Learning Iteration for Grades 2-3: Puzzles vs. UMC in Code.org

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Enrico Nardelli, Francesco Lacchia
University of Roma "Tor Vergata"
Italy

Renzo Davoli, Michael Lodi, Marco Sbaraglia
University of Bologna
Italy

Veronica Rossano, Enrichetta Gentile
University of Bari
Italy

Violetta Lonati, Mattia Monga, Anna Morpurgo
Università degli Studi di Milano
Italy

Luca Forlizzi, Giovanna Melideo
University of L'Aquila
Italy

Sara Capecchi
University of Turin
Italy

Ilenia Fronza
Free University of Bozen-Bolzano
Italy

Tullio Vardanega
University of Padua
Italy

ABSTRACT

This project, partially supported by research grant —-*anonymized*—- to —-*anonymized*—-, compares the effectiveness of two alternative instructional methods and procedures in supporting the learning of central concepts of Informatics in primary education. The project, contributed by eight university groups, runs in two rounds in the year 2022, with teachers' feedback helping to fine-tune the deployment of the interventions. The results that are beginning to emerge suggest that the two interventions may have measurable outcome differences in the short term. Additional data will soon be available to strengthen our analysis.

RESEARCH GOALS

To pursue the research goals of the project, we recruited a number of primary-school teachers and co-designed with them two variants of a learning module targeted to second graders engaged in the learning of the iteration (the loop) using block-based programming. We aimed to compare the relative performance-in-the-field of the two proposed learning variants in terms of children's measured effectiveness and perceived satisfaction by all participants. Variant V1 used the Use-Modify-Create (UMC) approach [2], requiring children to first use and modify projects we previously built for them with the Code.org Artist (Pre-Reader) lab [1], and then create their own projects in the same environment. Variant V2 used a standard set of coding exercises available in the Code.org platform, hence with a more rigid structure.

APPROACH

We run the project in two successive rounds of three elapsed weeks each. The first round took place in Spring 2022, the other in Fall 2022 (still ongoing). In the first round, we invited several hundreds of Italian primary-school teachers to the project, eventually recruiting 22 of them. We divided those teachers into two equal-size per-variant groups balancing provenance and professional profile. One group was assigned to the V1 learning variant, the other group to the V2 variant. The teachers in each group: (a) aligned their students using two Code.org lessons on sequences, identical across groups; (b) administered an identical pretest designed to assess the children's understanding of sequences; (c) taught the concept of iteration following the group-specific variant and methodological guidance; (d) administered an identical questionnaire to assess children's satisfaction with the activities and an equally identical post-test built to evaluate the children's syntactic, conceptual and strategic understanding of iteration; (e) completed an evaluation survey on the overall experience. The second round recruited ~100 teachers, the Fall period showing a better fit for this kind of interventions. The second round is following the same approach, improved with insights from lessons learned in the first round.

PRELIMINARY FINDINGS

184 second graders overall (age 7-8) participated in our first-round learning experiments (87, V1; 97, V2). This partition reflected the size of the participating classes. 13 of 22 teachers carried out all of the proposed activities; the others only a fraction of them. Preliminary analyses of the children-side responses show noticeable V1-to-V2 differences in a few hotspots. The V1 group: felt slightly more fatigued by the learning effort; had more troubles understanding the code shown in two pretest questions; performed worse in two post-test questions (a counted iteration of a single instruction and a counted iteration of two instructions), and better in one (a sequence of two counted iterations). Interestingly, no children opted out of the experiments and all found the activities very engaging. This bodes well for the learning of Informatics in primary schools.

REFERENCES

[1] Code.org. 2022. *Artist pre-reader.* https://studio.code.org/projects/artist_k1/new
[2] Irene Lee, Fred Martin, Jill Denner, Bob Coulter, Walter Allan, Jeri Erickson, Joyce Malyn-Smith, and Linda Werner. 2011. Computational Thinking for Youth in Practice. *ACM Inroads* 2, 1 (2011), 32–37. https://doi.org/10.1145/1929887.1929902

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