Open Scientific Learning and Practice for Everyone for Just, Equitable, Sustainable and Democratic Societies

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Research Methodology

Much of the process in this work resembles the well known participatory design approach (Schuler, 1993) where the researcher’s inquiries with students were mediated through Logo’s turtle, has connected geometric manipulations to the concept of programming. The theories of abstract automata and the theories of computing paradigms have played a significant role in determining what aspects of the tools worked and what did not. But it has also put an emphasis on the assumptions about possible approaches and means that could allow the learners to accomplish the balancing actions. We named this approach the Spatial Computing Paradigm (SCP). The combination of SCP and Logo has opened new ways of thinking about the phenomenon. It then directs the research methodology needed to reflect this design nature where innovations come not only from the students that advanced the researchers’ ideas and insights in ways that fit the current situation and are meaningful to the learner.

Some Results

The Balance Beam

The setup was an inverted pendulum mounted onto a robotic vehicle (Figure 1 left). The challenge was to prevent the vehicle from falling off and also return it back to the beam’s center. Only one setup was built to tolerate the reverse torque that was applied when the pendulum was falling. Two versions with different programming environments were tested. Students playing with the inverted pendulum (Left). The goal was to prevent the pendulum from falling. Two versions with different programming environments were tested.

The Inverted Pendulum (The Cart-Pole Challenge)

The cart-pole challenge was an interesting task that learners can engage in. The inverted pole was mounted on a robotic vehicle (Figure 1 right). The challenge was to prevent the pole from falling and return it to the center (regions 4, 5, 6). The learners had no prior programming experiences. Greg had done some attempts using a 2D representation of the pole’s state as a graph, but the learners found it hard to handle. The learners were able to develop a 3D understanding of the pole’s state using PyoLogo. (Left) the space shuttle’s on-orbit mission control. The space shuttle had to control its orientation using a combination of four states (positive position, negative position, positive speed, and negative speed). The learners were able to draw the state combinations on a 2D surface indicating the current angle/speed combination. It gave the learners a comprehensible view of what was going on during program execution. This method allowed the inverted pendulum to stay up-right for a long period of time. Phase-Planes can be introduced to learners by expanding the graphical representation of states (as described earlier) was created. For the inverted pendulum project, the learners (with the help of the researchers) developed a learning environment that was not fixed. It proceeded as the learners proceeded. Learners had to try different methods presented in this work. But the learners had to always reflect on their body movement and create hypotheses. The learner’s thinking to become meaningful to the learner. The Plane Controller would work well with children without spending time learning about how children think. The learner’s thinking to become meaningful to the learner.

Conclusions

We have conducted a design research. That is, we we have taught the learners how to think mathematically, how to relate mathematical operations (geometry) to one’s own body actions. This approach resonated well with the learners. The learners were able to relate mathematical operations (geometry) to one’s own body actions. This approach resonated well with the learners. The learners were able to relate mathematical operations (geometry) to one’s own body actions.
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