Can art museums help environmental education? An interdisciplinary vision to promote meaningful learning

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Abstract: Environmental education is a discipline that tries to find new methodologies and tools to advance in the achievement of its goals. The museum education proposed by art museums, because of its specific methods and power of significance, can be a way forward for environmental education that is worth exploring**.** The theory of meaningful learning can be used by both disciplines to support and achieve more meaningful, and therefore lasting, learning among people. The complementarity and synergy between these disciplines can be established from their points of conceptual coincidence. The main research goals of this article have been two: to study and show the intrinsic complementarity of these disciplines from a conceptual viewpoint, and to show how their combined strength and complementarity can inspire specific educational proposals for the challenges of education in the twenty-first century. For example, those that focus on educating on the complexity of the world. The presentation and discussion of this conceptual framework may suggest educational instructions that move towards the interdisciplinary nature of environmental education, using as an educational resource that which is housed in art museums.

Keywords: Environmental education; Meaningful learning; Museology; Complexity

¿Pueden los museos de arte ayudar a la educación ambiental? Una visión interdisciplinaria para promover un aprendizaje significativo

Resumen: La educación ambiental es una disciplina que busca encontrar nuevas metodologías y herramientas para avanzar en el logro de sus metas. La educación museística propuesta por los museos de arte, debido a sus métodos específicos y su poder de importancia, puede ser un camino a seguir para la educación ambiental que vale la pena explorar. La teoría del aprendizaje significativo puede ser utilizada por ambas disciplinas para apoyar y lograr un aprendizaje más significativo y, por lo tanto, duradero entre las personas. La complementariedad y sinergia entre estas disciplinas se puede establecer a partir de sus puntos de coincidencia conceptual. Los principales objetivos de investigación de este artículo han sido dos: estudiar y mostrar la complementariedad intrínseca de estas disciplinas desde un punto de vista conceptual, y mostrar cómo su fuerza y complementariedad combinadas pueden inspirar propuestas educativas específicas para los desafíos de la educación en el siglo XXI. siglo. Por ejemplo, aquellos que se enfocan en educar sobre la complejidad del mundo. La presentación y discusión de este marco conceptual puede sugerir instrucciones educativas que avancen hacia la interdisciplinariedad de la educación ambiental, utilizando como recurso educativo lo que se alberga en los museos de arte.

Palabras Clave: Educación ambiental; Aprendizaje significativo; Museología; complejidad

Introduction

Art museums can stir motivation and offer experiences that take advantage of the presence of objects and exhibits not found at schools (Rivière, 1989). They may use their potential to educate many types of visitors, and pass on knowledge in specific areas, seeking to adapt to their visitors (Falk and Dierking, 2000). Art museums have long been studying and summarily conveying similarly overarching cultural messages to the public in very meaningful ways. The materiality of art museums, venues and objects, is not an obstacle to their mission, but rather the means they use to foster a deep cultural education in a wide conception that includes environmental aspects (Leopold, 1949). This blend between venue, materiality and culture somehow makes children and adults rarely forget a visit. Even considering that those visits took far less time than those learning attempts in the classroom that escape memory far more frequently. This capacity to remember the visits -sometimes for life- may well indicate how meaningfully, how deeply the materiality of museums can convey deep environmental messages so that they integrate into visitors' lives through a potentially lifelong personal cultural development and commitment (NRC, 2009).

The interaction of art museum education with other educational disciplines can be configured as an interesting field of study. Thus, through common, complex and synergetic action, it is possible to broaden the limits and horizons of knowledge and of the methods and forms of learning that can take place in museums. For example, Environmental Education (EE) has important messages to convey. It is a discipline that promotes with its own methods the resolution of environmental problems and the restoration of an adequate human-nature link (Novo, 2003). They do not solely address emotions or partial areas of knowledge. They aim at changing behaviours in the real world on issues of material, personal and cultural consequence for individuals and society. Education has to fight a narrow understanding of what 'scientific' or 'environmental' means, and convey it as it is: a profound aspect of society and culture, linked to the whole of our being, and not just a partial, experimental or material issue. Education has to reach a core of human and cultural transcendence.

Art museums share with the environment their material side (given by objects and venues), which is transcended by the culture that objects, and the particular atmosphere of museums, embody and convey to the visitors. Together with learner motives and backgrounds and associated learning expectations, we have to count on 'the cognitive, social, and cultural learning processes and outcomes that are shaped by distinctive features of particular settings (NRC, 2009)'. The representation of reality through artworks can be a complementary way of helping to understand the reality that surrounds us. Art is not something to dismiss in the human world: this is an important thought for environmental educators. We all love to see and experience some way or another those valuable things we have to learn. And we end up loving more those environmental and cultural values we may see and feel. Art materiality is powerful in involving emotions in meaningful learning. The importance of art in the human and cultural world is one of the reasons why environmental education should be taught not as a separate discipline, but rather as a discipline common to all careers and walks of life. Our art is necessary to understand the human being properly, from whatever area of cultural expertise we address it. Art can connect us ultimately with

the ecological environment that surrounds us and makes our existence possible. Unfortunately, specialization in career training may result in insufficient attention to the synergic action that art and environment can contain. Art museums are open to as wide a spectrum of visitors as possible. And they can assume the role to teach us the depth of our materiality to allow us to also understand the roots of ecological and environmental problems, and make amends for this unfortunate shortage in environmental education.

People matter. Art museums have evolved towards becoming enticing and meaningful to increasing numbers of people. Education has to adapt itself to the circumstances of those it addresses. The theory of significant learning formulated by Ausubel (1968), the basis of the theory of Education (Novak, 1977), provides a conceptual framework that can guide the educational actions that take place in the Art museums and that can include the objectives, contents and methods proposed by EE (Novak, 1980). To be meaningful, it has to pay attention to their previously acquired knowledge, attitudes and skills. Not only concepts count, but behaviour, in order to make living and personally and collectively building a more human life and world possible. If anything, education is about people. Not about facts. People are also at the core of environmental concerns and education, which are material, but not only. They are of personal importance (Scheuering, 2004).

Environmental education is about caring for people and their environment, inseparably. Not just one should prevail: both have to, or neither will eventually, as they are both called to life and to live. The natural world has to be more and more recognized as of human concern. Culture has to admit that the rules of nature should be considered always in terms of personal, human consequence. And we should understand ourselves more and more as people who belong to the community of land (Leopold, 1966).

The aim of this research is twofold. First, it ultimately seeks to educate on environmental related issues by bringing together some of the expertise behind the meaningful learning theory, environmental education, and museology. This aspect of the research attempts to unite these fields of expertise into a synthetic understanding in search of their joint potential to support the design of strategies for museum-based meaningful learning interventions. Second, the research seeks to show that this synthetic understanding can effectively provide a sound base to design specific environmental educational programs in art museums. This assesses the application of the potential scope of the combination of environmental education, meaningful learning and art museum experience.

Methodology

The methodology used has been a bibliographic search of the conceptual frameworks of environmental education, museum education and the theory of meaningful learning that underpins both disciplines. From the bibliographic search, a synthetic research work has been carried out, looking for common points between both disciplines in a way that is aligned with the characteristics of the theory of meaningful learning. This synthetic work includes synergetic and complementary possibilities. The main result of the study is shown below in the form of a summary table.

The complementarity and synergistic action between Environmental Education, Museology and Meaningful Learning

Environmental Education

Environmental Education (EE) is conceived as a discipline that tries to give an educational response to the environmental crisis (Palmer and Neil, 1994). The recommendations already applied in the so-called Tbilisi Conference (Unesco, 1978) include aspects such as "making individuals and communities understand the complex nature of the natural and the built environments resulting from the interaction of their biological, physical, social, economic and cultural aspects" or "acquire the knowledge, values, attitudes, and practical skills to participate in a responsible and effective way in anticipating and solving environmental problems", including "aesthetic values". This discipline has developed since its inception in the so-called Stockholm Conference in 1972 (United Nations, 1973). In its more than forty years of existence, numerous plans, strategies and programs have carried out various actions aimed to restore an adequate person-nature relationship (Palmer, 1998). This allows an ability to overcome this environmental crisis, addressing the main environmental problems that threaten the planetary ecosystem equilibrium, in local and global levels. During these years, it has sought to achieve the intentions for which it was born (United Nations, 1973). But in reality, perhaps because it constitutes a dynamic and immensely complex field of study and interpretation (Palmer, 1998), the difficulty of fulfilling its objectives is clear, as revealed by Gigliotti (1990).

Environmental problems do not decline, but progress (Howell and Allens, 2016). The current pressing dimension of the old and the emergence of new environmental problems, such as global warming, place us in a still worrisome scenario that generates a perception of immobility or even regression in the achievement of the objectives intended by EE. This is why there is a permanent need to propose and test fresh educational initiatives that may help in improving our environmental behaviour, not only in schools, and not only outdoors but indoors. There is a need to give a boost to EE, even to look for alternative EE (Tsevreni, 2011; Schlottmann, 2012; Uzun and Keles, 2012) like the one that can be promoted in museums. John Dewey's writings (Dennis and Knapp, 1997), and Aldo Leopold's classic 'A Sand County Almanac' (Leopold, 1949) show that the sense of community, our belonging to the land, is of paramount importance for EE (Goralnik and Nelson, 2011). Museums can contribute immensely to fostering this sense and help advance the goals of EE.

Museology

Museums may be excellent environments for learning (Hein, 1998, 2000, 2012; Hooper-Greenhill, 2005, 2006, 2007; Falk, 1992, 2000, 2009; Burnham and Kai-Kee, 2011). Their role in society keeps growing in the eyes of society, and is permanently under discussion. From a cultural perspective, they are deemed instrumental in attaining higher levels of democratisation (O'Neill, 2008). Museums capture and convey cultural values, and yet they may become a mere tool in the hands of government policy (Holden, 2004). They may also be seen as 'institutions charged with both developing and embodying civic virtue and identity' (Castaneda, 2009). The social and educational roles assigned to museums evolve with society and education trends and in accordance with their own cultural field of interest (Moreno, 2004).

Historical studies on museums (e.g. Genoways and Andrei, 2008; O'Neill, 2008) may be of interest to 'any field that claims the public sphere as either its principle object of study or primary realm of scholarly practice' (Castaneda, 2009). The interest of an evolutionary and historical approach applies also to other museum-related learning venues, such as education libraries (Attebury and Kroth, 2012). Museums' evolution can be seen in the context of educational trends and schools of thought (Delors, 1996). But they are also influenced by many factors (NRC, 2009). It has been suggested for example that economic and professional pressures were the driving forces behind the transformation of community museums, which emerged during the late 1960s and early 1970s and transformed the traditional conception of an art museum (Moreno, 2004).

Museums act as mediators in learning. They offer unique opportunities to teach in an informal environment (NRC, 2009). They play their educational role in connection to other museum activities that should not be dismissed (Mayer *et al.* 2013). The importance of their educative purpose, the public they address, and their role as mediators has evolved over time (Zana, 2005). They open to a widening spectrum of people, and offer an excellent opportunity to convey education (Gómez, Balsari, Nusbaum, Heerboth and Lemery, 2013). The educative potential of museums may reach far, and combine very well with the task of teachers at schools (Kisiel, 2012).

Apart from non-educative factors, present-day education in museums shares in their historical educative background and experience, and it helps in order to understand the roots, the present and the possible future educational roles of museums. In any case, a historical approach to them conveys useful lessons to understand what has changed and what remains in present-day educative proposals in museums, and why. And to figure out what can be done in each venue and time, with its opportunities and constraints. For example, EE can find in this possibility of museum education a platform to achieve its objectives.

Meaningful learning

Novak's theory of education (1977, 1998) has played an influential role in EE and museum education advancement. His education theory proposes teaching techniques that build on the meaningful learning theory (Ausubel, 1968). This theory provides a theoretical framework that has proven effective in improving learning processes (Mayer, 2004). Meaningful learning is defined as 'the formation of viable relationships among ideas, concepts, and information' (Williams and Cavallo, 1995). Both authors (Ausubel and Novak) propose educational approaches that have been applied frequently in EE and Museum Education to foster knowledge about what the reality is, and improvements in behaviour, attitudes and values.

Ausubel's and Novak's contributions to meaningful learning theory may have its shortcomings and face misinterpretations. They have been challenged, of course. Meaningful learning has sometimes been seen as opposed to rote memorization. But it is unlikely, however, that such discrete categories of learning exist. Rote and meaningful learning, rather, are endpoints along a continuum of learning (Grove and Lowery Bretz, 2012). In any case, meaningful learning and the constructivist approach keep providing fresh effective guidance in teaching (Brandriet, Ward and Bretz, 2013; Garbett, 2011; Hartle *et al.,* 2012) and inspiring environmental education initiatives (Novak, 1980; Guruceaga, 2001).

Apart from concept building, the role of emotions has been also analysed in the meaningful learning context (Reis and Roth 2009; Boekaerts, 1988). This would encourage an educational process properly integrating 'thought, feeling and action' (Gowin, 1981, p. 11), as art museums can also enable the education of emotional intelligence (Goleman, 1996).

Complementarity and synergistic action

While developing the research in the three fields of expertise separately (i. e. museology, environmental education and meaningful learning) it became increasingly clear that their respective fields blend very well with each other in order to inspire and justify a sound educative proposal. For example, to begin with, one soon finds a common initial through the 'slow look' promoted by museums and the need to live more slowly that promotes environmental education (Novo, 2010). Museums can help in this task. Table 1 summarizes some of the concepts characteristics and proposals found during the research that exemplify this mutual complementarity and possibility of synergy. The issues of cultural depth, materiality, and the importance of the public in education. Following these chosen topics of focus, a suggestion of how the three fields of expertise connect and support each other to inspire and find a possible educational proposal can be set forth. The application of these three theoretical frameworks in art museums fits in with the proposals of Delors (1996) on the four pillars that support education for the XXI century: learning to know; learning to create, learning to live together and learning to be. The development of these skills involves education in multiple intelligences (Gardner, 2010), including intrapersonal and interpersonal ones and the intelligence to handle emotions (Goleman, 1996). This conceptual basis allows us to explore the potential of art museums to work on environmental education in a different and enabling way, open to a complex and changing world.

Table 1. Points held in common by the theoretical frameworks of Museology, Environmental Education and Meaningful Learning.

Museology	Environmental Education	Meaningful Learning
Promote interactivity, hands-on contact with museum objects, experiential and affective education. (Hooper-Grennhill, 2005, p. 106), (Hooper-Greenhill, 2006, pp. 238-245)	Promote learner's active involvement in learning process, and experiential education. (Tbilisi Conference, Unesco, 1977)	Promote active and experiential learning methodologies. Use of affectivity to boost meaningful learning. (Gowin, 1981, p. 11; Moreira, 2006)
Intend to familiarise society with the contents and concepts of objetcs and exhibitions. (Zubiaur, 2004, p. 61)	Use environmental sciences contents to reach a better knowledge of the environment. (Unesco-PNUMA, 1994, p. 1 21)	Curriculum planning, and learning, must be based on the most meaningful concepts (Zabala, 1997, p. 58).
Adapt the museum programmes to the target age bracket of the public.(Hooper-Greenhill, 2005, p. 114-118)	Adapt the environmental education syllabi to the age bracket of students. (Unesco-PNUMA, 1994, p. 21-23)	Adapt the education syllabi to the age bracket and psychological development of students. (Piaget and Inhelder, 1980)
Adapt the museum activities to the visiting public's knowledge. (Hooper-Greenhill, 2005, p. 138-140)	Adapt activities and contents to the population's socio-cultural context. (Unesco-PNUMA, 1994, p. 39)	Base learning activities on the learners' previous stock of knowledge. (Ausubel, 1976, p. 56)

Table 1. Continuation

Museology	Environmental Education	Meaningful Learning
Pay attention to the intangible heritage, which includes values. (Lee, 2004; Pastor, 2004, p. 44)	Promote education in environmental values. (Unesco-PNUMA, 1994, pp. 30-31)	Promote education in values, sometimes through the hidden curriculum. (Mayer, 1998)
Encourage active information searches on the museum objects by visitors. (Beyer, 2004)	Promote information search and critical discrimination. (Unesco-PNUMA, 1987, p. 25)	Learners must build up their knowledge by selecting the information meaningful to them. (Novak, 1998, p. 21; Ausubel, 1976, p. 450)
The museum should act as a learning facilitator, furnishing users with information. (Hooper-Greenhill, 2005, pp. 114-118)	Educators should act as facilitators and promoters of environmental knowledge. (Unesco-PNUMA, 1994, p. 27)	Teachers should act as learning facilitators. (Ausubel, 1976, p. 514)
Intend seductive, thrilling learning processes. (Hooper-Greenhill, 2007, pp. 170-187)	Education must be favoured by motivation. (Quetel and Souchon, 1985: 11; Caduto 1992, p. 9)	Meaningful learning is favoured by motivation. (Mayer, 2004)
Interdisciplinar. Seek to integrate scientific knowledge within popular culture. (Asensio, 1987)	Promote the integrated understanding of environmental and socio-economic issues. (Unesco-PNUMA 1994, p. 23)	Integrated contents favour understanding and the detection of conceptual errors. (Mayer 2004, p. 152)
Promote a context of fun-based learning, inspiration, and creativity. (Beyer 2004; Valdés 1999, p. 138)	Occasional use of simulation games as educative methodology. (Taylor, 1993).	Occasional use of play as an educative methodology. (Ballester, 2002)
Learning processes must be programmed to reach out any age bracket. (Valdés, 1999, p. 138)	Seek a lifelong durable, forward-looking education. (Unesco-PNUMA, 1994, p. 64)	Understand learning as a lifelong process (Novak, p. 1998).
Pay attention to relations between concepts, and promote complex thinking. (Screven, 1993; Beyer, 2004)	The environment is a complex reality, and must be approached in an integrated way. (Unesco-PNUMA, 1994, p. 21)	Use concept maps to foster the understanding of relations among concepts (Novak, 1998, p. 21)
Promote local-based and universal learning. (Valdés, 1999, p. 138)	Promote the attitude: 'Think globally, act locally'. (Unesco-PNUMA, 1994, pp. 87-94)	Intend to reach general knowledge from the learners' immediate particular setting. (Mayer, 2004)
Adapt to each personal experience and cognitive structure, and promote critical thinking. (Moreno, 2002, p. 181)	Promote personal critical thinking, e. g. in decision-taking procedures. (Unesco-PNUMA, 1994, p. 30)	Learning process should be adapted to each personal experience and cognitive structure. (Novak, 1998)
Allow freedom of movement (itineraries) to visitors, and the selection of alternative points of interest. (Lapaire, 1983, p. 76; Cameron, 1971)	Promote freedom in decision-taking and problem solving. (Unesco-PNUMA, 1994, p. 31)	Promote a personalisation of the learning, and divergence of contents among divergent people. (Ballester, 2002)
Conduct research on museology (Hooper-Greenhill, 1998, p. 9)	Conduct research in environmental education. (Unesco-PNUMA, 1994, p. 29)	Conduct research on learning processes (Zabala, 1997)
Pay attention to communication processes. (Hernández, 1998)	Consider the environmental educator as a communicator. (Unesco-PNUMA, 1994, pp. 29-35; Quetel, and Souchon, 1985, p. 11)	Tap into the learners' centres of interest, to reach a better communication. (Ausubel, 1976, p. 450; Mayer, 2004, p. 251)

Table 1. Continuation

Museology	Environmental Education	Meaningful Learning
The public must be studied, well-known. (Hooper-Greenhill, 1998, p. 9)	Conduct studies of behaviour, and on how the environment is perceived. (Benayas, 1992)	Conduct studies of constructivist applications. Knowledge of previous ideas. (Ballester, 2002)
Adapt to the diversity of the public. (Pastor, 2004, p. 55)	Adapt to the diversity of the public. (Unesco-PNUMA, 1994, p. 37)	Personalisation of the learning. Provide divergence of contents for divergent students. (Ballester, 2002)
Do not forget the importance of the presence of and contact with real objects. (Hooper-Grennhill, 2005: 106; Rivière, 1989, p. 280)	Real experiences can boost a favourable attitude towards the environment. (Giordan, 1993, p. 37)	Real experiences can boost motivation, emotion and meaningful learning. (Ausubel, 1976, p. 450)
Learning the competencies for XXI centuty (Delors, 1996)	Learning the competencies for XXI centuty (Delors, 1996)	Learning the competencies for XXI centuty (Delors, 1996)
Development of Multiple Intelligences (Gardner, 2010)	Development of Multiple Intelligences (Gardner, 2010)	Development of Multiple Intelligences (Gardner, 2010)
Development of emotional intelligence (Goleman, 1996)	Development of emotional intelligence (Goleman, 1996)	Development of emotional intelligence (Goleman, 1996)

Application of the table: a practical example

Table 1 allows to extend some of the powers that present the disciplines exposed separately. The museum artistic context allows working on environmental education from a different perspective. As an example of the educational possibilities offered by the combination of these disciplines, the case of their application to students at university level is shown. Specifically, an educational instruction called "Landscape Workshop" was designed for the subject "Society and Environment" belonging to the Environmental Sciences degree of the Science Faculty of the University of Navarra. This environmental education workshop took place at the University of Navarra Museum. Through abstract art, from the work "Más allá de la ceniza" (1977) by the artist and beauty ecologist César Manrique (Echarri and Echarri, 2018), various notions of landscape were worked on. First of all, in the exhibition rooms, work was done on the education of the gaze and the interpretation of what is looked at, through the "visual thinking" methodology (Yenawine, 2013) which promotes perception, the feeling towards what is looked at and the routine of thought "I see, I think, I wonder". In addition, the workshop included the compilation of a landscape "footprint" that the students had to intervene in an artistic way. Finally the instruction ended with an explanation and sharing of the works made by the students.

In this way, key principles of EA are worked on, such as the interdisciplinary nature and complexity of the environment, the holistic perspective, which are reflected in the concept of landscape, understood in an integral way, including its aesthetics. The use of artworks for the teaching of environmental content was highly valued by the students.

The instruction applied educational criteria suggested by the theory of meaningful learning, such as starting from previous knowledge and the singularities and centers of interest of the students, and sought experiential education and the integration of the emotional component in the teaching at the Art Museum.

Conclusions

This research work has been conceived to unify the most representative educational aspects of several disciplines, and tools, in a productive way. The synthesis carried out has found common criteria contents and possibilities involving museology, environmental education and meaningful learning. All these fields have an educational potential. Their joint consideration in an art museum adds up to more than the sum of their separate possibilities. Their integration may inspire specific educational programmes, which keep coherence with the criteria of each field separately. In sum, this article has involved research that has brought together different fields of theoretical, practical and conceptual knowledge seeking for synergy, and producing educational proposals.

The activities programmed in the "Landscape Workshop", as an example of the joint application of the theoretical frameworks on display, are based on the motivating capacity of the Museum's objects to promote understanding of the major environmental challenges, and the personal discovery of the role that behaviour itself can play in these challenges. They also seek to be playful, participatory and collaborative, all to facilitate the emotional involvement of the learner, and meaningful learning.

The social environment is changing and any educational syllabus has to innovate constantly to keep pace with these changes. At the same time, to bring to date or design new syllabi a sufficiently tested basis that may underpin new educative ideas is needed. The theoretical and practical synthesis of the disciplines carried out provides a new and coherent base for designing alternative educational syllabi in art museums that can work environmental education from a complex perspective, taking advantage of the benefits that museology can bring to the significance of learning in education for the twenty-first century, like the exposed "Landscape workshop".

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