

STORYTELLING AS AN INTERDISCIPLINARY STRATEGY IN GEOSCIENCE EDUCATION

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Abstract

Education can change the world. It influences our reasoning and is preponderant in the development of competencies. It is recognized that school teachers have difficulty involving and motivating students to learn about different complex topics, namely in Geoscience Education. It is up to the teachers to be creative and innovative. They must be able to implement diversified strategies and resources that motivate and actively involve the students in their learning process. Studies reveal that storytelling is an effective, meaningful, enjoyable, and creative way to enhance teaching and promote learning. Thus, storytelling is a powerful education strategy that should be promoted in science teaching. Telling stories makes us human, this is how we understand the world and our experiences. Good teachers tell well-known stories. Great teachers tell their own creative stories. This study aims to verify whether storytelling enhances the curiosity, motivation, and meaningful learning of students in Geosciences. The present study used a convenient sample of students (n=18) from a K7 class (range 12-14 age) who attended a Portuguese public school. The storytelling strategy was framed in an interdisciplinary approach in discussing subjects "A Woman in Science" and "Sustainable Development" within Natural Sciences and Education for Citizenship. Playful-sensory storytelling - "A story with Science", was presented to the students resorting to an audio-visual video. The constructed narrative challenged the students' imagination in a "Journey through Time and Earth". Mary Anning, the renowned "palaeontologist fossil hunter", traced the common thread that captivated the interest and engagement of pupils, revealing her work and reflection on the sustainable development of humanity. The assessment instrument applied at the end of the intervention was a questionnaire consisting of three open-ended questions. The content analysis of the three questions showed that the storytelling contributed to meaningful learning, motivation, and curiosity of students in learning Geosciences. Through the teacher's naturalistic observation, the involvement and participation of students in discussions were active. The study allows us to conclude that storytelling is a strategy to be considered in teaching Geosciences to promote the engagement and commitment of pupils.

Keywords: *Innovation, middle school, motivational complement, palaeontology, playful-sensory activity.*

1. Introduction

Citizen involvement in social and political issues is now more than a concern, an urgent need of modern societies, and a particular challenge for young people facing uncertainty and adversity. New generations need to be prepared to understand emerging global problems and act on them consciously and resiliently (Ortega & Miravalles, 2021), in line with the common vision of sustainable development for humankind expressed in the United Nations Agenda 2030. Therefore, it is essential that human beings recognise that life on Earth depends on the responsible management of the Earth system. The Earth Sciences provide citizens with knowledge, the capacity to question and to intervene responsibly in important issues of their daily lives (Orion, Shankar, Greco & Berenguer, 2020). In this regard, Earth science education has a fundamental role in promoting education for sustainability (Vasconcelos & Orion, 2021). Education can change the world (Ortega & Miravalles, 2021). It influences our reasoning and is preponderant in developing competencies (Bueno, 2017). In this context, interdisciplinarity is important as it can increase the ability to understand the complex challenges that the world faces today (Eagan et al., 2002), addressing the social, environmental and economic issues essential in education for sustainability (Vasconcelos & Orion, 2021). Studies show that teachers who implement new educational resources and strategies can lead to good practices in the field of sustainability, fostering the development of students as social innovators (Ryan & Tilbury, 2013).

One of the overall challenges of today's school is to develop meaningful and engaging learning experiences that are distinct from traditional teaching (Bromberg et al., 2013). Education is a highly personalized activity (Ivie, 2021), so it is up to teachers to be creative and innovative, contributing to improving the teaching and learning processes. They must be able to implement diversified strategies and resources that motivate and actively involve the students in their meaningful learning. Studies reveal that storytelling is an effective, meaningful, enjoyable, and creative way to enhance teaching and promote learning (Wang & Zhan, 2010). According to Serrat (2008), "Storytelling is the vivid description of ideas, beliefs, personal experiences, and life lessons through stories or narratives that evoke powerful emotions and insights" (p.1). Telling stories makes us human, this is how we understand the world and our experiences. Landrum and collaborators (2019) refer that storytelling is culturally universal and probably the oldest teaching method. As a teaching strategy, it makes education more interesting and enhances students' learning (Rowcliffe, 2004) and engagement in this process (Sheafer, 2017). Moreover, it can provide enriching learning moments conducive to active student participation and the construction of memorable knowledge (Rowcliffe, 2004). Good teachers tell well-known stories, but great teachers tell their own creative stories (Ortega & Miravalles, 2021). Besides sharing knowledge and potentiating the reflection of societal issues, storytelling arouses emotions, creating an emotional connection between the audience and the theme portrayed (Fischer et al., 2022). Thus, storytelling is a powerful strategy in education to explain complex subjects, which should not be neglected but promoted in science education (Van Gils, 2005), contributing to motivating and arousing students' curiosity (Sadik, 2008), particularly for the Geosciences. Furthermore, it is considered an effective pedagogical strategy for developing language skills (Isbell et al., 2004) and stimulating children's imagination (Egan, 1986). In a technological society, the art of storytelling also resorts to the digital using multimedia tools to create and present stories (Gürsoy, 2021), integrating written, visual and sound aspects that hold the student's attention and maintain their constant interest and curiosity. Digital storytelling constitutes an innovative pedagogical approach that contributes to students' deep and meaningful learning (Smeda et al., 2014).

It should be noted that the perspective of Science/Technology/Society in the science curriculum contributes to the student's scientific literacy through the development of critical thinking skills and knowledge mobilization (Autieri et al., 2016), aiming to make students aware of and value science and technology in their daily lives. The study of this author also mentions that these competencies allow for thoughtful and responsible decision-making in solving everyday problems.

2. Design

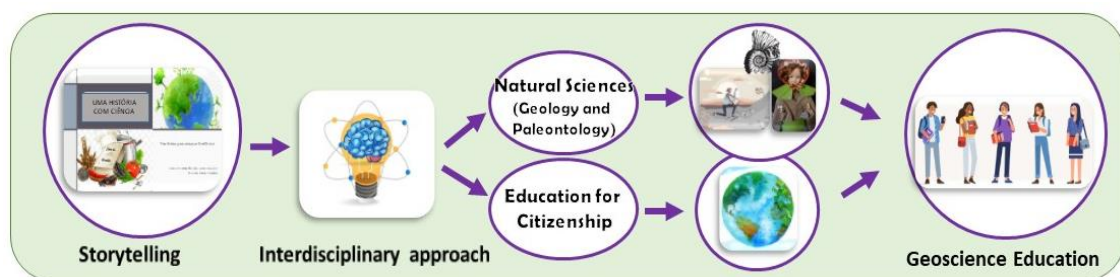
Related to the commemoration of International Women's Day, celebrated on March 8, 2022, a pedagogical action was developed in K7 class attending a public school in northern Portugal, which resulted in this research. In this context, with the focus on developing the students' essential learning in the subject of Natural Sciences, an interdisciplinary intervention was carried out in articulation with the curricular component of Education for Citizenship. As a strategic action for the teaching of Geosciences, playful-sensory storytelling was used in the discussion of the themes "A Woman in Science" and "Sustainable Development". The intervention took place in a 50 min class, in each of the taught areas, for a total of 100 min. The audio-visual video's content was presented and discussed from the storytelling called "A story with Science", designed by the second author of this paper (Figure 1a). The sensory narrative challenges the student's imagination on a "Journey through Time and Earth", in an encounter starring the characters Mrs Earth, our planet, and Mary Anning (1799-1847), the renowned English "palaeontologist fossil hunter", whose life story is the main thread of the narrative that keeps the viewer's and listener's interest, motivation, and involvement constant.

Figure 1. Original resources of the pedagogical intervention.



In the elaborated storytelling, the character of Mary Anning was also personified in a doll, whose characterization reproduces and carries the recognized "palaeontologist fossil hunter" to the real classroom scenario. The idea was to create a motivational complement and reinforce the students' empathy with this woman (Figure 1b). In addition to generating reflection on the action of man on Earth and raising awareness of the role of women in science, the narrative also aims to put the student in front of concepts and dynamic processes of the planet, starting with the understanding of geological time, through which the whole story unfolds. The presentation took place in the Education for Citizenship class, where the discussion was guided from the perspective of recognizing the impact of human beings on ecosystems and raising awareness for changing individual behaviours, essential for sustainable development. This discussion was extended to the Natural Sciences class, now focused on aspects related to Geosciences, namely Geology and Palaeontology. Following the discussion about storytelling, each student was given a flyer about Mary Anning (Figure 1c), whose description reinforced the message conveyed and the scientific knowledge that served as a motto for the subtheme, *The Earth tells its history*, related to Palaeontology. Simultaneously, a sensorial experience of tasting chocolate bonbons shaped like ammonite (Figure 1d), alluding to the marine fossils studied by the "palaeontologist", was promoted. Figure 2 systematises the interdisciplinary approach in the intervention made, designed for 100 min.

Figure 2. Summary to an interdisciplinary approach in Geosciences Education.



3. Objectives

This study that valued the interdisciplinary approach aimed to verify whether storytelling increases students' curiosity, motivation and meaningful learning in Geosciences.

4. Methods

The study used the technique of participant observation, being the first author of this work the teacher-researcher. As a facilitating learning agent, she had a real involvement in the research scenario, guiding the discussion after presenting the storytelling. This descriptive study used an assessment instrument applied at the end of the intervention, a non-evaluative questionnaire with three open-ended questions (one cognitive and two opinions) for the data collection, lasting approximately 10 minutes. The questions in the questionnaire were supported by the literature review and were directed to the teaching strategy used. They refer to the student's understanding of the message conveyed in the storytelling, their curiosity about the story presented, and how important the storytelling strategy is in learning Geosciences. Their reliability and validation were ensured. It should be noted that the instrument was validated by two experts in Science Education who helped in the content analysis and, after a meeting, reached a consensus. This analysis was performed using NVIVO software. After a careful content analysis, which allowed their categorization and codification, the researchers grouped them into the respective categories in Table 1.

The convenience sample consisted of 18 students from a K7 class (range 12-14 age) attending a public school in northern Portugal. Participants were informed about the study's goal, and all were volunteers, guaranteed anonymity and confidentiality in the data processing. All the data collected was subject to analysis, following the international ethical standards extended to the social sciences research.

Table 1. Analytical categorization of questions (A, B and C) and answers related to the questionnaire applied.

Question categories	Answer categories	F(n)=18
	Identifies, understands and discusses the message.	(10; 55,5%)
A. Message conveyed through the storytelling	Only identifies and understands the message.	(7; 38,9%)
	Doesn't identifies the message	(1; 5,6%)
B. Curiosity about Women in Science	Increases curiosity.	(16; 88,9%)
	Doesn't increases curiosity.	(2; 11,1%)
C. Importance of storytelling in motivating Geoscience learning	Relevant.	(17; 94,4%)
	Questionable relevance.	(1; 5,6%)

5. Discussion

The results shown in table 1 reveal that a significant number of students (n=10; 55.5%) were able to identify, understand and discuss the message conveyed in the storytelling, and some students, despite identifying and understanding it, were unable to discuss it. Only 1 student (5.6%) could not identify the message of the storytelling. The data analysis is in line with Rowcliffe's (2004) study. Regarding the character of Mary Anning portrayed in the story, it is significant the number of students (n=16; 88.9%) that demonstrated to have increased curiosity about the work of this woman. Only 2 students (11.1%) showed that they had not become curious, being enough knowledge obtained in the storytelling. The literature corroborates the results obtained in the speciality (Fischer et al., 2022). About the importance of this strategy in the motivation for learning Geosciences, the results point to its relevance in most of the students (n=17; 94.4%), being questionable in the minority (n=1; 5.6%), such as reiterated by the speciality literature (Sadik, 2008).

The content analysis of the three questions shows that storytelling contributes to meaningful learning, motivation, and curiosity of students in learning Geosciences. Through the teacher's naturalistic observation, the involvement and participation of students in discussions were active. Since it was a group of students who usually showed passivity and some lack of autonomy, the spontaneity revealed in the ability to intervene and critical thinking should be highlighted. Thus, the presented intervention proved particularly relevant for the students as an innovative strategy and significant learning (Smeda et al., 2014).

6. Conclusions

This research was conducted on a convenience sample, so the results are only indicative and cannot be generalised. The research results suggest that as an interdisciplinary strategy, storytelling favours and enriches the approach to scientific knowledge and increases motivation and curiosity. Therefore, an innovative teaching strategy which enhances the students' meaningful learning. The study also allows us to conclude that storytelling is a strategy to be considered in teaching Geosciences to promote the engagement and commitment of pupils.

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