



Contours of Science-Art Education: Pedagogical Principles of Art in Science Teaching - Lessons from the Global Science Opera

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Abstract

In the article we explore principles of art education and how art educators perceive and apply them in science-art teaching & learning. The research subject, the Global Science Opera (GSO), is characterized by a global community of students, artists, scientists, and educators co-creating a science-inspired opera. Relying on an existing theoretical basis to how art education principles may be contextualized within contemporary education we illuminate these principals seeking to capture the similarities and distinctions when art meet science in the GSO. The main art principles are described and presented in the light of Eisner's ideas, STEAM education, and the GSO approach. 6 art educators (who participated in the GSO during 2016-2021) were interviewed. Their opinions and experiences towards the arts' role in science teaching were collected, interpreted and presented. We use a qualitative method (interviews) as well a targeted literature review. Findings suggest that some principles of art education are closely linked to science teaching – such as communicative functions and the building of cooperation and relationships. Questions about implementation of science-art education with respect to e.g. keeping art and science in a balance, are discussed and followed by a summary of recommendations.

Keywords: Art education principles, art educators, science-art teaching, STEAM education, GSO.

Introduction

Since the Copernican revolution, humans perceived themselves as the universe's centre and knowledge was consequently separated into objective and subjective [17, p. 91]. Most schools have traditionally presented knowledge as independent disciplines [2]. Yet isolated academic subject matters (e.g. mathematics) often fail to engage contemporary students' motivation [2, 17]. Thus, science teaching in schools induces turning to the arts' opportunities. According to [3], arts inspire us, they enrich our lives and deepen our understanding of who we are and how we make sense of the world. There is loose agreement among academics and practitioners about what constitutes art-based pedagogies. Emphasizing artistic approaches in education can enhance creative approaches to learning and teaching as well as improve teamwork, intercultural communication, and adaptability in groups and by individuals [8, see also 13]. In this paper, we apply theoretical perspectives and thus contribute to further development of the GSO within STEAM discourse. GSO originates from STEM [12]. We find it interesting to apply an artistic approach to teaching and learning within the STEM subjects, as STEM subjects seem to become increasingly connected to moral values of sustainability. Thus, we assert that contemporary STEM education needs to internalize issues of empathy and ethics. These traits, along with sensory and intersubjectivity are grounding elements for arts as an ethically responsible human phenomenon [7]. We formulate the following research questions: how can the main principles of art be characterized within contemporary education? How do art educators perceive and apply such characterizations when working in science-art teaching & learning settings?

The aim of the article is to characterize contemporary art education principles from art-science teaching based on GSO examples.

Objectives

- To examine the main approaches of art principles in school
- To highlight the main contact points corresponding science-art teaching based on GSO examples

Methodology

- An integrative review of literature, and educational sources of the GSO (GSO4SCHOOL Guidelines and GSO Framework and Master plan)
- Interview with 6 art educators involved in GSO

The object of research is the Global Science Opera



Global Science Opera (GSO) is the first opera initiative in history to produce and perform operas as a global community. (www.globalscienceopera.com).

Research design and methods

Research design is based on 2 qualitative methods: *an integrative review of literature* and the GSO didactical material, and *semi-structured interview* with art educators, aimed at We thus illuminating contemporary art education principles. An integrative review synthesizes literature in order to comprehensively understand a specific topic [19]. Selection and review of literature was driven by the following research question: How are art education principles described in classical, STEAM, and GSO framework? A semi-structured interview helped capture contact points corresponding between science-art education pedagogical principles based on GSO practice. Both methods complemented each other in qualitative dimension. A semi-structured interview was conducted with 6 art educators (1 male, 5 female). The interview has a comparative aspect, since the 3 interviews were implemented during 2021 using Zoom, and 3 interviews were collected in 2016 live. Ethics: all art educators consented to take part. Names of interviewees have been anonymized. They were given the opportunity to cancel the interview at any time.

Theoretical framework based on Integrative review

We give an account of relevant theoretical perspectives and contribute to further development of GSO in relation to science teaching aims, and in relation within classical approach, contemporary art principles and STEAM discourse.

From a classical point of view, [6, p.44] outcomes of art education are wider than learning how to create or observe art works in museums. With and through the arts, students are able to understand, analyse, and perceive things in more complex, broader approaches and playful learning. Artistic processes are cognitive and include physical actions with which arts learning processes are realized. 5 aims of arts education are indicated: 1) art should give pride of place to what is distinctive about the arts; 2) art should try to foster growth of artistic intelligence; 3) art should help students learn how to create satisfying visual images, how to see and respond to what we call arts, and how to understand relationships among the arts, the role the arts play in culture; 4) art education should help students recognize what is personal, distinctive, and unique about themselves and their work; 5) art should enable students to secure aesthetic forms of experience in everyday life and cultivate habits of searching for and identifying aesthetic features [6, pp 42-45].

In this paper, our position regarding STEAM education is based on 3 arguments. First, STEAM has potential to improve the general attainment of young people, and the arts can improve cognitive abilities. Second, STEAM has potential to strengthen innovation, and to infuse creativity into entrepreneurship. Third, the argument for employment sees STEAM as a motivator and engager of young people into STEM subjects and careers as the arts can enhance teamwork, intercultural communication, improve observational skills and improve adaptability [1, p. 6].

A wide perspective and transdisciplinary view are drawn up by the GSO methodology. The concept is based on the ideas of vital importance to nurturing a dialogue, individual, collaborative, and communal activities for change and ethics. There are 2 main educational principles which resonate with how scientific issues and research outcomes are communicated to the students. The first relates to attaining disciplinary knowledge. The second relates to transferring and promotion of knowledges in a creative way. GSO combines Science with Arts, extending boundaries of subject interconnection in schools, while simultaneously providing a vehicle for creative STEM education, the acquisition of skills and opening new spaces for genuine enjoyment while learning [18, p. 7].

The integrative review allowed us to presuppose that contemporary art education principles are as follows: 1) art as a form of communication; 2) art as creativity and development of artistic abilities and self-expression; 3) art as aesthetic and source of beauty; 3) art as means to wellbeing and a social construct for community building.

Findings and Discussion

Art as a form of communication. Art communicates what cannot be transmitted in any other form (nor language), that can be received in ways that other forms of communication cannot achieve Art is a form of emotional communication [14], in which new ways of expression are founded. Scientific information expressed through art forms constitutes communication that impacts our relation to that information and our ways of identifying text with context, e. g. how does a formula, or non-visible term relate to a real social life. Art educators strongly agree that art as a form of communication plays important roles in education, and their expressed thoughts reflected the ideas expressed above:



Y. I think it's interesting to look for a parallels and metaphors in science and in real life, and glue them together to a very interesting performance for children (2016).

Art as creativity and development of artistic abilities, and self-expression. Participation as art creator, performer, and audience member enables students to discover and develop their own creative capacity and artistic competence. Basically, arts include any form that becomes a physical manifestation of a creative impulse [11, p.16]. A creative impulse related to the emotions associated with interest, inspiration, excitement, are main factors in learning. From the GSO approach, the development of artistic skills at any age must be a matter of curiosity. Looking otherwise, the first thing we need to do it is to realize that inspiration is art as well, so it is important to take note of things and students around that get inspire or make think deeply.

H. The GSO creates opportunities and space for artistic activities and exploration (2016).

Art as an aesthetic and beauty source. Drama researcher [4, p.19] pointed out that aesthetic term has 2 main meanings: first one related to beauty, second meaning described as a mode of thought of a particular style. That is, the focus of the aesthetic mode of thought is feeling. The fundamental principle for art educators is to develop beauty and aesthetic forms of combining them with scientific themes. Talking with art educators, we noticed that they prefer to see a final result as a vibrant and beautiful performance, they would like to see more scenes that of in-depth mastery.

K. To get unity is a big aesthetic challenge, because there were people from totally different cultures (2021).

Art as mean to a wellbeing and social construct for community building. Participation in the arts as creators, performers, and audience members (responders) enhances mental, physical, and emotional wellbeing. Artistically literate citizens find joy, inspiration, peace, intellectual stimulation, meaning, and other life-enhancing qualities through participation in the arts. The main point of art in the GSO is to express yourself, and enjoy what has been created.

I. They (students) were so happy, and even today they are following every picture, and they are so proud that there was a picture in this conference of them showing to the audience, they say, 'you know I'm really famous now' (2016).

The arts provide means for individuals to collaborate and connect with others in an enjoyable, inclusive environment as they create, prepare, and share artwork that brings communities together. Interviewees agreed on the GSO's globality, making cultural relationships and mutual understanding central.

I. It's cooperation of course, we have to fix things together. The international thing, that's the thing that motivates me in this project to keep going (2016).

Final Remarks, Limitation, and Recommendations

Final Remarks. Findings suggest that some principles of art education play important roles in GSO: communicative function for building cooperation and relationships. GSO offers students art focused opportunities to explore and evaluate their own needs, to increase their understanding about themselves in relation to others and their surroundings. GSO fosters activities that engage students in collaborative work and encourage them to explore different cultures, to understand the importance of the world community and partnerships.

Recommendations for future. Seeking to expand students` artistics abilities (talents as well) we need to help them perceive aesthetics and beauty in science-art teaching. We suggest: to encourage students to develop visual metaphors; to teach art concepts and develop skills that stimulate artistic achievements and to provide art activities that help students value artistic processes.

Limitation.The overarching question of implementation art-science education, how to keep art and science in good balance. Challenges for art educators are these: how can we integrate the "concrete" to "abstract" and vice versa? How to develop the creative transdisciplinary thinking which involves art and science disciplines in mutualrelationship? How can we move from very detailed and concrete knowledge to broader understanding that is derived from viewing the world from the long-term perspective of thinking, e.g. GSO THRIVE 2021.



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