

Pedagogical Strategies For Organic Waste Recycling In University Students

José Arles Gómez Arévalo¹, Audin Aloiso Gamboa Suárez², Raúl Prada Núñez³

¹ Doctor en Teología, Miembro del grupo Grupos Pedagogía-Ciencia-Espiritualidad (Categorizado en A) y docente investigador de la Corpas-Sana (categorizado en B) en Colciencias. Correo: Orcid: <https://orcid.org/000-0003-1774-3399>

² Facultad de Educación, Artes y Humanidades, Universidad Francisco de Paula Santander Cúcuta, Colombia, Investigador Grupo Rueda Universidad de Cartagena, Orcid: <https://orcid.org/0000-0001-9755-6408>

³ Facultad de Educación, Artes y Humanidades, Universidad Francisco de Paula Santander Cúcuta, Colombia, <https://orcid.org/0000-0001-6145-1786>

Abstract

This article is the result of research entitled: Recycling strategies in the context of university coexistence, carried out by the Juan N. Corpas University Foundation (Corpas Sana Group, Bogotá, Colombia) and the Research Group on Social Studies and Pedagogy for Peace (Giesppaz) of the Francisco de Paula Santander University (Cúcuta, Norte de Santander, Colombia). Based on the Sustainable Development Goals (SDGs), this research project aims to create an environmental and sustainable management plan for organic waste in the Juan N. Corpas University community (Bogotá, Colombia), to support the ecological and environmental activities of the institution. For its development, the qualitative paradigm was implemented, under a descriptive approach. Likewise, a survey was used as a technique for collecting and acquiring information, evaluating aspects such as: attitudes, values, work and knowledge of the participants in relation to the research. As pedagogical and didactic intervention strategies, three activities were implemented aimed at the reuse of organic waste and its subsequent transformation into a variety of handicrafts and reflection through lectures on sustainable development through recycling by means of didactic strategies. In conclusion, positive changes were observed on the part of the university students in terms of values and aptitudes in favour of recycling and environmental preservation, as well as towards the acquisition of new practical knowledge in favour of environmental balance in the context of higher education.

Keywords: Pedagogical strategies, environmental education, recycling, organic waste.

Introduction

Higher Education Institutions in Colombia and Latin America today play an invaluable role in the integral management of solid waste through special recycling programmes, as they are in charge of training most of the future professionals who will be the decision makers in many fields of knowledge. On the other hand, in Colombia, as in many parts of the world, recycling management is an urgent issue due to the high proliferation of waste, which is becoming an environmental and health problem in societies. As for the university academic communities, in particular, there is still much to be done, especially in the area of students, who frequently demonstrate a lack of awareness of the negative effects that the poor management of organic waste has on the contamination of soil, surface and groundwater and its contribution of greenhouse gases that are located in the atmosphere.

In terms of human beings, according to the Pan American Health Organisation, the accumulation of solid waste affects all people who live in urban areas in particular, as well as all communities living in a given region, which can affect the respiratory tract and spread pathologies such as dengue fever, among other affectations that they must endure such as pests and bad odours.

The Juan N. Corpas University Foundation of Bogotá (Colombia), in particular, considers that, within its institutional culture, greater emphasis should be placed on ensuring that its students not only know what recycling is, but also how to practice it through a training plan that involves the direct participation of its academic community, especially a population that is still in the formative process. Similarly, the Institution recognises that recycling is an important part of environmental education, which is conceived as a subject that is very little addressed by the higher education system in more general terms, even through relevant indicators that show that waste management and the unnecessary use of non-biodegradable materials on a daily basis in higher education centres generate pollution, which has repercussions on human life, as well as on the good management of healthy environments in educational contexts.

For this reason, the Juan N. Corpas University Foundation considers it urgent to create an educational plan to generate ecological awareness, values and positive attitudes that provide elements of reflection among students to motivate them in the creation of friendly habits with the protection and safeguarding of the environment along with good environmental management of organic solid waste, from a high valuation of recycling as an optimal environmental educational strategy. Likewise, the Institution recognises recycling as one of the most important experiences within the context of higher education, as it provides excellent results due to its high impact on the adequate and continuous promotion of a healthier environment and in accordance with the objectives of sustainable development, as set out by UNESCO. For these reasons, this research work aims to identify the contribution of recycling in the environmental education of university students, particularly those who interact in the Juan N. Corpas University Foundation.

Theoretical and conceptual elements

According to Pellegrini (2015), recycling is a way of benefiting from various materials contained in objects discarded as "rubbish" and which are susceptible to being exploited by means of a special intervention by the hand of man in such a way that they become "added values" thanks to their transformation into useful material that has already been reconsidered. On the other hand, the Corporación Autónoma Regional de Cundinamarca (CAR), mentions that environmental degradation refers to "Processes induced by human actions and activities that damage the natural resource base or adversely affect natural processes and ecosystems, reducing their quality and productivity" (CAR, 2020). As a result, several countries around the world are experiencing environmental problems associated with poor waste management and water pollution, as well as the loss of local flora and fauna.

In regions such as Latin America and the Caribbean (LAC), the waste generation rate is equivalent to 0.91 kg/inhabitant/day, for a total of 295,000 tonnes of solid household waste and 436,000 tonnes of solid urban waste generated daily (Toro et al., 2016). The segregation or separation of waste is carried out in an incipient manner by low-income people who do not have the technical preparation to avoid putting their health at risk, due to inefficient policies that do not promote an ecological culture among citizens or public waste management companies (PAHO, 2005). The collection and transport of MSW is carried out by 3 to 4 operators in vehicles with a load capacity ranging from 3 m³ to 15 m³, people who go from house to house collecting waste without any type of classification, with a frequency of 2 to 5 times per week, which depends on the degree of urbanisation of the cities (OPS, 2005).

The treatment of solid waste in LAC is classified into 3 management alternatives: Recycling, Composting and Thermal treatment (OPS, 2005)

- **Recycling:** The main wastes that are recycled for further processing into other products by companies are paper, cardboard, glass, plastics, wood and metals. However, it is estimated that only 2.2% of total solid waste is recovered and recycled, a figure that varies from country to country (Table 2).
- **Composting:** Although in LAC organic waste is the largest contributor to total MSW, the generation of organic waste is not linear with the composting process. Although there are some successful cases in Mexico, Salvador and Argentina, where this technique has been implemented since the 1960s.
- **Thermal treatment:** Countries that have experience with incinerators are Brazil and some Caribbean islands. However, these practices are limited for hazardous waste in industrialised countries.

Solid waste: Solid waste is the division of two types of waste, the first part of organic waste, which is made up of food, food, cardboard, paper and other organic materials. On the other hand, inorganic waste is found, which consists of plastic bottles, glasses, plates,

etc., glass and metals, mainly from household activities, construction and other activities. The negative effect produced by not managing this waste correctly is detrimental to human health and the integrity of the environment (Toro et al, 2016).

Similarly, in the research article "Alternativas y acciones en el tema de residuos sólidos planteadas por las municipalidades de Jiménez y Oreamuno y su relación con el desarrollo y la sostenibilidad" (Campos et al., 2012), from the Universidad Tecnológica en Marcha (Costa Rica); in it, the researchers present how the productive processes promote the production of waste in Costa Rica, based on the responsibility that the municipalities present when carrying out the integrated management of solid waste, where they establish as the main theme of the research the environmental problems that are being experienced through the generation of waste, requiring the implementation of sustainable development through awareness and the vision of local governments.

On the other hand, a quick analysis of the possible causes of this problem of solid waste production can be considered to be determined by cultural references in terms of consumerism, economic factors that increase purchasing power, technological factors that drive innovation in industry and trade strategies, the disorderly demographic growth in the different localities and the low level of environmental and sustainable awareness in cities. It is in this last reference, in which special emphasis should be made at national and global level, in order to promote the competent authorities of all levels, including educational institutions, to join efforts in the design, implementation, promotion and evaluation that are necessary to respond to or mitigate the problems raised.

Therefore, it is necessary to undertake actions from educational institutions in the training of human talent around the routes or programmes for the proper management and exploitation of solid waste produced in the area, as well as to encourage a change of attitude and perception of waste and to consider it as a potential waste that can be transformed into another element to be used and minimise the negative effect on the environment.

It should be understood that environmental awareness is composed of two parts, both the environment and the consciousness of the individual. Awareness is based through expression, such as emotions, behaviours and attitudes of people, as each person has unique characteristics, likewise the environmental component is based on the questioning of important environmental aspects, of which are classified by their importance and the difference between them (Pelinco, 2018).

Pedagogical strategies: these are defined as "actions that are carried out by a teacher to facilitate educational processes, together with the acquisition of knowledge and student learning, in addition to the curricular scenarios of organisation of training activities and the interaction of the teaching and learning process where knowledge, values, practices,

procedures and problems specific to the field of training are achieved" (Mora et al, 2013, p. 3).

In Colombia the educational processes present a myriad of problems, causing that in many cases the way in which knowledge is acquired is not the best, in the same way the inculcation of an environmental education is precarious causing that the students do not adopt positive aspects on the care and conservation of the environment, for such a reason the implementation of pedagogical strategies which achieve this important step is of vital importance, since from promoting environmental education in people, through pedagogical strategies, will be improving the quality of life of the same people, as the quality of knowledge that they manage to adopt for their daily life, in the same way it is expected that the implementation of such pedagogical strategies will make it possible to better address the environmental problems that arise today (Rodríguez & Vallejo, 2018).

Environmental education: is a training tool with the aim of promoting equity and development in its inhabitants, taking into account the difficulties that this implies, a generation of environmental thinkers is being trained to combat and mitigate the negative environmental impacts that are experienced on a daily basis. In 1972, environmental education was designated as an academic tool, which should be developed inside and outside educational institutions with the obligation to generate training for teachers as they are the main responsible for educating future generations and thus promote a better impact on students (Bravo & Lagos, 2020).

Environmental education is a social construct of knowledge generated through a series of collective questioning and reflections on the existing human-nature gaps (Gomes & Reyes, 2004; Otto & Pensini, 2017), which aims to generate development alternatives by transforming people's attitudes, habits and behaviour for the benefit of nature (Frantz & Mayer, 2014).

Community environmental education should focus on strengthening capacities and moving them towards participation-action (Trellez, 2015). The first step is based on having a simple but shared imaginary for the whole community: for example, all waste should be recycled (Odonkor et al., 2020), secondly, internal motivation (Lawrence et al., 2020) and as a result, community commitment is obtained (Díaz et al., 2015), which is materialised in actions for the care and conservation of the environment. This generates a "mirror" effect (replication and adoption) throughout the community, due to the transformative and motivational potential of a good participatory environmental conservation process (Basu & Punjabi, 2020).

Sustainable development: over the years it has been defined as the process which has the capacity to meet the needs of people, without directly and significantly affecting natural resources, seeing it as a living system which must be conserved and protected for future generations. For this reason, over the years and given the clear need to implement a system that maintains a balance between human needs and the availability of resources, it was decided to create the 17 objectives of sustainable development, in order to better address the development processes of current populations (Bravo y& Lagos, 2020).

In view of the evident environmental problems that are present on the planet, the need to implement sustainable development in societies has become one of the main challenges worldwide, both in economic and pedagogical aspects, including directly in universities, since it has been established in the framework of European convergence that one of the main needs to be modified in the curricula are the topics related to sustainability and development values, motivating students to be integral professionals, with the ability to be aware of environmental care and to be aware of the need to take care of the environment, One of the main needs to be modified in the curricula are the topics related to sustainability and development values, motivating students to be integral professionals, with the ability to be aware in relation to environmental care and thus improve and develop a professional ethic (Alcalá & Gutiérrez, 2020).

Similarly, in the process of creating sustainable development for societies, it has been decided to train teachers in various educational institutions for the coming years, with bases clearly related to sustainable development, since in this way, as they are responsible for shaping the generations of the future, it can be guaranteed that students acquire values, knowledge and attitudes related to the care and protection of the environment (Vásquez et al, 2020).

Methodological design

This research used the qualitative paradigm for its development, under a descriptive approach. Likewise, the survey was used as a technique for collecting and acquiring information, evaluating aspects such as: attitudes, values, work and present knowledge of the participants in relation to the research. As pedagogical and didactic intervention strategies, three activities were implemented aimed at the reuse of organic waste and its subsequent transformation into a variety of handicrafts and reflection through lectures on sustainable development through recycling by means of didactic strategies.

Regarding the qualitative approach, it is important to say along the lines of Sampieri et al. (2014), that: "There is a reality to discover, construct and interpret" (p. 12), likewise the starting point is that: "there are several subjective realities constructed in the research, which vary in form and content between individuals, groups and cultures. Therefore, the qualitative researcher starts from the premise that the social world is "relative" and can only be understood from the point of view of the actors studied" (p. 10).

These subjective realities, as stated in the previous text, are reconstructed through the eyes of the research subjects themselves, who, with their own views and ways of seeing life, as well as with their meanings, reconfigure their own reality; in this regard, taking up (Chárriez, 2012), he mentions that: "Qualitative methods allude to a style or way of investigating social phenomena that start from a basic assumption: the social world is a world constructed with meanings and symbols, which implies the search for this construction and its meanings. In this sense, they represent a process of social construction that attempts to reconstruct the concepts and actions of the situation under study (p. 51).

Population unit and instrument: 50 students from four faculties were taken as the focus group for the study, all belonging to the Juan N. Corpas University Foundation, the age range ranged between 18 and 24 years of both sexes (48% men and 52% women). As an instrument for data collection, a survey was applied (see Annex 1); as is known, this information collection instrument serves as an input for the description of the results and fulfilment of the general objective regarding the understanding and promotion of recycling as an alternative for improvement in the management of organic waste at the same University Foundation, through the development of pedagogical strategies. It should be remembered that the survey "is one of the most widely used social research techniques in the field of sociology, which has transcended the strict field of scientific research to become an everyday activity in which we all participate sooner or later. The stereotype has been created that the survey is what sociologists do and that sociologists are specialists in everything" (Roldán & Fachelli, 2015, p. 5).

Phases of the research: the entire methodological process of the research was developed in three phases, namely:

Phase I: Dissemination of the recycling proposal as an alternative for the management of solid organic waste among the students of the Fundación Universitaria Juan N. Corpas (Bogotá); in this phase of the research, a meeting was held with the participation of students who volunteered to collaborate with the implementation of the project. The meaning and objective of the research was explained and the recycling proposal was presented as an alternative for the management of solid organic waste and residues generated in the institution.

Phase II. Application of the survey and analysis of the results. The product obtained from the application of the surveys is summarised in the following section. Similarly, according to the results obtained, the need to initiate a recycling process in the institution was raised, especially with paper derived from academic activities, as well as cardboard, glass and plastic, as these are the most common waste products produced in daily activities within the university institution itself. The aim was to incorporate a culture of recycling in the student community. The community surveyed was pleased and proposed to disseminate the recycling proposal throughout the university foundation.

Phase III. Design of the pedagogical proposal for the recycling of organic waste in the university institution. Three pedagogical activities were organised according to the results obtained: Talks and evaluative discussions on the management of organic waste within the university foundation. These talks and discussions were based fundamentally on the presentation of global problems, based on waste pollution and the lack of implementation of waste recovery processes; in the course of the implementation of these strategies, students were able to participate by asking questions each time a topic was presented. A second activity consisted of an educational workshop with recyclable materials, which was based mainly on the reuse of organic materials (fruit peels, leftover food, coffee filters and aromatic herbs) that are thrown in the rubbish bins at the University Foundation to make a compost (natural fertiliser) to be used in the gardens of the same institution and as a third activity was th.

Finally, an evaluation was carried out with the participants in the research process to assess the activities carried out and to hear their conclusions on the correct uses that should be made of the waste generated at the University Foundation, as well as to reflect on what processes and attitudes should be taken into account at a general level in the academic community in order to make better use of recycling and their reflection on the environmental impact in the context of sustainable development.

Results

With regard to the results obtained through the implementation of the survey to identify the students' perspectives on the subject of recycling and which teaching strategies were the most appropriate to achieve greater environmental awareness and personal commitment among them from the perspective of recycling, from the seven questions analysed in the survey, it can be deduced that: the vast majority (90%) consider that it is important to recycle in the university context in order to care for the environment, because this contributes to a better quality of life, to the correct preservation of the balance between human beings and the environment and to generating a favourable impact in terms of sustainable development..

Regarding the second question, 75% of the students surveyed consider that in the academic space of the university campus more containers could be implemented to recycle organic material, as well as glass, paper, cardboard, plastic and batteries; in the third question, 87% consider that they have a clear notion of what selective waste collection is in their work and study space. Regarding the fourth question, on the actions they would support to make all students aware of the importance of caring for the environment, 58% believe that more campaigns should be carried out to raise awareness of what recycling is and how it is implemented, 27% believe that advertisements or notices regarding recycling should be placed on the university campus and 15% believe that enough has already been done in terms of recycling.

Regarding the fifth question on whether they knew the three Rs rule, only 35% said they did and 65% said they did not. Regarding the sixth question, 72% said they did not and only 28% said they did. Finally, with regard to the seventh question on whether they consider that the institution could implement more actions in defence of recycling among the members of their academic community, 88% said that it should do so and only 12% said that it was not necessary. Among the actions, some considered that activities such as recycling campaigns (47%), talks and competitions related to recycling (33%) and exchanges of experiences with other institutions (20%) could be carried out.

Likewise, in general terms, the students surveyed expressed their agreement with the articulation of the subject of recycling with environmental education, as well as with various areas of knowledge, collectively strengthening the care and conservation of the environment in academic spaces, as well as considering it important that initiatives and projects on this subject are projected to the community and the general population. Similarly, there was a general opinion that it is important to recognise that recycling organic waste in the institution contributes to minimising environmental pollution, as well as being willing to participate in academic and research processes on issues associated with environmental education through the recycling of solid waste and its impact on sustainable development.

Conclusions and recommendations

It is necessary to continue encouraging the implementation of various activities aimed at promoting the recycling of organic material in higher education institutions in Colombia and especially from the awareness of its importance in the context of sustainable development. Although progress has been made in the implementation of university programmes related to the subject, it is necessary to set in motion various initiatives by the academic communities and in general, which integrate collective effort and benefits; in this way, to motivate interdisciplinary integration and participation of multiple higher education institutions, especially from the formation of networks and inter and transdisciplinary research groups.

Most of the students surveyed expressed the need for higher education institutions to implement campaigns, conferences, talks and pedagogical activities to promote recycling, as well as ecological habits in their students, including the reuse of solid waste. Given this panorama, it is possible to demonstrate that the processes of recycling, the sense of belonging to the care of the environment, as well as the acquisition of environmental habits and notions of environmental education, depend on multiple variables (pedagogical, cultural, institutional policies, etc.), which require follow-up, monitoring and evaluation by teachers and pedagogical companions, as well as the will of management of the directives of the institutions of higher education..

Finally, the pedagogical strategies of intervention and reflection that were implemented, fulfilled the outlined purpose, promoting the acquisition of knowledge, values and skills

related to the care of the environment through the use of waste and rubbish produced on the university campus. Finally, the authors and theoretical-conceptual lines used, as well as the methodology employed, offered a horizon of meaning in terms of what the population required in terms of pedagogical and environmental education strategies, within the framework of sustainable development.

Referencias

- Burgos, F. L., & Pérez, Y. P. (2019). Propuesta de un Programa de gestión integral para el manejo de los residuos sólidos en el Corregimiento La Laguna del Municipio de Pitalito Huila. (Trabajo de grado). Universidad Nacional abierta y a distancia.
- Campos, R. R., Quirós, B. N., y Navarro, G. A. (2013). Alternativas y acciones en el tema de residuos sólidos planteadas por las municipalidades de Jiménez y Oreamuno y su relación con el desarrollo y la sostenibilidad (Artículo informativo). *Revista Tecnología en Marcha*, 26(2), 104-111.
- Castrillón, C. (2018). Guía práctica de manejo y transformación de residuos sólidos caseros, en la comunidad del barrio bella flor–Localidad Ciudad Bolívar Bogotá (Tesis de maestría) Universidad Católica de Colombia, Bogotá, Colombia.
- Castro, S. L. (2017). Gestión integral de residuos sólidos. Bogotá, Colombia. Repositorio Fundación Universitaria del Areandina.
- Contreras, L.D y Hernández, V.F.L. (2016). Propuesta para el manejo a los residuos sólidos generados en la plaza de mercado del casco urbano del municipio de la mesa Cundinamarca (Tesis de especialización) Universidad Libre, Bogotá, Colombia.
- Cortes, D. M. I. (2020). Estrategia para promover cultura ambiental mediante el manejo de residuos sólidos en la Institución Educativa Departamental Santa Inés. (Trabajo de grado). Fundación Universitaria Los Libertadores, Bogotá, Colombia.
- Cotán, F. A. (2020). El método etnográfico como construcción de conocimiento: un análisis descriptivo sobre su uso y conceptualización en ciencias sociales. *Márgenes* 1 (1), 83-103.
- Lawrence, K., Cooper, V., & Kissoon, P. (2020). Sustaining voluntary recycling programmes in a country transitioning to an integrated solid waste management system. *Journal of Environmental Management*, 257, 109966
- Londoño, B.K (2020). Optimización del manejo de los residuos sólidos en cumplimiento con el Plan de Gestión Integral de Los Residuos Sólidos de la Empresa EMPUARG S.A. E.S.P del Municipio de La Argentina Huila. Universidad Nacional Abierta y a Distancia.
- Mondragón, A.D.E. (2020) aprovechamiento de los residuos orgánicos producidos en los hogares del conjunto residencial bellavista, sector rural del municipio de garzón, para la obtención de biogas a partir de la construcción de un biodigestor (trabajo de grado). Universidad Pontificia Bolivariana.
- Mora, A., y Molina, N. (2017). Diagnóstico del manejo de residuos sólidos en el Parque Histórico Guayaquil. *La Granja, Revista de Ciencias de la Vida* 26(2). DOI: <http://dx.doi.org/10.17163/lgr.n26.2017.08>

- Posada, P.M.S. (2016). Estrategias Pedagógicas para el Manejo de los Residuos Sólidos en la Institución Educativa Agustín Nieto Caballero (Tesis de Especialización). Fundación Universitaria los Libertadores, Colombia.
- Pellegrini, N. y Reyes, R. (2015). Reciclaje de Papel en la Universidad Simón Bolívar. *Revista de Investigación* 67, 33, 45-57
- Odonkor, S. T., Frimpong, K., & Kurantin, N. (2020). An assessment of house-hold solid waste management in a large Ghanaian district. *Heliyon*, 6(1), e03040.
- Quispe, L. A. (2015). El valor potencial de los residuos sólidos orgánicos, rurales y urbanos para la sostenibilidad de la agricultura. *Revista mexicana de ciencias agrícolas*, 6(1), 83-95.
- Ramos, C. A. (2015). Los paradigmas de la investigación científica. *Avances en psicología*, 23(1), 9-17.
- Rodríguez, P.R y Vallejo, P.M.L. (2018). Estrategias didácticas en educación ambiental para el fortalecimiento de buenas prácticas ambientales (tesis de maestría). Universidad pontificia bolivariana. Leticia Amazonas.
- Roldán, P.L. y Fachelli, S. (2015). metodología de la investigación social cuantitativa. Barcelona, España. Creative Commons.
- Sampieri, Collado y Batista (2014), Metodología de la investigación. McGraw-Hill interamericana.
- Tertulién, M. P., Hernández, S. C., & López, T. S. (2015). Acciones estratégicas para la educación ambiental comunitaria en los estudiantes de la Universidad de Ciencias Médicas de Camagüey. *Humanidades Médicas*, 15(1), 128-144.
- Tréllez, E. (2015). Educación ambiental comunitaria en América Latina. PNUMA/ROLAC.
- Vásquez, C., Seckel, M. J., y Alsina, Á. (2020). Sistema de creencias de los futuros maestros sobre Educación para el Desarrollo Sostenible en la clase de matemática. *Revista Uniciencia*, 34(2), 16-30.)