
An education based on body and mind: the case of enacted planets

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Résumé

ENACTING planets

The study of the Solar System motivates students to do sciences, while a large number of subjects may be easily introduced through the observation and understanding of planet's motion. We show furthermore that the participation of the learner in enacted pedagogical sequence enhances its well-being and its cognitive activities. Those sequences use a large representation of the Solar System at a human scale ("a human Orrery"). First results of such activities done with 11 to 16 years old children and future projects will be presented.

Context: In 2013, a program called "kinaesthetic activities in teaching science and humanities" was granted by Sorbonne University, France, connecting UPMC (departments of physics and biology), Paris Sorbonne (departments of sports, Italian, and ancient Greek). A "human Orrery" was thus created, and used in different pedagogical context, from secondary school to University, and for general public. More details on this program may be found in Rollinde et al. (2015, in French). This work finds its theoretical foundation in cognitive science theory of enaction (Varela et al. 1991) that is already well known in Language Education (Glenberg et al. 2013, Glenberg 2015), Mathematics Education (e.g. Abrahamson, 2004; Segal, 2011) and in Physics Education (Johnson-Glenberg et al. 2016).

Content: The learners, or the public, enact the planet's movement with correct relative speed following the design drawn on the Orrery. Topics such as inertial movement, velocity-distance, force-velocity relation, that are known to be difficult, can be refined and perceived by the learners' body. The knowledge transposition is based on perceptions, while knowledge itself is learned through action. For once, body and mind are not separated in school!

First experiments in classroom: In 2014-2017, different secondary schools in Paris have enacted and then plot Kepler's laws (Rollinde 2017). In some schools, the design of the planets' orbits was drawn by the pupils themselves. It will be used thereafter by different teachers (physics, mathematics, technology and sports). First results already indicate a large motivation, curiosity, and a refined understanding of inertial movement. The impact on well-being will soon be studied through tools validated by Fenouillet et al. (2015).

References

*Intervenant

Web site (in French): planetaire.over-blog.com

Abrahamson, D. (2004) "Embodied spatial articulation". In D. E. McDougall and J. A. Ross (Eds.), *Proceedings of the Twenty Sixth Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* Vol. 2. Windsor, Ontario: Preney. pp. 791 – 797

Fenouillet, F., Heutte, H., Martin-Krumm, C., & Boniwell, I. (2015). Validation française de l'échelle multidimensionnelle de satisfaction de vie chez l'élève. *Canadian Journal of Behavioural Science / Revue canadienne des sciences du comportement*, 47(1), 83-90.

Glenberg, A. M., Witt, J. K., & Metcalfe, J. (2013). From the revolution to embodiment: 25 years of cognitive psychology. *Perspective on Psychological Science*, 8, 573–585.

Glenberg, A. M. (2015). Few Believe the World Is Flat: How Embodiment Is Changing the Scientific Understanding of Cognition. *Canadian Journal of Experimental Psychology*, 69(2), 165-171.

Johnson-Glenberg, M. C., Megowan-Romanowicz, C., Birchfield, D. A., & Savio-Ramos, C. (2016). Effects of Embodied Learning and Digital Platform on the Retention of Physics Content: Centripetal Force. *Frontiers in Psychology*, 7, 1819. <https://doi.org/10.3389/fpsyg.2016.01819>

Rollinde, E., et al. (2015), "Un apprentissage en mouvement", *9ème édition du colloque Questions de Pédagogies dans l'Enseignement Supérieur, 17-19 juin 2015, Brest, France*, pp. 747-776. <http://www.colloque-pedagogie.org/?q=node/751>

Rollinde, E. (2017), "Learning Science through Enacted Astronomy", *submitted to International Journal of Science and Mathematics Education*

Segal (2011) "Do Gestural Interfaces Promote Thinking? Embodied Interaction: Congruent Gestures and Direct-Touch Promote Performance in Math", *PhD Thesis, Graduate School of Arts and Sciences, COLUMBIA UNIVERSITY* (<https://academiccommons.columbia.edu/item/ac:132260>)

Varela, F. J., Thompson, E., Rosch, E. (1991), "The embodied mind: Cognitive science and human experience", *MIT Press, Cambridge, MA, USA*.

Mots-Clés: planets, solar system, sciences, kinaesthetic activities, experiments