

Chapter 9

The Use of Storytelling to Promote Literacy Skills in Biology Education: An Intervention Proposal

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ABSTRACT

This chapter provides biology teachers with a cell division-based teaching sequence to develop the literacy skills of 10th grade students using the storytelling potential. The objectives are 1) to analyze the design process of this sequence and 2) to examine how it is implemented in two classrooms in terms of a communicative approach. The sequence design is informed by the didactical transposition approach. The authors analyze the transformation of reference knowledge, firstly, into a teaching sequence of four activities organized around authentic issues, such as cancer treatment or reproductive problems, and then, into taught knowledge. The results show that the use of storytelling in design could enhance students' scientific literacy, scientific discourse, and problem-solving competence, as it allows for their greater participation (80-90% of utterances). Interactive approaches (8/10 episodes) predominate in experts-learners discussions, improving students' view of science as a process and not as a closed set of notions.

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INTRODUCTION

International assessments have shown the lack of scientific reasoning skills among students (Stammen et al., 2018). According to the American Common Core State Standards (National Research Council (NRC), 2013), literacy skills are essential to a correct building knowledge in science. For instance, in order to predict, explain or describe phenomena, students are required to synthesize and integrate information and to interpret diagrams or data. Oral and writing discourses are key means to defend their ideas, to demonstrate what they know about a concept and to convey what they have experienced. Therefore, learning science implies learning to use science language (Scott et al., 2006). Storytelling is a valuable tool to get it (Morais et al., 2019), as it allows to convey scientific information with high intrinsic cognitive load (Csikar & Stefaniak, 2018). Storytelling encourages students to develop their writing and oral communication skills (Yamac & Ulusoy, 2017; Elenein, 2019) and their critical thinking (Yang & Wu, 2012). It also helps teachers to introduce and explain scientific phenomena due to storytelling has the potential to engage more students in science disciplines, increasing their conceptual knowledge, motivation and success (Hung et al., 2012). For instance, the story of the ‘ghost in the machine’ of Tandy’s laboratory (Tandy & Lawrence, 1998) helps teachers to describe how scientists construct causal explanations of phenomena such as mechanic resonance by using available evidence.

Daily-problems in disciplines such as Biology require students to apply scientific knowledge to make decisions and to participate in public discussions about science. For example, the understanding of cell division models is essential to explain the etiology of pathologies, such as cancer or sterility, and to make decisions about the use of stem cells or the assisted reproduction techniques. Cell division topic includes complex relationships of unfamiliar and abstract concepts (Dahlstrom, 2014), which involves several learning difficulties, such as modeling mitosis and meiosis as continuous processes, recognizing cell division stages in real images, or relating them to diagrams and drawings (Dikmenli, 2010). Studies in Science Education about cell division are mainly focused on identifying students’ ideas about chromosomal dynamics (Chinnici et al., 2004). However, not much is known yet about their conceptions of the mitotic spindle and its role in the process, although a comprehensive knowledge about cell division requires considering all the cell structures involved (Esquivel-Martín, Pérez-Martín, Bravo-Torija & Sánchez, 2019). Storytelling could enhance its learning as it allows to incorporate the idea of dynamism into the process, through realistic audiovisual resources (Hadzigeorgiou, 2016).

Carrying out thinking-activities in science classroom is not an easy task for teachers (Chen, 2019) because, beyond the lack of time, they do not always have the professional skills needed to design learning environments where students can ask and be asked questions about issues that arise in the learning process, rather than those that are pre-established in textbooks, for example (González & Rossi, 2015). In addition, some teachers display a lack of scientific reasoning skills, such as hypothetical-deductive reasoning or conclusion-making based on evidence (Stammen et al., 2018). Others do not consider the pedagogical relevance of integrating the practice of literacy skills in science learning, so they do not usually provide their students with the opportunity to develop them (Masters & Park-Rogers, 2018). Nevertheless, teachers should shift their mindsets and promote a classroom culture that can support the use of both scientific practices and literacy skills to build and transfer knowledge to explain phenomena and solve real-life problems (Reiser, 2013). The storytelling approach in teacher education could promote the development of these teaching competences (Ibarra-Rius & Ballester-Roca, 2018), but creating and using stories to build a coherent storyline is also challenging for them (Cleverley-Thompson, 2018; Rei-

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