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Pedagogy of uncertainty: Laying down a path in walking with STEAM

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Abstract

Educators around the world are facing the challenges and opportunities of 21st Century education, such as the COVID-19 pandemic, STEAM education, and the rise of digital immersive technologies presenting a promising field for the development of new ways to maximize the learning experience (Bakker, Cai & Zenger, 2021) The integration of science, technology, engineering, art and mathematics (STEAM) offers an approach to educational design based on curricular integration and learning by doing with analog and virtual technologies (Quigley et al., 2020). In turn, STEAM promotes important pedagogical changes that encourage the development of new skills focused on collaborative work, inquiry and creativity in the face of a challenge or problem to be solved, as well as optimal sensorimotor deployment through haptic and visual perception when using emerging digital immersion technologies such as virtual and augmented reality (Videla-Reyes, Aguayo & Veloz, 2021). All these changes lead to a new framework of pedagogical action based on uncertainty, since they are unfamiliar or unknown in the field of traditional education.

Based on the above, we propose here the idea of a 'pedagogy of uncertainty', which can be read in light of the latest and unpredictable changes that 21st Century education is experiencing due to the COVID-19 pandemic, the emergence of technological tools and unfamiliar virtual and online platforms that teachers and students had to learn and use during the march of the virus. The approach that we suggest here is based on the potential of STEAM educational environment design that focuses on providing signs or patterns of an emerging world, unlike traditional teaching methods in which the path to which students should arrive is already laid down in advance. From a STEAM educational design approach, the teacher and her/his students *lay down a path in walking together*, a motto used by the enactive approach to cognition that considers "cognition as embodied action that is always oriented towards something absent: on the one hand, there is always a next step for the system in its perceptually guided action; for the rest, the acts of the system are always directed towards situations that are not yet in act" (Varela, Thompson & Rosch, 1991, p.238). In this presentation, we explore the notion of pedagogy of uncertainty in the light of enactivism, based on theoretical and empirical evidence about how teachers and students deal with an uncertain world by actively participating in integrated educational environments based on learning by doing approaches (Abrahamson, Dutton & Bakker, 2021). In particular, we make special reference to how teachers can make their students learn from clues, impoverished traces, or traces of information available within their learning environments to solve a challenge or problem, to the extent that they investigate, create, manufacture and/or actively participate in technology inside and beyond the classroom.

References

- Abrahamson, D., Dutton, E., & Bakker, A. (2021). Towards an enactivist mathematics pedagogy. In S. A. Stolz (Ed.), *The body, embodiment, and education: An interdisciplinary approach*. Routledge. <https://edrl.berkeley.edu/wp-content/uploads/2020/12/Abrahamson.Dutton.Bakker.in-press.TowardsEnactivistMathematicsPedagogy.chptr..Routledge-Dor-ABRAHAMSON.pdf>
- Bakker, A., Cai, J. & Zenger, L. (2021). Future themes of mathematics education research: An international survey before and during the pandemic. *Educ Stud Math* 107, 1–24. <https://doi.org/10.1007/s10649-021-10049-w>



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- Quigley, C.F., Herro, D., Shekell, C. *et al.* (2020). Connected Learning in STEAM Classrooms: Opportunities for Engaging Youth in Science and Math Classrooms. *Int J of Sci and Math Educ* 18, 1441–1463. <https://doi.org/10.1007/s10763-019-10034-z>
- Varela, F., Thompson, E., and Rosch, E. (1991). *The Embodied Mind: Cognitive. Science and Human Experience*. Cambridge: MIT Press.
- Videla, R., Aguayo, C., & Veloz, T. (2021). From STEM to STEAM: An Enactive and Ecological Continuum. *Frontiers in Education*, 6:709560. doi: <https://doi.org/10.3389/educ.2021.709560>