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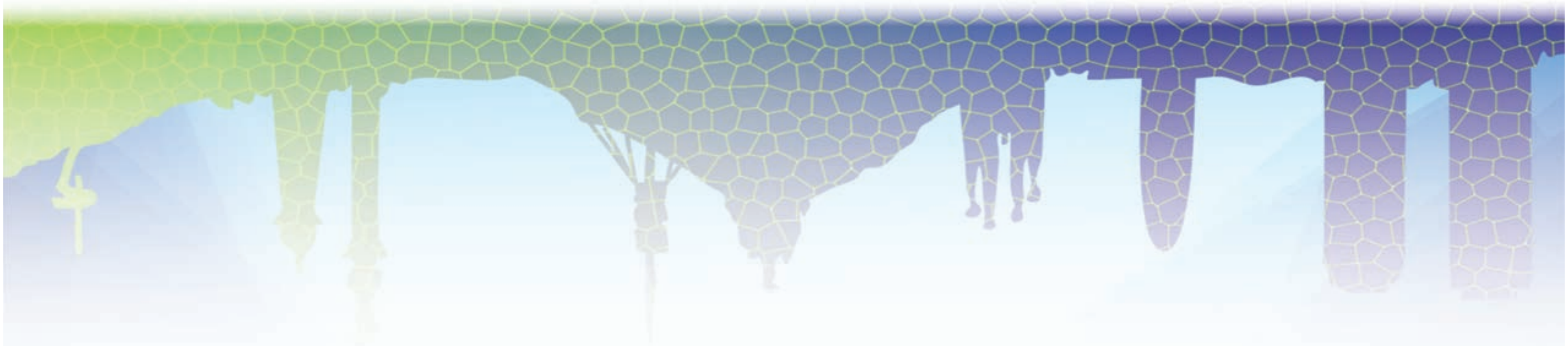

Design teaching sequences with augmented reality to promote visualization in chemistry.

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Visualization is one of the most important skills for science learning because there are complex concepts that refer to entities (e.g., atoms), properties (e.g. energy) and processes (e.g., metabolic pathways) at microscopic levels that can not be displayed or naked eye represented. (Gilbert, 2005). Visual models are used, as e.g. diagrams and animations to represent these events on a larger scale, to help students build knowledge of the contents. (Gilbert & Treagust, 2009). While there is plenty of theories about it (Gilbert, 2005), it is necessary to provide more examples of educational materials in the classroom on the nature of visualization for science education (Phillips, Norris, & Macnab, 2010). Also, there remains a gap in the literature regarding the nature of the representations based on the cognitive process of visualization, and even more about teaching sequences (TS) aimed towards promoting visualization for high school student . Our goal is to design, implement and evaluate TS in high school, by the implementation and validation of learning materials on main topics of chemistry and promoting metavisual ability by increasing visualizations (Gilbert & Afonso, 2014) with augmented reality (Carmigniani & Furht, 2011). The research design is framed from the perspective of Educational Design Research (Plomp, 2009) and take into consideration 3 phases (diagnosis, design and evaluation). Phase 1: for selecting the topics of the TS a survey of more than 5100 schools across the country was sent in digital format. Chemistry teachers were requested to select the issues that are complex to teach and have a high potential if materials were designed with a narrative that is significantly enhanced by augmented reality visualizations (Gilbert & Afonso, 2014). From 284 responses collected, the mostly topics selected by teachers were: a) quantum theory, b) spatial distribution of molecules, c) intermolecular forces, d) stoichiometry, e) colligative properties, f) physico-chemical properties of carbon and g) three-dimensional structure of organic molecules. Later, school and college textbooks were revised about the presentation of these issues from factually, resources and use of images perspective, finding that almost all the illustrations are "descriptions" that deliver data or exemplify the statement by the main text; plus some trivial explanations were evidenced. The presence of any "prediction" or "action" was not found. We are currently in the design phase and adjusting the TS according to inputs from the diagnosis stage, and examples will be shown at ECRICE2016.

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