



# Does Formal Environmental Knowledge Inform the Everyday Practices of Senior Secondary Biology Learners in Lesotho?

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## *Abstract*

*This paper explores the link between formal environmental knowledge encapsulated in the University of Cambridge International Examination Curriculum and learners' ability to translate this knowledge into everyday practices in Lesotho. The paper reports on research undertaken in three secondary schools in Lesotho based on an interpretive paradigm. Data was collected through questionnaires, followed by focus group interviews with learners. The findings suggest that learners have sound theoretical knowledge and awareness of environmental problems, but are not action competent with regard to such problems. In the context of this study, formal knowledge therefore does not inform everyday practices. Possible reasons for this may be due to a de-contextualised curriculum and a teaching and learning environment where 'action competence' is not nurtured.*

## *Introduction*

Rapid population growth has put pressure on land and other resources in many parts of Lesotho, resulting in severe environmental degradation (Lesotho Ministry of Finance and Economic Planning, 2005; Lesotho Ministry of Development Planning, 2012). Numerous organisations are engaged in efforts to develop a world population that is environmentally action-competent. Lesotho has joined this endeavour and ratified several environmental protocols. Since education is a vital factor in promoting environmental responsibility, this study focused on the way learners respond to the school curriculum and its implementation in the classroom.

The purpose of the study was to determine whether learners in Lesotho secondary schools make links between their formal environmental knowledge and everyday practices. The study focused on learners in Form D. This is the first year of the senior secondary phase of schooling and the average age of learners in this year is 16. The curriculum for this phase is that of the University of Cambridge International Examination (CIE). The national curriculum of Lesotho, which encapsulates both the local and the CIE curricula, envisages learners with characteristics that would enable them to change the state of the environment in Lesotho. The research questions addressed by this study are:

- What formal environmental knowledge do senior secondary biology learners from three schools in Lesotho acquire from the implemented curriculum?

- How do senior secondary biology learners from three schools in Lesotho use this knowledge to respond to environmental issues?

### *Contextual and Theoretical Framework*

In Lesotho, the inclusion of environmental issues is part of the national curriculum and environmental literacy as a goal of science education is mentioned. Environmental literacy refers to an individual's knowledge about the environment as well as the individual's attitudes toward environmental issues. It emphasises the development of appropriate skills and motivation to work towards the resolution of environmental problems, and active involvement in working towards the maintenance of dynamic equilibrium between the quality of life and quality of the environment (Hsu & Roth, 1998). According to Loubser, Swanepoel and Chacko (2001), environmental literacy is essentially the capacity to perceive and interpret the relative health of environmental systems and to take appropriate action to maintain, restore or improve the health of those systems. Roth and Lee (2002) further note that stewardship of our environment requires knowledge, attitudes and skills which are based on a commitment to shape the world in which we live through thoughtful and active participation. This view of environmental literacy espouses an educational approach that has a strong reflective component. Therefore, it can be said that an environmentally literate person meets the objectives of awareness, knowledge, attitude, skills and participation (Loubser *et al.*, 2001). Cutter (2002) describes three levels of environmental literacy and argues that at the lowest level, everyone has some awareness and understanding of basic relationships in the environment. However, the level of environmental literacy of a person or a society can be dependent on factors such as cultural, social and political context, as well as on education.

While the above objectives are very much part and parcel of most curricula dealing with the environment, the outcomes in terms of what learners have achieved appear to be less successful. Gurevitz (2000) argues that curricula often take a singular approach to the analysis and solving of environmental problems by placing too much emphasis on scientific understanding of environmental issues without considering the importance of engaging in real-life environmental problems. This means that learners often have formal knowledge which is not applicable to everyday life encounters. This mismatch between the intended and the implemented curriculum produces learners who have knowledge but fail to be action-competent. Aikenhead (1996) is also of the view that environmental responsibility is not correlated with knowledge of the environment. What is required is a deeper assimilation of environmental values as learners take ownership of the responsibility towards the environment. Similarly, Hungerford and Volk (1990) argue against the view that making human beings more knowledgeable about the environment and its problems will motivate them to act responsibly.

An increasing body of research points to the importance of learners' socio-cultural knowledge as well as their personal frameworks, which should be linked to formal learning to make learning relevant and to motivate learners (see for example Jegede & Aikenhead, 1999). The use of everyday experiences in science classes to help learners learn scientific ideas is an aspect of contextualisation that has been referred to as a 'context-to-science' teaching and

learning approach (Holman, 1987) and we are of the view that this approach may well be applied to the learning of environmental topics, as well as to enable learners to link their formal environmental knowledge and everyday practices (Stears, Malcolm & Kowlas, 2003).

Environmental learning has been identified as having three dimensions: learning about, learning in and learning for the environment (Cutter, 2002). To provide a holistic approach to environmental learning, all three components should be available through teacher-directed and unguided experiences throughout children's schooling (Hsu & Roth, 1998; Tranter & Malone, 2004). Learning about the environment focuses on key environmental knowledge and understanding of the ecological functioning of the environment (Gough, 2002; Tranter & Malone, 2004). Learning in the environment encourages interactions and experiences in the environment (Hsu & Roth, 1998). This enables learners to develop positive attitudes and values towards stewardship of the environment (Gough, 2002). When learning in the environment, it is envisioned that learners develop sensitivities towards the environment and this fosters values for taking action to conserve the environment (Gough, 2002; Tranter & Malone, 2004).

In education there is often the assumption that the instruction learners receive in the classroom translates into their learning (Hungerford & Volk, 1990). Similarly there is an assumption that learning about environmental issues has the potential to change learners' attitudes and behaviour towards the environment. The approach to environmental education is often focused on behavioural change where children are influenced to change their behaviour in a desired direction (Jensen & Schnack, 1997) without a change in their thinking. However, it has become clear that knowledge does not necessarily lead to behaviour change (Aikenhead, 1996; Gurevitz, 2000). As a result, the behaviour modification model has to a large extent been replaced by the 'action competence' approach where education aims to educate learners who are able to acquire the courage, commitment and desire to become involved in societal issues (Jensen & Schnack, 1997). The 'action competence' approach has gained support for many reasons, some of which are: the opposition to an overly strong emphasis on science knowledge and less on practical application; a realisation that a moralising approach in teaching does not work; and a need for authentic learning instead of simulated learning (Jensen & Schnack, 1997). The fundamental difference between the behaviour modification model and action competence is that a learner who is action competent has made a conscious decision to take action, whereas behaviour modification does not guarantee that any action will be taken (Jensen & Nielsen, 1996). As this study investigated learners' environmental practices, action competence was used as a theoretical frame.

### *Background to the Study*

Previous research found that the intended curriculum of Lesotho recognised and took into account global and national sustainable development aspirations (Molapo, Stears & Dempster, 2012). Unfortunately, guidelines as to how these goals may be achieved are not articulated clearly in the learning outcomes which are meant to clarify how the content in the curriculum should be addressed. This particular structure of the intended curriculum had an impact on the implemented curriculum in that it influenced the way teachers interpreted and implemented the curriculum. Teachers placed a high premium on factual content and were of the opinion

that learners needed knowledge of the environment more than anything else and once they had knowledge, they would be able to act on the various environmental problems they were faced with. They held the belief that taking learners into the environment would make very little or no difference as they are already aware of problems in their environment (Molapo *et al*, 2012). It could therefore be argued that the teachers focus only on learning about the environment (Molapo, *et al*, 2012). It is in light of these findings that this research was conducted. We were aware of the solid grounding learners received with regard to knowledge about the curriculum and we wanted to determine if the knowledge acquired informed their everyday practices.

### *Methodology*

This study is located within an interpretive paradigm as we wished to understand and explain learners' actions and practices. Such insight enabled us to understand how they link their formal environmental knowledge to their everyday practices. The methodological approach is qualitative and the research design for the larger study (Molapo *et al*, 2012, described above) was a case study of a number of participants at a certain period in time (De Vos, Strydom, Fouché & Delpont, 2002). This paper reports on the way in which learners enact the intended curriculum. The participants were located in three schools in Maseru, Lesotho. For ethical reasons, the schools shall remain anonymous.

While the research reported here obtained data from two sources, that is, questionnaires and focus group interviews, the larger study utilised a number of methods to obtain data. These were individual teacher interviews, classroom observations and document analysis. The findings from this part of the study revealed that the way in which teachers implemented the curriculum was quite different from that envisaged by the intended curriculum as teachers focused mainly on knowledge of the environment. We were then able to build on this understanding of the implemented curriculum to find out what exactly learners had learnt and how they were able to use this knowledge.

The type of sampling may be described as convenience sampling as one of the researchers had access to the schools. One teacher from each school who taught Senior Secondary Biology agreed to participate. A total of 138 learners were present in these three classes.

As already mentioned, the methods used to collect data were a questionnaire and focus group interviews. A group of learners not involved in the study agreed to answer the questionnaire to enable us to identify ambiguities in the instructions, clarify wording, and alert us to omissions or unanticipated answers. The necessary amendments were made prior to launching the questionnaire to the research population.

All questions in the questionnaire were open-ended and data were analysed qualitatively. We believed this was the best option as much of the data required was about views, attitudes and beliefs. The questionnaire was completed by 120 learners. The questionnaire was used to obtain insight, not only into learners' knowledge about environmental issues, but also their views, attitudes and beliefs, making it an appropriate instrument for this kind of data (Denscombe, 2004). Learners' views and perceptions of environmental issues were analysed, producing a number of categories.

The learner interviews served largely to gain greater clarity about the responses obtained from the questionnaires. The questions were therefore similar to those included in the questionnaire. The advantage here was that we could ask further probing questions to responses that required more clarity. Two group interviews were conducted at each school, resulting in six interviews in total. Participants volunteered for the interviews. They were divided into two groups based on teachers' advice as to which of the learners were confident and which were less confident. Each group consisted of four learners. We chose four learners as we believed that this was an ideal number to stimulate discussion around issues raised in the questionnaire. The interviews were conducted after school on the school premises. Questions from the questionnaires that required clarity were posed to each group and learners were asked to discuss them amongst themselves with the interviewer recording the conversations. When necessary, the interviewers would ask a question to prompt further discussion.

Analysis of the questionnaires and interviews provided insight into the ways in which learners behaved in relation to the environment. The questionnaire had 12 questions with sub-questions where learners were asked to explain their answers. These 12 questions formed four themes. Learner responses to each theme were then grouped into categories and the percentages of students who responded in each category were calculated. During the interviews learners were asked to expand on their knowledge of environmental issues. This produced a fifth theme. After due consideration, it was decided not to include one of the themes that emerged from the data as it did not relate directly to the research questions in this study. This research therefore reports on four themes that emerged:

- Learners' knowledge of environmental issues;
- Knowledge of the causes of an environmental problem;
- Learners' participation in solving environmental problems; and
- Their views on other peoples' attitudes towards solving environmental problems.

### *Findings and Discussion*

The first theme represents information only obtained during the interviews, and therefore represents only a sample of all the learners who completed the questionnaires. Results of the analysis of the questionnaires are presented in Tables 1–4. The tables show how each theme was subdivided into categories and includes quotations as examples of responses from learners. The percentage of learners whose responses fell into a particular category is indicated. The discussion of each theme further includes findings from the interviews as well.

#### **Knowledge of environmental problems among learners in Lesotho**

During the interviews, learners were asked to give examples of environmental problems in Lesotho. A number of examples were provided. These examples were grouped into three categories, i.e. social problems, local environmental problems and global environmental problems (based on theoretical knowledge).

The responses indicate a variety of individual opinions about environmental problems which are influenced by formal knowledge. For example, a number of examples of pollution were given, some of which are not common in Lesotho. Examples of conservation practices and endangered wildlife unfamiliar to Lesotho were also mentioned. When asked to rank the environmental problems in order of their severity, pollution was ranked first, followed by soil erosion and then wildlife destruction. While problems in the natural environment were ranked first, second and third, 44.2% of the responses covered problems in the social and economic environment. Socio-economic problems were not raised in the Biology classes, where only the biophysical environment was discussed. Responses illustrated a deep sense of socio-economic problems and this may be indicative of learners' priorities with regards to environmental problems that have an impact on humans.

### Knowledge of the causes of environmental problems (specifically littering)

This theme focused on littering as an example of an environmental problem. Learners' responses in the questionnaire as well as during interviews, did not reflect any blame on themselves for littering. Instead, other people and lack of facilities were mentioned as the cause for littering. Learner responses conveyed a sense that littering was more a symptom of an undisciplined community than an environmental problem. Their responses are presented in Table 1.

**Table 1.** Knowledge of the causes of environmental problems

Question	Categories and percentages	Examples of responses
What causes the problem?	Authorities lack action 41.7%	'no cleaners, Maseru City Council have no cleaners to pick up waste; food sellers' litter; teachers not punishing those who litter; government people do not punish those who litter; police do not check waste pipes'
	Poor attitudes 35%	'children do not care, they can't even clean the surrounding around their desks in classes, they just feel it's a free country everyone should do whatever they will, they are also reluctant to apply what they have learned from school in their everyday life'
	Lack of facilities 23.3%	'no dust bins with lids, dogs spread things all over, no sewage pipes, damaged pipes'

### Learners' participation in solving environmental problems

Learners' responses from both interviews and the questionnaire indicated that they participated in activities to address some environmental problems. The responses in Table 2 show ways in which learners participate in solving environmental problems. The different examples given were grouped into categories indicating possible reasons for participating in the way they do.

The responses in the questionnaires were mostly descriptions of what learners did at school. They did not mention what they did at their homes. The majority of learners who said they participated in these activities appeared to do so for extrinsic reasons (payment; fear of punishment) rather than from a desire to act 'for' the environment. Teachers may foster cleanliness at school but, at home and out of school, there may be no enforcement of good habits.

**Table 2.** Learners' participation in solving environmental problems

Question	Categories and percentages	Examples of responses
How do you assist in solving the problem?	Acting on changed attitudes 37.5%	'students [referring to themselves] are very concerned about the dirty school environment and they participate in collecting pieces of paper throughout the school campus on Friday, then burn them, clean toilets and burning rubbish, it is important to clean to avoid disease'
	Using available facilities 27.5%	'throwing waste in dustbins; place lids and bricks to stop dogs getting into bins'
	Making money 18.3%	'collecting cans for sale for recycling, egg trays and other paper and things like scripts to recycle'
	Complying with school rules 16.7%	'plastics not used in the school yard'[ to avoid littering]

During the interviews, learners were asked to elaborate on how they participate in solving environmental problems. The responses revealed some actions at home and these actions were informed by what we classified as formal knowledge (that is, knowledge learnt in the formal schooling context) or actions informed by informal information, which we classified as everyday knowledge (that is, knowledge obtained from the local environment and from anyone in that environment).

A total of 55.7 % of the responses fell into the formal knowledge category, illustrated by the example below.

'make garden of endangered species';

'I have collected some of the litter for recycling and using them in making some project at school'

Both actions above are based on knowledge obtained at school. Learners learn about endangered species and recycling in biology.

A smaller percentage (48.3%) fell into the everyday knowledge category as illustrated by the following example:

'weeds can always be removed and gardens ploughed to keep the environment attractive'

'by collecting rubbish and burning it; burying rotten waste'

The actions above are informed by what they see family and community members doing and is therefore categorised as environmental actions informed by everyday knowledge.

### Learners' views of other people's attitudes towards solving environmental problems

An aspect that emerged from the questionnaires that generated this theme was learners' tendency to blame other people for the problems observed in the environment. They believed that some people did not care enough and neglected their duty (see Table 3).

**Table 3.** Learners' sense of other peoples' attitudes towards solving environmental problems

Question	Categories and percentages	Examples of responses
How do other pupils in your school take part in solving the problem?	No education (lack of awareness) 58.3%	'ignorant people those who do not care, they don't fight against pollution but continue to pollute the environment, they throw plastics everywhere they like'
	Neglected duty 41.7%	'it is the responsibility of cleaners', 'teachers must punish those who make the place dirty'

These responses demonstrate how learners shifted the responsibility for preventing and solving local environmental problems to other people. Other people are blamed for environmental problems. Some learners even suggested that some people were ignorant and had to be punished for littering. When asked to explain, they seemed to think the answer lay in instructions or punitive action from a higher authority.

During the interviews, participants were asked if learners, not from their school, participated in curbing environmental problems. While the majority gave responses that were similar to those presented in Table 3, a small number of participants acknowledged that some community members were engaged in such activities:

'They work together to collect plastics and papers to burn them'

'They began to make handmade mats out of the waste'

The majority of participants were convinced that most members of the community have little regard for the environment and gave reasons for this as presented in Table 4. Answers to this question confirmed the trend that emerged from the previous question – that participants knew what the problems were, but did not take responsibility and regarded other people as responsible for them.

The responses showed that learners have sound knowledge of the environment. This is to be expected as the curriculum implemented by the teachers places emphasis on learning 'about' the environment. Some learners wrote that they take action for a sustainable environment, but no concrete evidence of this emerged from either questionnaire or interview responses. Most of them mentioned learning from science only, yet the curriculum analysis conducted in a related study (Molapo *et al.*, 2012) showed that a number of subjects at primary level have environmental content as well.

Participants' knowledge of the environment is mostly linked to the effect of environmental degradation on people, rather than on biodiversity in general. For instance, water pollution was



described as affecting humans but no mention was made of the effect on aquatic organisms. Forty-four percent (44%) of the responses with regard to listing environmental problems were of a socio-economic nature related to poverty, HIV and AIDS and lack of sanitation. Participants' understanding of the environment is not limited to the biophysical environment as their examples included both the economic and social dimensions of environment. The fact that many of them listed social problems is an indication of the importance they attach to these problems, rather than the problems of the biophysical environment. This finding raises the question of what kind of environmental learning occurs in the formal schooling context. Hart (2002) is of the view that socially critical issues should be included in curricula to make such curricula more relevant.

**Table 4.** Reasons for persistence of environmental problems

Reasons	Percentage	Examples of responses
Attitudes- poor attitudes were responsible for environmental problems	51.7%	'they seem to have inherited those attitudes from their parents; maybe they do not care about their environment as I do; some of them are careless so they are not worried about after effects of what they do, like urinating everywhere'
Community support; little support from community	33.3%	'this problem is general and affects most of the citizens, as a matter of fact no attempt is made more basically by us as students because we are also facing the same problem'
Knowledge and skills transfer; inability to translate knowledge and skills into action	15%	'they are also reluctant to apply what they have learnt at school in their everyday life most importantly, it is because we are not engaged in agricultural studies so the other pupils are unable to participate in any of the tasks of taking care of plants'

The findings also showed that learners placed a high premium on environmental knowledge pertaining to global issues. They were eager to demonstrate their knowledge of global warming and deforestation. While knowledge of global issues is important, learners should be able to act in their own environments and for this, knowledge of their local environment is required. Gurevitz (2000) believes that contexts where learners are taught formal knowledge not applicable to everyday life, will not allow them to become citizens who are able to reflect on their values and personal behaviour. Knowledge of their local contexts will assist in empowering learners as future citizens (Jenkins, 1992).

### *Conclusion*

The learners in this study are not action competent. In spite of adequate knowledge, participants do not appear to have the necessary attitudes to initiate action-taking, irrespective of the nature of the environmental problem. They are inclined to blame authorities for not keeping the environment clean. Reference was made to solving environmental problems, but these were all related to the school environment and were either linked to teachers instructing learners to clean and pick up litter or when they receive money for recycling. This raises the possibility

of external agents driving their behaviour in a certain direction rather than on internal convictions. This is supported by our observation that in one school, which was without litter, the principal and teachers were very strict in maintaining clean surroundings.

While participants indicated that education is important, they simultaneously shifted responsibility to the school and the community. The notion that punishment can be used to solve environmental problems enforces the view that learners do not really view education as an option for solving environmental problems. Statements such as ‘we are taught to care’ point to an awareness only rather than the ability or will to take action. This attitude speaks to the type of environmental education learners receive, as Steele (2010) is of the view that the way in which education prepares learners to act in the world influences their actions. Environmental issues have to be addressed through a comprehensive, learner-centred approach (Hawtrey, 2007) which does not aim at teaching about the right solutions to environmental issues but at focusing on enabling the learners to construct their own understanding of the issues based on their previous knowledge and acting on them. While Jensen and Schnack (1997) hold similar views, previous research in Lesotho has shown that this is not the case (Molapo *et al.*, 2012) because formal learning focuses on information about the environment, rather than action for the environment. The keys to the translation of knowledge into action are ownership and empowerment. While learners in the context of this study demonstrated that they have knowledge, they have not taken responsibility and are not empowered by this knowledge.

In conclusion, the findings show that action competence was not attained through formal schooling in the studied context. Studies in other contexts have produced similar results (Lakin, 2006; Prokop, Tuncer & Kvasničák, 2007). Previous research had indicated that the Lesotho curriculum has the intention of stimulating action in learners (Molapo *et al.*, 2012); however, this is not happening. This suggests that a stronger focus on education for personal relevance and consideration of societal needs is required (Eisner, 2002). There is a need for ‘empowerment’, developing a sense of ‘ownership’ and improving the capacity of learners to address environmental issues in their own communities by becoming action competent.

### *Notes on the Contributors*

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## References

- Aikenhead, G. (1996). Towards a first nations cross-cultural science and technology curriculum for economic development, environmental responsibility and cultural survival. Paper presented at the International Organisation for Science and Technology Education (IOSTE), August 1996. Edmonton: Alberta.
- Cutter, A. (2002). The value of teachers' knowledge: Environmental education as a case study. Paper presented at the American Educational Research Association Annual Meeting, April 2002, New Orleans. <http://SearchERIC.org/ericdc/ED466456.htm>, visited 12 December 2009.
- Denscombe, M. (2004). *The good research for small-scale social research projects*. Berkshire: Open University Press.
- de Vos, A., Strydom, H., Fouché, C. & Delport, C. (2002). *Research at grass roots: For the social sciences and human service professions*. Pretoria: van Schaik.
- Eisner, E. (2002). Five basic orientations to the curriculum. In Gultig, J., Hoadley, U. & Jansen, J.(Eds), *Curriculum from plans to practices*. Cape Town: South African Institute of Distance Education, pp.109–126.
- Gough, A., (2002). Mutualism: A different agenda for environmental and science education. *International Journal of Science Education*, 24(11), 1201–1215.
- Gurevitz, R. (2000). Affective approaches to environmental education: Going beyond the imagined worlds of childhood? *Ethics, Place and Environment*, 3(3), 253–268.
- Hart, P. (2002). Environment in the science curriculum: The politics of change in Pan-Canadian science curriculum development process. *International Journal of Science Education*, 24(11), 1239–1254.
- Hawtrey, K. (2007). Using experiential learning techniques. *Journal of Economic Education*, 38(2), 143–152.
- Holman, J. (1987). Resources or courses? Contrasting approaches to the introduction of industry and technology to the secondary science curriculum. *School Science Review*, 68, 432–438.
- Hsu, S. J. & Roth, R.E. (1998). An assessment of environmental literature and analysis of predictors of responsible environmental behaviour held by secondary teachers in the Hualien area of Taiwan. *Environmental Education Research*, 4, 229–249.
- Hungerford, H. & Volk, T. (1990). Changing learner behaviour through environmental education. *The Journal of Environmental Education*, 21(3), 8–21.
- Jegede, O. & Aikenhead, G. (1999). Transcending cultural borders: Implications for science teaching. *Journal for Science & Technology Education*, 17(1), 45–66.
- Jenkins, E. (1992). School science education: Towards a reconstruction. *Journal of Curriculum Studies*, 24, 229–246.
- Jensen, B. & Nielsen, K. (1996). *Pupils' activities, actions and action competence*. Copenhagen: Research Centre for Environmental and Health Education.
- Jensen, B. & Schnack, K. (1997). The action competence approach in Environmental Education. *Environmental Education Research*, 3(2), 163–178.

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- Lakin, L. (2006). Science beyond the classroom. *Journal of Biological Education*, 40(2), 89–90.
- Lesotho Ministry of Finance and Economic Planning. (2005). *Lesotho Vision 2020 Report*. Maseru: Government Printers.
- Lesotho Ministry of Development Planning. (2012). *National Strategic Development Plan 2012/2013–2016/2017*. Maseru: Government Printers.
- Loubser, C., Swanepoel, C. & Chacko, C. (2001). Concept formulation for environmental literacy. *South African Journal of Education*, 21(4), 317–323.
- Molapo, L., Stears, M. & Dempster, E. (2012). Teachers' interpretation and implementation of the curriculum with regard to environmental education: A case study of three Lesotho schools. *Acta Academica*, 44(4), 202–229.
- Prokop, P., Tuncer, G. & Kvasničák, R. (2007). Short-term effects of field programme on students' knowledge and attitude toward biology: A Slovak experience. *Journal of Science Education and Technology*, 16(3), 247–255.
- Roth, W.-M. & Lee, S. (2002). Scientific literacy as collective praxis. *Public Understanding of Science*, 11, 33–56.
- Stears, M., Malcolm, C. & Kowlas, L. (2003). Making use of everyday knowledge in the science classroom. *African Journal of Research in Mathematics, Science and Technology Education*, 7, 109–115.
- Steele, R. (2010). *Reorienting teacher education to address sustainable development: Guidelines and tools environmental protection*. Bangkok: UNESCO.
- Tranter, P. & Malone, K. (2004). Geographies of environmental learning: An exploration of children's use of school grounds. *Children's Geographies*, 2(1), 131–155.