



Received: 24 August, 2022

Accepted: 03 September, 2022

Published: 05 September, 2022

***Corresponding author:** José Carlos Góis, Department of Mechanical Engineering, Association for the Development of Industrial Aerodynamics, University of Coimbra, Coimbra, Portugal, Tel: +351 934 552 096; E-mail: jose.gois@dem.uc.pt

Keywords: Municipal solid waste management; Environmental education; Schools; Public health; Angola

Copyright License: © 2022 Panzo TI, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

<https://www.peertechzpublications.com>



Research Article

Environmental awareness on solid waste management practices: A case study in Angolan secondary schools

Talita Ima Panzo¹, José Carlos Góis^{2*} and José Manuel Mendes³

¹Department of Civil Engineering, Faculty of Sciences and Technology, University of Coimbra, Coimbra, Portugal

²Department of Mechanical Engineering, Association for the Development of Industrial Aerodynamics, University of Coimbra, Coimbra, Portugal

³Faculty of Economics, University of Coimbra, Coimbra, Portugal

Abstract

This paper presents a case study on the environmental awareness of the students of secondary schools in Angola and analyses the environmental education programs in the two cycles. The study was carried out in the four largest provinces of Angola and the results were obtained from questionnaires to the students and interviews with the school coordinators and the waste management officers in the region. The results show that the students have moderate consumption habits of electricity and water, demonstrated by 40% of students following the appropriate attitude, and have reasonable knowledge about the scenarios that produce large environmental impact, marking 3 out of 9 options: river pollution, toxic waste in the soil and sewage discharge on the beach as the most relevant, together reaching almost 50% of the responses. However, they have a gap in knowledge about the health impact of solid waste disposal in dumps site close to urban areas, as evidenced by the high number of children and adolescents living near these areas and with some of them helping their families as waste pickers. The poor environmental education program and the nonexistence of school activities on these issues contribute for disassociate the linkage of waste disposal in dumps with diseases. As waste disposal in dumps is current in almost all provinces in Angola, except Luanda, environmental education in schools plays an important role in preparing children and adolescents to adopt practices in the future that protect the environment and contribute to the reduction of public health problems. In addition, children and adolescents can indirectly influence their parents on these issues.

Introduction

Environmental Education (EE) has become a tool of assistance for environmental problems since the 70s. The EE is fundamental for individuals and communities to acquire environmental awareness, through knowledge and experiences, making them capable of acting individually, and collectively and dealing with environmental issues, as well as participating in monitoring the implementation of environmental policy [1]. Over the years, humanity's concerns about environmental sustainability issues have become increasingly evident, highlighting the important role played by education and environmental awareness in this context [2].

The concentration of the population in urban areas and the strong marketing to push the population to adopt consumption habits, as well as the economical and industrial development, have led to an increase in waste production and the level of toxicity. Consequently, people living in precarious urban communities are exposed to serious health risks. Over the last decades, environmental policies were established in developed African countries to respond to the environmental impact on public health and quality of life in cities [3]. A significant number of actions for this goal have been addressed to Municipal Solid Waste (MSW) management and EE [4,5]. Nevertheless, there is a lack of awareness in the population on the importance of waste management [6,7] and municipal

governments only adopt remediation actions to manage Public Cleaning services.

Angola has around 25 million inhabitants, most of them living in urban areas (62.3%) [8]. After its independence in 1975, Angola had several periods of civil war that ended in 2002, which took a significant number of human lives, weakened infrastructures, and institutional capacity building. In the last decade, the Government has been engaged in the reconstruction and development of the country, creating infrastructures to provide essential services. Many decisions were directed toward waste management, with the issue of a strategic plan for MSW management in 2012 [9]. However, the urban waste in most of the cities in Angola is still thrown onto streets and roads because there are no waste containers or are in insufficient numbers and the waste is scattered around, as shown in Figure 1.

These practices can be ascribed to the deficiency of MSW infrastructures, attitudes towards MSW management, and the lack of EE. Great strides are being made to rebuild the education system in Angola. At the end of the civil war, 72 percent of youths ages 15 to 24 were literate (83 percent of males and 63 percent of females). By 2014, that number had risen to 77 percent (with 85 percent of males and 71 percent of females being literate). By 2013, attendance had tripled, with around six million students enrolled. Between 2016 and 2017, Angola opened 200 new schools, and numerous humanitarian organizations, work to collect and send donated school supplies to Angola [10].

It is well known that individuals gain environmental attitudes through environmental education. Therefore, environmental education, from the perspective of environmental protection, should not only inform and build a sense of responsibility but also influence an individual's behaviors [11]. However, this education can be successful when it is based on life experiences initiated in the early years of life. For this reason, experiences gained during school age help shape an individual about the environment [12].

Thus, this study has an objective to assess the environmental awareness of secondary school students and evaluate the environmental education programs and MSW management.

Materials and methods

A survey was conducted in secondary schools in Angola's four largest provinces during the 4th trimester of 2019 to assess students' environmental awareness and attitudes. The provinces with the highest population density (based on 2014 census data) and largest MSW production in Angola (based on PESGRU, 2012) are Luanda, Benguela, Huíla and Huambo. The four provinces together have 54% of the population and were therefore selected as sample regions for this study. -Secondary education is divided into two three-year cycles: 1st cycle from 7th to 9th grade and 2nd cycle from 10th to 12th grade.

12 schools participated in this survey: 7 from the 1st cycle and 5 from the 2nd cycle. A total of 684 students aged between 12 to 25 years old answered the questionnaire (59.6% belonging to the 1st cycle and 40.4% to the 2nd cycle). At each school, a sample of between 50 to 80 students was chosen and divided into two groups according to the two cycles described above, and the selection was done independently of the gender, race, and age of the student. A questionnaire with 12 closed questions on environmental issues and behavior patterns towards environmental problems was conducted to students of both cycles, immediately after a brief presentation of the objective of the study. Simple and direct language was used in the questionnaire to allow a better understanding of the questions by the students in both cycles.

In order to assess the relevance and clarity of the language used in the questionnaire, a preliminary survey was conducted in two schools in the province of Luanda, both with two cycles: one in the center and one in the periphery, in a peri-urban area. Based on the results of 75 pupils from the 1st cycle and 82 of In the 2nd cycle, a few questions were reformulated and others eliminated. To validate the answers to the a questionnaire conducted in the 4 provinces of this study, only those that mentioned an option or the maximum acceptable were considered. The results for each item of the questionnaire were arranged in a range from 0 to 100%. For questions requiring only one option, the result for each option is the ratio of the total responses for this item divided by the sum of responses for the various options. Where multiple options were acceptable, the calculated result for each option is the ratio of the total responses from this option divided by the sum of responses from all options.



a) Lobito city



b) Luanda city

Figure 1: Examples of waste collection points in urban area in Angola. Source: authors.



In order to search for information about the strategic plans for EE and MSW management and implementation levels respectively were analyzed the legislation and conducted interviews with the school coordinators and waste management officers of each province. The objective of the interview with the school coordinators was to know about the support of the Ministry of Education in coordinating and providing teaching materials for the implementation of EE in schools, the actions taken, and the difficulties encountered. Regarding the interview with MSW management officials, the objective was to find out the capacity of municipalities as members of the province to implement PESGRU and how citizens were involved with stakeholders.

In summary, the following steps were taken as methodology: (1) identification of the provinces with more inhabitants and MSW production to represent more than 50% of the population, (2) contact with the person in charge of MSW management in each province, (3) preparation and validation of the questionnaire to be carried out in secondary schools, (4) contacting potential schools in the different provinces explaining the research study and selecting among those who accept to participate, (5) defining the parameters for selecting the sample of students in each school, (6) fixing the dates for the survey and interview in the schools and in the provincial office, (7) data collection and analysis of the results.

Results and discussion

Strategic plan for municipal solid waste management and implementation

For many years, the Law n.º 5/98 of June 19th was the only legal tool used to respond to environmental issues in Angola. However, economic and population growth in recent years has led to the creation of a legal framework capable of responding to the environmental problems generated by this dynamic. Indeed, in 2012 Angola's government approved the Strategic Plan for the Management of Municipal Solid Waste [9] issued by the Presidential Decree n.º 196/2012 of August 30th, and the Waste Management Regulation, issued by the Presidential Decree n.º 190/12 of August 24th, establishing the framework for funding planning programs and mobilizing society and stakeholders for a qualitative jump in the MSW management.

The PESGRU was designed for a time horizon until 2025 and is aligned with the objectives for the development of the millennium (2015 and 2020) and the Program "Angola 2025 – a country of future". The objectives, targets, and monitoring procedures were established for each strategic axis. The purpose of training human resources and improving population environmental awareness as well as the legal framework and the financial support to waste management implementation are described in this legal document.

With the implementation of PESGRU, the government intended to solve environmental and public health problems. The main goals were to increase the waste producer's responsibility by encouraging him to follow an environmental protection strategy to achieve environmental objectives,

contribute to the minimization of environmental impacts (IA), improve the quality of public health, and in addition to creating opportunities for business in this area. The program is based on the hierarchy of waste management principles (waste prevention, reuse, recycling, recovery, and disposal), environmental protection criteria, and equity in the whole national territory.

Despite the several programs for the implementation of the MSW strategic plan the established deadlines are compromised. The recent economic crisis of the country, which compelled the government to request IMF financial intervention, the inability of administration services to manage the contracts with the solid waste collection operators, and the incapacity of the municipal government to implement taxes and consequently generate enough revenue to maintain the contracts with the operators are the main reasons for the delay in implementing PESGRU.

The analysis of the interviews of waste management officers shown a lack of funding required for the implementation of PESGRU and the weakness of technical assistance provided by the National Ministry of the Environment and the National Department of Environmental Education to provinces. With the exception of Luanda, no province of this study had a landfill operating when this survey was conducted. The landfill of Huambo province was under construction but was halted due to a lack of funding. Therefore, MSW was disposed of in the vicinity of the future landfill. In Benguela and Huila provinces there were no landfills under construction and MSW were disposed of in dumps. So, no significant changes were achieved in relation to new landfill facilities built after the approval of PESGRU.

Environmental awareness of the school population

The assessment of the environmental awareness of Angolan secondary school students was carried out in the four most populated provinces, covering the two study cycles that make up this level of education. Figure 2 shows, in percentage, the distribution of the sample by province and cycle level.

The environmental awareness of students in Angolan secondary schools is expressed by the results of responses to various questions about the environment, sustainability, and waste management.

The following figures show the average results obtained for each question, comparing the two cycles. The table on the right side of each figure shows the standard deviation (SD) of the scores achieved for each question.

The results of the questions about the environment, sustainability, and waste management are shown in Figures 3 to 5.

The results obtained in Figures 3 to 5 show almost the same trend for both cycles. Although more than 50% of students claim to know the meaning of "3R policy", the relatively high SD value does not allow to recognize this trend. More than 80% of the students of both cycles associated appropriate actions



related to environmental sustainability. Water pollution (in rivers and the sea) and toxic waste disposal on soil are referred to as the most powerful impact scenarios on the environment, followed by wildfires and dumps, in a list of 9 options. Overall, students revealed a reasonable knowledge about environmental impacts and other related subjects.

Results of questions about water and electricity consumption and the sound level habits when listening to music are shown in Figures 6 to 9.

The results show that habits on electricity and water consumption are similar for both cycles. Except for a very positive habit concerning energy consumption for lighting, the other consumption habits are moderate. The tax applied to electricity consumption strongly influences this behavior, contrary to the free charge of domestic water in large zones of provinces. The results achieved regarding habits and behaviors

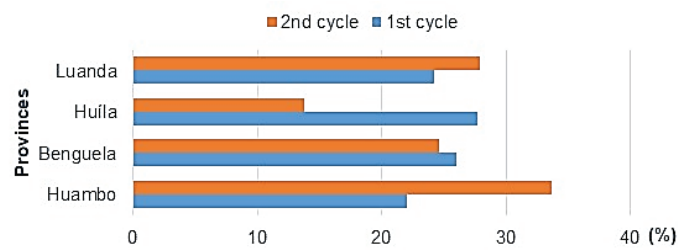
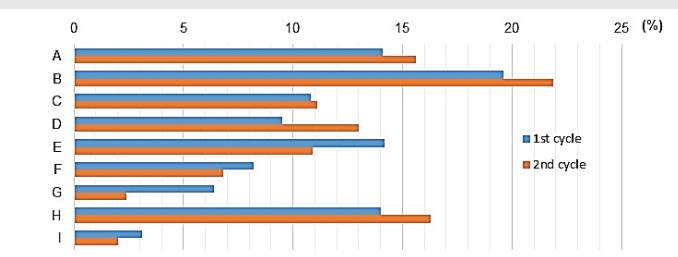
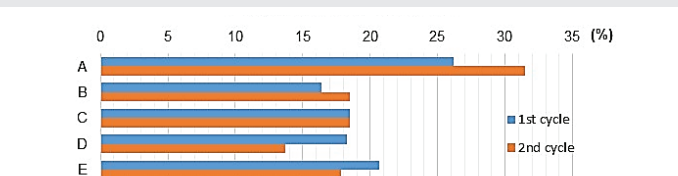


Figure 2: Sample distribution of students.



	SD	1st	2nd
A-Toxic waste in the soil			
B-A polluted river (with a large number of dead fish floating)	A	2.67	2.84
C-A oil spill (with large number of sea birds dead)	B	2.61	3.75
D-A dump	C	4.94	1.34
E-A wildfire	D	2.31	0.96
F-Exhaust gas from a flue gas stack	E	2.15	3.01
G-Traffic jam	F	1.67	2.06
H-A dump sewage onto the beach	G	2.92	1.7
I-A big pile of scrap metal	H	3.24	4.1
	I	2.33	1.72

Figure 3: Which of these scenarios is more impactful from an environmental point of view (3 answers maximum)?



	SD	1st	2nd
A-Human actions and activities without compromising the future of the next generations			
B-Exploitation of mineral resources in a controlled and simplified way	A	6.81	7.19
C-Adopt personal and business attitudes towards recycling	B	3.13	2.18
D-Use of non-renewable energy sources	C	3.96	2.06
E-Development of sustainable management in companies to minimise waste	D	3.21	6.24
	E	3.28	2.75

Figure 4: What is environmental sustainability?

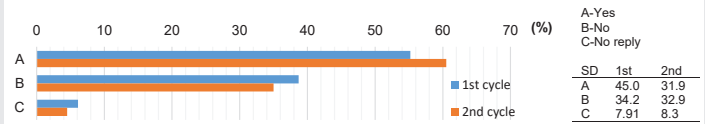


Figure 5: Do you know it means the "3R policy" related to waste management?

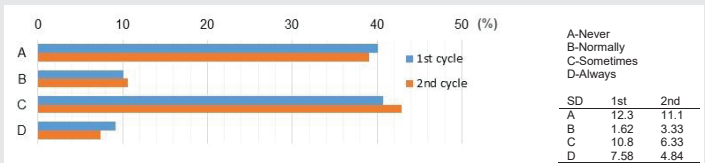


Figure 6: Water is running all time while you brush your teeth?

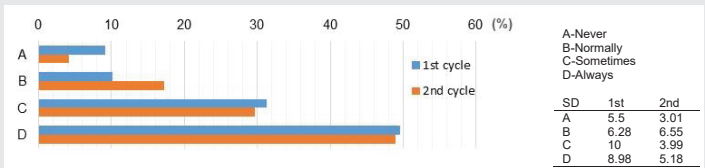


Figure 7: Do you turn light off when you leave the room?

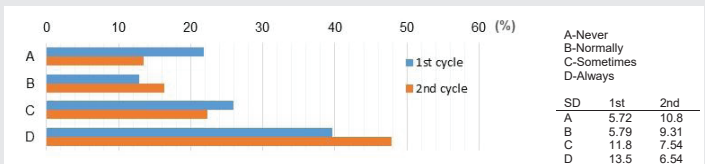


Figure 8: Do you leave the TV in standby mode when you turn it off?

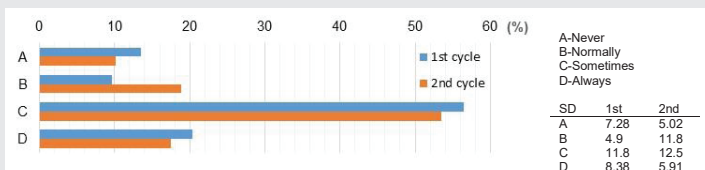


Figure 9: Do you use to listening to music too loud?

(Figures 6–9) show a relatively low SD value, which indicates a relative homogeneity of habits and behaviors of students regarding electricity and water consumption in all provinces.

The results obtained about school transportation habits and preferences are described in Figures 10,11. Walking is the main way to get to school for students of the 1st cycle. Bicycle is not used by students of the 2nd cycle and is also residual for 1st cycle students. Among the students of the 2nd cycle, the predominance is public transport and private car. These options by students of the 2nd cycle arise from their age and relative autonomy. In opposite, the lower relative autonomy of students in 1st cycle seems to be the principal reason for the low relevance of public transportation. When comparing buses or trains to go to school, the bus is the preference for 80% of students in both cycles. This result is strongly influenced by transportation available in the country. Due to the civil war until 2002 many railway lines had to close. The rehabilitation of Angolan's railway network is ongoing and only three structural lines are basically in operation today.

About 95% of students of both cycles demonstrated a very



positive attitude towards the willingness to participate in cleaning actions, whether at school or at the beach. Regarding the preference between the options “more plants or trees” or “more refuse containers” in the school area, the students of the 2nd cycle have a similar preference for both options, while 1st cycle students prefer the first option (Figure 12).

Regarding environment protection, the students of the 2nd cycle are more critical of government action than 1st cycle students (Figure 13). Nearly 50% of the 2nd cycle students consider that the national government doesn't take enough care about environmental protection. Among the students of the 1st cycle, the answers are more balanced, although negative opinions are superior (if we include the opinion that “the government, although concerned about environmental protection, is inefficient”). Low SD values obtained for this question make the results quite representative. The difference between the results observed for the 1st and 2nd cycles students can be explained by the fact that Angola's adolescents are assumed as adults by society and justice early than in Europe and other developed countries, despite the age of 18 years being established by law as the official age of adulthood [13-15].

Globally the results show that students in general have a medium level of knowledge about environmental issues and moderate habits on the consumption of water and electricity and enthusiastically face activities that protect and benefit the environment. The government action in relation to environmental protection is not efficient enough in the opinion

of students, with greater prominence among the 2nd cycle students.

The reliability of the survey is demonstrated by the SD of each item, which attests to the dispersion across different schools and regions.

Environmental education in school programmes

No strategic plan or specific actions designed for environmental education was refereed by school coordinators of public schools. Furthermore, teachers were not encouraged to conduct proper lessons or extra-curricular activities addressed to environmental issues. A few activities relating to environmental education were mentioned by coordinators of private schools, but without any strategic planning. A huge challenge is being pursued by school coordinators to change the perception of low risk of diseases that students attribute to the disposal of waste in dumps. In general, students believe that the risks of contracting disease exist only for people searching for materials in dump sites, according the opinion of school coordinators, based in their attitudes.

The educational project for both cycles is similar to its approved in several developed countries (in Portugal the Decreto-lei nº 55/2018 of 6 July support the Portuguese educational project for secondary school; in France information about education project for secondary school is available in the website: @education.gouv.fr searching by “Enseignements au collège”; in United Kingdom an example of education project for secondary school is available in “The National curriculum in England: key stages 3 and 4 framework document, 2014” by Department for Education @<https://www.gov.uk/government/organisations/department-for-education>). No specific subjects are addressed to environment issues, but the educational project for both cycles includes subjects that allow teachers to establish links to environment issues as environment impact, environment protection, environmental sustainability and responsibility. Geography and Biology subjects are compulsory for the 1st cycle and include in their contents topics and subtopics related to environment issues as: climate, relevance of water, nature conversation and protection, natural sources, environmental protection, and natural sources in Angola and Africa. Moreover, a subject on Citizenship Education, recently introduced for the 1st cycle comprises topics as: health care, environmental problems, environmental attitudes. The education project for the 2nd cycle offers three options courses: Sciences, Economics and Laws, Human Sciences. The course of Sciences includes Biology and Geology subjects in the educational project. The content of Geology offers several paths to teachers establishing links to environmental issues, with themes as the origin and structure of the Earth, geological processes, Earth's materials. The content of Biology includes the topics of biodiversity and ecosystem dynamics, which can be explored by teachers to discuss environmental issues. The course on Economics and Laws includes Geography subject being content fully committed to the study of the continents, with themes as the ozone hole in Antarctica, the vulnerability of coastlines, patterns and development in Asia and Latin America.

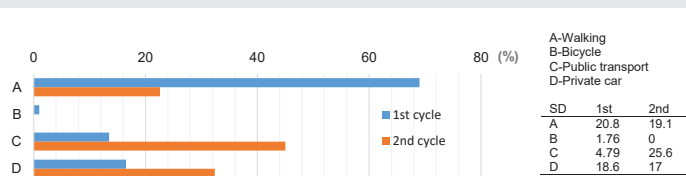


Figure 10: How do you come to school?

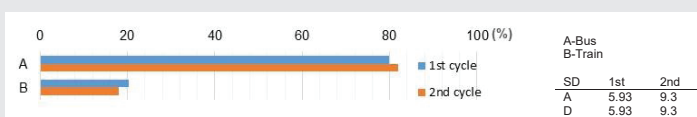


Figure 11: Between bus and train to travel, what would you choose?

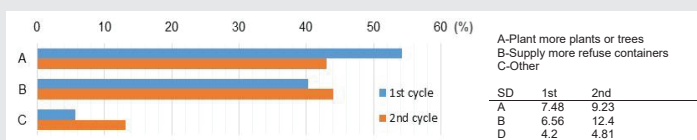


Figure 12: Which proposal do you suggest for improving school spaces?

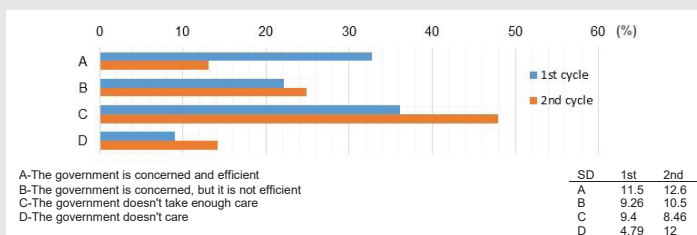


Figure 13: Which statement do you agree more?



Therefore, the curriculum for the secondary school offers many ways for teachers to explore to discussing the environmental issues in Angola and in the World. However, no didactic materials about EE and specific actions on environmental issues were carried out by the schools participating in this research.

Conclusion

A significant effort was performed by Angolan government to regulate MSW management, establishing strategies and goals to be achieved in 2025. However, the implementation of environment policy runs slowly due to the economic crisis and inability to manage this mission by the national ministry and local administrations. Environmental education is a fundamental tool to change behaviours, mentalities and attitudes regarding waste management. A questionnaire applied to Angolan students of secondary school demonstrated a medium level of knowledge about environmental issues, moderate habits about consumption of water and electricity and good attitudes towards the environment. But, the low perception of students about the relationship between diseases and the unsuitable waste management practices is a serious problem that require the reform of educational curriculum and establish specific programmes to developed by schools focused on environmental issues and the relationship to public health. These result are in agreement with those obtained by Yalçinkaya and Çetin (2018) with secondary school students in Niğde, central Turkey's Anatolia province.

From the interviews with representatives, there was no mention of any communication between the provincial MSW management offices and schools towards the MSW management and the impact on public health. The lack of funding and technical assistance from the local MSW management administration and the low incentive for teachers to carry out curriculum activities focusing on environmental issues did not allow the enrichment of the environmental awareness of the school population.

The cooperation between schools and local administrations responsible for waste management, within the framework of the national environmental plan, should be implemented in two ways: with the inclusion of EE in school activities and the professional training of local administration staff responsible for waste management. Didactic materials and specific actions should be developed by school in cooperation with local administrations to improve student' level of knowledge about environment issues and diseases caused by poor waste management.

References

- Desa A, Kadir BA, Yusooff Y. Environmental Awareness and Education: A Key Approach to Solid Waste Management (SWM) – A Case Study of a University

in Malaysia. In LM Rebellon, IntechOpen. DOI: 10.5772/48169. 2012. <https://www.intechopen.com/books/waste-management-an-integrated-division/environmental-awareness-and-education-a-key-approach-to-solid-waste-management-swm-acase-study-of-a>.

- Hoang T, Phan T, Takaaki K. Measuring the effect of environmental education for sustainable development at elementary schools: A case study in Da Nang city, Vietnam. *Sustainable Environment Research*. 2016; 26 (6):274-286.
- African Ministerial Conference on the Environment. Action for Environmental Sustainability and Prosperity in Africa: Embracing Policy Delivery and Implementation Through the African Ministerial Conference on the Environment. 17th Regular Session of the African Ministerial Conference on the Environment (AMCEN), under the theme "Taking action for Environmental Sustainability and Prosperity in Africa". 11-15 November, Durban, South Africa.
- Parrot L, Sotamenou J, Dia BK. Municipal solid waste management in Africa: strategies and livelihoods in Yaoundé, Cameroon. *Waste Manag*. 2009 Feb;29(2):986-95. doi: 10.1016/j.wasman.2008.05.005. Epub 2008 Jul 24. PMID: 18656342.
- Gbadamassi M, Adéchian S, Baco M, Tossou R. Waste Management in Cosmopolitan West African Cities: Towards the Need for Environmental Education of Populations. *Asian Journal of Education and Social Studies*. 2020; 7(1): 17-25.
- Couth R, Trois C. Carbon emissions reduction strategies in Africa from improved waste management: a review. *Waste Manag*. 2010 Nov;30(11):2336-46. doi: 10.1016/j.wasman.2010.04.013. Epub 2010 May 7. PMID: 20452197.
- Oruonye ED, Tukura ED, Ahmed YM. Assessment of public perception and awareness of the effect of poor solid waste disposal on the Environment in Jalingo Metropolis. *Asian Review of Environmental and Earth Sciences*. 2018; 5;1: 27-33. DOI: 10.20448/journal.506.2018.51.27.33
- INE. Resultados definitivos do recenseamento geral da população e da habitação de Angola 2014. Luanda: Instituto Nacional de Estatística. 2016.
- PESGRU. Plano Estratégico para a Gestão de Resíduos Urbanos., Diário da República. I Série. Angola. 2012; 196/12: 168.
- UNICEF. Using data to improve education in Angola. 2017. <https://www.unicef.org/stories/using-data-improve-education-angola>
- McGuire NM. Environmental education and behavioral change: An identity-based environmental education model. *International Journal of Environmental & Science Education*. 2015; 10(5):695-715.
- Yalçinkaya E, Çetin O. An investigation of secondary school students' environmental attitudes and opinions about environmental education (EE). *Review of International Geographical Education Online (RIGEO)*. 2018; 8 (1): 125-148. <http://www.rigeo.org/vol8no1/Number1Spring/RIGEO-V8-N1-7.pdf>
- International Bureau for Children's Rights. Diagnóstico sobre a justiça para crianças em Angola: sumário executivo. Luanda: UNICEF Angola. 2018.
- Borchers C, Boesch C, Riedel J, Guilahoux H, Ouattara D, Randler C. Environmental Education in Côte d'Ivoire/West Africa: Extra-Curricular Primary School Teaching Shows Positive Impact on Environmental Knowledge and Attitudes. *International Journal of Science Education*. 2013; 4:3.
- Impala. Press conference by Joana Pedro, technician from the Department of Financial Statistics of the Angolan INE. 2019. <https://www.impala.pt/noticias>.