

Full Length Research Paper

A critical analysis on waste and environmental education: a case study

Carla Cândida de Siqueira Santos¹, Rafael da Silva², Elânia Maria Marques Bergamaschi³, Paulo Roberto Bergamaschi⁴, Alessandro Camilo Neres^{1,2}, Vanessa Oliveira Leitão⁵, Hisao Nishijo⁶, Tales Alexandre Aversi-Ferreira⁶

¹State University of Goiás, Anápolis, GO, Brazil.

²Latin American Faculty of Anápolis, Anápolis, GO, Brazil.

³Metodista University of Piracicaba, UNIMEP, Piracicaba, SP, Brazil.

⁴Faculty of Mathematics, Federal University of Goiás, UFG-Catalão campus, Catalão, GO, Brazil.

⁵Brasília University, UnB, Brasília, DF, Brazil.

⁶System Emotional Science, Graduate School of Medicine and Pharmaceutical.

Abstract

This paper presents results of a survey on perceptions of the population of the Jundiá neighborhood, Anápolis-Goiás-Brazil, on issues related to consumerism, waste production and critical environmental education. The study aims to reflect on the importance and relevance of a population to realize the necessity of being critical in relation to the production of solid waste. This qualitative research made use of questionnaires to survey the perception of residents, with a view to devise and propose targets for both waste reduction and its destination. The results indicate that the population studied lacks of information and environmental education practices.

Keywords: Consumerism, Critical Environmental Education Review, Waste.

INTRODUCTION

We live in a society where domination and capitalist exploitation are themes in evidence. However, Brazil, by adopting this economic model, has allowed privileges to an organization of conditions for the industrial capitalist production (Cortella, 2006). As a result, society has a high consumption of manufactured goods, leading to production of large-scale waste, especially solid waste, which made man an agent of environmental degradation.

Based on this line of thinking, consumerism (Bensaid, 1999 *apud* Loureiro, 2007) is so globalized. This fact has striking implications, as the overproduction and over consumption for a small portion of the population, causing an excessive use of natural resources, and under-consumption, exploitation and expropriation for a large group of people, "(...) enabling the understanding of the production-flow-distribution-consumption cycle, ensuring the expansion of private accumulation of socially generated wealth" (Casanova, 2006, *apud* Loureiro, 2007).

According to Loureiro (2007) we must understand that the major environmental problem is not the number of people on the planet or the consumption of natural resources to ensure their basic needs, but the exaggerated consumption of resources by a small portion of the population such as in the United States of America, waste and production of unnecessary goods and harmful to quality of life (Reigota, 2001), mainly due to scientific and technological advances that do not necessarily promote well being to mankind (Cortella, 2006) and that can generate social exclusion.

Researches show that every human being throughout his life in a capitalist culture consumes "nearly 22 tonnes of other forms of life, not including those used for not-food purposes (clothing, footwear, objects, fun, transport, experiments,...)" (Cortella, 2006).

In consumer society, the destination and treatment of solid wastes of domestic origin (domestic waste) is a challenge for cities, especially medium and large urban centers, and this challenge involves the general question of education, and more particularly Environmental Education (EE). Education aimed at the issue of waste is an opportunity for municipalities to manage household

*Corresponding Author E-mail: aversiferreira@gmail.com

waste in a participatory manner, protecting the environment, and promoting social inclusion of citizens who are outside the production process.

Works on waste management represent one of the most important aspects to be covered in EE associated with all social classes, and the opportunity for the population to see, feel and work with waste is important to provide practical learning in EE (Adamns, 2004).

EE studies indicate that reducing waste production is as or more important than treating it, which favors less the final link of the chain - the destination of the waste - reducing the volume of waste at the beginning of the productive process.

However, only in the seventies, criticisms were made with more detailed analysis regarding the meaning of the human being on the planet and the impacts caused by him and about his fragility as biological being. To Lovelock (1987); Lutzenberger (1990), Thompson (1990) *apud* Loureiro (2003), the human being is just another existing species on the planet and presents possibilities of disappearing at any time.

It is essential to think in a healthy and balanced environment. Passing through literature, we find that there are several concepts relating to the environment, among them are:

i): "(...) a set of fixed data and balance of competing forces that determine the life of a biological group". (Pierre Jorge *apud* Reigota, 2001);

ii): "(...) what surrounds an individual or group, encompassing cosmic, geographical, physical environment and social environment with its institutions, culture, values." (Belga Duvigneaudia *apud* Reigota, 2001);

and iii): "(...) a particular and / or perceived place where they are in dynamic relationship and in constant interaction between natural and social aspects." (Reigota, 2001).

In this paper, we will use the term environment in a more dialogical sense for understanding that it is composed of relations that are capable of causing mechanisms of cultural, historical, technological and political creations that allow changes in nature and society. Therefore, it is understood that the term environment is broad and complex.

According to Leff (2002), the environment is complex because it does not involve only the "natural" development of raw materials, but also refer to man and society as a whole and for being in constant change caused by scientific and technological advances. However, it can be understood as a dynamic, social and political space, where man is a constituent part of this environmental complexity.

Thus, whether by demagoguery or by the gradual

increase in concern for the environment, there is nobody today who do not express a growing concern about landfills and their undesirable effects on the environment. The main goal of this whole process is to generate the need on those who produce, either people in their homes, public institutions, companies, factories, hospitals, stimulating the creation of a new culture of waste.

The change on the discourse on waste, the insertion of each active citizen in the challenge of the waste issue, monitoring and enforcement of decisions of public authorities in relation to waste are key elements in the educational work that has as a goal, to take people out of a state of political impotence, showing that the waste is a problem of all (Gazzinelli et al., 2001).

Thus, it is necessary to accomplish a critical (Loureiro, 2007; Tozoni-Reis, 2007; Loureiro, 2003) and political EE (Reigota, 2001) because it is capable of providing social and environmental transformations. EE is inserted in the education process and in teaching practices, which is an important process for transformation of reality into a world socially fairer and environmentally sustainable (Marpica and Logarezzi, 2010).

Therefore, EE is "an educational and social praxis which aims to build values, concepts, skills and attitudes that enable the understanding of the reality of life and the lucid and responsible performance of social, individual and collective actors in the environment" (Loureiro, 2002). Tozoni-Reis (2007) argues that EE should have social practice as a tool to promote transformation and construction of social relations with the perspective of humanity to understand the meaning of social and environmental sustainability.

An EE that has this claim must go beyond the awareness of the population. In the Belgrade Letter *apud* Reigota (2001), some goals indicative of EE are defined, such as: i) Awareness: aimed at providing awareness of the environment, as well as being sensitive to them, ii) Knowledge: to provide the understanding of the environment and existing problems, and iii) Behavior: to perceive the sense of social values, a deep sense of concern for the environment and willingness to contribute to protection and quality; iv) Competence: to ensure technical capacity to solve environmental problems, v) Evaluation capacity: enabling the ability to evaluate policies and programs related to the environment, and vi) Participation: to realize that there are responsibilities for immediate action in view of solving problems within the environment.

Once the EE goals are achieved, it could be inferred that it is definitely understood as a political, ethics, transformational and emancipatory education (Tozoni-Reis, 2007), to prepare citizens to act in a critical and

reflective way in relation to the environment. However, it must be understood as an education proposal that could contribute for the population to participate and achieve citizenship.

In this sense,

"(...) To understand the nature of the challenge to humanity with respect to the permanence of thinking structures disarmed in the epistemological point of view to realize the human-nature relationship in another way, different from the mechanic game of dualities proposed by the rationalist formal logics. " (Barreto, 1992 *apud* Grün, 2007).

Moreover, Loureiro (2003) argues that the world is one. However, we understand that EE is an important addition to awareness. To promote sustainability, it should be critical, political, democratic, liberating and transformative, contributing to social and environmental transformations, mainly aiming at the responsibility of all citizens.

Brazil, as a developing country with large population is a major producer of waste; therefore, EE in Brazil must be undertaken in schools, neighborhood associations, clubs and other locations within easy access of the population.

Brazil generates around 230 000 tonnes of waste (Philippi-Júnior et al., 2004), of this total, 22% are deposited in open dumps or landfills. About 75% of the waste is thrown in controlled or sanitary landfills; however, about 70% of districts that are serviced have open dumps. Recently, IBGE data indicate that the number of municipalities that generate a final and proper destination of solid waste increased between 2000 and 2008; however, two years ago, 50.8% of cities threw their solid waste into landfills.

Solid wastes from an urban area are composed of what is called trash (mixed waste from households, commerce, services and public activities, in food preparation, the performance of professional duties and the sweeping of public areas), as well as special waste, more problematic and dangerous, from industrial processes and medical and hospital activities (Braga, 2004).

Solid waste, when poorly managed, cause risks i) air pollution, ii) soil, surface water and groundwater contamination, and iii) public health by spreading diseases, iv) visual pollution, and also cause bad odor and others (Philippi-Júnior et al., 2004).

In this context, due to the high waste production in Brazil, strong and incisive EE should be implemented. However, studies on how people think about EE and manage waste are scant.

Therefore, the aim of this study was to investigate the concepts of EE and waste treatment, associated with socio-economic aspects of a sample of the population

from the Jundiaí neighborhood, Anapolis, state of Goiás, Brazil, to hypothetically respond on a small scale, the relationship of society with waste production and processing.

METHODOLOGY

This qualitative research (Lüdke and André, 1986) was conducted from March 2005 to January 2006, along with residents from the Jundiaí neighborhood in the city of Anapolis-Goiás, Brazil. The Jundiaí neighborhood is considered a class-A neighborhood of the city and one of the largest with about 20,000 inhabitants and 5766 households with 100% with basic services (electricity, piped water and garbage collection). It is considered an expanded center with increasing building constructions offering commercial and economic growth for Anapolis.

It is considered that the neighborhood has a good geographical location, areas with high real estate value and composed of residents of good socioeconomic status. Notwithstanding, there are also low-income people living in shacks that are usually rented.

To accomplish the research, it was necessary to go into the field to understand the perceptions of the population on issues related to the consumption of manufactured goods, as well as waste production and destination.

For data collection, nine out of the seventy blocks that existed at the time in the neighborhood were randomly selected. Thus, it was necessary to visit all households from these blocks for the application of a structured questionnaire with closed questions.

It is noteworthy that there were still cases where there were people at home and others where people were not willing to answer the questionnaire. The total number of completed questionnaires was eighty-four. The collected data were tabulated, organized and analyzed later.

The statistical analysis was performed using the frequencies of responses obtained by the questionnaire and the correlation between some parameters was performed using the Pearson's χ^2 test (Triola, 1999; Centeno, 1982).

RESULTS

After the fieldwork, socio-economic data and criteria on the waste destination and knowledge on EE were analyzed. The data were cataloged in Table 1.

Over 60% of households visited had 3-4 residents, featuring a neighborhood of small families, 70% of respondents had one or more cars, about 56% had computer with internet access, 73.81% had school-aged

Table 1. Parameters and frequencies evaluated by the questionnaire

	Parameters evaluated by the questionnaire	Types	Number of people		Percentage (%)	
I	Gender	Male (M)	22		26.19	
		Female (F)	62		73.81	
II	Age (years)	13→25	M5	F14	M 6.0	F17.0
		26→40	M10	F22	M12.0	F26.0
		41→60	M5	F24	M6.0	F28.5
		61→89	M2	F2	M2.3	F2.3
III	Number of residences	0→2	13		15.5	
		2→4	51		60.7	
		4→6	16		19.0	
		6→8	4		4.7	
IV	Cars	Do have	59		70.24	
		Do not have	25		29.76	
V	People with access to internet	Yes	47		56	
		No	37		44	
VI	Children in school age	Public Schools	20		23.81	
		Private schools	39		46.43	
		Both	3		3.57	
		None	22		26.19	
VII	Garbage bags produced per day	0→2	66		78.57	
		2→ or more	18		21.43	
VIII	People who use recyclable material	Yes	52		62	
		No	32		38	

Table 1 Continue

IX	People who reuse plastic packages	Reuse	39	46
		Throw in the garbage can	45	54
X	People who recognize recyclable packages	Recognize	68	81
		Do not Recognize	16	19
XI	Preference to buy recyclable packages	Yes	28	33.33
		No	29	34.52
		Depends on the price	27	32.14
XII	Separation of garbage	Yes	33	39
		No	51	61
XIII	Give away or sell recyclable packages	Yes	45	54
		No	39	46
XIV	Consider waste collection efficient	Yes	46	54.76
		No	38	45.24
XV	Implementation of a selective collection system	Yes	72	85.71
		No	3	3.57
		Indifferent	9	10.71
XVI	Destination for batteries	Common garbage	49	58.33
		Give back where they bought it	26	30.95
		None	9	10.71

children, 46.3% of those studying in private schools, or more than half of students attend to private schools.

Almost 80% of respondents produced up to two bags of garbage per day in their homes, most of the population of the Jundiaí neighborhood (62%), consumed manufactured product, thereby increasing the level of disposable materials.

The percentage of people who had the habit of reus-

ing plastic packaging (46%) was slightly lower than those who threw them away (54%), not reintroducing the waste in the production cycle.

Approximately 81% of the study population claimed to have knowledge on which were recyclable packaging; however, only 33.33% of the people adhered to products with reusable packaging and 32.14% checked only the price factor at the time of purchase.

Table 2. Association of parameters analyzed by the χ^2 test.

	Related parameters (categories of Table 1)	χ^2	Null hypothesis for $\alpha=0.01$
1	V and VII	9.758326629	Rejection
2	X and XI	21.47829037	Rejection
3	IV and IX	9.795918367	Rejection
4	IV and XII	18.23017903	Rejection
5	V and XVI	13.76871795	Rejection
6	IV and VI	4.293556102	Acceptance
7	IV and V	3.681071211	Acceptance

Of those surveyed, 39% used some form of separation to rule out the trash and 54% sold or donated materials to be recycled, and 58.33% of respondents threw batteries in common garbage.

The parameter owning a car was used as an estimate of high socio-economic level for relations between variables.

The calculation of χ^2 indicated that there was no uniformity among parameters 1) access to information through the Internet and garbage bags produced per day, 2) knowing and using recyclable packaging, 3) socio-economic level and reuse of plastic packaging; 4) socio-economic level and separation of garbage, 5) Internet access and destination given to batteries, however, the null hypothesis was accepted for 1) relationship between socioeconomic status, and children enrolled in schools, and 2) relationship between socioeconomic status and access to the Internet (Table 2).

DISCUSSION

Through Table 2, analysis number 4, it could be observed that there was homogeneity among the parameters owning or not a car and what kind of school that their children study. These parameters are indicators of high socio-economic level and any of them could be used to examine relationships among responses; however, the fact that the families may not have any children can interfere in the analysis; therefore, owning a car is the parameter that best indicates the socio-economic level of the population under study.

The homogeneity between owing or not a car or access to internet (which means to have fast and easy access to information), means, in this study, that high socio-economic status, access to information and good cultural level (majority of children enrolled in private schools) co-exist in most of the population studied.

Furthermore, heterogeneity was observed from relations, on the one hand, owning a car, access to information and high socio-cultural level and on the other hand, the reuse of packaging of purchased products, separation of

garbage, transportation of packaging for recycling and destination of the batteries, data that indicate that access to information and good socio-cultural level do not seem to sensitize citizens from this sampling about the increasing volume of waste they produce (Table 2).

This analysis putatively indicates little compromise between knowing and doing in this population because, according to Gazzinelli et al. (2001), it is required that the citizen understands that he, at his home, is responsible for reducing the volume of waste generated.

According to Adamns (2004), it is necessary to work issues related to waste production in a systemic and complex approach, aiming to educate the population to reduce the consumption of manufactured products, giving preference to natural products, which was not observed in this study.

The data from this study corroborate the reports (Santos, 2000) that for the individual, in general, garbage is not a problem because he believes that society will give it the ultimate solution when the pickup truck collects the waste that he generated, being exempted from social responsibilities.

This fact was more accurately verified in Table 1, parameter XIV, which respondents consider that the garbage collection system of Anápolis is efficient, because for most, the fact that the pickup truck passes every day on time is enough, according to participants in the interviews.

The concept of efficiency is below what is expected from people sensitive to environmental problems arising from the waste production.

However, the majority of respondents said they would find good if Anápolis had a selective garbage collection system (Table 1).

Another aggravating fact in terms of EE is the relationship between destination given to batteries and level of information (Table 2), because a population with greater capacity for consuming goods, such as the neighborhood studied, also consume and have many electric and electronic products that use batteries.

Thus, if the consumer population of specific goods does not deal adequately its consumer products, the

ethical value of this population is below the minimum requirements of responsible citizenship, for there is legislation on the disposal of batteries and cells (Brasil, 1999a,b), which text indicates that batteries made with lead, cadmium, mercury, necessary for the operation of any type of appliances, vehicles, mobile or fixed systems, as well as electric and electronic products containing non-replaceable batteries in their structure, after energy depletion, should be delivered by users back where they were bought or to the technical assistance network authorized by their respective industries. Cells and batteries with up to 0.010% by weight of mercury, when they are zinc-manganese and alkaline-manganese type, up to 0.015% by weight of cadmium, when they are alkaline-manganese and zinc-manganese type, up to 0.200% by weight of lead, when they are alkaline-manganese and zinc-manganese type, up to 25 mg of mercury per cell, when they are miniatures and button type batteries, may be disposed together with household waste in licensed landfills.

Although not all the cells present the same toxicity degree on health and environmental terms, Reidle and Gunther (2002) indicate the need to update the existing legislation to ensure that all batteries are collected and treated.

It is also critical that people understand that:

"(...) one thing is to be aware of the problems; another thing is to pay higher values or to change the basic lifestyle. The

consumer must be convinced that when he purchases goods, he is in fact exercising a social, political and moral responsibility that goes beyond his individual interests. (...). We live today not just in an environment of market economy, but in a 'market society' in which values such as solidarity, social participation, equality and pursuit of collective welfare are worn and have been replaced by individualism and consumerism". (Lazzarini and Gunn, 2002).

Among the reasons for finding absurdity in human behavior towards the environment, is that inequality can lead to irrational consumption, waste on the one hand, and, on the other, personal frustrations and violence that may result from the inability to participate in this consumerism (Sodré, 1998 *apud* Lazzarini and Gunn, 2002).

In the case of the population studied, it seems that the waste prevails, because, according to data obtained, this population has high purchasing power which would decrease the likelihood of personal frustrations; however, the strength of the media and globalization that shows how people live in developed countries can explain some kind of social unrest in developing countries.

Thus, it is a matter of educating for changing, and for that, one must take into account the relationships of

social, environmental, political, and economical and domination areas (Tozoni-Reis, 2007).

It is considered that the EE itself "will not solve the complex global environmental problems" (Reigota, 2001), however, it may be useful by educating concerned citizens, participatory and critical in relation to the environment.

EE should be understood as a global necessary good in view to ensuring that men are agents of change, transformation and political participation and critical citizens, in order to consolidate "(...) democracy, the solution of environmental problems and a better quality of life for all." (Reigota 2001).

Thus, it is therefore an education for citizenship.

Education is the foundation of EE associated with pedagogical practices (Marpica and Logarezzi, 2010) to be developed at all stages of education, however, EE should not be based only on education, but also on the values of society, which are naturally present in life as it is not indifferent to the environment, and because life in society, the assessment process involves the construction of rules for practical action for the maintenance, integrity and development of the society as a whole (Bonotto and Semperebone, 2010).

It is important to develop educational activities in the cognitive, affective and practical areas to improve the possibilities for effective individual learning of a given value, in this case the environmental awareness (Bonotto, 2008), and Janke and Tozoni-Reis (2008), observed in a study on quality of life and EE in a participatory action research, that it highlights the possibility and importance of partnership between the academic knowledge (which emerges from the research institution) and community knowledge (which emerges from the reality studied).

Therefore, studies on how the population understands the nature and deals with it is also an analysis of values, inserted in the current ethical and moral contexts.

Based on results obtained, it could be considered that the population under study lacks of educational, moral and ethical values in relation to the environment, especially in relation to other countries like Japan, where the separation of garbage is mandatory and selective collection occurs in all provinces.

The activities of separating waste in Japan for selective collection requires handbook. In some cities like Yokohama, there are ten types of waste separation; Hiroshima has eight, and the weekly collection has specific days for the various wastes (Manzini, 2008).

The result is clean streets and objects such as paper, plastics and recycled bottles are used every day by the population. The mandatory garbage separation and selective collection results in decreased waste production per household, decreases consumerism (exception to the

fact that Japan is a major consumer), increases the consumption of disposable materials, creates jobs for people in recycling industries, and reduces the transmission of diseases.

This whole process is necessary for the little space available in Japan, therefore, the "culture of recycling" was created a few decades ago (Manzini, 2008), which is taught in schools from early age.

Those who do not want to separate garbage have to pay high fines, which reduces non-compliance with the law, and this procedure does not transform, by itself, the Japanese in ethical and moral people in relation to the environment, but the law enforcement by fees, social insistence and the fact that if the garbage is not placed for collection on the correct days, the person will have to keep it at home, which are procedures which effectively and actively worked out, besides the fact that if the population mostly did not cooperate, perhaps the design of the "culture of recycling" was not working in that country.

A Brazilian student who lives and studies in Japan reports that some Brazilian people who live in this country insist on not separating the garbage, they rather pay fines, like some Japanese.

In this study, since the neighborhood in question has economic and social characteristics equivalent to developed countries, the comparison is suitable and indicates that the application of fines and a selective collection service could assist in preserving the environment and provide greater visibility to EE, because if rules on production and garbage collection have been adequately written and proposed so that to generate public interest, it would already be a favorable propaganda.

Then, in Brazil, it would be necessary to initiate a recycling culture with the aid of the general population, governors, teachers and even the writers of textbooks, because according Marpica and Logarezzi (2010), textbooks have several weaknesses as a tool support for environmental education in schools, especially in the context of practical activities.

In particular, the books of the last grades of the elementary school present predominance of anthropocentric aspects, with utilitarian appreciation of nature, with epistemological overvaluation over other forms of knowledge, individualism over the collective (Bonotto and Semprebone, 2010).

In the educational context, teachers play a central role in theoretical and practical knowledge about EE, but they need to be aware and well trained. This need finds evaluative barriers, according to Cinquetti and Carvalho (2004), who observed teachers not much worried about environmental issues even taking a course on environmental education, whereas only the theory about

EE is equivalent to EE itself.

Moreover, actions taken by some groups have demonstrated that developing interesting and responsible activities for students in relation to EE with the effective participation of the community and teachers, good results are obtained, including improved learning (Cerati and Lazarini, 2009), because

"Although not restricted to the school community or to formal education, it is as a teaching resource that studying the environment is valued, due to the impressive results - for it gives quality - in the teaching-learning, interpersonal and intrapersonal relations. The perception of the daily life, the social, cultural, historical reality, the natural and physical environment was and still is crucial in the formation of independent and committed citizen, and must be a constant practice to guide societies in the "era of knowledge" towards the construction of knowledge for socio-environmental sustainability and improved quality of life." (Lestinge and Sorrentino, 2008).

There are only few studies on public perceptions associating EE and garbage in Brazil, so that the sample studied here is representative of the behavior of a population as heterogeneous as the Brazilian population, but the observed data indicate a worrying situation with regard to how people are treating themselves, the society, and how education is preparing individuals for the future, and finally, how environmental education fits in this context.

In conclusion, the facts indicate that the population sample studied does not adequately deal with the garbage and has no actual knowledge on EE in behavioral terms.

REFERENCES

- Adamns BG (2004). O lixo numa abordagem educacional mais complexa. *Educação Ambiental em Ação* 8-2004/II <http://www.revistaea.arvore.com.br> retrieved: 15.08.2005.
- Bonotto DMB (2008). Contribuições para o trabalho com valores em educação ambiental. *Ciência and Educação* 14: 295-306.
- Bonotto DMB, Semprebone A (2010). Educação ambiental e educação em valores em livros didáticos de ciências naturais. *Ciência and Educação* 16: 131-148.
- Braga B, Hespanhol I, Mierzwa JC, Barros MTL, Spencer M, Porto M, Nucci N, Juliano N, Eiger S (2004). *Introdução à engenharia ambiental*. Prentice Hall: São Paulo, SP.
- Brasil (1999). Conselho Nacional do Meio Ambiente. Resolução No 263, de 12 de novembro de 1999 www.cprh.pe.gov.br/downloads/263de12denovembrode1999.doc retrieved: 02.02.2012.
- Brasil (1999). Conselho Nacional do Meio Ambiente. Resolução Nº 257, de 30 de junho de 1999 http://www.mp.ba.gov.br/atuacao/ceama/material/legislacoes/resolucoes/resolucao_CONAMA_257_1999.pdf. retrieved: 02.02.2012.
- Centeno AJ (1982). *Curso de estatística aplicada à biologia*. Editora da Universidade de Goiás: Goiânia, GO.
- Cerati TM, Lazarini RAM (2009). A pesquisa-ação em educação ambiental: uma experiência no entorno de uma unidade de

- conservação urbana. *Ciência and Educação* 15: 383-392.
- Cinquetti HCS, Carvalho LM (2004). As dimensões dos valores e da participação política em projetos de professoras: abordagens sobre os resíduos sólidos. *Ciência and Educação* 10: 161-171.
- Cortella MS (2006). *A Escola e o Conhecimento: fundamentos epistemológicos e políticos*. 10ª ed. Cortez-Instituto Paulo Freire: São Paulo, SP.
- Gazzinelli MF, Lopes A, Pereira W, Gazzinelli A (2001). Educação e participação dos atores sociais no desenvolvimento de modelo de gestão ambiental do lixo em zona rural em minas Gerais. *Educação and Sociedade* 22:225-241.
- Grün M (2007). *Ética e Educação Ambiental: A Conexão Necessária*. 11ª ed. Papirus: Campinas, SP.
- Janke N, Tozoni-Reis MFC (2008). Produção coletiva de conhecimentos sobre qualidade de vida: por uma educação ambiental participativa e emancipatória. *Ciência and Educação* 14: 147-157.
- Lazzarini M, Gunn L (2002). Produção e consumo sustentáveis. Artigo-base sobre produção e consumo sustentáveis. In: Camargo A, Capobianco JPR, Oliveira JAP. *Meio-ambiente Brasil: avanços e obstáculos pós-Rio-92*. Fundação Getúlio Vargas: Rio de Janeiro, RJ, 413-449.
- Leff E (2002). *Epistemologia ambiental*. 2ª ed. Cortez: São Paulo, SP.
- Lestinge S, Sorrentino M (2008). As contribuições a partir do olhar atento: estudos do meio e a educação para a vida. *Ciência and Educação* 14: 601-619.
- Loureiro CFB (2002). Educação ambiental e movimentos sociais na construção da cidadania ecológica e planetária. In: Loureiro CFB, Layrargues PP, Castro RS. *Educação Ambiental: repensando o espaço da cidadania*. Cortez: São Paulo, SP.
- Loureiro CFB (2003). O movimento ambientalista e o pensamento crítico: uma abordagem política. Quartet: Rio de Janeiro, RJ.
- Loureiro CFB (2007). Pensamento crítico, tradição marxista e a questão ambiental: ampliando os debates. In: Loureiro CFB. *A questão ambiental no pensamento crítico: Natureza, Trabalho e Educação*. Quartet: Rio de Janeiro, RJ, 13-67.
- Lovelock JE (1987). Gaia – Um modelo para a dinâmica planetária e celular. In: THOMPSON, W. I. *Gaia: uma teoria do conhecimento*. Gaia: São Paulo, SP.
- Lüdke M, André MED (1986). *A Pesquisa em Educação: Abordagens Qualitativas*. Editora Pedagógica e Universitária LTDA: São Paulo, SP.
- Lutzenberger J (1990). *Gaia, o planeta vivo*. LandPM: Porto Alegre, RS.
- Manzini G (2008). No Japão, colocar lixo na rua requer manual de instruções. *Folha.com*. <http://www1.folhaol.com.br/folha/cotidiano/ult95u375012.shtml> retrieved: 24.08.2010.
- Marpica NS, Logarezzi AJM (2010). Um panorama das pesquisas sobre livro didático e educação ambiental. *Ciência and Educação* 16:115-130.
- Philippe-Júnior A, Bruna GC, Roméro MA (2004). *Curso de gestão ambiental*. Manole: Barueri, SP.
- Reidler NMVL, Gunther WMR (2002). Impactos sanitários e ambientais devido aos resíduos gerados por pilhas e baterias usadas. XXVIII Congresso Interamericano de Ingeniería Sanitaria y Ambiental. <http://www.cepis.ops-oms.org/bvsaidis/iii-117.pdf>. retrieved: 20.08.2010. México.
- Reigota M (2001). *O que é educação ambiental*. Col. Primeiros Passos. Brasiliense: São Paulo, SP.
- Santos LC (2000). *Os caminhos do lixo em Campo Grande: disposição dos resíduos sólidos na organização do espaço urbano*. UCDB: Campo Grande, MS.
- Tozoni-Reis MFC (2007). Contribuições para uma pedagogia crítica na educação ambiental: reflexões teóricas. In: Loureiro CFB. *A questão ambiental no pensamento crítico: Natureza, Trabalho e Educação*. Quartet: Rio de Janeiro, RJ.
- Triola FM (1999). *Introdução a estatística*. LCT: Rio de Janeiro, RJ.