



MALMÖ
UNIVERSITY

XVIII IOSTE Symposium

Future Educational Challenges
From Science & Technology Perspectives

Book of Proceedings



Stockholm
University



IOSTE



XVIII IOSTE SYMPOSIUM

*Future educational challenges from a science and
technology perspectives.*

Malmö, Sweden, 13-17 August, 2018

Editors: Anna Jobér, Maria Andrée and Malin Ideland

Designed by Fredrik Svensson and Anna Jobér

ISBN 978-91-7104-971-1

DOI 10.24834/978-91-7104-971-1

Published online at Malmö University <https://doi.org/10.24834/978-91-7104-971-1>

© 2018 by the IOSTE 2018 conference committee. All rights reserved. Copying or distributing in print or electronic forms without written permission is prohibited.

To cite this book of proceedings: Name, N. & Name, N. (2018). Title of the paper. In A. Jobér, M. Andrée and M. Ideland (Eds). *Future Educational Challenges from Science and Technology Perspectives. XVIII IOSTE Symposium Book of Proceeding*. (pp. xx-yy). Malmö: Malmö University. Retrieved from <https://doi.org/10.24834/978-91-7104-971-1>



XVIII IOSTE SYMPOSIUM

Future educational challenges from a science and technology perspectives.

Malmö, Sweden, 13-17 August, 2018

The exhibition “Out of Water Diving”: influences on students’ conceptions about marine environment and about the relationship of this ecosystem with their daily lives

Naomi Towata^a, Suzana Ursi^{b*}

^a Instituto de Biociências, Universidade de São Paulo, R. do Matão, 14, Cidade Universitária, São Paulo, Brasil, 05508-090.

* Corresponding author e-mail address: suzanaursi@usp.br

Abstract

This work aimed to investigate the initial conceptions and check whether and how the exhibition “Out of Water Diving” (OWD) influenced conceptions about marine environment (ME) and the relationship of this ecosystem with students’ daily lives. A structured questionnaire was used, which was applied before and after OWD and answers were analyzed by open categorization. 185 students from São Paulo (Brazil) answered the initial questionnaire and 155 answered the final one. The number of students who could establish the relationship with ME and their daily lives was low, but with slightly increasing after OWD (from 14% to 23%). Concerning the organism that students expected to find on ME, the chordates were the most cited (fishes, sharks and whales). However, the citations of some no chordate animals (starfish and jellyfish) and seaweeds were higher after OWD. Students reported that they had more interest about ME after OWD. It is not easy for students to establish relationships between their daily lives and the ME. However, our data indicate that the OWD had positive influences, as it aroused more interest about this environment and more students stated that they were able to establish relationship between their daily lives and ME.

Keywords: Coastal environments; Environmental Perception; Marine environments, Model of Ecological Values; The Coastal Questionnaire (CEQ)

INTRODUCTION

Coastal and marine environments have a great ecological relevance, as well as it represents a significant source of natural resources to human consumption (Babier, 2017). However, these important ecosystems have been suffering a lot with pollution and overexploitation. Many of the largest cities in the world, where population growth rates are high, are located near the coast. Gray (1997) highlighted that these huge populations increase the pressures on utilization of resources in coastal areas and, in addition, lead to habitat degradation, fragmentation and destruction. Coastal and marine environments are sometimes overlooked based on an apparent distance between them and people’s daily lives. Therefore, it is evident the need for Environmental Education programs to focus on this environment (Towata and Ursi 2017). However, recently, a review article highlighted that there are few numbers of this kind of programs in Brazil, despite the country’s extensive coastline (Pedrini, Ursi, Berchez, Correia, Sovierzoski and Mochel, 2014). A critical step to develop Environmental Education programs, including the ones focused on marine ecosystems, is to understand the perception and the connectedness that people establish with these environments (Towata and Ursi 2017). Environmental Perception is a complex concept; however, we accept that it is the relation that people establish with the environment in which they are inserted, which occurs through perceptual and cognitive mechanisms (Whyte, 1977).



XVIII IOSTE SYMPOSIUM

Future educational challenges from a science and technology perspectives.

Malmö, Sweden, 13-17 August, 2018

The interactive exhibition Out of Water Diving (OWD) is inserted in this context of Environmental Education activities focused on improving the perception about marine ecosystems. It is part of the Underwater Trial Project, from Institute of Bioscience, University of São Paulo (Brazil). The project is based on a holistic concept of Environmental Education, aiming at the development of the individual in terms of behavior, ethics and environmental values, instead of only transmitting ecological and biological concepts (Berchez, Carvalhal and Robim, 2005). This work aimed to investigate the initial conceptions and check whether and how the OWD influenced these conceptions of students about marine environment and about the relationship of this ecosystem with students' daily lives.

METHODOLOGY

The interactive exhibition Out of Water Diving (OWD) was composed by 13 posters and 7 play activities about diving, marine and coastal environments and their biodiversity, as described by Ursi, Pirani-Guilardi, Amancio, Ribeiro, Towata and Berchez (2010) (Figure 1). At the beginning of the OWD, participants received a guide sheet with questions to help them explore the materials. At the end, the participants could do the self-correction, since the correct answers were presented in the last poster. The themes of the posters were scuba diving, diving procedures, diving history, Physics in diving, Geology, tide, seaweeds diversity, seaweeds in your daily life, plankton, sea animals, environmental balance, environmental impacts and guide sheet responses.

The play activities were:

- model with diving equipment, in which participants can try to breathe with mouthpiece;
- game about decomposition time in the marine environment;
- herbarium of seaweeds that can be touch by the participants;
- "Touch-Touch" activity, which is composed by boxes with a hole where the participant put the hand and try to identify the object by touch;
- correlation game between types of diving techniques used over time and historical events (of the world and of Brazil);
- microscope with sample of marine plankton;
- projection on the wall of the phrase "Marine Biodiversity - I am also responsible", in which participants can take pictures.



XVIII IOSTE SYMPOSIUM

Future educational challenges from a science and technology perspectives.

Malmö, Sweden, 13-17 August, 2018



Figure 1. Examples of one poster (a), the guide sheet (b), and some playing activities (c, model of diver; d, Touch-Touch; and e, decomposition game) of OWD.

It was done a semi-experiment, as described by Lankshear and Knobel (2004), in which the educational intervention was the OWD. This exhibition was placed at a public school of São Paulo city (Brazil) and it was used a structured questionnaire to collect data. It was applied around three months before and one month after OWD. 185 students (13-15 years old) answered the initial questionnaire and 155 students answered the final one. It was used four questions of this questionnaire in the present work (Table 1). The responses collected before and after the OWD were quantified and compared. The explanations of question 2 were analyzed by open categorization, using Straus and Corbin (1990) methodology.

Table 1. Question related to students' conceptions about marine environment.

| |
|--|
| Question 1 |
| When you think about the marine environment, the 3 first words or expression are: <input type="checkbox"/> entertainment <input type="checkbox"/> food <input type="checkbox"/> religion <input type="checkbox"/> fear <input type="checkbox"/> cleaning <input type="checkbox"/> work <input type="checkbox"/> curiosity <input type="checkbox"/> pollution <input type="checkbox"/> boring <input type="checkbox"/> beauty <input type="checkbox"/> health <input type="checkbox"/> disease <input type="checkbox"/> other: <input type="checkbox"/> other: |
| Question 2 |
| Is there any relation between your quotidian and the marine environment? <input type="checkbox"/> Yes. <input type="checkbox"/> No. If you chose "Yes", explain your answer. |
| Question 3 |
| Write 8 marine organisms. |
| Question 4 |
| Your interest about marine environment is: <input type="checkbox"/> very high. <input type="checkbox"/> high. <input type="checkbox"/> medium. <input type="checkbox"/> low. <input type="checkbox"/> very low. |



XVIII IOSTE SYMPOSIUM

Future educational challenges from a science and technology perspectives.

Malmö, Sweden, 13-17 August, 2018

RESULTS

When asked about words they could associate with marine environment, “curiosity” and “beauty” categories were the most cited by students on initial (59 and 51%) and on final (68 and 62%) questionnaires. Additionally, after OWD, the percentage of some categories changed. For instance, “cleaning” and “health” decreased (respectively from 29 to 21% and 22 to 15%) and “food” and “entertainment” increased (respectively from 14 to 18% and 33 to 43%) (Figure 2). The absolute percentage of students who could establish the relationship with marine environment and their daily lives (Question 2) was low, but with slightly increasing after OWD, from 14% to 23%. The main relations cited in the initial questionnaire were “food” (44%) and “go to the beach” (12%). After OWD, the most observed answers were related to the “use of substances derived from sea” (33%), followed by food (30%) and the “necessity of no polluted marine environments” (17%) (Figure 3). The use of substances derived from sea was not cited in the initial question, showing that this subject was unknown or forgotten by the student, and OWD exhibition significantly changed this situation.

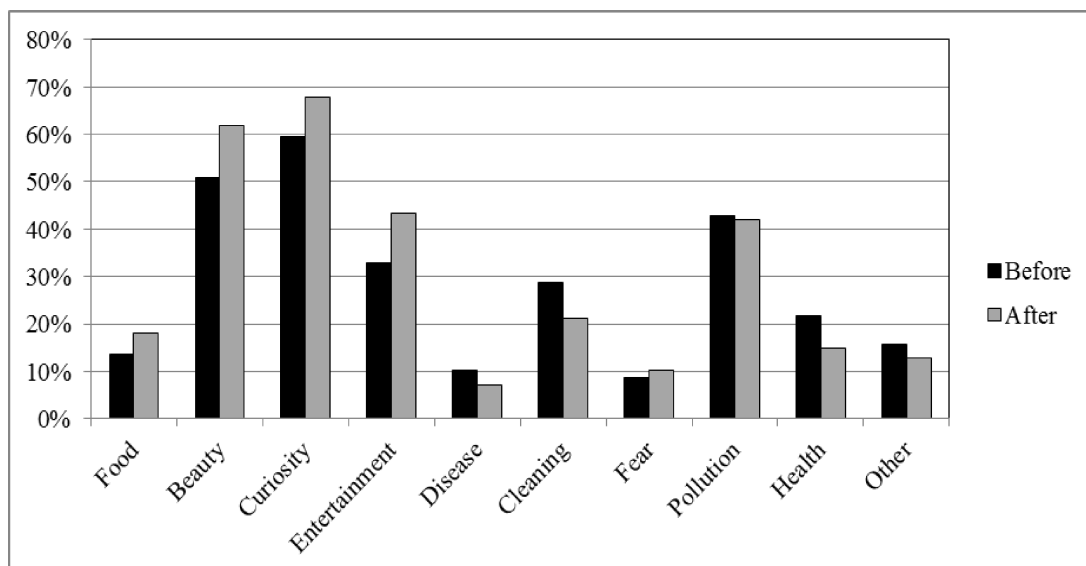


Figure 2. Occurrence (%) of words related to marine environment found on students' answers before and after OWD.



XVIII IOSTE SYMPOSIUM

Future educational challenges from a science and technology perspectives.

Malmö, Sweden, 13-17 August, 2018

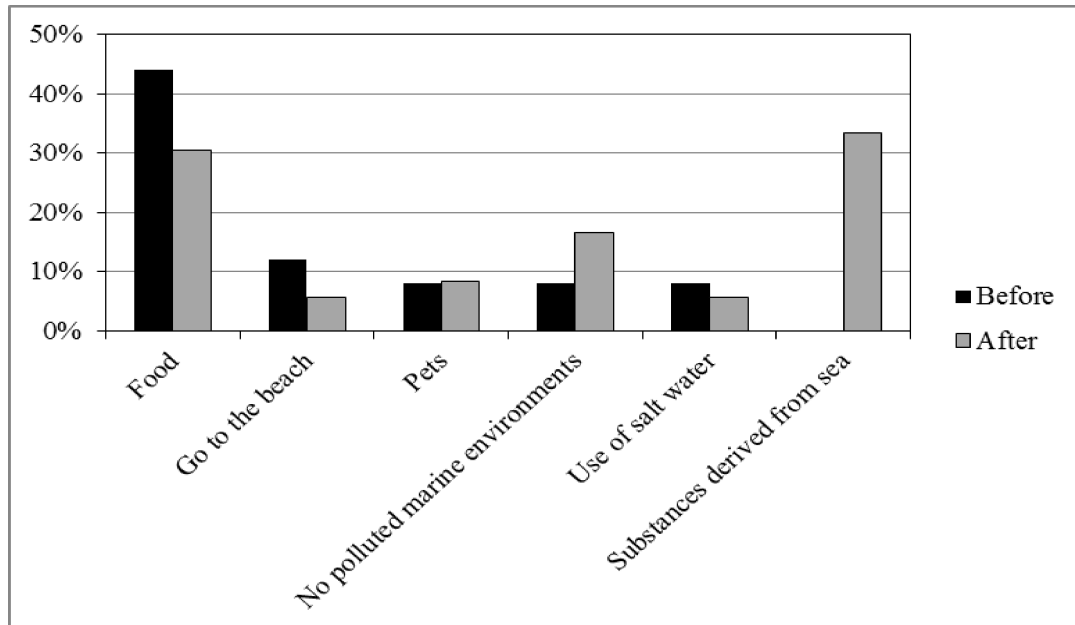


Figure 3. Occurrence (%) of categories found before and after OWD on the answer of students that can establish relation between their quotidian and the marine environment.

When students were questioned about their interest about marine environment, we observed the following frequencies before OWD: very low or low - 26%, medium - 43%, high or very high - 31%. After OWD, the interest increased: very low or low - 11%, medium - 52%, high or very high - 37% (Table 2).

About the organism that students expected to find on marine environment, the chordates were the most cited organisms before and after OWD: fishes (81 and 77%), sharks (81 and 72%) and whales (72 and 67%). However, the citations of some no chordates animals, as starfish and jellyfish, and seaweeds were higher after OWD. The biggest increase was related to seaweeds, from 27 to 59%.

Table 2. Occurrence (%) of categories found before and after OWD on the answer of students related to the interest about marine environment.

| Category | Before OWD | After OWD |
|-----------|------------|-----------|
| very high | 10 | 6 |
| high | 21 | 31 |
| medium | 43 | 52 |
| low | 20 | 10 |
| very low | 6 | 1 |



XVIII IOSTE SYMPOSIUM

Future educational challenges from a science and technology perspectives.

Malmö, Sweden, 13-17 August, 2018

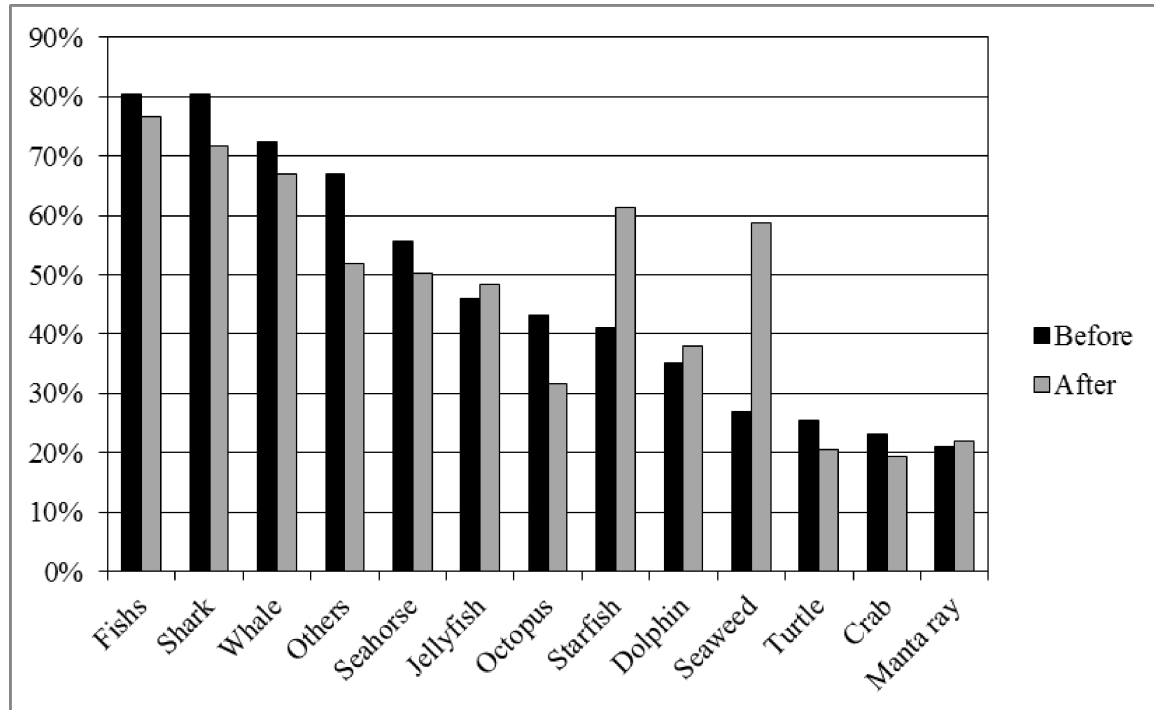


Figure 4. Occurrence (%) of categories found before and after OWD on the answer of write eight marine organisms.

DISCUSSION

The results highlighted that it is not easy for students to establish relationships between their daily lives and the marine environments, corroborating some other investigations conducted in Brazil (e.g. Katon, Towata, Berchez and Ursi, 2014; Katon, Towata, Berchez, Oliveira and Ursi, 2013; Savietto, Katon, Towata, Berchez and Ursi, 2014). Probably, the physical distance is an aggravating factor. This situation partially changed after OWD, when a greater percentage of students recognized a relationship between their daily lives and the marine environments. However, students show a vision more focused on what Amérigo, Aragonés, Frutos, Sevillano and Cortés (2007) define as the anthropocentric dimension of the environment. To these authors, the anthropocentric dimension is distinguished by the fact that man does not see himself as part of the environment, being a more selfish view of the man-environment relationship. Students also present a predominantly utilitarian conception, in which the environment is considered as the set of natural elements at the disposal of man (Flores and González-Gaudiano, 2008). Towata and Ursi (2017) discussed that stimulating students to do this correlation is a great challenge, because establishing connectedness seems to be even more difficult to marine environments than to land ecosystems. In this situation, the necessity of Environmental Education program to focus on coastal and marine ecosystems is significant. These programs can be a privileged context for bringing participants closer to the environment and conservation issues. The results of the present work agreed with this idea, because they indicated that the OWD had positive influences, as it aroused more interest in marine environment and more students stated that they were able to establish a relationship between their daily lives and the marine environments.



XVIII IOSTE SYMPOSIUM

Future educational challenges from a science and technology perspectives.

Malmö, Sweden, 13-17 August, 2018

When thinking about the marine environment, students related to the marine environment with curiosity. After the OWD, this occurrence is even greater, which is a positive result, since such curiosity may promote actions to further increase knowledge about this environment. Children's natural curiosity has been seen as an intrinsic motivation for learning, which is very important in early childhood education (Sagoff, 1974). According to Pietrocola (2004), scientific activities become interesting and instigating when they are able to excite our curiosity. Science can be a source of pleasure if it can be conceived as creative activity. Imagination must be thought of as the main source of creativity. Curiosity is the engine to put our imagination in motion. Thus, curiosity, imagination and creativity should be considered as the basis of a teaching that can result in pleasure.

Other encouraging point was that students recognize a greater variety of organisms after the exhibition. The percentage of citations about seaweeds more than doubled after OWD, which is especially important when we think about the phenomenon called “plant blindness” when people are not able to recognize or value plants, as well as their importance in the daily life and their aesthetical and ecological value (Wandersee and Schussler 2001). This phenomenon can be related to physiological, evolutionary and cultural factors, including the small amount of attention given by the media to this subject (Wandersee and Schussler, 2001, 1999; Hershey, 2002, 1996; Balas and Momsen, 2014; Salatino and Buckeridge, 2016). We can expect that the “plant blindness” concept can also be applied to seaweeds, that are a non-monophyletic group, nevertheless traditionally related to plants. Then, OWD can be recognized as a tool to minimize this blindness when associated to marine environments.

CONCLUSIONS

An important step to promote the habitats conservation is to recognize and value their biodiversity, and we interpreted that OWD is a good example of activity that can stimulate students' interest and knowledge about these issues. Therefore, we hope that our data can be subsidy for the evaluation OWD exhibition by its creators in a continuous improvement process, as well as to inspire new educational programs that focus on marine environments.

ACKNOWLEDGEMENTS

The authors thanks FAPESP - Fundação de Amparo à Pesquisa do Estado de São Paulo (BIOTA Program, Process 2010/50172-4) for financial support and CAPES- Coordenação de Aperfeiçoamento de Pessoal de Nível Superior for the scholarship of Naomi Towata (Finance Code 001). The authors also thank basic education students that participated in this research.

REFERENCES

- Amérigo, M., Aragonés, J. I., Frutos, B., Sevillano, V., and Cortés, B. (2007). Underlying dimensions of ecocentric and anthropocentric environmental beliefs. *The Spanish Journal of Psychology*, 10(1), 97-103.
- Balas, B., and Momsen, J. L. (2014). “Attention “Blinks” Differently for Plants and Animals.” *Life Sciences Education*, 13(3), 437-443.
- Babier, E. B. (2017). Marine ecosystem services. *Current Biology*, 27(11), 507-510.



XVIII IOSTE SYMPOSIUM

Future educational challenges from a science and technology perspectives.

Malmö, Sweden, 13-17 August, 2018

- Berchez, F., Carvalhal, F., and Robim, M. J. (2005). Underwater Interpretative Trail - guidance to improve education and decrease ecological damage. *International Journal of Environment and Sustainable Development*, 4(2), 128-139.
- Flores, R. C., and González-Gaudiano, D. (2008). Representaciones sociales Del médio ambiente: um problema central para El processo educativo. *Trayectorias*, 10(26), 66-78.
- Gray, J. S. (1997). Marine biodiversity: patterns, threats and conservation needs. *Biodiversity and Conservation*, 6(1), 153-175.
- Hershey, D. R. (1996). A historical perspective on problems in botany teaching. *American Biology Teacher*, 58(6), 340-347.
- Hershey, D. R. (2002). Plant Blindness: We Have Met the Enemy and He Is Us. *Plant Science Bulletin*, 48(3), 78-84.
- Katon, G. F., Towata, N., Berchez, F. A. S., Oliveira, V. M., and Ursi, S. (2013). Percepção de estudantes que vivem distantes do litoral sobre o Ambiente Marinho [Perception of students living far from the coast about the Marine Environment]. *Enseñanza de las ciencias: revista de investigación y experiencias didácticas*, v. extra, 1342-1347.
- Katon, G. F., Towata, N., Berchez, F. A. S., and Ursi, S. (2014). Percepção de Ambientes Marinhos e Costeiros: uma visão de estudantes de um curso técnico em meio ambiente [Perception of Marine and Coastal Environments: a view of students from an technical course on environment]. *Revista de Ensino de Biologia da SBEnBio*, 7, 2648-2660.
- Lankshear, C., and Knobel, M. (2004). *A Handbook for teacher research. From design to implementation*. Glasgow: Bell and Bain Ltd.
- Pedrini, A. G., Ursi, S., Berchez, F. A. S., Correia, M. D., Sovierzoski, H. H., and Mochel, F. (2014). *Metodologias em Educação Ambiental para a conservação socioambiental dos ecossistemas marinhos* [Methodologies in Environmental Education for the socio-environmental conservation of marine ecosystems]. In Pedrini, A.G., and Saito, C.H. (Eds.), *Paradigmas Metodológicos em Educação Ambiental* [Methodological paradigms in Environmental Education]. 1ed. (pp. 132-151). Petrópolis: Vozes.
- Pietrocola, M. (2004). Curiosidade e Imaginação – os caminhos do conhecimento nas Ciências, nas Artes e no Ensino [Curiosity and Imagination - the paths of knowledge



XVIII IOSTE SYMPOSIUM

Future educational challenges from a science and technology perspectives.

Malmö, Sweden, 13-17 August, 2018

- in Science, Arts and Teaching]. In Carvalho, A. M. P. (Ed.), *Ensino de ciências: unindo a pesquisa e a prática* [Science teaching: combining research and practice]. Thomson Pioneira: São Paulo.
- Sagoff, M. (1974). On preserving the Natural Environment. *The Yale Law Journal*, 84, 205-267.
- Salatino, A., and Buckeridge, A. (2016). “Mas de que Te Serve Saber Botânica?” [“But What Does It Serve You to Know Botany?”]. *Estudos Avançados*, 30(87), 177-196.
- Savietto, S. F., Katon, G. F., Towata, N., Berchez, F. A. S., and Ursi, S. (2014). Ambientes marinhos e costeiros: qual a percepção de estudantes de escolas do litoral norte de São Paulo? [Marine and coastal environments: what is the perception of students from schools located on the North coast of São Paulo?]. *Revista de Ensino de Biologia da SBEnBio*, 7, 6746-6757.
- Strauss, A., and Corbin, J. (1990) *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage.
- Towata, N., and Ursi, S. (2017). Perception and connectedness with marine and coastal environments: the perspective of basic education and undergraduate students from two Brazilian cities. *Conexão Ciência*, 12(2), 256-363.
- Ursi, S., Pirani-Guilardi, N., Amancio, C. E., Ribeiro, H. L., Towata, N., and Berchez, F. A. S. (2010). Projeto Trilha Subaquática virtual nas escolas: proposta de uma atividade didática sobre o ambiente marinho e sua biodiversidade [Virtual Underwater Trail Project in schools: proposal of a didactic activity about the marine environment and its biodiversity]. *Revista de Ensino de Biologia da SBEnBio*, 3, 3821- 3829.
- Wandersee, J. H., and Schussler, E. E. (1999). “Preventing Plant Blindness.”. *The American Biology Teacher*, 61(2), 82-86.
- Wandersee, J. H., and Schussler, E. E. (2001). Toward a Theory of Plant Blindness. *Plant Science Bulletin*, 47(1), 2-9.
- White, A. V. T. (1977). *Guidelines for fields studies in Environmental Perception*. Paris: UNESCO/MAB.