Research Article

Byotubers: active methodologies in marine environmental education for children

Abstract

The present study measured the effectiveness of educational technologies, combining the Internet and Smartphone devices used in environmental education program-guided field trips in a Brazilian coastal city public school (Guarujá-SP, Brazil). For this purpose, we organized a YouTube channel called "Byotubers." It had 5,355 views in 24 countries and 22 uploaded videos in 9 months. In 2017, the program served a hundred elementary school ages between 9 and 12 years. With active methodologies and investigations applied to the group, the studies indicated us to strengthen ties between school and family.

Keywords: rocky shore, environmental perception, YouTube, smartphone, internet integrated learning

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Introduction

A substantial part of the planet's population shows interest in mitigating the current environmental problems.[1] However, people feel powerless to face the problems due to scale issues, awareness level, and other different reasons.[2] It is necessary to work on the relations of feelings (intention, impotence, empowerment, and frustration) through socio-cognitive approaches.[3] Training is fundamental for students' empowerment. Certain situations experienced by the students can enhance resolution skills[4] and creates a sense of ownership, making them self-confident and transforming agents. Facilitating educators provides such situations and contributes to socio-environmental responsibility.[5] Biggers[6] also warns about bringing investigative action into the teaching-learning process of the students.

Information and Communication Digital Technology (ICDT) can contribute as a pedagogical tool to the educational process because it provides creative freedom and authorship for all involved.[7,8] Through the Internet, society spreads knowledge in groups, between pairs, and among virtual tribes.[9] Therefore, social networks can also play a fundamental role in Environmental Education, not only in preservation issues but also in spreading and stimulating attitudes and sustainable behaviors.[10]

Environmental education on social networks comes as a new education model. Environmental Edu-communication considers that the integration between education and communication is fundamental for developing individual and sustainable social education.[11–13] It also considers the diversity of forms to capture, feel and understand the world in a learning environment integrated with the social and cultural background.[11,14,15] Environmental studies combined with technology and communication means appealing activities to the students to provide "flavor to knowledge." Fernandes[16] relates "knowing" to knowledge that generates "flavor," playfulness, emotion, and happiness to learn.

The present study deals with usual and accessible technology smartphones, the Internet, and social networks) combined with traditional pedagogical activities for the development of the individual, promoting education and environmental preservation. Its goal was to develop new pedagogical practices in environmental education, focusing on the biodiversity of the rocky shore environment and involving nature, playfulness, technology, and social networks.

Thus producing a junior video channel on YouTube to help disseminate marine environment ecological information acquired by fourth-grade elementary school students living in a low-income context in a Brazilian coastal city.

Materials and methods

The Environmental Education Program was designed in an elementary city school in Guarujá (São Paulo, Brazil) at the beginning of the school year of 2017, with one hundred students, aged between 9 and 12 years old, studying in the 4th year and five school teachers. The focus on the marine environment, more specifically on the rocky shore ecosystem, was due to the proximity of the school to the Beach (Mar Casado Beach), which made field activities possible. The pedagogical team also supported carrying out the studies, and video editing spread on social networks. Among others, it had the support of five teachers in the 4th year in addition to the pedagogical coordinator, who worked in sync with the school principal and officials of the city education and environment departments. A 14-year-old student from another school unit was invited to produce videos and keep a channel on the social network in junior/teen language adapted to the participant's age group.

The *ByoTubers* program (Figure 1) was designed according to a sequence shown in Table 1. We compared the initial diagnosis results with the final to evaluate its pedagogical efficacy. The field visits were designed as playful and educational activities to encourage research and investigation. In the classroom, the students would previously prepare themselves for the scheduled visit. Later, also in the school, the results of these activities were organized by student groups to shoot and launch the videos for the *Byotubers* channel on YouTube social network.

The *Byotubers* channel was implemented for this program. On it, the students spread productions from their active and investigative actions. The first author (the teacher in charge of the program) made the shootings in collaboration with the students. The videos were recorded according to the learners' interests in the themes to be addressed. We also considered the pace of knowledge acquisition to ensure that all activities were pleasant. The videos were produced in simple and informal language with a casual format to reach the most significant number of young people. The students only recorded the videos when they felt ready and sure.
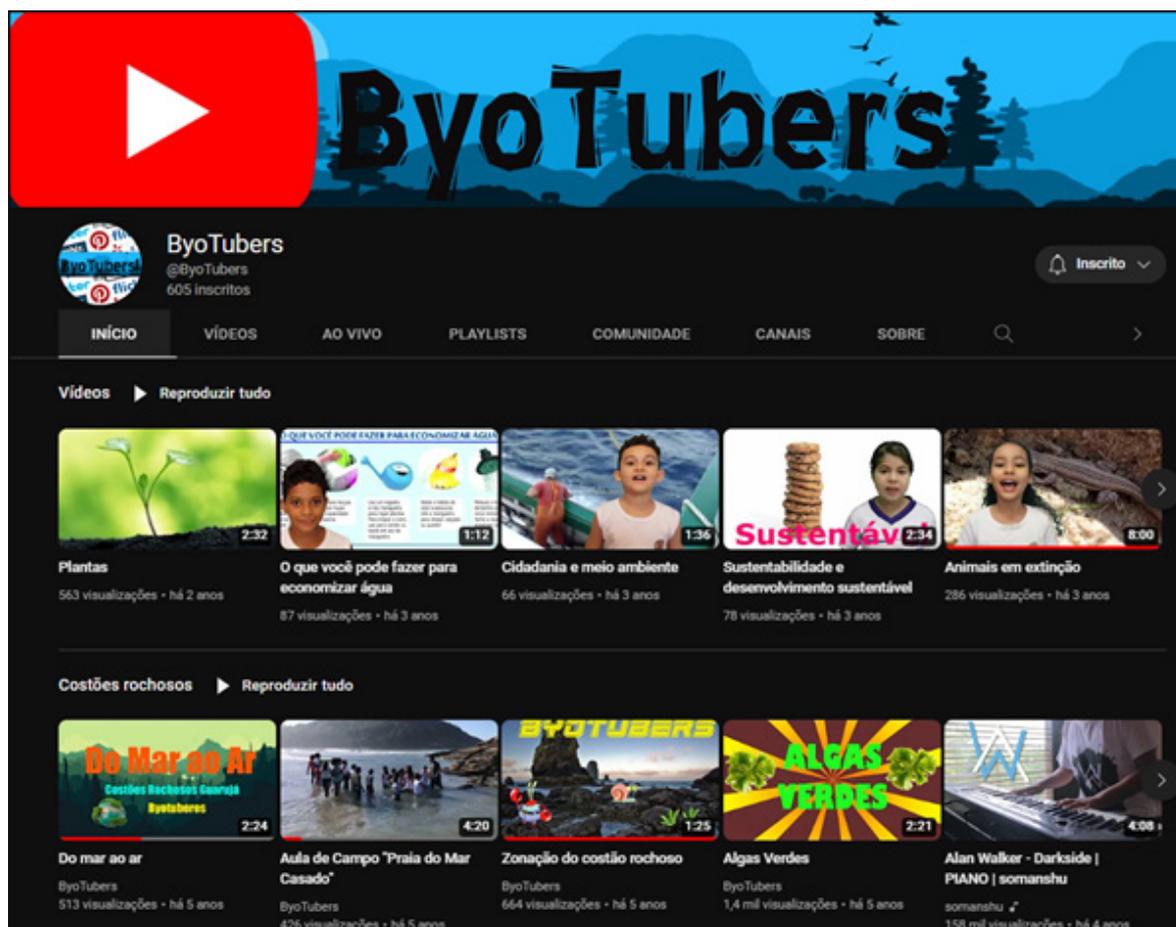
Figure 1 Screenshot of Byotubers website.

We based the program's efficacy on qualitative-quantitative analysis of the student's answers to the initial and final inquiries.[17] These were systematized and represented in percentages in tables using the methodology of Pereira et al.[18] We classified answers into three categories: (a) **Satisfactory**, where the domain to pertinent items to the study was shown; (b) **Partially satisfactory**, where the partial domain to the pertinent items to the study was shown and (c) **Unsatisfactory**, where the total incomprehension related to the study was shown. For an ongoing evaluation within the program, the videos also presented questions in a virtual game *(quiz)* where the interested parties answered two multiple-choice questions about the addressed theme. The students themselves prepared these questions. Their results show possible adjustments to future videos.

Methodologies applied in the classroom

A technical visit to the Aquarium in the city happened to bring students and the marine environment closer together and to sensitize and foster curiosity about this biodiversity. Later, the teachers developed some concepts related to the marine environment in theory classes to support the research and investigations that the students would create. Once the theory classes were over, the teachers, in sync, launched concepts that should be investigated and researched by the participants in a virtual environment and brought into the classroom in specific notebooks for the study. In class, the students would gather in groups of interest and think about their research to group the information in order of relevance to systematize it. The groups have chosen representative members to read their final products and organize topics following their order and relevancy, where they all should take notes in their notebooks. The groups had the task to design the *quiz* used in the videos to measure the understanding of Internet users. The video *scripts* they reproduced on the *Byotubers* channel on YouTube social network spread the final products of their research. The concepts developed in the present study were chosen and introduced concerning knowing to preserve. This process happened, during the beginning of the class (in the first 50 minutes), three times a week throughout the school year of 2017.

Methodologies applied in field classes

Each field activity was developed in 3 hours, amounting to 21 hours of field visits. The Field activities classes were organized on two consecutive days, with the participation of 50 students a day. Four teachers and a member of the pedagogical team to have safety and efficiency during the Field trip, dividing the students into groups under the supervision and guidance of the teachers. On the beach, we realized activities related to observing and measuring the zonation of the organisms found and their frequency; the students used spreadsheets with common organisms and possible measurements of their zonation. Similarly, for the activities related to pollution by solid residues, the students used spreadsheets with likely items that permitted to make the organization of the observed data easier. The teachers helped the students fill out these spreadsheets and transfer the information into their research notebooks. These notebooks also gathered surveys on curiosities and possible inquiries to be investigated to generate new research.

Results

The comparison of the answers of the students indicated the efficacy of the methodology of the program. Table 2 shows the evolution of the answers as satisfactory and the decrease in the answers as unsatisfactory. In the initial diagnosis, there was only one item (number 2) with the highest percentage of correct answers (41%). In the final diagnosis, all the items obtained a rate above 77% of satisfactory answers. Table 3 shows the metrics of the virtual games *(quiz)* for 15 videos available on the channel, making it possible to evaluate the participants' performance. Only two videos had corrected answers below 62%, while the others were above that value.

Although these practices began in March, we inserted videos in June/2017. In nine months of making the videos available (June/2017 to March/2018), the *Byotubers* channel got 224 registrations and 5,355 hits. Besides Brazilian Internet users, the videos were accessed by people in another 24 countries (Table 4). Table 5 shows that 73% of the accesses to the *Byotubers* channel on the social network were made via a mobile device; however, these devices only kept 35%¨of the viewing time average (about 1 minute). The metrics of *Byotubers* also showed that the female gender (93%) had the most interest in the contents of the channel (Table 6). Internet users aged between 35 and 44 composed sixty-seven percent of the viewings; 20% were those aged between 45 and 54 years old and only 14% were those aged between 25 and 34 years old (Table 7).

Table 1 Strategies used to meet the proposed goals for the development of the study

Strategies	Goals
Initial diagnosis of the student's perception related to the intertidal rocky shore environment.	Define strategies and actions to be developed.
1st Field Visit to the Aquarium in "Guarujá."	Know and foster curiosity about marine biodiversity.
2nd Field Visit to "Mar Casado Beach."	Know the intertidal rocky shore environmental ecosystem.
3rd Field Visit to "Mar Casado Beach."	Bring the studied concepts closer to record the video: "From the Sea to the Air, we must care for the environment."
4th Field Visit to "Mar Casado Beach."	Observe and record in a spreadsheet the zonation of the intertidal rocky shore environment organisms.
5th Field Visit to "Mar Casado Beach."	Record and quantify the solid residues found and collected on the beach.
6th Field Visit to "Mar Casado Beach."	Collect and observe dead snail shells to contextualize the differences between bivalves and gastropods.
7th Field Visit to "Branca Beach."	Know and compare the distribution of the organisms by zones of the Coast of "Mar Casado Beach."
The final diagnosis of the student's perception.	Evaluate the efficacy of the program.

Table 2 Results of the initial and final diagnosis of the students' perception

No	Items answered by the students	Initial			Final		
		Satisfactory	Partially Satisfactory	Unsatisfactory	Satisfactory	Partially Satisfactory	Unsatisfactory
1	If there is some relation between your daily life and the marine environment	1%	26%	73%	78%	15%	7%
2	Three first words or expressions that come to your mind when you remember the marine environment	41%	42%	17%	96%	4%	0%
3	If you know what an Intertidal rocky shore environment is	0%	3%	97%	83%	14%	3%
4	What kind of organisms can be seen in the Intertidal rocky shore environment	2%	9%	89%	88%	8%	4%
5	If you believe that the Intertidal rocky shore environment has any importance	1%	12%	89%	84%	9%	7%
6	What could be done to preserve the Intertidal rocky shore environment	22%	10%	68%	89%	8%	3%
7	If you know some educational channels about Environmental Education	22%	10%	68%	96%	2%	2%
8	How often have you accessed these channels	3%	5%	92%	76%	19%	5%
9	If you didn't access any channel, what was the reason	0%	5%	95%	87%	8%	5%

Note: YouTube Analytics. (n.d.) *Byotubers channel*. Retrieved February 14, 2018, from https://www.youtube.com/analytics?o=U

Table 3 Metrics of the virtual *quiz*

Videos	Question 1		Question 2	
	Hits	**Mistakes**	**Hits**	**Mistakes**
Sea and Ocean	87%	12%	100%	0%
Green Algae	100%	0%	100%	0%
From Sea to Air	66%	33%	100%	0%
Zonation of the Intertidal rocky shore environment	100%	0%	100%	0%
Mollusks	92%	7%	100%	0%
Crustaceans	100%	0%	100%	0%
Ecosystems	85%	14%	80%	20%
Quiz	100%	0%	100%	0%
Difference between sea and ocean	88%	11%	100%	0%
Porifera	91%	8%	80%	20%
Biodiversity	91%	8%	100%	0%
Seahorse	71%	28%	62%	37%
Field class "Mar Casado Beach"	92%	7%	100%	0%
Ecosystems	85%	14%	80%	20%
Life Net	100%	0%	100%	0%

Note: YouTube Analytics. (n.d) *Byotubers channel.* Retrieved February 14, 2018, from https://www.youtube.com/analytics?o=U

Table 4 Countries that accessed the *Byotubers* channel on social network

Country	Viewing time minutes (%)	Viewings (%)	The average duration of viewings	Average viewed Percentage (%)
Brazil	5.531 (97%)	5.141 (98%)	1:04	34%
Nicaragua	80 (1,4%)	24 (0,5%)	3:20	93%
The United States	8 (0,3%)	9 (0,2%)	2:02	64%
Portugal	13 (0,2%)	28 (0,5%)	0:26	24%
Angola	6 (0,1%)	4 (0,1%)	1:30	92%
United Kingdom	5 (0,1%)	7 (0,1%)	0:41	29%
Unknown Region	5 (0,1%)	2 (0,0%)	2:21	30%
Mozambique	4 (0,1%)	4 (0,1%)	0:54	36%
France	3 (0,1%)	3 (0,1%)	1:03	51%
Mexico	3 (0,1%)	4 (0,1%)	0:39	47%
Spain	3 (0,1%)	5 (0,1%)	0:30	25%
Thailand	2 (0,0%)	1 (0,0%)	2:21	98%
Bolivia	1 (0,0%)	1 (0,0%)	1:15	99%
Kuwait	1 (0,0%)	1 (0,0%)	1:06	76%
Ecuador	1 (0,0%)	1 (0,0%)	1:00	77%
Germany	1 (0,0%)	2 (0,0%)	0,26	10%
Saudi Arabia	1 (0,0%)	3 (0,1%)	0:15	46%
Ukraine	1 (0,0%)	1 (0,0%)	0:35	41%
Indonesia	0 (0,0%)	2 (0,0%)	0:12	13%
Chile	0 (0,0%)	1 (0,0%)	0:21	15%
Argentina	0 (0,0%)	1 (0,0%)	0:16	11%
Malaysia	0 (0,0%)	1 (0,0%)	0:16	11%
Costa Rica	0 (0,0%)	1 (0,0%)	0:12	16%
Itály	0 (0,0%)	4 (0,1%)	0:02	2,2%
Canada	0 (0,0%)	1 (0,0%)	0:06	7,8%

Note: YouTube Analytics. (n.d.) *Byotubers channel.* Retrieved February 14, 2018, from https://www.youtube.com/analytics?o=U

Table 5 Type of devices used to view the *Byotubers* channel on the YouTube social network

Type of device	Viewing time in minutes (%)	Viewings (%)	Average duration of Viewings (minutes)	Average viewed percentage (%)
Mobile Device	4.340 (75%)	3.902 (73%)	1:06	35%
Computer	1.062 (18%)	1.151 (22%)	0:55	31%
Tablet	238 (4,1%)	228 (4,3%)	1:02	35%
TV	116 (2,0%)	57 (1,1%)	2:01	70%
Game Console	29 (0,5%)	16 (0,3%)	1:50	50%
Unknown	1 (0,0%)	1 (0,0%)	0:44	62%

Note: YouTube Analytics. (n.d.) *Byotubers channel.* Retrieved February 14, 2018, from https://www.youtube.com/analytics?o=U

Table 6 General average of gender of internet users who accessed the *byotubers* channel on social network

Gender	General Average (%)
Female	93%
Male	6,6%

Note: YouTube Analytics. (n.d.) *Byotubers channel.* Retrieved February 14, 2018, from https://www.youtube.com/analytics?o=U

Table 7 Average duration time by gender and age of the internet users who accessed the *byotubers* channel on social network

Spectator's age	Average viewing time (%)	Male	Female
25 a 34 years	14%	43%	57%
35 a 44 years	67%	0%	100%
45 a 54 years	20%	0%	100%

Note: YouTube Analytics. (n.d.) *Byotubers channel.* Retrieved February 14, 2018, from https://www.youtube.com/analytics?o=U

Discussion

The results of the initial and final diagnoses (Table 2) showed the evident efficacy of the program, with a decrease in the percentage of unsatisfactory answers and an increase in the rate of satisfactory answers. It was possible to notice that the participants developed a critical view of man's role in nature and his relationship with it. Of the students' answers to the final diagnosis in item 5 ("Do you believe the Intertidal rocky shore environment has any importance?"), 84% was satisfactory. Similarly, with 89% of adequate answers to the 6th question ("What could be done to preserve the Intertidal rocky shore environment?"), the present program shows that the students developed a reflexive and holistic view. Dunkley[19] also connects students with the natural environment, expanding sensitization and awareness about the environmental crisis. Table 3 reveals high hits in the virtual games (quiz) and shows that the students effectively spread their knowledge and practices to other social network users. The methodologies applied in the present program also provide sensitization toward environmental issues of the participants, leading them to positive attitudes toward the environment in the present and future. The field practices enrich the man-nature relationship, create the perception that people are part of the ecological system, and allow ethical sense, values, and sustainable attitudes to develop.[20] Another public recognition was winning the award "FROM SEA TO SEA, THE ENVIRONMENT WE MUST TAKE CARE OF," sponsored by the City Hall, during Environment Week to promote critical and ecological awareness among the new generations. The winning participants developed a video to alert and sensitize the spectators about the threats caused by plastic and micro-plastic to the oceans on the planet. The mayor of Guarujá personally delivered a register to winners in the Official Gazette of that city.

All this resulting experience acquired by all parties involved in the project had important behavioral influence and can trigger pro-environmental attitudes. Childhood experience and education influence positive environmental and social behavior.[21]

Despite the difficulties, and low technical quality of the videos, made in an amateur way, without favorable conditions (poor light and acoustics environment, bad balanced track sound, background scenarios sometimes not so appropriate), the parties' attitudes contributed to the success of this program. Students, teachers, and the school community participated, developing important bonds of unity, trust, and respect. Within nine months of evaluation, the channel got 224 entrants, with viewing in 24 countries (Table 4), accessed by 5,355 Internet users. Brazil had the highest number of viewings

(5,141), with an average duration of a little over one minute, that is, 34% of the average time of the videos (Table 4). Unlike those carried out in countries such as Nicaragua and Angola, whose Internet users viewed more than 90% of the duration of the videos.

Mobile devices were the most used (73%) to access the videos (Table 5). Information from the Regional Center of Studies for the Development of Information Society shows that 87% of the students in the 4th and 5th years, the target audience for this present program, use this device for studies. However, only 2% of these students use school to make such accesses, which shows that 98% of these practices are carried out outside the educational institutes.[22] The use of smartphones to access the Internet is also seen in countries such as India, China, the United States, and Sweden.[23] This reality is starting to reflect in the school environment.

The teacher must combine technology with pedagogical practices, showing the benefits of its proper use and transforming intruders into allies that improve school performance.[24] Also, this can modify the interests of students already accustomed to the wide variety of stimuli provided by the Internet.[25] Anderson et al.[26] warn that young people and adolescents' incorrect use of the Internet contributes to their becoming obsessed and compulsive individuals. Livingstone et al.[27] show that young people and adolescents are more vulnerable in the face of virtual networks. So, they suffer digital exclusion because some parents prefer to safeguard their children from possible problems caused by the Internet. However, Rosa et al.[28] reaffirms for the interaction of young people with media. Still, they also warn about the excessive use of technological equipment because it can impact their users' health.

The interested audience, predominantly female (93%), aged between 35 and 40 years old, suggests that the students used their mothers' email accounts to access and spread their videos. The proximity between teachers, students, and mothers must be considered a strategic element in implementing an educational policy. The guidance about the healthy use of the Internet could show positive effects, decreasing the risks of the emergence of addictions and disorders. Students, guided by teachers and responsible guardians, must learn to deal with the freedom that different technology uses provide.[29] Gikas and Grant[30] state mobile devices are excellent allies because they maximize learning in non-formal places and spread the knowledge acquired from other people around the world. In the present study, it was possible to notice that the students learned to deal with technologies positively and dynamically. Such attitude also increased interest in school activities and subject matters, expanding and strengthening the bond between teachers, students, and the school community. Kim et al.[31] found that mobile devices combined with social networks make the teaching-learning process more dynamic. The students learned several languages and ways of exploration, maximizing the learning about environmental education. However, technology doesn't override the teacher's presence in the classroom but contributes to the integration and contextualization of the studied subject matters.[32] Borges et al.[33] state that the YouTube social network is an efficient disseminator of information and an important tool for teaching-learning. YouTube can be a pedagogical support tool both in formal and non-formal education.[34] Quintanilha,[35] creating and posting videos on social networks have proven to be a practical resource because it provides the students with more emotional involvement and commitment besides contributing to spreading knowledge to other Internet users.

Finally, the YouTube network makes numerous videos about Environmental Education available, but those produced by students

between 9 and 12 years old in formal education are rare. In addition, most videos are aimed at older Internet users, and most are for the education of university professors and students. However, Ardoin et al.[36] point to an increasing concern about involving students aged between 5 and 11 years old and, mainly between 9 and 11 years old, in Environmental Education programs in formal education. The present program, besides ratifying the norms of the Basic National Common Curriculum,[37] favors a critical view of the individual's actions and allows for the development of skills and competencies to act positively in social, economic, and environmental issues.[38]

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Conflicts of interest

The authors declare there are no conflict of interest.

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