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Random Walks as a Royal Road to E-STEAM in Math Education(Article)

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Abstract

Context . Millions of learners worldwide experience mathematics nowadays as an inescapable tool of cognitive abuse and punitive selection. Most traditional teaching thwarts natural human cognitive resources. Problem . We would like to contribute to alleviating the aforementioned cognitive abuse, sharing the insights afforded by our exploration of enactive and metaphorical approaches to learning and teaching, inspired by E (embodied, enactive, extended, embedded, ecological)-cognition. We aim at understanding mathematical thinking processes and practicing an experimental epistemology of mathematics, not just prescribing actions to be undertaken in the classroom Method . Our theoretical scope is E-cognition. Our main research method is based on enactivism (enaction à la Varela) including metaphorical analysis, participant observation, and semi-structured interviews. Moreover, we discuss illustrative examples of learning activities related to random walks and STEAM (Science, Technology, Engineering, Art & Mathematics), particularly physics and art (dance and choreography). Results . Embodiment, enacting and metaphorising make a dramatic difference in mathematics learning processes. Learning activities related to random walks and deterministic dynamical systems enacted through dance and choreography can play a significant antidotal and remedial role against cognitive abuse in the teaching of mathematics. Beneficial insights are triggered, for students, teachers, and mathematics educators. Implications . We suggest new horizons for research and practice in mathematics education informed by E-cognition and metaphorisation, with an antidotal and therapeutic effect against cognitive abuse in teaching. Further research is commendable on the often-stressful transition process from an abusive and repressive education to a more open enactivist education, which could use micro-phenomenological interviews among other techniques. It could involve scaling up our experimentation, particularly with prospective and in-service teachers. Limitations are related to the small number of students and teachers hitherto involved. Constructivist content . Our research aims at developing a radically enactivist mathematics education inspired by Varela's enaction.

Author keywords

Bayes | choreography | cognitive abuse | cognitive bullying | dance | dynamical systems | embodiment | enaction | Francisco Varela | metaphor | random walks

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