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To cite this version:
Jeanne Dobgenski, Angélica da Fontoura Garcia Silva. A practical experience in pre-service teacher education focusing on computational thinking. Twelfth Congress of the European Society for Research in Mathematics Education (CERME12), Feb 2022, Bozen-Bolzano, Italy. hal-03748506

HAL Id: hal-03748506
https://hal.science/hal-03748506
Submitted on 9 Aug 2022

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A practical experience in pre-service teacher education focusing on computational thinking

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Keywords: Pre-service teacher training, mathematics education, block-based programming.

Introduction

Computational thinking (CT) is a recent topic in most Brazilian schools since it was included in the National Common Core Curriculum – NCCC (Base Nacional Comum Curricular – BNCC) in 2018. NCCC aims to guide school curricula and provide for the development of CT through Mathematics teaching (Ministério da Educação, 2018). The purpose of this research is to present how elementary pre-service teachers apply CT skills when they design a lesson to teach elementary mathematics.

Theoretical framework

In this research we consider Selby and Woollard’s definition (2013, pp. 5) of CT: it “is a focused approach to problem solving, incorporating thought processes that utilize abstraction, decomposition, algorithmic design, evaluation, and generalizations.” This approach combines the four CT pillars showed by BBC Learning (n.d) and the Reference Curriculum in Technology and Computing (Raabe et al., 2020, p. 19): abstraction, algorithms, decomposition, and pattern recognition.

Code programming using block-based programming languages is a popular form to develop CT skills (Hsu et al., 2018). Brennan and Resnick (2012) identified computational concepts by studying activities in the Scratch online community. These concepts are common in many programming languages and include sequences, loops, parallelism, events, conditionals, operators, and data.

Methodology

This research is qualitative in nature and seeks to address the following research question: how do pre-service teachers include computational thinking concepts when they design elementary mathematics activities from NCCC’s perspective? To discuss this research question, we analyzed an activity developed by three of thirteen participants of a pre-service teacher training process, which took place over four months, with one 3-hour session per week, in a Brazilian private university in 2021. Due to the COVID-19 pandemic, all classes were remote, synchronous, and occurred via a virtual meeting program. The aim of this training process was to discuss CT connection with elementary mathematics teaching. Through a teaching experiment, we proposed tasks to the students in which they had to think how to design mathematics lessons using unplugged and plugged CT for their future primary education classes. Data were collected from pre-service teachers’ protocols, training’s video recordings, and Scratch’s programming code from plugged activities designed. Data were analyzed taking into account CT definition and concepts mentioned
before. The analyses of qualitative data sources were divided to identify the frequencies of CT concepts and of aspects of CT definition.

**Statement and discussion of results**

The proposed lesson had to consider one of the elementary mathematics ability previewed in NCCC, which introduces the concept of geometric orientation to children. Pre-service teachers explored Scratch’s programming language and proposed a pre-made scenario presented in Figure 1. They made a small program to provide pupils only with a yellow butterfly flapping the wings.

![Figure 1: Plugged activity proposed by students](image)

In the teachers’ code programming, we found sequences as expected: 16 loops (repeat and forever), 5 events that occur when the green flag is clicked or a space key is pressed, and 5 parallelism actions, three of which begin simultaneously when the green flag is clicked and two happen when the space key is pressed. Teachers did not consider conditionals, operators, or data in their code.

Pre-service teachers’ description about how they constructed this activity reported they did not make the code in one step; they had to split it in small parts (like move to the right, move up, move down…) and synchronize Scratch’s actors’ movements. Analyzing all data source, we found evidence the participants used all the CT pillars to conclude the task (abstraction, algorithms, decomposition, and pattern recognition).

**References**


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