Principles for Designing Environmental Education Programmes: A literature review

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Principles for designing environmental education programmes: A literature review

by Eija Soini (PhD, Development Geography)

Connecting science and practice

Designing a completely new environmental education programme for a specific area, tailored to address local environmental problems of the area while remembering the large global issues can be a challenging task. I found myself in the middle of this task in early 2014 as I started to plan an environmental education programme for secondary schools in the drylands in northern Tanzania. I did not yet have any pedagogic training, though I had been designing different agricultural and environmental related training sessions offered to farmer groups for some years. I also had a good understanding of the local environmental issues in the area due to having done both environmental and human geographic research and community development projects in the area since 2000.

I started the task by investigating what environmental issues are covered by the school curriculum, namely through lessons in geography and biology. My idealistic thought was that the extra-curriculum lessons – nature clubs, as we called them - would be timed to coincide with the relevant environmental topics in geography and biology, thus deepening the knowledge offered by the curriculum and offering practical activities related to the topics. However, it was soon obvious this didn't work. The geography book series used in the secondary schools in Tanzania is from the 1980s. In addition to being very poorly written in erroneous English, illustrated by some naive drawings and fuzzy greyscale photographs, the books did not address any current environmental issues. The biology book series was a high quality international product. However, ecology was covered in nine pages only for the whole four year secondary school. No wonder environmental awareness is poor in Tanzania. In addition, the reality is that only a tiny minority of school children in Tanzania have any school text books at all. The most common learning method is by the teacher lecturing from the front of the class, writing notes on the blackboard and children copying the text into their exercise books. Most schools have no other teaching facilities – laboratories, instruments or computers - than blackboard and chalk.

The easiest part of designing such an environmental education programme was the selection of topics. Environmental problems can be seen almost everywhere in East Africa and they have been researched extensively. Rapid population growth, poverty and lack of knowledge about alternatives have made resource use unsustainable. From the livelihood point of view the biggest problems are soil erosion and fertility depletion on agricultural lands (e.g. Tittonell & Giller 2013, and references within), deforestation (e.g. Lung & Schaab 2010), increasingly erratic climate and increased mean temperatures due to climate change (Waithaka et al., eds, 2013; van de Steeg et al. 2009), and lack of waste management (UNEP 2002). From the conservation point of view, wildlife conservation is a very distant and irrelevant issue to most of the common people. Environment or nature is mainly seen as a resource that can be used, not a value as such. Further, national parks have not been able to protect wildlife against the globally organised crime of

poaching. According to Craigie et al. (2010), large mammal populations in national parks have decreased by 59% between 1970 and 2005. Based on this understanding I made the following list of lessons. They echo the issues mentioned above and attempt to address them:

- A human run world (anthropocene). Introduction to current environmental problems caused by humans and the need of humans to solve them.
- Land degradation and sustainable land management practices.
- Endangered species and poaching.
- Waste management and the problem of plastic waste.
- Domestication of animals and plants (incl. hybrid and GM seeds). This lesson has a strong emphasis on humane treatment of domestic animals, especially dogs that are very mistreated, underused and neglected in Tanzania.
- Climate change and its consequences globally and in Tanzania (and in one's home location).
- Rapid population growth and its consequences.
- Functions of trees in the ecosystem.
- National parks in Tanzania: Wildlife conservation in gazetted areas; a trip to a national park.
- Tree nursery establishment (This is not the last lesson, but needs to be timed according to the rainy season).

After the selection of topics the harder questions followed. What does the programme aim at, namely how do we realistically set our objectives or goals? Is it possible to achieve attitudinal change and ultimately through that pro-environmental behaviour by such a programme? If so, what should we do to make it possible? Specifically, what roles do emotions and knowledge play in driving human behaviour? What role does aesthetic appreciation of nature play in pro-environmental behaviour? Is it necessary? If so, how can one teach others to see the beauty in nature? Or simply, is delivering environmental information, raising awareness and helping to build understanding on the environmental issues our sole main aim? Does awareness and understanding lead to behaviour change?

This paper is my personal journey to find answers to these questions based on environmental psychological theories, research on effective approaches in environmental education, research based practices by other environmental education programmes, and guidelines set by the UN and some major environmental education associations and practitioners.

Methods

This study is based on a literature review that strives to be an open and "comprehensive narrative syntheses of previously published information" that gives answers to the stated research questions (Green et al. 2006). I used Google Scholar to look for papers from 2010 to 2016 on environmental education – assuming that any important older paper will be referred to in these newer papers. I first used 'environmental education' as a search word on its own. This yielded a wide variety of papers. As I looked through the titles of the first 110 papers I realised that many of them gave an indication of objectives in their titles – such as environmental education as a strategy for conservation, environmental education for transformation of attitudes or values, for

personal growth, to change consumer behaviour, building connectedness with nature, for sustainable development, for educating environmentally literate public, for green identity, for developing an ecological worldview. This, together with the contents of the UN declarations, made me realise that environmental education always aims at changing the participants in one way or another in order to result in action.

Thus, in the process of reading, the centre of my interest shifted to searching for scientific understanding on what actually brings about pro-environmental attitudes and behaviour. I narrowed my search by adding the words 'behaviour change' and 'attitude change' with 'environmental education'. I also tried 'age' and 'aesthetics', both of which yielded very little of any relevance to the topic. I also got increasingly interested in the actual teaching methods. However, the scientific papers did not go to that level of detail in didactics so investigation of didactic methods is not part of this paper.

I browsed many more but used a total of 13 papers as my primary sources of information and did not trace the original references within these papers. In addition, I have used different declarations from the UN organisations related to environmental education or education of sustainable development, and the guidelines by the North American Association of Environmental Education for best practices (NAAEE, 2010).

Guiding principles for setting objectives

Environmental education gained international recognition for the first time when the UN Conference on the Human Environment held in Stockholm in 1972 declared that environmental education must be used as a tool to address global environmental problems (UNEP 1972). Several other declarations followed: Belgrade Charter in 1975 (UNESCO-UNEP, 1976), Tbilisi declaration in 1977 (UNESCO, 1978) and a report called 'Our common future' by the World Commission on Environment and Development in 1987 (WCED 1987). In 1992 the World Conference on Environment and Development in Rio de Janeiro continued to use the term, and it was on the agenda again at the World Summit on Sustainable Development at Johannesburg in 2002. According to Jickling and Wals (2008) and Tilbury (1995) the international emphasis has– especially since 1990s - moved toward education for sustainable development. In December 2002, the United Nations declared a Decade of Education for Sustainable Development (ESD) beginning in 2005 with the words:

> "Education for Sustainable Development allows every human being to acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future. Education for Sustainable Development means including key sustainable development issues into teaching and learning; for example, climate change, disaster risk reduction, biodiversity, poverty reduction, and sustainable consumption. It also requires participatory teaching and learning methods that motivate and empower learners to change their behaviour and take action for sustainable development. " (UNESCO, 2005)

When looking at this declaration from the point of view of setting objectives, the important point to note is that the emphasis is on acquiring a combination of necessary knowledge, skills, attitudes

and values which lead to motivation, empowerment and behavioural change; and ultimately to action to shape a sustainable future. The statement also assumes that participatory learning methods are needed. These among other things ensure the inclusion of local knowledge and experiences. However, as this declaration from 2005 is very human centred due to its sustainable development goal, it is worth going back to the older ones to capture more of the essence of environmental education.

The Tbilisi declaration from 1977 is still the one referred to by the North American Association for Environmental Education in their guidelines, and according to them forms the basis of all environmental education done since then. The Tbilisi declaration that built on the Belgrade Charter established three broad goals:

1. To foster clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas
2. To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment
3. To create new patterns of behaviour of individuals, groups and society as a whole towards the environment

These goals are remarkable in their holistic approach. They list awareness and knowledge; values and attitudes; concern; commitment to protect and improve the environment; the skills needed to do so; and the needed behavioural patterns of individuals and the society as a whole. They don't either forget urban areas.

The guidelines by the North American Association for Environmental Education set six core principles to take into account when planning an environmental education programme, three of the six particularly concern attitudes, values and affections (2, 3 and 6) and the rest concern knowledge and skills:

1. Systems: The complex nature of the issues requires understanding the relationships and interactions of the whole.
2. Interdependence: Humans are a part of the natural order.
3. The importance of where one lives: The sensitivity ('connection to nature', see later), knowledge, and skills needed for this local connection provides a base for expanding to larger systems and broader issues.
4. Integration and infusion: Environmental education works best when infused across the curriculum, rather than being treated as a separate discipline or subject area.
5. Roots in the real world: Investigation, analysis, and problem solving are most effective when they concern real world issues.
6. Lifelong learning: Critical and creative thinking, decision making, communication, and collaborative learning are a project for the whole lifetime.

In addition to the above declarations and the guidelines from the North American Association of Environmental Education – which give rich ideas on how to set the objectives - a lot of research has been done in connection with assessment or evaluation of environmental education programmes. This is very relevant to setting objectives. According to Carleton-Hug and Hug (2010, and references within) one of the biggest challenges of evaluating environmental education

programmes is their lack of clearly articulated program objectives. Further they argue that another problem related to this is when the program's stated mission or objectives are not aligned with actual program activities. Goals and objectives should be explicitly linked to activities that aim to achieve them.

The goals and objectives of the declarations are naturally not specific enough to use as objectives for a specific environmental education programme in a specific locality. Objectives need to be tuned according to the locality, according to the participants and according to the topics taught. Thus an approach to setting overall objectives for a programme is to work them out *together* with the objectives – and activities - of each lesson. The process of setting objectives must vary a lot depending on the size of the programme, i.e. the number of different topics covered. In a narrow (short) programme one can work out the overall objectives first and then design lessons that aim at achieving this. However designing lessons for a larger programme, planners need to be aware that the overall objectives of the programme (if stated) will be constantly recreated (or living) in the process of designing more lessons and setting their objectives and planning their activities.

Further, categorising the lesson and programme objectives according to the different domains such as knowledge, skills, attitudes, values, concern or motivation or commitment, empowerment, enjoyment, behaviour etc is necessary to ensure a balanced approach and to know what to measure in the final evaluation.

As this paper will not have a separate section about instructional guidelines due to the fact that the scientific papers I reviewed did not have information on practical didactical matters, I have included here the instructional principles of the North American Association of Environmental Education. They do fit under the title of setting objectives, because instructional principles will necessarily affect the objectives and the content of the programme. The principles are:

- Instruction should be guided by the learner's interests.
- Instruction supports independent thinking and effective, responsible action. Independent and collaborative tasks should anticipate the ways in which problem solving optimally happens in the real world.
- Instruction should give plenty of opportunities to develop communication skills. This means learners will be able to demonstrate their knowledge.
- Instruction should give a balanced approach and present information fairly and accurately.
- Instructors foster learners' innate curiosity and enthusiasm starting from close by and expanding later. The programme should give the participants continuing opportunities to directly discover the world around them.

These principles are set to ensure a balanced approach that builds knowledge and skills in both the subject matter and the social setting, develops attitudes and values, cultivates one's own interests, gives opportunities to solve problems oneself, and encourages for action. Taking into account learner's interest and supporting independent thinking will allow the space needed to accommodate different cultures. The last point adds the aesthetic dimension to the teaching, i.e.

the importance of creating opportunities to discover, be inspired by awe and the wonder of nature, the 'wow!' phenomenon.

But much more knowledge is needed in order to plan activities that work to achieve the set objectives. The latter part of the paper concentrates on research that sheds light on the mechanisms that lead to attitude change and pro-environmental behaviour.

What drives behaviour

As promoting pro-environmental behaviour is the ultimate objective of an environmental education programme, understanding the variables that influence pro-environmental behaviour are essential for planning an effective programme.

Cheng and Monroe (2011) look back to earlier studies on pro-environmental behaviour that focused on cognitively driven - knowledge driven - behaviours. It was thought that increasing knowledge can strengthen attitudes in addition to change behaviours. This started to change in the 1990 when studies showed the opposite. Cheng and Monroe (2011) give references to studies that show that increasing environmental knowledge does not directly lead to pro-environmental attitudes and, ultimately, behaviour. Further Shultz writes in 2011 that "although there are instances in which individuals are motivated but lack sufficient (or accurate) information about what behavior to change or how to change, generally information or education alone will not induce a change in behaviour". Thus newer research has focussed mainly on the affective (i.e. emotional, feeling based) aspects of behaviour change.

A lot of research suggests that attitude is a vital element in behaviour (Cheng and Monroe 2012, and references within). In research attitude is often divided into subgroups of affective factors, such as emotional affinity, empathy, and sympathy. Cheng and Monroe (2012) and Ernst and Theimer (2011) give examples of several studies that give evidence of the importance of attitudes leading to behaviour. One study concludes that for "both the active members of environmental organizations and the general public, emotional affinity toward nature, indignation, and interest in participating in nature experiences predicted 47% of the variance in behaviours". Another study suggested that "adults' affective and experiential connection to nature can be used to predict environmental behaviours". Yet another study suggested that "sympathy mediated the relationship between environmentally friendly behaviors and all other factors such as self-esteem and personal control." One more study "concluded that taking the perspective of animals being harmed generated feelings of empathy. These "other-oriented feelings of concern about the perceived welfare of another" potentially lead to relevant behaviour. Cheng and Monroe's (2011) own study suggest dimensions in children's experience, namely enjoyment of nature, empathy for creatures, sense of oneness, and sense of responsibility that stimulate pro-environmental behaviours.

Shultz (2011) does not use the word attitude, but emphases the importance of motivation. He claims that motivation is the driving force behind behaviour change. I do not attempt to present any scientific speculation here whether attitudes and motivation describe the same disposition or

whether there is a difference between them. In everyday language they seem to coincide, though motivation sounds more of an active term, motivation to do something.

Connection with nature

'Connection with nature' is a central concept from environmental psychology that tries to explain how pro-environmental attitudes build and how they translate to pro-environmental behaviour. According to the references in Ernst and Theimer (2011), 'connection with nature' is understood as a degree to which an individual associates oneself with nature. Those who associate themselves with nature tend to have more biospheric attitudes, while those with less of an association may still be concerned about the environment, but they focus on issues that directly affect themselves. If people feel connected to nature they will be less likely to harm it, as harming nature means harming themselves.

Ernst and Theimer (2011) present a comprehensive literature review of the concept of 'connection with nature'. The literature sees that 'connection with nature' is essential in fostering responsible environmental behaviour and environmental protection. A closely related term (basically a synonym) from environmental education studies is 'environmental sensitivity'.

Ernst and Theimer (2011) and Cheng and Monroe (2011) refer to studies in the 1980s in which the researchers explored memories from environmental and conservation professionals. They discovered diverse pathways for the development of environmental sensitivity (connection with nature) and cognitive and behavioural components that led the conservationist to their careers. The most common influences cited are as follows: interaction with natural areas, frequent contact with habitat, family, hunting/fishing, teachers, and other non-familial role models, books, habitat alteration, and solitude. Other studies found similar categories of influences such as being outdoor, experiences in natural or rural settings, usually with family or other role models. Several other studies support the idea that "spending a lot of time outdoors, positive experience in natural environments, influential family members or other role models, and good memories in natural areas during childhood or adolescence influence people's interest in the environment in addition to work for its protection" (references in Ernst and Theimer 2011).

What is worth noting is the presence of a role model in nature experiences, i.e. parents, teachers or other adults who "allowed them to explore nature freely, engaged in nature experiences with them, or even taught them about nature". A role model can be an important motivator that leads to pro-environmental behaviour.

Ernst and Theimer (2011) give evidence of a myriad of subsequent (since 1980s) studies according to which environmental sensitivity or 'emotional affinity' toward nature has been found to be a significant predictor of environmental behaviour or nature-protective behaviour, or studies that show that nature experiences have significant correlations with pro-environmental behaviours. "The more one has an affective connection with the natural environment, the greater one's intentions to engage with it".

So how much time in nature makes you connected with it? Cheng and Monroe (2011) refer to studies that found that "the first most significant predictor of affinity toward nature is frequency of time in nature, and the second most significant predictor being past frequency of time in nature (time during childhood)" . Studies that support this claim further state that "self-nature associations are malleable, but that change requires long-term or repeated experiences". According to Cheng and Monroe (2012) environmental education meta-analyses support the same: long programs are more likely than short programmes to lead to change. They further conclude that "it is reasonable to believe that EE programs may have the ability to foster connectedness to nature, particularly when they include frequent and/or extended experiences". More accurate time recommendations could not be found.

At what age are children's' attitudes most malleable? As I mentioned earlier, search words 'environmental education' and 'age' did not yield relevant papers that would have specifically dealt with the effectiveness of attitude change in different ages of children. However, Cheng and Monroe did refer to a study that suggested that "experience in nature before age 11 is associated with the development of influential positive adult attitudes, but nature experiences at other ages may also be influential to people's proenvironmental behaviors." Another study by Liefländer and Bogner (2014) found that 9-10 year old students were more responsive than 11-13 year olds. However, their study was of a very short environmental education programme and attitude change can hardly be expected.

Transformative learning is a term used of education that transforms attitudes and values. Galen D'Amato and Krasny (2011) use transformative theory in their study of adventure training that takes its participants to nature for an extended time. They attempt to capture the factors explaining why student's claim that they have gone through significant personal transformation during the course. Transformative learning occurs when one can no longer interpret one's current experience with one's old assumptions. One's cognitive system searches for new ways to reorganise until new structures have been created. Transformative learning relates to what is called a 'disorienting dilemma'. It leads to critical self-reflection, new social interactions, planning for action, and competence and self-confidence as a result of taking action. Such learning results in personal growth as well as in questioning and changing one's behaviours. In Galen D'Amato's and Krasny's (2011) study students attributed their personal transformation to "spending extended time in pristine nature, separation of the course from normal life, the community that formed among course participants, and the intensity and challenge of the course."

Finally and according to Shultz (2011), it is good to note that individuals naturally tend to see themselves as separate from nature: "This belief manifests itself across many policies, programs, and actions by individuals, communities, and countries". Thus it requires a decisive effort to foster connection with nature and using transformative learning methods.

Human-place bonding and locally relevant approach

Both Ernst and Theimer (2011) and Kudryavtsev et al. (2012) reviewed literature about another concept exploring the human–nature relationship, namely, human–place bonding, referring to the

emotional bond that develops between an individual and the environment. According to their literature review the concept of place attachment originates from the 1970s but has since then been developed by many scholars. A number of papers (mainly from the early 2000) suggested that sense of place fosters pro-environmental behaviour and related emotions, attitudes, and pro-environmental behavioural intentions and sense of responsibility or personal concern of that place. Some papers talk about 'place identity', meaning that place is incorporated to one's self-definition. One paper uses the term 'place rootedness' and proposes that it leads to 'a sense of deep care and concern for that place.'

Place attachment can be developed through both 1. Direct experiences with places, especially long-term, frequent, and positive experiences (experiential) and 2. Learning about places from indirect sources rather than direct contact (instructional approach). The experiential approach implies that participants develop place meanings through first-hand encounters with places. The instructional approach, in contrast, contributes to place meaning and place attachment through teaching about places by indirect means such as lectures, storytelling, books, art, movies, websites, and other media. This latter approach emphasizes meanings conveyed by instructors. (Kudryavtsev et al. 2012, and references within).

Some studies show that interactions with other people also influence place attachment. The most important reasons for place attachment can be social interactions that happen within a specific place (Kudryavtsev et al. 2012, and references within).

It is interesting that Kudryavtsev et al. (2012) also point that the human-place bonding theory has been questioned by some studies as the research done within the topic leaves some gaps. It has been challenged by the fact that the impact of place attachment on pro-environmental behaviour has been studied mostly in places with plenty of natural elements (e.g. parks and rural areas). Would the relationship apply in more urbanized or disturbed settings? Also, the majority of studies have been conducted with adults. Would the conclusions be applicable to children and the youth? And lastly, as is the case with studying any other single influencing factor in a process, one cannot know how and to what extent place attachment interacts with other factors influencing pro-environmental behaviour. In some cases pro-environmental behaviour (e.g. in nature restoration work) can be influenced by such 'simple' things as income, time and equipment' (Gosling and Williams 2010).

What is closely related to place-affection or place bonding is locally relevant approach in education in general. Scannell and Gifford (2011) found in their study about an information campaign on climate change that local messages were more effective than global messages. They refer to psychological literature related to perceptions of psychological distance, the degree to which objects, people, places, and events are removed from an individual's immediate, direct experience. Psychological distance may hinder pro-environmental behaviour if the issues are felt to be outside one's daily sphere. Conversely bringing the topic close to participant's own life fosters motivation to do something about it.

Self-identity, self-efficacy and group identity

There is scientific evidence that self-identity and past behaviour are important influences on behavioural intention. I reviewed a paper about green identity by Whitmarsh and O'Neill (2010). In addition to referring to earlier research on self-identity as predictor of behaviour, they found that "selfidentity was a significant predictor for several of these categories of behaviours, namely waste reduction, regular water and domestic energy conservation, and eco-shopping and eating (for which it was the strongest predictor). However, one-off domestic energy conservation, travel and political behaviours were not significantly predicted by identity."

Closely related to self-identity is the social environment that we conduct the environmental education in and the social environment that we manage to create within the group of participants. In many places in which environmental education is acutely needed, pro-environmental attitudes are not prevalent in the society at large. Shultz writes that "humans tend to look to the behavior of others as a guide for interpreting events and for choosing a course of action. In many situations, the prevailing norm does not favor conservation". Thus being able to create a pro-environmental, well-cooperating, supportive group of the environmental education participants – a group that one enjoys being part of and can identify with - seems an important principle. As Galen D'Amato's and Krasny's (2011) study also suggested, "the community that formed among course participants" was mentioned by the participants as one key factor leading to personal transformation.

Self-efficacy – a term closely related to self-identity - seems a central term in the guidelines of the North American Association of Environmental Education. It refers to a participant's realistic picture of himself/herself as an effective and active citizen who can play a part in influencing things around him. Environmental education should actively help participants see how they can play a role that "creates change, meets individual needs, and promotes the common good" and find "ways in which learners, individually and collectively, are able to help maintain environmental quality and resolve problems and issues". According to the latter quotation self-efficacy is both an individual and collective feeling of capacity to do something. Thus for creating the collective feeling of capacity participants need to form a cohesive social group. Closely related other terms referring to self-efficacy are empowerment and ownership (of environmental issues).

Knowledge and information

The role of information and knowledge is still an important one even though according to current scientific understanding it is not the primary driver of behaviour. Shultz (2011) refers to human irrationality, biases and beliefs that lead people to wrong conclusions and thus misguided behaviour. He gives examples of studies that showed that there are both spatial and temporal influences on individual-level judgments about the severity of environmental problems. Beliefs lead the general public to think that environmental problems are more severe globally than locally, they rank loss of biodiversity as a lower priority than more salient threats such as poor economic conditions, terrorism, or even traffic congestion, and they think that environmental problems are likely to become worse in the future.

Thus information and knowledge are essential in building as accurate a picture as possible of the environmental issues and in guiding behaviour. Central to building an accurate picture is helping participants understand the interconnectedness of nature and the fact that humans are part of the complex natural system.

Many other skill related components belong to the knowledge and information domain. These are skills for investigation, exploration and discovery; skills for problem solving by using knowledge and information; communication skills for articulating knowledge and information; collaboration skills; and decision-making based on the choices offered by knowledge and information. All these should be practiced in real world situations with a local connection.

Creating fascination and wonder by exploration and discovery

By using 'environmental education' and 'aesthetics' as search words in Google Scholar only three papers of any relevance were found. The first one is by van der Hoeven Kraft et al. (2011). They introduce a concept 'connections with Earth'. They write that "there are many ways in which people connect with Earth; for example, an aesthetic appreciation for the beauty of a landscape; a sense of awe or wonder at the power of geological processes; or a profound feeling of personal attachment to a particular place on Earth. The same range of responses that we combine as 'connections with Earth' is termed 'aesthetic appreciation', 'values of life', 'beauty', 'sublime', or 'sublimely cool' by other authors, who posit that direct sensory experiences and a sense of awe or wonder can lead to increased meaning and value, engagement of the emotions, and a deep sense of caring about Earth".

Van der Hoeven Kraft et al. (2011) refer to other studies stating that scientific knowledge is a valid, even essential part of the aesthetic or sublime experience, particularly as it increases the meaning and value found in nature, and concern for its sustainability. And further: "The importance of integrating research on human connections with Earth and research on motivation is illustrated by the insight that it is not a question of the public having sufficient scientific knowledge, but whether they have sufficient interest in engaging in such appreciation". Galen D'Amato and Krasny (2011) in their paper about adventure training in wilderness found that students attributed the significance of their course to living in the wilderness that exposed them to "awe-inspiring nature resulting in increased respect and admiration for nature".

Milne (2010) who wrote his paper in the context of primary science education picks the children's 'inborn sense of wonder' as one of the foundations in science education. He argues for the "importance of feelings and emotions that set the scene for exploring the role wonder can play in primary science education". He also refers to a paper from the 1970s which proposes that science educators should "stimulate joy, wonder, satisfaction and delight in children as a result of their encounters with science". He further argues, referring to studies from the early 2000 that "more phenomenological - aesthetic approaches to teaching and learning needs to be implemented in science education classrooms, if students are to become engaged with and continue their studies in science". He continues "whatever teaching learning approach is used, it appears that there needs to be a period of exploratory activities that, with teacher direction and input, provide

aesthetic experiences of natural phenomena that will assist the promotion of a sense of wonder, leading to a desire for understanding and explanation of the phenomena for the learners involved." To describe children's dispositions he uses words like fascination, anticipation, engagement, awe, wonder and interest that spark curiosity and can lead to the use of scientific inquiry to develop explanations of natural phenomena.

A comprehensive meta-analysis of effective practices

A commendable meta-analysis of environmental education programmes by Stern et al. (2014) reviewed 66 papers on environmental education programme outcomes and came to a conclusion that the following practices commonly lead to an effective environmental education programme:

1. Active and experiential engagement in real world environmental problems.
2. Issue based, project-based, placed based and investigation focussed programmes in real-world nature settings.
3. Empowerment and student centred leaning geared towards developing skills and perceptions of self-efficacy.
4. Multidisciplinary approach that aims to provide a holistic experience in which students investigate real-world environmental issues.
5. Social engagement: Cooperative group work enhances success, intergenerational communications and teacher engagement (one's own teacher takes part) are effective and provide role models of adults.
6. Instructor's style and identity matters (teacher's verbal and non-verbal communication styles is a strongly determining factor in student outcomes). Things that matter are comfort, eloquence, apparent knowledge, passion, sincerity and charisma, genuine care and concern for students, and passion for the subject.
7. Emotional connections: Interactions with animals and places, extensive group discussions, involvement with the community.
8. Holistic experience: Involves conveying a complete study or a coherent picture of which participants are part of, with a clear take-home point for students to reflect. This may involve pre-experience preparation and post-experience follow-up.
9. Focus on specific places and issues linking content to student's home lives and provoking reflection.

Most of the above points have been touched by this paper in one way or the other. Worth noting is the emphasis on experiential learning. In addition, point number six, instructor's style and identity, has not been mentioned by any other studies reviewed for this paper. Stern et al. (2014) write: "Interestingly, this particular theme is not overtly present within NAAEE guidelines. The formal education literature, however, has long considered teachers' verbal and non-verbal communication styles to be prominent determinants of student outcomes".

Conclusions

The purpose of this literature review was to find important guiding principles for planning environmental education programmes. The following are my conclusions based on what I found.

UN declarations about environmental education give a meaningful and holistic basis for setting general objectives. Environmental education programmes commonly aim at fostering attitudes that lead to pro-environmental behaviour. Objectives should be specific to the location, to the participants of the programme and the topics taught. Objectives need categorising according to domains such as knowledge, skills, attitudes, values, concern or motivation or commitment, empowerment, enjoyment, behaviour, in order to ensure a balanced programme.

Many interconnected things play a role in an environmental education programme. I have sketched the main components found in literature in Figure 1 and drawn the lines of influence between them.

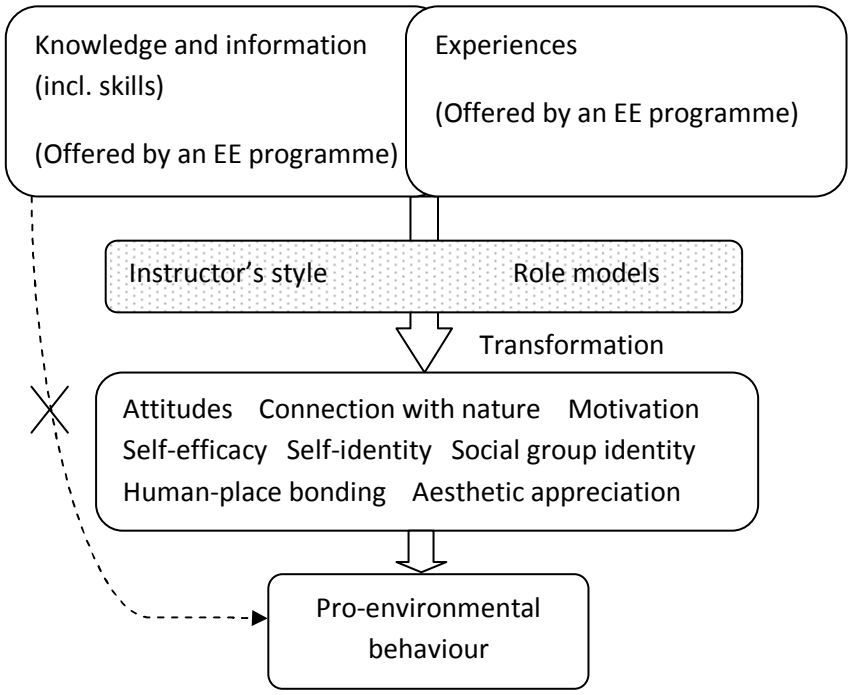

Figure 1. Important components playing a role in environmental education, and lines of influence leading to pro-environmental behaviour. Research shows that the direct connection between knowledge and information and pro-environmental behaviour does not work.

In its simplest form an environmental education programme offers only two components: 1. Knowledge and information and 2. Experiences. These are the planned programme including the topics, objectives, activities and methods. However, implementation of the programme necessarily introduces a filter. The programme is delivered by an instructor, and other role models influence the outcome. According to literature instructor's style and identity and role models are prominent determinants of student outcomes. They determine whether participants experience personal growth and attitudinal transformation that lead to pro-environmental behaviour.

As the objectives of environmental education programmes commonly aim at behavioural change, it is important to understand how attitudes change. Theories or concepts such as connection with nature, human-place bonding and transformative learning give a research based approach for

planning a suitable programme that leads to pro-environmental behaviour. Connection with nature forms by spending time in nature with a suitable role model. Human-place bonding explains how building a meaningful and affective bond with a specific place leads to the desire to conserve the place. Transformative learning theory describes a learning experience in which a new situation forces one to question one's earlier structures of thinking and form new structures of thinking leading to personal growth.

Literature also suggests that self-identity plays a significant role in behaviour. Self-identity is closely related to attitudes. Though attitudes concern certain issues, identity is how we define ourselves. Thus cultivating and building a pro-environmental identity is important in environmental education programmes.

Self-identity is also related to human social behaviour patterns in which humans typically look for clues from each other in guiding their behaviour. As pro-environmental attitudes are not prevalent in most of the places that acutely need environmental education programmes, being able to create a pro-environmental, well-cooperating, supportive group of the environmental education participants – a group that one enjoys being part of and can identify with - seems an important principle.

Cultivating self-efficacy, or empowerment, also plays an important role in an environmental education programme. It gives the participants a realistic sense of self-confidence of their own roles as active citizens who can play an important role in environmental matters. Self-efficacy concerns both individual and collective feeling of capacity. Thus a cohesive social group is essential for a collective self-efficacy.

Aesthetic appreciation refers to a sense of wonder that can lead to increased meaning and value, engagement of emotions, and a sense of caring about nature. In order to create such experiences learning methods selected for an environmental education programme should allow for exploration and discovery.

According to current scientific understanding delivery of knowledge and information does not directly lead to behaviour. However, building up participants' knowledge and understanding of the environment is essential for a successful environmental education programme. Central to this is helping participants understand complex systems of nature, with humans being part of the system, and offering skills needed for pro-environmental behaviour. These skills include: investigation and exploration skills; problem solving by using knowledge and information; communication skills to articulate knowledge and information; collaboration skills; and decision-making based on the choices offered by knowledge and information. These should be practiced in real-world situations with a local connection.

Most of the research in environmental education and environmental psychology has been done in North America and Europe. This may raise the question whether the findings are applicable elsewhere in the world. It is reasonable to think that the main theories and concepts related to human learning are applicable universally. In addition, the UN declarations – if anything – are

written through consultation with all its members. Also, when perused carefully, the instructions based on good practice in environmental education programmes all emphasise the importance of things such as locally relevant objectives, learner's own interests and independent thinking, involvement with the local community, student centred learning, issues linking content to student's home lives. This ensures the programme planned will be locally relevant and culturally sensitive.

As a final conclusion, my personal journey to find out how environmental education programmes should be planned has been inspirational. Even though some results may be slightly elusive due to many factors simultaneously playing a role, research does give a firm basis for the principles for planning a successful environmental education programme.

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