

Positioning of Environmental Education in Life Sciences (Grade 12)

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ABSTRACT

The purpose of this paper is to explore the positioning of environmental education in the Life Sciences policy documents and examinations in Grade 12. This paper is premised on the Margaret Archers Realist Social Theory as theoretical framework. This paper adopted a qualitative research approach, using content analysis to explore the coverage of environmental impact topics in Life Sciences as a subject. Through document analysis, this paper uses the purposive sampling method to select Life Sciences as a subject to review. Inclusion and exclusion criteria were used for sampling the documents. The findings of the paper suggest that positioning of environmental impact topics in the policy is aligned with the practice of the examinations. Furthermore, this study revealed that most of the environmental impact topics outlined in CAPS are not covered in the exit level examinations. This paper recommends that further studies be conducted to find the exploration of the alignment of environmental impact topics in other core subjects in Grade 12.

Key words : Environmental education, Realist Social Theory, CAPS, Life Sciences, Environmental impact topics

Introduction

The purpose of this paper is to explore the positioning of environmental education in Further Education and Training (FET), specifically in Grade 12. The Department of Basic Education (2016) states that the National Curriculum Statement Grades R-12 gives expression to the knowledge, skills and values worth learning in South African schools. According to the Department of Basic Education (DBE), this curriculum aims to ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. In this regard, the curriculum promotes knowledge in local contexts, while being sensitive to its global significance. The paper investigates the exploration of Life Sciences in policy document and Grade 12 exit-level examination coverage of environmental impact top-

ics between 2012 and 2015, which is characterised by the decade of education for sustainable development.

Importantly, it can be noted that environmental education (EE) and education for sustainability development (ESD) are educational responses to negative environmental impacts locally and globally based on the scourge of environmental degradation. The education sector has experienced several shifts in the curriculum since 1994, affecting the coverage, teaching and examination of environmental impact topics in the South African (FET) phase. These effects might have profound consequences for curriculum delivery, which culminates in a negative impact on the fight against pollution, climate change, deforestation, desertification and loss of biodiversity. It is in this regard that Hill, Alan and Woodland (2006) contend that in the global environ-

ment, nature is seen as a provider of natural resources that are critical to satisfy human needs.

This view of nature as a resource is implicit in the definition of sustainable development of the World Commission on Environment and Development (WCED), now called the Brundtland Commission, which focuses on the present and future needs of humankind (World Commission on Environment and Development 1987). In support of sustainable development and alleviation of environmental problems, this paper aims at exploring environmental impact topics in the curriculum on aspects such as coverage in the policy and exit-level examination.

Moreover, since the First Industrial Revolution, the rapid development of society has resulted in many global environmental problems such as global warming; a rise in sea levels; ozone depletion; air and water pollution; land degradation; and destruction of wetlands and deforestation (Dunnette and O'Brien, 1992; Kupchella, 1992; Xu, 2015). These environmental problems outlined above can be partially dealt with by using a curriculum that includes a consideration of environmental impact topics in the curriculum. Against this background, the protection of the global resources of land, fresh water and marine biological and genetic resources and energy must be of paramount importance (Sitarz 1994). The most remarkable change recently is the shift between developed and developing worlds in a competition for status of the most polluting nation. Xu (2015) reveals that the UN Climate Change report, 2013 shows that the earth's temperature increased by 0.85 degrees Celsius in the period from 1818 to 2012; and the past three decades (1990 – 2015) was the warmest in the past 1400 years.

In this paper, the researcher refers to environmental impact topics to topics such as ozone depletion, global warming, energy consumption, acid rain, air pollution, marine pollution, mineral resource depletion, soil destruction, soil erosion and desertification. Furthermore, environmental impact topics are not limited to biodiversity reduction; extinction of plants and animals; nuclear reactors and waste disposal; human health and diseases; world hunger; land use; solid waste disposal; hazardous chemicals; habitat destruction; invasive species; water quality and wildlife management. According to Department of Basic Education (DBE 2016), the National Curriculum Statement Grades R-12 (NCS) stipulates policy on curriculum and assessment in the schooling fraternity. To improve implementa-

tion, the National Curriculum Statement was amended and the amendments came into effect in January 2012 (DBE 2016). These amendments led to the development of a single comprehensive Curriculum and Assessment Policy Statement (CAPS) for each subject to replace Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R-12 (DBE 2016). It is also against this background that this paper explores the coverage of environmental impact topics in Life Sciences in the beginning of CAPS from 2012 to 2015.

Problem statement

The paradigm shifts in the curriculum since 1994 in South Africa have resulted in problems associated with the integration of environmental impact topics in the new curriculum (CAPS) by educators. These environmental impacts have negative implications in global proportions such as climate change, solid waste accumulation and so forth. Le Grange (2013) argues that the new language of education involves risk and the risk is magnified when the environment is put in the equation. According to Le Grange, environmental problems are complex and today's solutions could become tomorrow's problems. The modern era has brought about human civilization that has resulted in an imbalance between natural resource utilisation and its sustenance on earth. Le Grange (2013) argues that the previous South African curriculum, the Revised National Curriculum Statements, did not have environment as key component but created space to facilitate EE processes. Although this exclusion may be true, it is important to explore the coverage the alignment of environmental topics in the post 2011 on FET documents.

Review of literature

Environmental Education (EE) is a programme that promotes and advocates the efficient usage of natural resources and prevention of natural resource degradation. It is also the process of recognising values and clarifying concepts to develop skills and attitudes that are necessary for understanding and appreciating the interrelatedness among people, their culture and biophysical surroundings (Taylor, Littledyke, Eames and Coll 2009). Puja Mondal Environment (2016:1) explains that EE is focussed on aspects of human behaviour "which are more di-

rectly related to man's interaction with bio-physical environment and his ability to understand this interaction". Hattingh (2014) outlines one of the outcomes of EE as the ability to recognise and evaluate those values that inform our attitudes and actions towards the environment. He further describes environmental philosophy as a field of theoretical reflection in which this value is made explicit, systematically studied and critically evaluated in terms of certain ethical standards. In contrast to Taylor's *et al.*, Di Chiro (2014:9) posits that EE is sometimes criticised for the components included in the curriculum. Moreover, Le Roux (2014) sees EE research as seeking to extend knowledge where research conducted for this purpose is driven by curiosity. He describes this type of research as one that shows the natural world how it works and the interrelationship between the various elements of the natural world. Hattingh (2014) argues that EE properly understood is ineluctably holistic in the sense that its ultimate concern must be with understanding our place in the cosmos and the proper character of our participation in it, specifically in its dimension. Bonnet (2013), furthermore, highlights that it is important to identify the ways in which science, social policies and practices are implicated in the degradation of the environment.

EE is linked to education for sustainable development through its focus on positive environmental impacts. Its objective, according to Tilbury *et al.* (2003), includes the promotion of values and ethics at different levels to make an impact on people's lifestyles and behaviours and to help build a sustainable future. Furthermore, environmental impacts study is an education process designed to motivate, equip and involve individuals and social groups in reflecting on how they currently live and work and in making an informed decision, thereby creating ways to work towards a more environmentally conducive world (Tilbury *et al.*, 2003). Irwin and Lotz-Sisitka (2005), when conceptualising the history of EE in South Africa, note that there were contemporary forms where EE reached the country in the mid-1970s stimulated by the Belgrade Charter of 1975 and the Tbilisi Principles of 1977. They note that prior to the Belgrade Charter, the Tbilisi Principles, EE was about soil erosion and it was termed "conservation education" until the late 1970s. Conservation education was later subsumed in EE and it now forms an important component in the broader field of EE (Irwin and Lotz-Sisitka, 2005).

The authors reveal that the development of EE in South Africa has been met with resistance and debates about philosophical assumptions of the individuals debating the ideas. The ideas of EE and constructive debates in a conference on outdoor education held in Pretoria in 1980 had an impact on the hosting of the first large conference on EE in South Africa in 1982 that took place at Treverton College, Mooi River in KwaZulu Natal (Irwin and Lotz-Sisitka, 2005).

Aims of the South African curriculum and its linkage to EE and environmental impact topics coverage

The National Curriculum Statement Grades R-12 gives expression to the knowledge, skills and values worth learning in South African schools. This curriculum aims to ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. The curriculum ensures that learners acquire the basic skills and knowledge of environmental impacts, which affect all creatures that benefit from nature. In this regard, the curriculum promotes knowledge in local contexts, while being sensitive to global imperatives such as global warming, deforestation, pollution and so forth.

According to (DBE 2014:4) the Life Sciences National Curriculum Statement Grades R-12 serves the purposes of:

- "equipping learners, irrespective of their socio-economic background, race, gender, physical ability or intellectual ability, with the knowledge, skills and values necessary for self-fulfilment, and meaningful participation in society as citizens of a free country;
- providing access to higher education for an example knowledge of the environment;
- facilitating the transition of learners from education institutions to the workplace; and providing employers with a sufficient profile of a learner's competences".

Aim of the study

The aim of this paper is to explore the alignment of the coverage of environmental impact topics between the CAPS FET documents and examinations.

Objective of this study

- To explore coverage of environmental impact topics in the Life Sciences FET curriculum.
- To find whether there is alignment of policy

with the actual practice in the form of examinations in the FET curriculum for Life sciences.

Research questions

- What extent environmental impact topics are being covered in the Life Sciences FET curriculum?
- Is there any alignment between policy and actual coverage of environmental impact topics in the Life Sciences FET curriculum?

Theoretical Framework

This paper uses the Realist Social Theory (RST) as a theoretical framework. This theory emerged from the field of RST, primarily from the contribution of Archer (1995). RST assists in structuring the general idea of understanding and interpretation by defining and organising the key concepts within this paper. RST views reality as complex and recognises the role played by structure, culture and agency to foster relations through mechanisms that influence human behaviour. It therefore also incorporates the approach of critical realism (Bhaskar, 2008). Given (2008) reveals, that realist theory conceives three realms of reality: the actual, the real and the empirical. The actual domain refers to events and outcomes that occur in the world. The real domain refers to the underlying relations, structures and tendencies that have the power to cause changes in the actual realm. The empirical domain refers to individual perspectives of reality. These three domains are seen to be significant in the context of this study since it explores the coverage of environmental impact topics in the FET curriculum. De Souza (2013) noted that the aspect of structure in a context comprises emergent and internally related properties without which public institutions and organisations could not exist. Structure has various components, namely, roles, positions, practices, resources and processes. In support of her statement above, Archer (1995) writes that autonomy is also temporal in the sense that such structural properties neither are the creation of contemporary actors nor are they ontologically reducible to raw resources; they are dependent on current human interactions with the environment instead. She contends that realism is achieved when properties identified at different levels or strata are real and causally powerful. Bhaskar (2008) supports Archer's notion that reality is constituted on a range of levels or strata, incorporating

structures and mechanisms that bring about the events that influence our experiences. She further posits that realist theory reflects an analysis of properties between the micro and macro level. In this study, the focus is on the micro level where the structure is the curriculum that is analysed by exploring environmental impact topics.

Methodology

This section discusses methodology underpinning this paper, which comprises research approach, research design, study sample, instruments and data analysis techniques.

Research approach

This paper employed a qualitative research approach in the document analysis. On one hand Macmillan and Schumacher (2010) summarise the major characteristics of qualitative research as a natural setting, rich description, process orientation, inductive logic, participant's perspective, emergent design, context sensitivity, direct data collection and complexity. On the other hand, Johnson and Christensen (2008) believe that qualitative research can be used to describe what is seen and to come out with or generate new theories.

Research design

MacMillan and Schumacher (2010) state that research design describes the way in which we conduct a study, including when, from whom and under what conditions the data will be obtained. The research design for this paper was document analysis. According to Bowen (2009), document analysis is a systematic procedure for reviewing or evaluating documents, both printed and electronic material. Document analysis was used in the paper because it is less time-consuming and the documents are in the public domain, especially since the advent of internet (Bowen, 2009). DBE documents were used as source of data in this paper.

Document sources and sampling

The Curriculum and Assessment Policy Statement (CAPS), past examination papers for Life Sciences were used as sources for this paper. This paper concentrated on the first four years after the change of the curriculum from old NCS to CAPS. These documents were sampled from the Department of Basic Education where written text was analysed to ex-

plore environmental impact coverage in the FET phase in Life Sciences. Inclusionary and exclusionary criteria were used as sampling technique whereby essential documents were identified and irrelevant documents excluded. Among the criteria used was the age of the documents used – four years after the inclusion of CAPS. Frey (2018) contends that once both inclusion and exclusion criteria have been applied, the resulting documents will comprise the final sample. A rubric was used a data collection instrument.

Data analysis techniques

Data were sourced from documents based on key environmental impact topics text written in the introductory section of this paper. The analytical procedure in this paper entails finding, selecting, appraising and synthesising data contained in documents (Bowen 2009). This paper analyses data by examining information collected from different methods, where the researcher was able to corroborate findings across data sets and reduce the impact of biases that exist in a single study. This paper corroborates findings based on Life Sciences policy documents and examination papers used by teachers in teaching environmental impact topics in the classroom. Content analysis was used in this paper, since information was organised into categories related to the central purpose of research. These processes involved skimming, reading and interpretation (Bowen, 2009 and Frey, 2018).

Validity and reliability

To ensure validity and reliability of the documents used, the researcher used different sources of data and the analyses were based on different consecutive years from 2012 to 2015. The documents that were analysed are used by the Department of Basic Education as policy guidelines and assessment for learners.

Findings

Coverage of environmental impact topics in the CAPS policy document

The paper found that in the CAPS curriculum Life Sciences have a section that stipulates incorporation of environmental content. One of the general principles for all subjects is that:

Human rights, inclusivity, environmental and

social justice: infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. The National Curriculum Statement Grades R-12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors (DBE 2016:5)

In order to support the infusion of environmental impact topics in all the subjects in the CAPS curriculum, the National Curriculum Statement Grades R-12 aims to produce learners that are able to use science and technology effectively and critically show responsibility towards the environment and the health of others. It is on this principle and aim that this paper purposefully selected Life Sciences as a subject to be analysed since it is classified as a core subject in the FET band by the DBE.

In addition, the CAPS document for Life Sciences stipulates the actual mark allocation of environmental impact topics in the Grade 12 final examination. The 25 marks allocated for environmental impact topics represent 8% of the total mark composition of the paper, as shown in Table 1 below. Table 1 shows that the Life Sciences policy allocates about 2.5 weeks for teaching environmental impact topics.

Exploration of environmental impact topics in Grade 12 exit-level examinations

The findings also show that in the exit-level examination (Grade 12), Life Sciences had an average of about 8.8% coverage of environmental impact topics, as indicated in Table 2 below.

CAPS replaced the old NCS, which was used for the last time in 2014 in Grade 12. Table 2 also shows that 2013 had the highest coverage on environmental impact topics and 2014 the least coverage.

Table 2 shows the actual coverage of environmental impact topics in the exit level examination in Life Sciences Grade 12. These findings in Table 2 is fully aligned to the percentage coverage of environmental impact topics between 2012 and 2015. In 2012, only two topics were covered which were loss of biodiversity and desertification. In 2013, three topics were covered and these were invasion of alien species, effects of mining on quality of water and carbon monoxide emissions. In 2014 and 2015 this study showed that five topics were covered, which are loss of biodiversity, global warming, alien plant invasion, food wastage and poor farm practices.

Discussion of Findings

Exploration of environmental impact topics in the CAPS document

The findings of this paper show that the CAPS policy documents conform to the RST theoretical framework based on structure, culture, agency and relations. The CAPS policy is structured according to the previous curriculum but also updates it and aims to provide clearer specification of what is to be taught and learnt on a term-by-term basis. Teachers and learners act as change agents in the learning process. The CAPS policy documents stipulate what is to be learnt in different subjects of the curriculum. The teachers and learner's ideas, theories, beliefs, values and arguments about the subject represent the culture of teaching and learning. The researcher has noted that the clearly stated marks that need to be allocated for environmental impact topics make the examiners work easier because they would know how much content of environmental impact topics to be included in the exit-level examinations. This seems to be the desired way of ensuring that education policy is implemented in assessment, such as examinations to ensure alignment of policy and practice as shown in Table 1 and 2.

Exploration of environmental impact topics in Grade 12 exit-level examinations

The October/November examination papers for

Life Sciences were scrutinised for evidence of environmental impact topics, as stipulated by the curriculum policy. As shown in Table 2, the average from 2012 to 2015 was about 8.8%. The findings show that the policy played an important role in ensuring that the breadth of content coverage of environmental impact topics is aligned to practice (examinations). It appears that the alignment of the coverage is likely to influence teachers and learners to have in-depth knowledge of environmental impact topics in their livelihood. The constant coverage of environmental impact topics in the examination, as seen in Table 2, have a positive effect on the way teachers prepare learners for exit-level examination. It seems that the alignment of examination papers to policy helps agency, such as teachers and learners, to know what to expect in the exit-level examination in terms of the depth of environmental impact topics coverage in the curriculum. Additionally, alignment of policy and practice ensures that the 17 sustainable development goals would be realised. See Figure 1 below for environmental impact topics in one of the CAPS Life Sciences exit-level examinations. This paper also revealed that environmental impact topics such as loss of biodiversity, poaching and alien plants invasions appears to be covered repeatedly between 2012 and 2015. Table 3 analysis also showed that a combination of eight environmental impact topics were covered between 2012 and 2015. However, topics such

Table 1. Coverage of environmental impact topics in CAPS policy

	Life Sciences
Total number of topics	12
Total number of environmental impact topics	1
Tuition time allocation for all the topics in the exams (weeks)	28
Time allocation for environmental impact topics (weeks)	2.5
Percentage time allocation of environmental impact topics (%)	9
Mark allocation of environmental impact topics	25 marks out of 300
Percentage coverage in the examination of environmental impact topics	8%

Source: Author

Table 2. Actual percentage coverage of environmental impact topics in the exit-level examinations

YEAR	LIFE SCIENCES			
	Examination exit-level years			
	2012	2013	2014	2015
Marks allocated out of 300	31	33	19	23
Percentage coverage	10%	11%	6%	8%
Average coverage (RNCS vs CAPS)	8.8%			

Source: Author

as deforestation, reduction of carbon footprint, droughts and floods, methane emissions, ozone depletion, destruction of wetlands, borehole effects on aquifers, water pollution and solid waste disposal were not covered at all between 2012 and 2015.

Alignment amongst the CAPS policy projections and the exit level examinations

RST is evident in the way examination papers are aligned with the CAPS policy projections. The structure of the CAPS policy in terms of content coverage influences the structure of the content of environmental impact topics in the examinations. Importantly, the Life Sciences policy document shows coverage of about 8% of environmental impact topics when compared to an average of 8.8 % actual examinations in the CAPS curriculum. The findings of Life Sciences show an insignificant difference of less than 1%; and generally, this paper concludes that in Life Sciences the CAPS policy projections and the actual examinations in the new curriculum from 2012 to 2015 were aligned. It is important to mention that the CAPS policy projections in Life Sciences specifically mention the number of marks

that must be allocated to the topic in the exit-level examinations. Based on the alignment, it can be concluded that specifying the breadth of content coverage in the examinations also helps the examiners to fully adhere to the policy projections. In addition, the teachers and learners will be better prepared in teaching and learning process, knowing that the components of environmental impact topics will be examined in the exit-level examinations. In contrast to the alignment, this paper found that some envi-

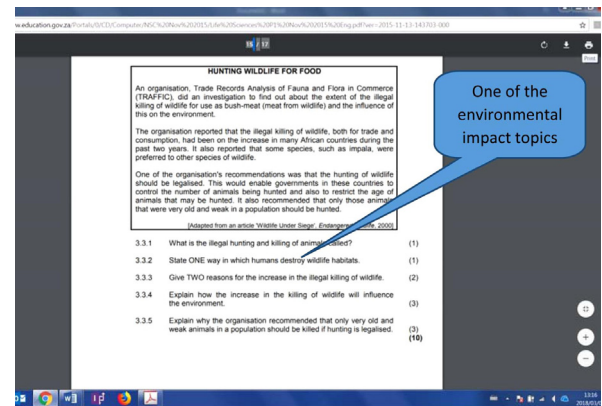


Fig. 1. Life Sciences (Paper 1) October/November 2015
Source: (DBE 2016)

Table 3. Actual environmental impact topics coverage in the exit level examinations

Environmental impact topics covered in Grade 12 CAPS policy document	2012	2013	2014	2015
Carbon dioxide emissions		X		
Reduce carbon footprint				
Deforestation				
Greenhouse effect and global warming			X	
Desertification	X			
Droughts and floods				
Methane emissions				
Ozone depletion				
Construction of dams				
Destruction of wetlands				
Poor farming practices				X
Exotic plantations and depletion of water table				
Boreholes and effects on aquifers				
Water wastage and quality				
Water pollution				
Effects of mining on quality of water		X		
Thermal pollution, water purification and recycling				
Loss of wild varieties				
Food wastage				X
Loss of biodiversity	X		X	
Poaching, alien plants invasions		X		X
Indigenous knowledge systems				
Solid waste disposal				
Safe disposal of nuclear waste				

ronmental impact topics that are stipulated in the policy are not covered in the examination between 2012 and 2015. This raises a concern in where teachers might feel that these topics are less important which can result in those topics being ignored by teachers when teaching Life Sciences.

Possible impact of documents as a structure to teaching and learning

This paper can assume that that a teacher, as an agent of change in the classroom, are not only using past examination papers in the learning process but also use examination guidelines as one of the documents that influence successful teaching and learning of environmental impact topics in the school. For example, teachers have the teaching experience they have accumulated in the school environment to know which topics will be set for examinations and more emphasis is focused on those topics. It would appear that the documents play an important role in the teaching and learning structure of the learning process. Mustam and Daniel (2016) contend that the integration of environmental impact topics in Malaysia is done in subjects such as Geography, English, Bahasa Malaysia (national language) and Science. Studies of integration of those subjects reveal that knowledge among learners is high and the major shortfall is the teachers' poor implementation of the EE curriculum as their approaches did not live up to expectations since the focus was on preparing the students for the national examinations. In contrast to the findings of their research, this paper found that the CAPS curriculum is loaded with content that needs to be completed before learners sit for the examinations and Life Sciences ensures that about 8% of environmental impact topics is examinable.

Conclusion and Recommendations

The paper revealed that in Life Sciences there was a difference of less than 1% between policy coverage and exit level examinations and this shows that the CAPS policy coverage and the examination papers are aligned. It would appear that the CAPS covered many aspects and provided details of what to teach in each term with all topics to be covered as shown in Table 3. EE, as a structure, which is shaped by the design of curriculum content, the assessment and the way in which the teachers teach the content to learners. Structure also influences the roles that the

teachers and learners take on in the classroom, educational practices and the processes they engage in when they are teaching and learning environmental impact topics in the CAPS curriculum. This paper showed that most of the environmental impact topics stipulated in the policy documents are not covered in the examinations. This omission could not affect the breadth of the coverage of the topics when the researcher compared the policy and the actual practice in the examination. Implications that can be drawn from this paper are that the policy and practice in Life Sciences are aligned which seems to improve content knowledge of the subject. This paper recommends that further studies be conducted to find the exploration of environmental impact topics in all core subjects in Grade 12 since this paper was limited to one subject where analysis focused between 2012 and 2015.

References

- Archer, M.S. 1995. *Realist Social Theory: The Morphogenetic Approach*. New York: Cambridge University Press.
- Bhaskar R. 2008. *A realist theory of science*. London: Routledge Taylor & Francis Group.
- Bonnet, M. 2013. Self, environment and education. In: *International Handbook of Research on Environmental Education*, edited by Stevenson et al. New York: American Educational Research Association. 87-92.
- Bowen, G.A. 2009. Document Analysis as a Qualitative Research Method *Qualitative Research Journal*. 9(2) : 27-40 [Online]. Available from <https://doi.org/10.3316/QRJ0902027>
- Department of Basic Education. 2014. *Curriculum assessment policy statements* [Online]. Available from: [http://www.education.gov.za/Curriculum/CurriculumAssessmentPolicyStatements/ta bid/419/Default.aspx](http://www.education.gov.za/Curriculum/CurriculumAssessmentPolicyStatements/ta%20bid/419/Default.aspx). [Accessed 17 September 2014].
- Department of Basic Education. 2016. *CAPS curriculum*. [Online]. Available from: http://www.education.gov.za/Portals/0/CD/National%20Curriculum%20Statements%20and%20Vocational/CAPS%20FE T%20_%20AGRICULTURAL%20SCIENCE%20_%20WEB_1CC4.pdf?ver=2015-01-27-153938-370. [Accessed 8 June 2016].
- De Souza, DE. 2013. *Elaborating the context-mechanism-outcome configuration (CMOC) on realist evaluation: A critical realist perspective*. Sage 19 (2) : 141-154.
- Di-Chiro, G. 2014. Application of a feminist critique to environmental education. *Australian Journal of Environmental Education* 30 (1): 9-16.
- Dunnette, D.A. and O'Brien, R.J. 1992. *The science of global change. The impact of human activities on the environment*. Washington DC: American Chemical Library.

- Frey, B. 2018. *The SAGE encyclopedia of educational research, measurement, and evaluation* (Vols. 1-4). Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781506326139
- Given, LM. 2008. Methodology. In: *The Sage Encyclopedia of Qualitative Research Methods*. [Online]. Available from: <http://methods.sagepub.com>. DOI: <http://dx.doi.org/10.4135/9781412963909.n267> [Accessed 17 November 2016].
- Hattingh, J. 2014. Environmental philosophy and ethics: a critical overview of anthropocentric, ecocentric and radical value positions. In: *Environmental Education and Education for Sustainability. Some South African perspectives, edited by CPLoubser. .* (2nd ed.) Pretoria. Van Schaik, 80–105.
- Hill, J., Alan, T. and Woodland, W. 2006. *Sustainable Development*. Hampshire: Ashgate.
- Irwin, P. and Lotz-Sisitka, H. 2005. History of environmental education in South Africa. In: *Environmental Education. Some South African Perspectives, edited by CP, Loubser* Pretoria. Van Schaik.
- Kupchella, C. 1992. Education of environmental specialists and generalists in American Universities. In: *The Science of Global Change. The Impact of Human Activities on the Environment, edited by Dunnette & O'Brian*. Washington DC: American Chemical Library. 473–480.
- Le Grange, L. 2013. Why we need a language of (environmental) education. In: *International Handbook of Research on Environmental Education, edited by RB, Stevenson et al* New York: American Educational Research Association, 108–114.
- Le Roux, C. 2014. Environmental education research. In: *Environmental Education and Education for Sustainability. Some South African Perspectives, edited by CP Loubser*. (2nd ed.) Pretoria: Van Schaik, 199–224.
- Maraviæ, M., Ivkoviæ, S., Segedinac, M. and Adamov, J. 2014. Serbian school system as a barrier to the development of environmental awareness. *New Educational Review*. 35 (2) : 229-239.
- McMillan, H. and Schumacher, S. 2010. *Research in Education*. (7th ed.) Boston: Pearson.
- Mustam, B. and Daniel, E.S. 2016. Informal and formal environmental education infusion: Actions of Malaysian teachers and parents among students in a polluted area. *Malaysian Online Journal of Educational Science* 4 (1).
- Sitarz, D. 1994. *Agenda 21. The Earth Strategy to Save our Planet*. Boulder: Earth Press.
- Sterling, S. 1995. *Sustainable Education re-visioning Learning and Change*. Dartington: Green Books.
- Taylor, N., Littlelyke, M., Eames, C. and Coll, R.K. (Eds.). 2009. *Environmental Education in Context*. Rotterdam: Sense Publishers.
- Tilbury, D., Goldstein, W. and Ryan, L. 2003. Towards environmental education for sustainable development: The contributions of NGOs in the Asia-Pacific region. *International Review for Environmental Strategies* 4 (1): 59–73.
- World Commission on Environment and Development, 1987. *Our common future* [Online]. Available from: <http://www.un-documents.net/our-common-future.pdf>. [Accessed 07 December 2016].
- Xu, L. 2015. *Impact of climate change and human activity on the eco-environment. An analysis of the Xisha island*. Heidelberg: Springer.