

STUDENTS' VIEW OF REEF ENVIRONMENTS IN THE METROPOLITAN AREA OF RECIFE, PERNAMBUCO STATE, BRAZIL

Uma visão da classe estudantil sobre ambientes recifais na Região Metropolitana do Recife, Estado de Pernambuco, Brasil

Flávia Andréa Leal de Vasconcelos¹, Fernanda Duarte Amaral², Andrea Quirino Steiner³

ABSTRACT

Most of the Brazilian coast has reef environments, important ecosystems from both the ecological and human viewpoints, yet under a continuous process of degradation. An instrument that can be used to halt threats to these ecosystems is environmental education (and one of the best places to use it is at school), but environmental perception studies must be first carried out to portray the target group. This study aimed to analyze the perception of students of the Metropolitan Area of Recife (Brazil) on the elements that characterize the importance of reef environments, as well as to evaluate educational tools that would be efficient in promoting awareness about this theme. To achieve this goal, questionnaires were applied to two grades of three public and three private schools before and after an educational intervention based on 291-strong sample analyzed. The questionnaire included ten items that collected the students' basic data, as well as several aspects on reef environments. In addition, teachers of those grades were interviewed. There were no differences in knowledge between the two types of school; before the intervention, the understanding of the theme was in general poorly constructed in all of the schools studied. However, the five-senses workshop proved to be an efficient instrument for teaching the sciences.

Key words: *environmental perception, environmental education, reef environments, middle and high school education.*

RESUMO

Grande parte do litoral brasileiro apresenta ambientes recifais, importantes ecossistemas dos pontos de vista ecológico e humano, mas sob contínuo processo de degradação. Um dos instrumentos para combater as ameaças aos recifes é a educação ambiental (e acredita-se que a escola é um dos melhores locais para utilizá-lo), não sem antes realizar estudos de percepção ambiental para caracterizar o grupo em foco. Este estudo objetivou analisar a percepção de alunos da Região Metropolitana do Recife (PE) sobre os elementos que caracterizam a importância dos "ambientes recifais", além de avaliar instrumentos pedagógicos eficientes na sensibilização sobre este tema. Para tanto, foram aplicados questionários em duas séries de três escolas públicas e três particulares antes e depois de uma intervenção pedagógica, totalizando 291 alunos analisados. O questionário continha dez questões que abordavam diversos aspectos do ambiente recifal. Professores destas turmas também foram entrevistados. Os resultados foram sistematizados e analisados qualitativa e quantitativamente. Não houve distinção entre o conhecimento do tema e o tipo de instituição de ensino, sendo este geralmente pouco construído em todas as escolas estudadas antes da intervenção. Contudo, a oficina dos cinco sentidos mostrou-se eficiente estratégia pedagógica para o ensino das ciências.

Palavras-chaves: *percepção ambiental, educação ambiental, ambientes recifais, ensinios fundamental e médio.*

¹ Pesquisadora-colaboradora do Laboratório de Ambientes Recifais da Universidade Federal Rural de Pernambuco, Rua Dom Manoel de Medeiros, s/n, Recife, PE. E-mail: flavinhabiologa@gmail.com

² Professor Associado 1 na Universidade Federal Rural de Pernambuco (UFRPE) e Bolsista de Produtividade de Pesquisa do CNPq. E-mail: fdamaral@db.ufrpe.br

³ Bióloga da Associação Pernambucana de Defesa da Natureza (ASPAN). E-mail: coorelin@aspan.org.br

INTRODUCTION

Reef environments are important marine ecosystems because they provide shelter and support for several communities, aggregating approximately 25% of all marine life (Bryant *et al.*, 1998). Most of the Brazilian coast has reef environments; the majority is beachrocks, which have considerable coralline fauna and great ecologic and economic importance, and stretch for long distances in parallel lines along the coast (Maida & Ferreira, 1997; Castro & Pires, 2001).

Cnidarians are crucial components of reef fauna. They are an important part of the food chain and are a source of food for fishes and crustaceans of commercial interest, as well as several types of invertebrates (Migotto *et al.*, 1999). Among them are the corals, which are well represented in Pernambuco, the state where this study was carried out: of the 26 species of zooxanthellate and azooxanthellate corals and hydrocorals, at least 15 occur in this state (Maýal *et al.*, 2002).

Unfortunately, Pernambuco's coastal ecosystems have been suffering several degradation processes and, consequently, biodiversity losses. An example is a diagnosis carried out by Barros *et al.* (1999 *apud* Albuquerque, 2005) in the Santa Cruz Channel, which identified several negative impacts, such as predatory fishing, industrial and urban discharges, mangrove deforestation, water contamination, and habitat destruction. A solution would be to inform local populations about these facts, in order to promote changes in attitude through information and training. Albuquerque & Albuquerque (2005) point out that it is common for communities to be unaware of the true causes or solutions for environmental problems – even those with reasonable levels of information.

Nevertheless, before developing any kind of environmental education project it is vital to be familiar with the population's relationship with the environment – in other words, their environmental perception. After all, one of the main aims of an environmental perception study is the pre-diagnosis of the studied segment's information needs, to then construct an environmental education program focused on environmental concepts and issues related to environmental phenomena and problems (Marin *et al.*, 2003).

According to Reigota (1994), perception is constructed interactively and shared by different groups that understand and transform their reality through this view. On the other hand, Del Rio & Oliveira (1999) admit that the way we see the world is the result of a perceptive process in which we record and give meaning to the reality around us,

both in a social and individual context.

The importance of research for planning conservation strategies is evident, but there are difficulties in protecting natural environments because of differences in perception and values among individuals of diverse cultures or socioeconomic groups that carry out distinct functions in these environments' social plan. The report of the Intergovernmental Conference on Environmental Education organized by UNESCO and the United Nations Environment Program (UNEP) also lists recommended aims for environmental education:

“to succeed in 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, and acquire the knowledge, values, attitudes, and practical skills to participate in a responsible and effective way in anticipating and solving environmental problems, and the management of the quality of the environment. (...) To carry out these tasks, environmental education should bring about a closer link between educational processes and real life, building its activities around the environmental problems that are faced by particular communities and focusing analysis on these by means of an interdisciplinary, comprehensive approach which will permit a proper understanding of environmental problems”.

School is one of the best places to carry out environmental education activities, as long as the students are allowed to develop their creativity, interest, and curiosity (Reigota, 1994). However, the first step must be to analyze the students' prior knowledge on the subject and how it is related to their daily life. In this way they will become more motivated to learn and the educator will be able to conduct his/her class in a better manner, and prone to understand threats to the environment and the consequences to the planet's (Leal & Gouvêa, 2000) and their own quality of life.

Science teaching must consider empirical knowledge obtained after countless tries – it follows no method or organized structure and is passed on from generation to generation. Differently, scientific knowledge seeks to understand not only the phenomena, but also its causes and laws. It is methodical, systematic, objective, and reliable (Chalmers, 1993).

Due to all of these issues, it is necessary to rethink science teaching and to encourage new ways of learning science and biology. Changing educational practices implies recognizing that it is not only the teacher that must change – several aspects of the school and the community must also be taken into consideration to promote their transformation. Above all, what must be present in all activities developed by the teacher – field trips, laboratory classes, debates, etc. – is open dialogue with the students and respect for their ideas (Bizzo, 2002). These were the elements that this study tried to use, in order to develop practices that link theory and practice inside the classroom.

Thus, this study aimed to analyze the perception of students from public and private schools at the Metropolitan Area of Recife of some aspects of reef environments, including importance and threats, as well as to develop efficient educational methodologies to promote the awareness of this issue.

MATERIAL AND METHODS

Initially, three public (Escola Pintor Manuel Bandeira, Escola Professor Olívio Montenegro, and Escola Regueira Costa) and three private schools (Colégio 2001, Colégio Carneiro Leão, and Escola Ativa) were chosen. Among the students from the private schools, most (54%) were male; the opposite happened in the public schools, where 52% were female. In the 6th grade, age varied from 11 to 14 in the private schools and from 11 to 17 in the public schools. For the 9th grade, age varied from 14 to 19 in the private schools and from 15 to 23 in the public schools. Most students were from the cities of Olinda, Recife or Paulista. Informal interviews were made with the teachers in order to collect information on the classes and their contents.

At another moment, 6th and 9th grade students filled in questionnaires that aimed to verify their knowledge before the intervention (130 questionnaires were filled out by 6th graders and 161 by 9th graders). The questionnaire included ten questions (open and closed) that collected basic information on the students and on their knowledge of the importance, definitions, threats and ways to conserve reef environments and related organisms; these grades were chosen because, in the Brazilian curriculum, they are the years where living beings are studied, including phylum Coelenterata (as cnidarians were still called in the schools and in many textbooks).

Later, two educational interventions were carried out: a lecture called “Reef environments:

what they are and why should they be conserved?”, which focused on the importance of reef environments (emphasizing phylum Cnidaria), their biodiversity, and the threats they withstand; and a “five-senses workshop” adapted from GIGA (2005), aimed to promote the students’ awareness of reef environments and their importance using the five senses:

1. Seeing: photos of reef environments were used here, including degraded and polluted areas;
2. Listening: for this sense the students listened to the sound of dolphins, whales, waves, and seashells;
3. Smelling: the students could smell products made from marine organisms, and also compare the smell of clean and polluted seawater;
4. Touching: marine organisms with different textures and morphologies (such as sponges, hydrocorals, medusas, jellyfish, corals, sea-anemones, mollusks, starfish, sea urchins, seahorses, etc.) were available for the students to touch;
5. Tasting: the students could taste several kinds of food from the sea: fish cakes, candy made from algae, etc.

The workshop ended up with a debate where it was possible to put together the students’ prior knowledge and the knowledge obtained from the intervention, as well to evaluate the theme’s importance.

After the interventions, a date was scheduled for the students to fill in another questionnaire (with the same questions), in order to evaluate the effectiveness of the intervention. Lastly, the results derived from 582 replications of the two questionnaires were systemized and analyzed statistically. Three evaluation categories were created to classify the students’ answers:

- Satisfactory – complete or almost complete answers;
- Partially satisfactory – for answers with minimal, incomplete information;
- Unsatisfactory – totally incorrect or blank answers.

Statistical analysis was carried out to compare the results between the two types of school (public and private) and before and after the educational intervention. The programs Microsoft Excel 97 and STATISTICA for Windows Release 4.1 (Pearson’s χ^2 test) were used, at a 5% significance level.

RESULTS

Questionnaires

Most teachers interviewed had graduated in biology with a teaching habilitation. Phylum

Cnidaria was part of the 6th grade program and was included in the textbooks under the “living beings” topic which was not included in all of the schools’ 9th grade program, though. We also observed that none of the schools – public or private – had biology or science laboratories. Neither did any of the schools carry out field trips to any kind of marine environment, even those near the beach.

Among all of the students’ answers, a total of 21 animals were cited for the question “When you go to the beach, do you see the organisms that inhabit that environment? If so, list the ones you have seen”; the animals that stood out the most were fish, crabs, sea urchins, starfish, and jellyfish. Others cited less frequently were medusas, corals, sponges, shrimp, oysters, shellfish, morays, octopuses, seahorses, sea turtles, dolphins, and squids. In addition, other organisms or parts of organisms were mentioned, such as algae and shells. Alternatively, many students only perceived the physical environment (sand, air, water, etc.) or even alterations in the environment (trash and feces, for example), as well as elements that are not part of the marine environment (dogs, horses, cockroaches, rats, etc.). A few did not perceive the natural environment at all, and viewed the beach as a place with the sole purpose of providing leisure, whose organisms and their importance were unknown. After the intervention, only marine organisms were cited.

In relation to the question “What is a coral?”, most students, regardless of grade or school, defined corals as rocks. However, after the intervention, 99% answered satisfactorily (animals).

Regarding coral reefs, most students acknowledged their importance, but rarely specified it. Among those who did, the most frequent answers were their ecologic importance (food or shelter for fish – 62.4%), their function as a natural barrier against predators like sharks or protection against the rising seas (28.2%), or maintaining ecologic equilibrium (9.4%); the remaining answers were considered unsatisfactory. After the intervention the students were able to list several other types of importance, such as for: medicine, pharmacology, and dentistry; oxygen production; the cosmetics industry; and the other kinds of importance that had already been cited in the first questionnaire.

In relation to reef environments, it was easy to observe the frailty of the students’ knowledge on this theme in both grades: almost all defined them as “an environment formed by reefs” or as a “group of coral reefs”. Even after the intervention this did not change much; at most they answered that it was “an area with marine life”.

In the question “To you, what is the best way to conserve/preserve reef environments?”, 87% of the students answered “not polluting” or “not throwing trash on the beach or in the sea”, while 13% admitted not knowing the answer. After the intervention, other ways of conservation were cited, such as not stepping on the reefs or avoiding oil leakage.

Before the intervention, the most frequent answers to the question “If there was a decrease in the number of marine organisms, how would this negatively affect land organisms?” were “only the marine organisms would be affected” and “there would be little consequences, as marine organisms only interfere in oxygen production”. After the intervention, however, most answered that land organisms would be greatly affected, as they influence global climate.

The answers to the question “Do you know whether coral reefs suffer any threats? Explain your answer” before the intervention were similar to those to the question about conservation yet with some additions, such as boat anchoring, fishing with the use of explosives, sale of marine organisms and parts of organisms, collecting marine organisms for aquariums, etc. After the intervention, the number of threats mentioned increased considerably.

Workshop

The workshop took place after the lecture in order to help appraise its content. It caused great interest among the students, especially the senses of touch and sight. The students were more participative in this activity than in the others (lecture and questionnaire), and it was evident how satisfied they were in having a different kind of class. It is important to note this method’s versatility, as it considers the different kinds of learning appropriate to the different individuals.

Using sight the students could compare what was discussed in the lecture with the photos. Taste brought about different reactions as the students tried the different flavors and remembered several other kinds of foods that come from the sea. Foods that are not normally linked to the sea were also pointed out, such as ice cream and sweets made with agar. The CDs with the sound of dolphins, whales, etc. made the students feel the sea and its intrinsic importance. For smell, students were surprised with the great variety of non-food products made with marine organisms and their pleasant aroma. Touch was the most interesting sense; we observed that most students enjoyed feeling the animals, their textures, and shapes. The students were very excited

about this part of the workshop and asked many questions.

Statistical analysis

The analysis of 9th grade students' answer to the question "What is a coral?" showed that there was no significant relationship with the type of school (public or private), neither before nor after the intervention. However, the difference was significant when comparing the answers from these two moments. When observing the same question for the 6th graders, there is a clearly significant relationship between the answers and the types of school, both before and after the intervention, with better results among the private schools. Comparing the answers before and after the intervention, significant differences were found, showing the efficacy of the educational instrument used (Table I).

When asked about coral reefs' importance, there were significant differences between the answers of the students of the two types of schools before the intervention in both grades. However, after the intervention there was no difference in the 9th grade, suggesting that the knowledge became more homogeneous among the public and private schools; the same did not happen for the 6th grade (Table II).

When comparing the knowledge on reef environments, there were significant differences per type of school in the 6th grade both before and after the intervention (Table III). For the 9th grade, Pearson's χ^2 test showed significant differences in relation to the type of institution solely before the intervention.

Table I - Observed frequencies for the answers of 6th grade students before and after the intervention and for the answers of 9th grade students to the question "What is a coral?"

Grade	Treatment	Group	Answer			
			SA	PS	UN	Total
6th	Before intervention	PBS	0	0	64	64
		PVS	10	1	55	66
		TOT ^a	10	1	119	130
	After intervention	PBS	37	0	27	64
		PVS	56	1	9	66
		TOT ^b	93	1	36	130
Overall total			103	2	155	260
9th	Before intervention	TOT	1	4	156	161
	After intervention	TOT	133	2	26	161
	Overall total ^c		134	6	181	322

Notation: PBS - public school; PVS - private school; TOT - total; SA - satisfactory; PS - partially satisfactory; UN - unsatisfactory; a) n = 130, $\chi^2 = 11.65$, df = 2, P < 0.01; b) n=130, $\chi^2=13.85$, df=2, p<0.01; c) n=321, $\chi^2=225.51$, df=2, p<0.01

Once more, differences in knowledge before and after the intervention were highly significant in both grades (Table III), with a great decrease in the number of unsatisfactory answers.

In relation to the question "To you, what is the best way to conserve/preserve reef environments?", there were significant differences between the answers of the two types of school in both grades. Again, the workshop was proven effective concerning this question (Table IV).

For the question, "If there was a decrease in the number of marine organisms, how would this negatively affect land organisms?", there were significant differences between public and private schools except for the 9th grade students before the intervention (Table V). Once again, the intervention's result was quite interesting (Table V) and a large number of students answered satisfactorily after the lecture and workshop.

Lastly, for the question "Do you know whether coral reefs suffer any threats? Explain your answer" there were significant differences for the 6th grade (before and after) in relation to the type of school (Table VI). Differently, in the 9th grade this difference was only found before the intervention (Table VI), as knowledge became more homogeneous among the schools after the intervention. Yet again, the analysis of this question showed the effectiveness of the instruments used to promote the students' awareness of the theme (Table VI) - the differences between the answers before and after the intervention were highly significant in both grades.

Table II - Observed frequencies for the answers of 6th grade students before and after the intervention and for the answers of 9th grade students before the intervention to the question "Do you think coral reefs are important?"

Grade	Treatment	Group	Answer			
			SA	PS	UN	Total
6th	Before intervention	PBS	0	20	44	64
		PVS	3	47	16	66
		TOT ^a	3	67	60	130
	After intervention	PBS	11	43	10	64
		PVS	25	39	1	65
		TOT ^b	36	82	11	129
9th	Before intervention	PBS	2	18	32	52
		PVS	5	72	32	109
		TOT ^c	7	90	64	161

Notation: PBS - public school; PVS - private school; TOT - total; SA - satisfactory; PS - partially satisfactory; UN - unsatisfactory; a) n=130, $\chi^2=26.92$, df=2; p<0.01; b) n=129, $\chi^2=13.00$, df=2, p<0.01; c) n=161, $\chi^2=15.44$, df=2, p<0.01

Table III - Observed frequencies for the answers of 6th grade students before and after the intervention and for the answers of 9th grade students before the intervention to the question "What are reef environments?"

Grade	Treatment	Group	Answer				
			SA	PS	UN	Total	
6th	Before intervention	PBS	0	4	60	64	
		PVS	0	20	46	66	
		TOT ^a	0	24	106	130	
	After intervention	PBS	1	20	43	64	
		PVS	9	39	16	64	
		TOT ^b	10	59	59	128	
	Overall total ^c			10	83	165	258
	9th	Before intervention	PBS	0	11	41	52
			PVS	2	48	59	109
TOT ^d			2	59	100	161	
After intervention		TOT	30	90	41	161	
		Overall total ^e		32	149	141	322

Notation: PBS - public school; PVS - private school; TOT - total; SA - satisfactory; PS - partially satisfactory; UN - unsatisfactory; a) n=130, $\chi^2=12.49$, df=1, p<0.01; b) n=128, $\chi^2=24.87$, df=2, p<0.01; c) n=258, $\chi^2=38.13$, df=2, p<0.01; d) n=161, $\chi^2=9.45$, df=2, p<0.01; e) n=322, $\chi^2=55.64$, df=2, p<0.01

Table IV - Observed frequencies for the answers of 6th grade students before and after the intervention and of 9th grade students before and after the intervention to the question "To you, what is the best way to conserve/preserve reef environments?"

Grade	Treatment	Group	Answer				
			SA	PS	UN	Total	
6th	Before intervention	PBS	0	10	54	64	
		PVS	1	26	39	66	
		TOT ^a	1	36	93	130	
	After intervention	PBS	9	36	19	64	
		PVS	26	34	6	66	
		TOT ^b	35	70	25	130	
	Overall total ^c			36	106	118	260
	9th	Before intervention	PBS	1	4	47	52
			PVS	3	39	67	109
TOT ^d			4	43	114	161	
After intervention		TOT	64	70	27	161	
		Overall total ^e		68	113	141	322

Notation: PBS - public school; PVS - private school; TOT - total; SA - satisfactory; PS - partially satisfactory; UN - unsatisfactory; a) n=130, $\chi^2=5.93$, df=2, p=0.05; b) n=129, $\chi^2=10.54$, df=2, p<0.01; c) n=259, $\chi^2=33.42$, df=2, p<0.01; d) n=161, $\chi^2=1.66$, df=2, p=0.44; e) n=161, $\chi^2=9.84$, df=2, p<0.01; f) n=322, $\chi^2=51.70$; df=2; p<0.01.

Table V - Observed frequencies for the answers of 6th grade students before and after the intervention and for the answers of 9th grade students after the intervention to the question "If there was a decrease in the number of marine organisms, how would this negatively affect land organisms?"

Grade	Treatment	Group	Answer			
			SA	UN	Total	
6th	Before intervention	PBS	14	50	64	
		PVS	25	41	66	
		TOT ^a	39	91	130	
	After intervention	PBS	47	17	64	
		PVS	37	29	66	
		TOT ^b	84	46	130	
	Overall total ^c		123	137	260	
	9th	Before intervention	TOT	86	75	161
			After intervention	PBS	48	4
PVT		83		26	109	
TOT ^d		131		30	161	
Overall total ^e		217	105	322		

Notation: PBS - public school; PVS - private school; TOT - total; a) n=130, $\chi^2=3.96$, df=1, p<0.05; b) n=130, $\chi^2=4.29$, df=1, p=0.04; c) n=260, $\chi^2=31.24$, df=1, p<0.01; d) n=161, $\chi^2=6.06$, df=1, p=0.01; e) n=322, $\chi^2=28.62$, df=1, p<0.01.

DISCUSSION

In the second half of the 20th century, the attention of researchers from several fields (such as geography, psychology, sociology, anthropology, and architecture) was drawn to the human beings' perception of the environment; not only the natural environment, but also the environment in general, including cities and the urban environment (Ferrara, 1993; Del Rio, 1999; Kohlsdorf, 1999). In general, the history of environmental perception studies shows a close relationship to the so-called humanistic geography (Amorim Filho, 1999), a movement that gathered strength in the 1970's as a way to oppose excessive abstraction and theorization in geography and other sciences in the 1960's (Amorim Filho, 1999). More recently, researchers of the biological sciences and other related fields have become interested in the theme, in order to verify human beings' relationship with the natural environment and what makes a person conserve or destroy nature (for instance, see: Oli *et al.*, 1994; Lykke, 2000; Conforti & Azevedo, 2003; Baía Júnior & Guimarães, 2004; Konrath *et al.*, 2004). Unfortunately, despite growing interest in environmental perception inside the field of marine biology and the great number of studies being carried out by undergraduate and graduate

university students in Brazil, few are actually getting published.

Steiner *et al.* (2004) published one of the only papers involving the environmental perception of students of the marine environment. The study was carried out with middle and high school students of the Fernando de Noronha Archipelago (6th to 9th grade), as well as with the adult population. In general, the results were quite different from those of the present study, with high percentages of satisfactory answers. However, in that case the interviewees lived inside an Environmental Protection Area and near a National Park; in addition, the focus on environmental education was much stronger at that school and was directed to marine biology as it was an island in the Atlantic Ocean. This comparison reinforces the importance of environmental education inside and outside school as an instrument in the conservation of nature. In the case of the schools that were part of this study, despite the importance of reef environments for the cities of the Metropolitan Area of Recife and their closeness to them, this topic does not always receive the attention it deserves. This became clear with the absence of field trips to the beach in all of the schools, as well as with the student's level of knowledge about the topic before the intervention.

Nevertheless, there were some points in common: the importance of coral reefs cited by the students were similar to the results of Steiner *et al.* (2004), where the types of importance most cited by the adult population were food and shelter for fish; on the other hand, the variety of answers in the study mentioned was much greater – more than 30 types were listed. Another point in common was the difficulty in defining reef environments, which occurred both in Steiner *et al.* (2004) and in the present study, even after the intervention.

In contrast, after the educational intervention carried out in this study, knowledge of corals increased significantly – 99% of the students answered correctly, which once more reinforces the methodology's effectiveness.

It is interesting to analyze some aspects of the question "When you go to the beach, do you see the organisms that inhabit that environment? If so, list the ones you have seen." As previously mentioned, some students only perceived the physical environment, while others were more aware of modifications in the environment – such as trash, litter and even feces – as well as animals and other elements that are not part of the marine ecosystems (dogs, horses, cockroaches, rats, etc.). This suggests a negative perception of the area, described by Tuan (1983) as topophobia. Others

did not observe the natural environment in itself, but perceived an area of leisure – a view of nature as an exclusive supplier of raw materials and services, common after the Industrial Revolution (Ribeiro, 2004). This view also became evident in the question that dealt with the problems humanity would face with the loss of marine biodiversity: before the intervention, most students answered that "only the marine organisms would be affected" or "there would be little consequences, as marine organisms only interfere in oxygen production". In this case the student places him/herself as an element that is external to nature, although nature used to be so close that it was impossible to perceive the environment as something extra-human; with time, it became perceived as a separate entity until it got to the point where man felt the right of "dominating" nature and its resources (Carvalho, 1991 *apud* Ribeiro, 2004).

In this context, Cervo & Bervian (1996) stated that, to make the teacher's work easier, he/she must first know the students' thoughts and attitudes towards the environment, as they may be heterogeneous and science is a process of construction. In this way it might be easier to uncover aptitudes and to promote changes in attitude. Still reflecting a certain degree of anthropocentrism, the answers regarding conservation of reef environments were closely related to the environment the students live in – the urban environment. Thus, the main threats cited for these ecosystems were pollution and waste, problems linked to urbanization and industrialization. Similarly, not polluting or throwing trash in the sea was pointed out as the main way to conserve reef environments.

Once more it is important to highlight the remarkable increase in satisfactory answers after the educational intervention, as shown by the statistical analyses. The use of these educational instruments, especially the five-senses workshop, enabled students to experience the topic studied and make connections with their own life experiences. In this way, we believe that this type of class is valuable in changing the anthropocentric view of nature and marine environments that was evident before the intervention.

It is also interesting to note the difference in knowledge between the two grades, before and after the intervention. The data analysis suggests that the intervention was less effective in the 6th grade, which might be related to the fact that the lecture included more content, while the workshop focused on fixating the information. After all, 6th grade students – due to their age – get more involved in dynamic activities. Accordingly, this type of interventions must include

more content in the workshop and reduce the lecture time. This corroborates with Reigota (1994), who points out the importance of taking students' age into consideration during environmental education activities and establishing objectives according to the targeted audience when developing teaching methodologies.

In general, the analyses also showed that the distinct infrastructure and teaching conditions of public and private schools did not influence students' knowledge of reef environments. The same can be said for closeness to the sea, which did not necessarily affect their knowledge of this ecosystem and its biodiversity. Hence, given the importance of reef ecosystems for the region, it is essential that schools give this topic the attention it deserves, using dynamic methodologies that take into consideration students' prior knowledge and their relationship with the environment.

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