Submission of Abstract: Please use NORMAL style for all text in the Abstract Template

Abstract title (Use sentence case)	Robotics and simulation on physics study in elementary school
Type of Presentation	Paper ☒ Short Paper ☐ Panel ☐ Workshop ☐
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Keywords (please select 5 from list on website)	Elementary education , Conditions for learning , Curriculum , organising for learning, .
Audiovisual requirements (PCs will be the standard computer)	Computer ☒ Data projector ☒ Other ☐ Please specify:
What is the main message of your contribution with respect to the workshop's title?	Using new tecnology can change the relationship bewteen spontaneous thinking, congitive development and science curriculum.
Abstract (400 – 600 words)	On the project reported on this paper, we had the intention to increase relations between spontaneous beliefs and scientific thinking on 14-16 years old students, developing activities that use concrete observation to systematize abstract knowledge. We developed a kinematics study building robotics experiments to collect data, analyzing these data to find results and conclusions, to be represented on a virtual simulation built in Imagine by the students. We began by asking the students to say their spontaneous thought about movement. Their answers were expressed in a quite intuitive way, as: "a lighter car moves faster "or "a powerful motor accelerates quickly". We discussed those initial observations, refined them, formulating hypothesis to be verified, trying to find relations between variables, such as "the more weight you put on a car, more slowly it will move". Teachers had not "explained" the subject or given suggestions, and were not worried about building correct ideas, but letting

	the students create a method to verify the correction of their spontaneous beliefs, so they could lead them into useful and specific knowledge. Then we created collective strategies to verify the hypotheses accepted as valid ones, and planned experiments. Those plans included some robotic constructions that would be necessary to run the experiments. Each group built an equipment with behaviors and functions defined by the planned experiment: Tracks to measure speed, cars to control force, mass or aerodynamic shape. They described their construction. One group wrote: "We built a very simple car to observe the interference of weight in speed. We choose very light materials, to be easier for the car to move with extra weight. It has an empty box in the middle. It will run along a track carrying different numbers of fishing weights, we will chronometer its movement. We suppose that with more weight, it will move slower." We ran the experiments, using a track with sensors to determine speed. We made qualitative and quantitative analyses from resulting data, searching for relations between them. When the project began, the students wished to extract conclusions from direct observation of the movements. For instance, they wanted to build "cloned" cars, with a small difference between them, that should run side by side so they could visually compare their behavior. Later, all of them figured out that comparing numeric results should offer more details to analyze, so they could built powerful conclusions on how each factor influenced the speed. They where, step by step, choosing abstract thinking rather than concrete observation. Our expectation about incorporating scientific knowledge onto spontaneous thought and action was confirmed by their use of proper vocabulary to define relation between values and describe experiments, their conclusion about the necessity of isolating and controlling each chosen factor, and the definition of systematic methods for validating hypothesis. When we began the discussions, each student thought his own ideas were correct and obvious. They got surprised by the variety of ideas and different solutions their partners gave for the same problem. They realized some of the initial ideas were not clear, sometimes even for it's author, and by the argumentation their were refining knowledge and building a collective mental model of the observed phenomena. The final step was to "translate" this model into a simulation, a living model that represented objects and their behaviors, quantities and their relations, responding, in real time, for the

	manipulation of any user. In order to build that simulation they had to learn some programming and a build a system integrating the knowledge they have acquired on the subject.
Short biography of presenter (maximum 50 words).	The author is a teacher, a pedagogist and a computer programmer. Worked as a teacher in elementary school for 17 years, the last 10 of them teaching informatics. Has developed many researches and practical experiments involving projects pedagogy, Logo language and the relation between cognitive development and curriculum.
What are the themes, relevant to the scope of the workshop, that you think should be discussed?	