Promoting Environmentally Sustainable Attitudes and Behaviour Through Free-choice Learning Experiences: What Is The State of the Game?

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Abstract:

Environmental education, both in and outside of the classroom, aims to facilitate adoption of sustainable practice by both school students and the general public. This paper explores the role of free-choice learning experiences in this regard. An overview of theoretical approaches underpinning free-choice learning research is provided, examples are presented of the ways in which informal educational settings can promote environmentally sustainable attitudes and behaviour, and the factors contributing to the effectiveness of these endeavours are discussed. By reviewing research evidence in relation to these issues, the paper identifies the current 'state of the game' and areas where new research is needed.

Lifelong learning is widely perceived as 'a vital ingredient of capacity building for a sustainable future' (Fien & Lopez Ospina, 2004, p. 38). Such learning is essential to help people build the 'personal and social capacity' to grapple with sustainability issues in their own lives and work (Scott & Gough, 2004, p. 3). Although much of the literature examining sustainability education is concerned with formal education programmes, only a small percentage of the public's understanding of the world in general, and environmental conservation and sustainability in particular, is gleaned from such sources (Falk, 2001). Over the course of a lifetime, the average citizen spends only 3% of his or her time in school (Falk & Dierking, 2002). No matter how successful school-based efforts might be, individuals need to continually access and be able to evaluate materials from a range of information sources such as the media, internet, and other free-choice learning experiences, to update their knowledge and understanding of rapidly changing and evolving environmental issues and challenges. Such sources can also contribute to students' learning within school-based programmes.

There is already an established infrastructure of organisations providing opportunities for free-choice learning beyond and outside of the formal education system. These include the broadcast and print media, libraries, museums, science centres, zoos, aquariums, botanical gardens, environmental centres and community organisations (Falk & Dierking, 2002). This informal education

network has the potential to reach a wide cross-section of the general public. For instance, wildlife based, free-choice learning environments in Australia attract approximately 5 million visitors annually (Tribe, 2001).

Although the aims of informal educational settings are generally much broader than those emphasised in formal learning settings (Schauble et al., 1996), many of these are consistent with the aims of environmental education. For example, desired learning outcomes may include encouraging curiosity and exploration, changing attitudes, evoking feelings, developing a sense of personal, cultural and community identity, and making decisions about moral and ethical issues (Schauble et al., 1997; Hein & Alexander, 1998; Falk & Dierking, 2000). Many informal educational sites thus provide opportunities for both the public and school students to learn about environmental sustainability issues. Indeed, a key focus of modern zoos, aquariums and wildlife encounters in natural environments is to facilitate and support the development of pro-conservation attitudes, knowledge and behaviour among their visitors (Broad & Weiler, 1998; Dierking et al., 2002; Woods & Moscardo, 2003).

In responding to Rickinson's extensive review of learners and learning in school environmental education (2001), Dillon (2003) argues that 'environmental educators have much to learn from the research done in museums, field centres, botanical gardens, etc. – the informal sector' (p. 217). In particular, he notes that research in informal learning environments has attempted to apply general education theories and research from the formal learning sector in non-school settings. This paper builds on Dillon's position by exploring findings of research in informal educational environments that are relevant to environmental educators, specifically in relation to the promotion of environmentally sustainable attitudes and behaviours. It presents:

- a brief overview of some of the theories of learning and communication that have been employed to underpin the design of learning experiences in informal educational environments;
- examples of how informal educational settings can contribute to the development of environmentally sustainable attitudes and behaviours;
- a discussion of factors found to contribute to environmental learning in informal educational environments;
- suggestions for areas where further research needs to be undertaken in order to improve the effectiveness of informal

educational settings in facilitating the learning of environmentally sustainable attitudes and behaviours.

In this paper, the terms 'informal educational setting' and 'free-choice learning' are used, as defined by Falk and Dierking (1998). Thus the term 'informal' is used to refer to a variety of settings outside school classrooms, while the term 'free-choice' is used to refer to the type of learning that typically occurs within these settings – learning that is driven by the needs and interests of the learner rather than by the dictates and needs of an external authority. In the case of school visits to informal educational settings, the extent to which free-choice learning is able to occur will depend on the amount of autonomy students are allowed.

Overview of Theoretical Issues Underpinning Free-choice Learning Research

It is important to note that, in the museum literature in particular, the emphasis has changed in recent years from one of 'message transmission' or 'meaning-taking' to 'meaning-making' (Uzzell, 1998; Silverman, 1999). Thus the focus of free-choice learning research is on the multiple ways in which visitors make sense of the information they encounter, rather than whether visitors 'get the message' the provider intended to convey. While attitude and behaviour change are acknowledged as important outcomes of a free-choice learning experience, these need to be understood as part of 'a broad range of dimensions involving knowledge, skills, aesthetic responses and emotions' (Hooper-Greenhill, 2004, p. 163).

In considering how free-choice learning experiences might promote environmentally sustainable attitudes and behaviour, it is important to interpret these learning outcomes in their broadest sense. Changes in attitudes and values may involve changes in feelings about particular species, the environment in general, social and political issues, one's own place in the world or interactions with other people. It may involve an increase in empathy, an increase in motivation or a change in perceptions, or it may confirm for learners what they already know (Hooper-Greenhill, 2004). Similarly, changes in behaviour may involve lifestyle changes, talking to others about environmental issues, joining volunteer programmes, or donating to environmental organisations. It may involve changes in actual behaviour, or changes in behavioural intentions.

Falk and Dierking's (2000) Contextual Model of Learning is widely accepted as a theoretical construct for understanding and

investigating free-choice learning. This model conceptualises learning as being constructed over time, as the process and product of the interactions between three overlapping contexts – the personal, the sociocultural and the physical (Falk & Dierking, 2000). The model recognises that free-choice learners have a range of prior experiences and motivations for learning that influence the way they experience the learning environment, and that learning is a cumulative process drawing on a wide variety of sources over long periods of time. For these reasons, the learning that occurs in free-choice contexts is notoriously difficult to measure. The Contextual Model of Learning is consistent with recent constructivist (Hein, 1996, 1998) and socio-cultural (Schauble et al., 1997) theories of learning, which view learning as an active process of meaning-making that emerges as individuals interact with phenomena and cultural knowledge in a social context.

While free-choice learning research generally interprets learning in this broad sense, research in environmental interpretation has focused more specifically on the ways in which environmentally sustainable attitudes and behaviour can be developed through experiences in informal educational settings. Interpretive practice is generally informed by a broad, multi-disciplinary theoretical base, with input from research in education, psychology, sociology, cultural studies and tourism (Ballantyne & Uzzell, 1999). One particularly influential theory in relation to attitude and behaviour change, however, has been Ajzen's (1985) Theory of Planned Behaviour. The theory posits that behaviour is a function of three categories of salient beliefs: behavioural beliefs (beliefs about the outcomes and consequences of particular behaviour); normative beliefs (beliefs relating to social pressures to perform or not perform the behaviour); and control beliefs (beliefs about our ability, knowledge, skill, resources and opportunity to perform the behaviour). Thus, environmental interpretation that aims to influence specific attitudes and behaviour is often designed to challenge the salient behavioural, normative or control beliefs upon which the attitudes and behaviours are based, and/or promote behavioural, normative or control beliefs that will achieve the desired outcomes (Ham & Krumpe, 1996).

Examples of How Informal Educational Settings Promote Environmentally Sustainable Attitudes and Behaviour

Although learners in informal educational environments often spend only short periods of time engaged in the learning experience, research suggests that such experiences can have an important influence on their attitudes and behaviour. Presented here are examples from four different informal educational contexts, which

illustrate their potential impact on the development of environmentally sustainable attitudes and behaviour.

Encounters with nature:

Encounters with nature, particularly those involving wildlife, can have a strong emotional impact on participants (Ballantyne et al., 2001a, 2001b; Ballantyne & Packer, 2002). Research in zoos and aquariums indicates that visitors' experiences in such settings contribute to their basic knowledge, understanding, awareness and beliefs in relation to sustainability issues (Adelman et al., 2000; Ham and Weiler, 2002). In a qualitative study of visitors' free-choice learning experiences in a variety of settings, including an aquarium and a national park, Packer (2004) found that for many participants, the learning experience involved questioning and rethinking their attitudes and behaviour in relation to environmental issues. For example, one aquarium visitor reported that seeing the aquarium displays had prompted him to change his attitude to trawler fishing: 'I'd like to see that stopped. Look what they kill! They destroy and they ruin the bottom of the ocean, they must do … because you see what's all there.'

Although some studies have found that short-term changes in levels of commitment or planned activism may not persist over time (Adelman et al., 2000; Rickinson, 2001; Dierking et al., 2003), other studies, especially those focusing on wildlife encounters in natural environments, do report significant improvements in the adoption of environmentally sustainable practices after visitors leave the site. Two Australian studies, for example, found that the majority of visitors to a turtle rookery (Howard, 1999) and a wild dolphin encounter (Orams, 1997) were not only more knowledgeable after their visit, but also reported having engaged in specific conservation behaviour such as removing litter from beaches and informing others about conservation issues, up to six months after the experience.

Sustainable tourism:

Sustainable tourism provides visitors with the opportunity to observe and interact with a protected environment without destroying or damaging the resources on which its future depends (Fallon & Kriwoken, 2003). Ecotourism in particular is often considered an ideal method of enhancing the long-term conservation of wildlife and wildlife habitats (Reynolds & Braithwaite, 2001; Wilson & Tisdell, 2001). The definition of ecotourism used by the Australian National Ecotourism Strategy emphasises the important place of education and interpretation:

'ecotourism is nature-based tourism that involves education and interpretation of the natural environment and is managed to be ecologically sustainable' (Commonwealth Department of Tourism, 1994, p. 17). The recent rise in popularity of ecotourism experiences has provided both opportunities and challenges relating to the interpretation of natural and protected sites (Ballantyne & Uzzell, 1999). The growing tourist demand for such experiences provides important resources that can be applied to environmental education activities. However, the resulting increase in visitation may have detrimental effects in terms of habitat destruction and changes to the behaviour, feeding patterns and well-being of wildlife (Orams, 1994; Ballantyne et al., 2000; Weiler, 2000).

One approach to managing this problem is to develop site-based interpretation and signage designed to influence visitor behaviour (Orams, 1996b; Ham & Weiler, 2002; Porter & Howard, 2003). This provides an attractive alternative or adjunct to the use of physical controls such as barriers, paths and boardwalks to 'harden' or protect endangered areas (McArthur & Hall, 1996; Orams, 1996a). Ham and Krumpe (1996) discuss the application of the Theory of Planned Behaviour (Ajzen, 1991) to encourage horse campers, through carefully-designed signs and brochures, to adopt new behaviours to lessen their environmental impacts. Ballantyne and Hughes (in press) developed and compared signage using three different theoretical approaches (Theory of Planned Behaviour, Protection Motivation Theory (Rogers & Prentice-Dunn, 1997) and Constructivist Learning Theory) designed to reduce the incidence of visitors feeding wildlife in national park areas. Both studies suggest that well-designed signage (that focuses on specific beliefs or misconceptions identified within the target audience) is potentially effective in changing visitors' on-site behaviour.

The use of interpretation to influence visitor behaviour in relation to their visit to a particular site is an important management tool with the capacity to reduce inappropriate behaviour through education (Orams, 1996a). While it is important to maintain this function, Ballantyne (1998) urges interpreters to extend their vision beyond the needs of the site itself to include 'the development of an environmentally literate society' (p. 78). Interpretation which challenges visitors to examine their environmental attitudes and the impacts of their actions, and develops visitors' skills in identifying, analysing, evaluating and applying solutions to environmental problems can contribute to this ultimate goal.

School field trips:

Environmental education teachers often use visits to natural areas such as national parks, state forests and bushland areas to support and extend formal school environmental education programmes. Such experiences allow students to apply theoretical knowledge to real life examples and engage emotionally with environmental issues (Ballantyne and Uzzell, 1994; Ballantyne et al., 2001b). For example, Ballantyne, Fien and Packer (2001a) found that fieldwork in the local environment was particularly effective in influencing students' environmental learning as well as facilitating the role that students played as catalysts of environmental change in their homes and communities.

In another study investigating the impact of school field trips in promoting environmentally sustainable attitudes and behaviour, school students' expectations regarding environmental education experiences in natural areas, and their attitudinal and behaviour changes were reported (Ballantyne & Packer, 2002). Questionnaire responses from 580 students aged 8–17 years confirmed that learning in natural environments is attractive to students and has an important impact on their attitudes towards the environment, their desire to look after the environment, their behaviour in natural areas and their household environmental practices. For example, students made the following comments regarding the ways in which they had changed their household practices as a result of their excursion to a natural area: 'I've changed the amount of shampoo, rubbish and water I use' (9-year-old); 'I turn off the taps and wash our car on the grass' (10-year-old); 'I make my family recycle' (13-year-old); and 'I'm more conscious of what I put down the drain' (15-year-old).

Issues exhibitions:

Today's museums and science centres provide experiences that encourage visitors to explore not only historical artefacts and scientific phenomena, but also contemporary social issues. Issues exhibitions provide information on relevant issues and encourage visitors to think critically, make decisions, interact with other visitors, and explore their own feelings on complex topics (Pedretti, 2002). Pedretti (2002) cites the example of the Mine Games exhibit at Science World, Vancouver. Here, visitors participate in a simulation game that explores the multiple impacts of building a potential mine, concluding with a mediated debate of the issue from a variety of perspectives. Pedretti argues that issues-based exhibitions are able to present a multiplicity of views that challenge

visitors to actively explore, experiment and draw conclusions about issues of relevance to their lives.

The *EcoLogic: creating a sustainable future exhibition* in Sydney's Powerhouse Museum is another example of a museum exhibition designed to explore society's changing values and attitudes to the environment. The exhibition uses objects, artworks, videos and interactives to explain complex issues and challenge visitors to make sustainable lifestyle choices. As part of this exhibition, the Bigfoot touch-screen controlled interactive programme estimates the size of a visitor's ecological footprint from their answers to 15 questions. Such experiences can provide a powerful way of challenging visitors to think about their own impact on the environment.

Factors Contributing to the Adoption of Environmentally Sustainable Attitudes and Practice.

A number of research studies have attempted to explore the factors that contribute to the effectiveness of free-choice learning experiences in influencing the adoption of environmentally sustainable attitudes and practices. One of the key difficulties of assessing the educational impact of free-choice learning experiences is that visitors differ greatly in their pre-visit experiences, knowledge, attitudes, interests and motivations. Learners in free-choice contexts are a more heterogeneous group than is typically the case in formal education settings (Falk & Dierking, 2000). Such differences directly affect how each individual perceives and responds to the experience. This high degree of variability has made it historically difficult to measure the outcomes and impact of free-choice learning experiences (Falk & Adelman, 2003). Quantitative results can be misleading, either suggesting that no learning has occurred when in fact it has, or suggesting that learning has occurred uniformly when in fact it is stronger in some sub-groups than others (Falk, personal communication, July 2004). Consequently, much of the research in this area relies on qualitative data.

Factors that have been most consistently identified include those that arouse learners' emotions, challenge their beliefs and enhance their environmental conceptions. These processes are intimately interconnected and cannot be neatly separated. Ballantyne and Packer (1996) present a theoretical framework for understanding environmental learning as a meaning-making process that incorporates the deepening and expansion of personal knowledge of sustainability issues; changes in awareness, appreciation and concern for wildlife; development of intentions to take or refrain

from specific personal actions that have an impact on the environment; and enactment of lifestyle changes designed to support environmental sustainability. They propose that, to accomplish lasting, meaningful and effective change in environmental conceptions, it is necessary to employ a range of strategies that address the learner's knowledge, attitudes, values and behavioural orientations as part of an integrated approach. For example, such an approach may include a focus on emotions or beliefs, as illustrated in the research findings presented in the following section. It is important to recognise, however, that different strategies will be effective for different people in different contexts and so a combination of strategies will usually be most effective.

Arousing emotions:

Recent theories of learning have started to take greater account of the role of emotion in learning, and the interaction of cognition and emotion is one of the most active and rapidly developing areas within psychological science (Eich & Schooler, 2000). Emotion plays a role as a motivational force in learning, influencing our selection of what we attend to, and what seems important to explore (Boler, 1999). Moderate levels of emotional arousal produced by novel, surprising, complex or ambiguous stimuli result in curiosity and exploratory behaviour (Berlyne, 1960; Csikszentmihalyi & Hermanson, 1995). Attraction to, interest in, or enjoyment of a topic or task can also lead to increased attention, greater concentration, and an increased willingness to learn (Krapp et al., 1992; Pekrun, 1992). Emotion also acts as an important ingredient in memory. The emotional aspects of activities and events provide important contextual memory prompts that aid later recall of information (Sylwester, 1994). For example, many people can vividly recall receiving news of the assassination of President Kennedy or the death of Princess Diana. Such phenomena have been termed 'flashbulb memories' and serve as evidence of the powerful effect of emotion on learning.

The role of emotion in moral judgement and attitude development has been explored somewhat more extensively than the role of emotion in learning, as the emotional aspects of these processes have long been recognised. Attitudes, for example, are commonly understood to include both cognitive and affective components, and models of attitude change specify several ways in which emotions may participate in the process (Breckler, 1993). Similarly, social judgement, morality and ethical stances are seen as a joint product of both cognition and affect (Kaplan, 1991; Yob, 1997). In relation to 'nature-protective behaviours' such as reduced energy

consumption, Kals, Schumacher and Montada (1999) contend that rational decision making processes are not sufficient to explain engagement in such behaviours without taking into account the power of emotions such as feelings of guilt, fear or emotional affinity toward nature.

Ballantyne, Fien and Packer's (2001a, 2001b, 2001c) work regarding the impact of environmental education programmes on student learning suggests that emotional engagement may be a powerful factor contributing to the achievement of environmental education and sustainability goals. For example, school students who were asked what aspects of an environmental education programme had contributed to changes in their knowledge, skills, attitudes, values and behaviour towards the environment, frequently cited information or observations that appeared to be emotionally charged, e.g., 'a chance encounter with a scrub turkey whose leg had become entangled in a piece of string'; 'knowing that there are animals and people dying from pollution'; 'imagining and listening to what could happen if we don't change' (Ballantyne et al., 2001b). Ballantyne and Packer (2002) found that school students on field trips to natural areas reported that observing and experiencing wildlife in the natural environment aroused empathy ('the really little animals that we found – they can't defend themselves if someone put detergent or something in the water'; 14-year-old) and became an aesthetic experience ('seeing them up close and seeing how beautiful and delicate they are' 10-year-old). Packer (2004) also found that in many cases, visitors to free-choice settings reported that challenges to their personal attitudes were stimulated, or at least accompanied by some emotional involvement, e.g., 'Probably seeing that turtle out the front, how it had that big cut thing on its back, made me think about boat safety' (aquarium visitor).

Using quantitative methods, Howard (1999) demonstrated that visitors to a turtle rookery were more likely to report both an intention to engage in turtle conservation behaviour and to report having actually engaged in such behaviour, if they had reported their experience at the turtle rookery as 'arousing' (including the ideas of excitement and surprise). According to Packer (2004), visitors to free-choice settings perceive aspects such as learning, discovery and excitement to be part of the same construct, and that this 'learning and discovery' construct represents the essence of the experience of learning in such sites (Packer and Ballantyne 2002; 2004). Thus free-choice learning contexts are well-placed to influence environmental attitudes and behaviour using appeals to the emotions.

Although the studies above indicate that emotional engagement may impact positively upon the development of environmental attitudes and behaviour, it is unclear how long this impact might last. The limited evidence that is available suggests that when an emotional component is involved, the impact of the experience may be longer-lasting than when an individual is not emotionally engaged. Further research is needed in this area.

Challenging beliefs:

Ham and Krumpe (1996) suggest that informal environmental education programmes aiming to influence visitors' attitudes and behaviours should address the specific beliefs that are prominent, pertinent and important to the target audience. Based on the Theory of Planned Behaviour (Ajzen, 1985, 1991), Ham and Krumpe argue that 'themes that are selected and developed on the basis of salient beliefs will be strategically more useful than those selected for other reasons' (p. 18). Similarly, Ballantyne (1998), drawing on constructivist theory, argues the importance of developing an understanding of visitors' prior knowledge, attitudes and behavioural orientations. In a large-scale survey of visitors to a World Heritage area in Queensland, Australia, Ballantyne, Packer and Beckmann (1998) demonstrate that visitor characteristics such as motivations, attitudes and interests influence their use of and response to various information and interpretation services. The learning experience is thus likely to be more effective if both the messages and the media are designed to target particular visitor groups.

Challenging learners' beliefs about their own ability (or inability) to make an impact on environmental problems is also an important issue to address. Providing positive experiences that demonstrate to learners that they can have an influence in their own local environment helps to overcome the 'action paralysis' identified by Uzzell and Rutland (1993). Even young children can have an influence with regard to everyday household practices such as walking or riding a bike to school, taking shorter showers, turning off taps and lights and purchasing environmentally-friendly cleaning products (Ballantyne et al., 2001a). Alsop and Watts (1997) stress the importance of demonstrating to learners the applicability of the knowledge they develop. To this end, knowledge should be 'trustworthy, 'do-able,' and 'useful for decision-making' and should apply – or be able to be made to apply – to actions they take in their own lives (p. 648).

Enhancing environmental conceptions:

Based on a constructivist perspective, Ballantyne and Packer (1996) suggest that, in order to design meaningful learning experiences, environmental educators must be aware of the range of conceptions held by learners, and how these might support or interfere with the new information being presented or the desired learning outcomes. Approaches based on this view focus on learners' existing conceptions or misconceptions regarding a phenomenon, help learners become aware of their own and alternative conceptions, and selectively confront them with new information or learning experiences designed to challenge inaccurate or inadequate conceptions (Ballantyne & Bain, 1995). Informal educational settings such as museums and science centres are in a unique position to address environmental misconceptions by designing exhibits that accurately demonstrate relevant phenomena and challenge learners to question their accuracy and to search for alternative explanations (Ballantyne, 2004).

One powerful way of challenging learners' environmental conceptions has been identified in research by Ballantyne, Fien and Packer (2001a, 2001b). Focusing on the evidence of an environmental problem (particularly in relation to human impact and mismanagement), the effects of the problem (particularly in relation to wildlife and wildlife habitats), and the efforts needed to alleviate the problem (practical steps the learner can take), allows the cognitive, affective and behavioural elements of environmental education to be effectively integrated. It is suggested that learning experiences in informal settings that incorporate a clear focus on these three aspects, and that include (without exploiting) the affective element of each, will be most effective in promoting environmentally sustainable attitudes and behaviours.

Recommendations for Current Practice and Future Research

From the above it is clear that informal educational environments provide important opportunities for the promotion of environmentally sustainable attitudes and behaviours that are rarely possible in more formal contexts. They allow learners to engage with and in the environment, to observe the evidence and effects of environmental mismanagement, and to explore and construct their environmental knowledge, skills, attitudes, beliefs and behaviours in personally relevant and meaningful ways. However, such learning contexts are limited in what they can achieve in isolation. Adelman, Falk and James (2000), for example, found that changes in conservation behaviour engendered by an aquarium visit were short-lived, and similar findings have been reported elsewhere

(Rickinson, 2001; Dierking et al., 2003). Adelman et al. interpret their finding as being due to the absence of reinforcing experiences after the visit. Indeed, the lack of opportunities for preparatory and follow-up experiences has been cited as one of the shortcomings of informal educational settings (Ballantyne & Uzzell, 1994). The future of environmental education, it is argued, lies in the understanding that it is a lifelong learning endeavour. By integrating free-choice and formal environmental learning experiences, we equip individuals not only to adopt environmentally sustainable attitudes and behaviours, but to continue exploring and developing their relationship with the environment throughout their lifetimes. In this regard, it is suggested that a metacognitive approach to the design of learning experiences in both formal and informal learning environments would accomplish this aim (Ballantyne, in preparation).

Although the recent past has seen an increasing amount of research undertaken into the impact of informal educational settings and free-choice learning experiences on the development of environmentally sustainable attitudes and practices, there is still much needing to be done. For example, more work is needed to:

- advance the theoretical understanding of the role and impact of free-choice learning experiences on students' and visitors' learning for sustainability;
- identify factors that facilitate learning for sustainability and, in particular, those that support learners' adoption of environmentally sustainable practices;
- examine the impact of type and length of engagement (e.g. day visit vs residential programmes);
- develop empirically based principles for the design of learning experiences in informal settings that optimise learning for sustainability;
- develop better instruments to measure learning for sustainability, particularly for young learners;
- investigate the impact of 'authentic' experiences in the environment on learning for sustainability;
- determine how emotional engagement during an environmental learning experience impacts on students' understanding, attitude development and subsequent action over time;
- develop appropriate methods for determining visitors' prior knowledge to inform the design of effective learning experiences;
- investigate the impact of different follow-up processes;
- explore the long term impact of issues-based exhibitions and interpretation on visitor learning for sustainability and the adoption of enduring attitudes and sustainable practices.

Finally, research regarding the ways in which formal and free-choice learning experiences can work together to help individuals make informed choices for the environment should be encouraged. For example, to what extent do free-choice learning experiences motivate students to engage in further exploration and in-depth learning regarding environmental issues? Can the teaching strategies developed for use in formal contexts be successfully adapted for use in informal settings? Collaborative research that integrates the formal and informal learning sectors will provide a strong foundation for addressing the aims of environmental education into the future. As signalled by Knapp (2000, p. 36), 'We must begin to find new and better ways to combine formal environmental education efforts with those of non-formal environmental education. The similarities between them require that the success of either depends on the development of partnerships'. Unfortunately, as the investigation of the 'state of the game' in this paper indicates, the development of such partnerships and the sharing of pedagogical skills and insights are not common. Accordingly, much still needs to be done to combine the knowledge, skills and experience of teachers, interpreters and museum educators to improve the impact of learning experiences in formal and informal settings, thus facilitating ongoing lifelong learning for sustainability.

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