EPFL

■ **CHILI**
computer–human interaction
in learning and instruction

LEARN
Center for Learning Sciences

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# Developing Collaborative Mathematical Learning Activities with Tangible Robots

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MOTIVATION

There are many concepts in the mathematics curriculum that children will need to learn. One of these is learning about slopes, which is not necessarily intuitive. Furthermore some children may not be motivated to learn new mathematical concepts. The idea is to make it more fun by interactivity. Such work has already been done at the CHILI laboratory at EPFL but it had for limitation the requirement to be played in a classroom which is an issue in this time of pandemic.

METHODS
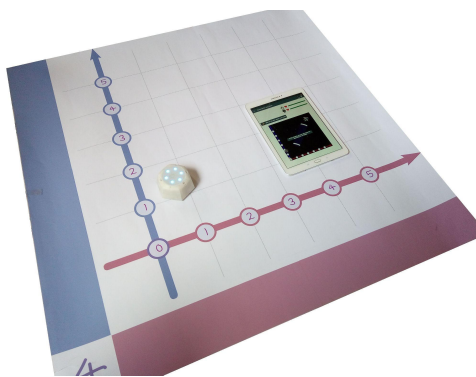
This work continues the work of Sina Shahmoradi. It proposes an implementation of a game that allows one to learn this notion in a more didactic way. A game for three players has been implemented and is played in three rounds where all players will play at least once each available role: X-axis control, Y-axis control, observation and control of the game flow. The goal of the game is to get a spaceship from a starting point to an ending point quickly enough to prevent it from perishing in the vacuum of space. In doing so, players will understand the concept of connecting two points in space and "feel" the effects of the axes. This makes a more attractive option for children than the more common paper exercises.

RESULTS

Each player has a robot, a tablet and a playing map. The tablet controls the flow of the game, the robot serves as a cursor for the players, and the map serves as a support for the system. Players can play remotely or in a classroom. The system is programmed to send data online to a database through Firestore. This system is compatible with a web version (without a robot) developed by Lorenzo Rovati. The robot has reinforced the didactic side of this game and improves its appeal to children. The robot moves by itself on the field to prepare the game. During the game, it can give if configured a haptic feedback that helps to memorize the notion of slope.

Link to the code repo and report: https://c4science.ch/diffusion/11400/repository/master/