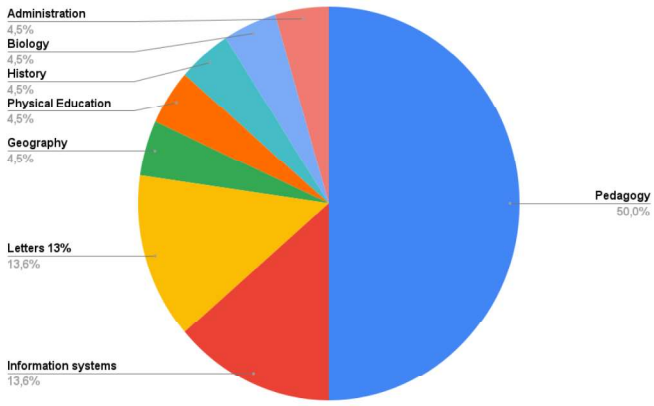

Figure 1 -Teacher training Area

As for the pedagogical experience and the time of acting in education, we also verified a great variation that was evidenced in Figure 2.

In the execution of the course, considering the hybrid perspective, the *Google Classroom* platform was used to carry out the asynchronous activities and for the synchronous activities the *Google Meet* video conferencing platform was used.

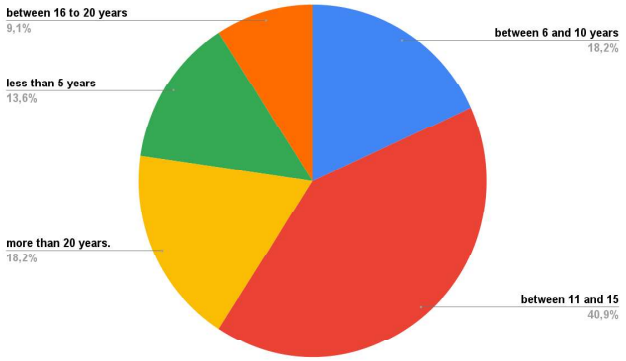

Figure 2 - Time in Education

As illustrated in the diagram in Figure 3, the training process began with an asynchronous online meeting, in which stage 1 involved the participation of the teachers who authored the MOOC by Lovelace: Computational Thinking at IFES [6][7].

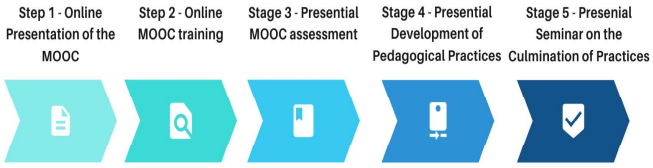

Figure 3. Stages of The Training Process.

The guests introduced the Court of Lovelace and showed how to carry out the training using the MOOC. In this same step, the initial phase of data collection was carried out, through an online form, made available so that the participants could respond.

Stage 2, it was based on the experiences of Lovelace's MOOC: Computational Thinking. At this stage, the teachers were instructed to take the course in the period established between August 2021 and October 2021. The contents included: Introduction to CT; Decomposition; Abstraction; Pattern Recognition and Algorithm.

Stage 3 culminated in a face-to-face meeting, in which a conversation circle was held an order to answer questions, discuss the learning built during the course and explore situations of possible applications of the CT practice in the teacher's pedagogical context.

To strengthen CT learning, we carried out some practices with unplugged activities [3].

In that same face-to-face meeting, the proposal for the preparation of CT pedagogical practices seminar was presented to the teachers, in this Way the teachers were invited to develop activities with unplugged or plugged-in practices using CT in the classroom.

Stage 4 took place between the months of October and November 2021, when the teachers developed and applied the project proposal in the classroom with their students.

In stage 5, a face-to-face seminar was held, on December/ 2021, for the presentation of pedagogical projects with CT practices, five (5) projects were presented, and one project was developed and presented by one of our teachers with the participation of his elementary school students, bringing animation and the exchange of roles when the other teachers had to carry out the activities proposed by the students.

All the other projects were presented in a dynamic and practical way, with the development of plugged in and unplugged activities challenging the participation of the teachers present. In this last stage, the final data collection phase was carried out through a form the participants responded to perform the data analysis.

RESULTS AND DISCUSSIONS

The first results show the importance of this subject in teacher training, since CT is already under discussion for inclusion in the National Curriculum of Brazilian Basic Education.

In the analysis of the data, the first perception leads us to a reflection on the questions that involve the interest in the participation in the CT course by pedagogues and teachers.

Considering the evolution and the intimate relationship of computing in the most diverse segments of society. In addition to the evident insertion of computing in each stage of Brazilian Education.

This new reality and this lack of interest leads us to a reflection and provokes questions about what would be the barriers that lead to resistance regarding this theme in the part of teachers.

We raise some questions to think about and reflect on. Could it be that the difficulty lies in the fact that many teachers are learning to use computing and digital technologies in their adult lives? Being considered digital immigrants [8].

Would this difficulty be related to the initial training? The scope of this information shows us the opportunity and importance of this subject in teacher training, since the PC is already under discussion for inclusion in the National Curriculum of Brazilian Basic Education.

A point evaluated in the research was the level of knowledge of teachers about the term Computational Thinking. Regarding this question, we obtained the following data, as shown in Figure 4.

When asked if they have ever used computing to solve some kind of problem. 86.4% have already used it and 13.6% believe they have never used computing in their problem situations.

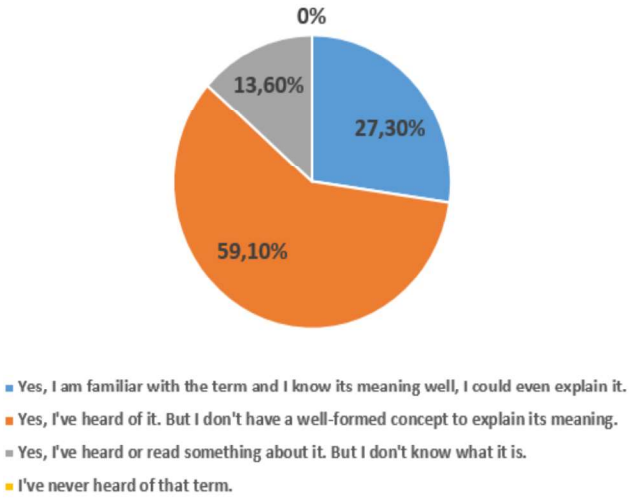

Figure 4 - Amount of professors who knew about "Computational Thinking".

The teachers marked the terms they made with Computational Thinking. The total of these terms are available in Figure 5.

It is important to highlight that most of them associated the Computer object with the term Computational Thinking before their formation. Problem solving appears in the third most chosen object.

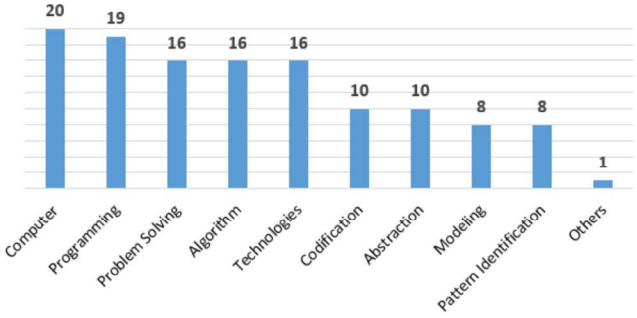

Figure 5 - Association of the word Computational Thinking.

When asked about the contribution that the development of computational thinking can bring to the formation of students, positivity was general and 100% of the teachers said that yes, CT practices help in the development of logical thinking.

This reflects in several areas that the student has contact with at school and in his daily life. The Figure 6 below shows the main contributions of the CT in Brazilian Basic Education pointed out by the teachers.

Yes, as it helps to develop the resolution of logical thinking. And this reflects in several areas that the student has contact with at school and in his daily life.
Through strategies to act directly in solving students' learning problems
Identifying problems and developing tools to solve them.
Yes. With the teaching of robotics, the understanding and application of algorithms, programming and teaching them to apply this technique to everyday problems exemplifying.
Yes. Computational thinking develops the ability to plan, execute and develop skills that relate to technology and life.
Yes. In problem solving, in the ability of logical reasoning among other skills.
The work of developing computational thinking brings effective learning to the student, stimulating logical reasoning, making it faster and more efficient.

Figure 6 - CT in Brazilian Basic Education pointed out by the teachers.

Finishing the application of the initial assessment, the teachers were approached about the feasibility of working with Computational Thinking and answered the following question.

Do you consider the practice of Computational Thinking applicable in your daily work in the classroom? Exemplify, as shown in Figure 7.

Yes. Both through the use of logical reasoning in classroom activities and the decomposition of tasks to form the whole.
Yes. The work of the Educational Technology teacher is, at its core, interdisciplinary.
Yes. It is applicable, but not daily. When in robotics, we work with the teaching of algorithms.
Yes. For the student to reach a final result of a simple project, for example, in Robotics, to turn on an LED, the student needs to recognize the materials that will be used.
Yes. Even in Early Childhood Education, I apply through educational games involving logic and solving challenges.
Yes. I believe that helping the student to evaluate a problem and consider the possibilities of solution.
Yes. It allows the student to reflect on their reasoning and have more autonomy.
Yes. Through technology and tools, the mediation of the problems that are solved by the students happens with an attractive and practical class.

Figure 7 - Practice of Computational Thinking applicable in your daily work in the classroom

According to the answers obtained, the teachers believe that the practices developed with the TC are possible in their pedagogical practice within an interdisciplinary context. Involving in this process the development of logical thinking and autonomy in problem solving.

After completing the training, we carried out a final evaluation survey and had the return of seven teachers. We asked the following question about CT training: Did it make sense in the context of your pedagogical practice? All answered that they did the pedagogical practice.

We leave the following discursive question: What changes in your pedagogical practice using CT? We obtained several answers, among them, we can highlight.

Increases efficiency
Understanding in other processes hitherto not observed.
I can better view the use in everyday school life.
It shifts to the greater desire to introduce computational thinking to students' daily lives.
Improved use of logic in teaching use
I had already been working on my pedagogical practice, it came to improve my work further.
Best way to teach and organize

Figure 8 - What changes in your pedagogical practice using the PC?

Analyzing Figures 7 and 8, we can observe that there was a change in the teachers' perspective regarding the application of TC in their pedagogical practices. It is possible to see that the training contributed to a greater understanding of the concept of TC, its possibilities and contribution to the development of learning in Basic Education, thus promoting the interests of 21st Century education.

We assess that hybrid training using the MOOC, with face-to-face meetings combined with pedagogical practices, supports the idea that CT is a fundamental skill for everyone, not just for computer scientists. Schools were challenged to explore the concepts of computational thinking, that is, to make use of the possibilities of computing processes in order to, through a sequence of creative actions, solve problems and understand how the problem was solved.

FINAL CONSIDERATIONS

From the reflections that occurred with the completion of this training, we can highlight the importance of promoting continuing education for teachers, as developed in this work, for the strengthening and implementation of practices with CT in Basic Education.

Considering in this perspective the difficulties that many teachers have to insert the concepts of computing in their classes, as a possibility the contextualization and the concrete learning of the taught concepts.

In this reality, we can also reflect on another preponderant factor, which is the difference between the technological reality experienced between these two generations, as verified in this study, considering the percentage of teachers who participated in this training, as described above, and the students who are taught by them, when it comes to technology and computing skills.

Another point to be highlighted is the difficulty that many teachers may find to foment time to build new knowledge, in this sense, it is opportune to combine teacher training, in a hybrid way, considering the difficulties they find in

reconciling the extensive workload that many teachers face and the many activities to be developed for the realization of a class itself, and the opportunities for the effectiveness of their qualification to act as multipliers using CT in their pedagogical practices.

We conclude that more actions are needed to develop CT in the training of Basic Education teachers, whether in the initial training of new teachers or in continuing education, and that these include a methodology that allows greater teacher participation.

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