Environmental Education Research

Routledge
Taylor & Francis Group

Environmental Education Research

ISSN: 1350-4622 (Print) 1469-5871 (Online) Journal homepage: www.tandfonline.com/journals/ceer20

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To cite this article: Meng Wu, Zhen Zhu, Jin Chen, Lijuan Niu & Chi-Chang Liu (2020) Autobiographical memory functions: an emancipatory approach to construct environmental education outcomes, Environmental Education Research, 26:5, 632-649, DOI: 10.1080/13504622.2020.1724890

To link to this article: https://doi.org/10.1080/13504622.2020.1724890

ENVIRONMENTAL EDUCATION RESEARCH
2020, VOL. 26, NO. 5, 632–649
https://doi.org/10.1080/13504622.2020.1724890

Autobiographical memory functions: an emancipatory approach to construct environmental education outcomes

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ABSTRACT

In this study, we assessed how 34 young adult participants in an environmental education (EE) program from 2011 to 2014 constructed their learning outcomes through interviews and the exploration of autobiographical memory functions (AMFs) regarding program experiences. We articulated a variety of directive, social, and self AMFs, including the achievement of the top five typical objectives of EE, increase in positive social norms through reminiscing and sharing memories, and attainment of diverse personal growth. We also constructed the relationship of these outcomes with the ultimate objective of EE. This method can presumably be used to emergently construct outcomes for evaluating emancipatory EE programs, which are on the request of tackling wicked environmental problems.

ARTICLE HISTORY
Received 25 October 2018
Accepted 30 January 2020

KEYWORDS
Autobiographical memory function; outcome evaluation; emancipatory perspective; qualitative evaluation; shark

1. Introduction

Although environmental education (EE) has diverse theoretical and practical concerns (Sauvé 2005), the ultimate objective of EE mainly focus on cultivating responsible environmental citizens who can perform pro-environmental behaviors (Hungerford and Volk 1990; Short 2009; Torkar 2014; Siegel, Cutter-Mackenzie-Knowles, and Bellert 2018) to enhancing human-environment relationships. Two different methods for accomplishing this were distinguished by Wals et al. (2008): the instrumental perspective, which seeks to change the predetermined irresponsible environmental behaviors of target groups through EE, and the emancipatory perspective, which seeks to provide participants with opportunities for positive development and to encourage autonomous thinking, active dialogue, and the self-determined establishment of their own objectives and plans for action (Schusler and Krasny 2010; Mayer and Tschapka 2008; Jickling and Wals 2008). Because environmental issues are wicked problems without universal or fixed solutions (Wals 2007; Brown, Harris, and Russell 2010; Lotz-Sisitka et al. 2015) which require people to respond from diverse perspectives and through making their own deliberate decisions, a relatively more emancipatory perspective seems more suitable than an instrumental perspective for facilitating people to tackle wicked environmental issues.

However, current EE models still emphasize changing predetermined behaviors (Hungerford and Volk 1990; Kollmuss and Agyeman 2002; Brody 2005; Bamberg and Möser 2007; Heimlich

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Supplemental data for this article is available online at https://doi.org/10.1080/13504622.2020.1724890.

and Ardoin 2008; McDonald 2014; Morren and Grinstein 2016), continually seeking well-articulated, more measurable and sophisticated outcome indicators to both increase and 'prove' their programs' effectiveness (Wals et al. 2008). Therefore, methods for evaluating non-predetermined outcomes (Wals et al. 2008) produced by learners' autonomy and self-determination (Wals 2010) still require exploration.

With this consideration in mind we find that inviting audiences to share their memories of an EE program for the purpose of understanding how they perceive their own gains and subsequent autonomous behavioral decisions may be a suitable evaluation method from the perspective of emancipatory EE. The experience of participating in an EE program may become an autobiographical memory (AM) for participants. In light of the directive, social, and self functions of AM, this learning experience can provide participants with:

1. guidance for developing subsequent environmental attitudes, behaviors, and social skills;
2. materials for reminiscing with other participants, sharing with nonparticipants, or even teaching others, which may incite change in more people or expand the effect of the program; and
3. pleasant memories with which they can enrich their lives (Liddicoat and Krasny 2014).

In practice, this evaluation approach initiated by Liddicoat and Krasny (2014), which consists of conducting a summative outcome evaluation by interviewing participants after the completion of the program from the perspective of autobiographical memory functions (AMFs), can be conveniently applied to other EE programs. We can regard the EE experiences of participants as their AMs, since their own participation experiences are precisely their personal memorable episodes (Kihlstrom 2009; Williams, Conway, and Cohen 2008). Then we can analyse the influence of the program by constructing directive, social, and self AMFs from these experiences.

Thus we can use Liddicoat and Krasny's (2014) initial work as a start point to tackle the question how to evaluate EE outcomes in an emancipatory posture. However, the EE outcomes constructed through AMFs in their study (Liddicoat and Krasny 2014) were insufficiently complete for the explication of all aspects contained in the three functions. For example, the self function was not well recognized; therefore, it remained unclear how participants understood or explored themselves through their EE program experiences. Furthermore, the role of social and self AMFs in the achievement of the primary EE objective (behavior change) was ambiguous. As a new evaluation method, AMFs should be 'crystallized' (Tracy 2010) through existing EE theories and further improved if they are to become a more effective tool for constructing and understanding EE program outcomes.

Therefore, in our study we explored a more detailed categorization of AMFs constructed from EE experiences and attempted to synthesize AMFs, typical EE objectives clarified by the Tbilisi Declaration, and behavioral science theories, such as the theory of planned behavior (TPB) (Ajzen 1991, 2002). More specifically, we investigated the following research questions within the context of an EE program:

1. How do the AMs of EE program participants perform directive, social, or self functions?
2. How do directive AMFs reflect the five typical EE outcomes?
3. How do social or self AMFs influence the environmental behaviors of participants?

2. AMFs in EE evaluation

Long-term memory is classified as explicit memory (which can be consciously extracted) or implicit memory (which guides performance but cannot be intentionally recalled) (Baddeley 2001; Baddeley, Eysenck, and Anderson 2009). Explicit memory can be further divided into semantic memory (general knowledge) and episodic memory (memory associated with specific events)

(Baddeley 2001; Baddeley, Eysenck, and Anderson 2009). AM is primarily a form of episodic memory involving personal experiences in particular (e.g. objects, characters, and events that one experienced at a specific time and place) (Kihlstrom 2009; Kopelman and Kapur 2001; Tulving 2002), but it is also combined with some factual semantic memories (such as the name of one's school) (Williams, Conway, and Cohen 2008). AM has three main functions or uses (Bluck et al. 2005), which were used to access outcomes of residential outdoor environmental education (ROEE) programs (Liddicoat and Krasny 2014).

2.1. Directive functions

AM can direct attitude and behavior. Experiences are used as a reference for solving current problems or as a guide for current or future behavior (Williams, Conway, and Cohen 2008; Pillemer 2003; Bluck et al. 2005). Researchers found that ROEE experiences could encourage outdoor recreation and environmental stewardship behaviors and facilitate in the learning and use of relevant scientific knowledge and interpersonal skills (Liddicoat and Krasny 2014), resulting in notable changes and improvements in environmental behavior and knowledge and social skills.

However, according to the consensus of UNESCO/UNEP. (1978) and further explanations by North American Association for Environmental Education (Paul and Byron 2014), the typical objectives and corresponding outcomes of EE are environmental awareness, knowledge, skills, attitudes, and behaviors. Thus, the evaluation results of ROEE programs (Liddicoat and Krasny 2014) do not seem to reflect all of the typical outcomes of EE, such as environmental awareness, skills, and attitudes. Hence, further explorations are required to assess the use of AMFs for constructing EE outcomes and the possible dimensions of these outcomes.

2.2. Social function

AM can encourage relevant social interactions by providing material for conversation (Bluck et al. 2005; Williams, Conway, and Cohen 2008). Sharing personal experiences can increase intimacy, and reminiscing about common experiences can enhance existing social connections (Williams, Conway, and Cohen 2008; Alea and Bluck 2003; Kihlstrom 2009). Researchers have found that the AM of ROEE might provide participants with a shared experience that they could recall together, share with nonparticipants, and even use to educate or encourage others to participate (Liddicoat and Krasny 2014).

However, the significance of these interactions on the ultimate objective of EE (changing the behaviors of learners) (Hungerford and Volk 1990) remains unclear. As one of the most effective theories for explaining and predicting behavior (Sheppard, Hartwick, and Warshaw 1988; Pavlou and Fygenson 2006; St John et al. 2014), the TPB indicates that the more positive a person's attitude (overall evaluation of the behavior) (Ajzen 2002), social norm (perceived social pressure or expectations of valued others regarding the behavior) (Finlay, Trafimow, and Moroi 1999), and perceived behavioral control (perceived difficulty of the behavior, including self-efficacy and required resources and opportunities) (Pavlou and Fygenson 2006) towards a behavior is, the greater is the person's behavioral intention and therefore the greater is the likelihood that the person will perform that behavior (Ajzen 1991, 2002). Reminiscing about shared experiences and sharing experiences with others may construct positive social norms in the person's social circle and in turn promote positive behaviors.

2.3. Self function

AM can help individuals understand themselves. Memory enables people to create and maintain a continuous sense of self over time (Williams, Conway, and Cohen 2008; Bluck et al. 2005) as

well as reflect on themselves, evaluate their progress towards individual goals, and conceptualize their futures (Kihlstrom 2009; Williams and Conway 2009). Memory can promote self-insight and self-growth as well as encourage personal change and self-regulation in adulthood (Bluck et al. 2005).

Although ROEE provided participants with positive memories, it did not reflect the two self AMFs (Liddicoat and Krasny 2014): self-reflecting on the continuity of life and recording progress towards personal goals (Bluck et al. 2005; Conway 2001). This absence may be because respondents were too young for self-reflection or because the society did not encourage participants to pursue environmental life goals (Liddicoat and Krasny 2014). Conversely, it may be because the dimensions of self (Myers and Twenge 2012; Woolfolk 2012; Santrock 2013), such as self-efficacy (Bandura 1997; Pajares 1997), self-esteem (Campbell and Lavallee 1993; Spencer and Markstrom-Adams 1990; Wigfield, Byrnes, and Eccles 2006; Roeser, Peck, and Nasir 2006), traits (Ashton 2013; Ashton and Lee 2007; Ashton, Lee, and De Vries 2014), interests (Hidi 1990; Hidi and Baird 1986; Hidi and Renninger 2006), and life visions (possible selves) (Markus and Nurius 1986; Taber and Blankemeyer 2015; Oyserman and James 2011), were insufficiently clear in the interview outline used by Liddicoat and Krasny (2014), leading to the inability of respondents to realize or recall these aspects in the moment and thus fail to provide an answer.

In conclusion, the outcomes constructed from the use of AMFs in other studies have not corresponded to typical EE outcomes; the effects of each AMF on changing the behavior of learners have remained nebulous. Our study attempted to improve the application of the AMF method in EE outcome assessments by elaborating on aspects of AMFs through consideration of typical EE outcomes and the TPB. By bridging AMFs with existing EE theories, this study offers new insights into how AMFs can be used to assess the achievement of EE objectives.

3. Methods

A qualitative method is defined as the holistic study of social phenomena in a natural setting that forms an interpretive understanding of an action and its subjective meaning (Chen 1996, 2000). We used qualitative research to understand 'the meaning, for participants in the study, of the events, situations, and actions they are involved with and of the accounts that they give of their lives and experiences' (Maxwell 2005, 17). Because our study retrospectively explored how participants had constructed (Schacter 2012; Conway and Loveday 2015), experienced, perceived, interpreted, reflected, and used their AMs of EE experiences to generate personal meanings, qualitative interviews conducted by a postmodern 'traveller-interviewer' (Kvale and Brinkmann 2009) were appropriate for this project (Mason 2002; Kihlstrom 2009). That is, we did not want to and we cannot evaluate how precise their AMs were, but we focused on the meaning participants attached to their AMs, which are mental constructions of the past but not the past per se (Conway and Loveday 2015). Limited research on the use of AMFs in EE outcome evaluation also justified an emergent, iterative, and inductive approach to generating data and analysis (Merriam 2009).

3.1. Research settings

We collected data from a No Shark Fin (NSF) program of the Beijing office of Roots & Shoots (R&S) in 2015. At that time, R&S had developed for 20 years and had worked with more than 1,000 schools to implement EE in mainland China (Wong 2014), indicating remarkable educational outcomes and research benefits. They advocated that the purpose of EE was to 'teach knowledge about nature, animals and human, cultivate skills to live in harmony with them, and encourage actions with attitudes of concern for the environment, animals, and communities' (Wong 2014). This perspective of EE outcomes is essentially consistent with the Tbilisi

Declaration and thus might provide the potential to answer the first and second research questions. According to R&S, 'EE is an important supplement to school's quality education … Students learn about environmental issues, seek for solutions, and incite change with their actions. Moreover, they conveyed positive information they received to their relatives and friends … '(Wong 2014). R&S's concerns regarding the development and interpersonal interactions of participants may provide sufficient rich information to answer the first and third research questions. Moreover, after 20 years of development, R&S wished to understand its own effect on participants, which might encourage it to support this research.

NSF is an environmental-action program in which groups of college students volunteer to participate. Each candidate team needs to submit their own one-academic-year environmental-action project proposal aimed at raising public awareness about protecting sharks and collecting pledge signatures for abstinence from the consumption of shark fins at the beginning. According to the quality of submitted project proposals, several eligible teams will be selected and invited to join the program. They will be provided with certain essential materials, funding (1,000 CNY per team), and instructions by R&S for refining and conducting their projects. During their own activities, the students learned by teaching others (Duran 2017). These teams will compete in project influence (numbers of pledge signatures collected) and creativity (novelty of activities conducted). The top three teams of the two categories will earn small bonuses (1,000 to 3,000 CNY per team in 2011, 2012, and 2013; 1,000 to 5,000 CNY per team in 2014) and get ranking certificates. Each team will get a participation certificate.

Although NSF seemed to have a predetermined outcome (i.e. abstinence from the consumption of shark fins) which made the program instrumental to some extent, we argued that it was emancipatory in nature, because throughout participation was voluntary and self-determined. Participants' conscious approvals of the aim of NSF and decisions on their own actions reflected that they had the autonomy to co-create their own learning objectives, process and outcomes.

As an environmental-action program, NSF might provide participants supportive context for positive youth development (Schusler and Krasny 2010). Diverse outcomes, especially self AMFs, and the emancipatory feature of NSF might emerge from these personal growth. This program also reflected some characteristics of EE best practices, such as 'active participation,' 'project-based learning,' and 'cooperative/group learning' (Stern, Powell, and Hill 2014), which might afford data in the form of a rich variety of educational outcomes useful for answering the research questions.

3.2. Data collection

We developed our interview outline based on studies on AMFs (Bluck et al. 2005; Liddicoat and Krasny 2014), typical EE outcomes (UNESCO/UNEP. 1978; Paul and Byron 2014), the TPB (Ajzen 1991, 2002; Finlay, Trafimow, and Moroi 1999; Pavlou and Fygenson 2006), and diverse dimensions of the concept of self (Myers and Twenge 2012; Woolfolk 2012; Santrock 2013). The outline followed a semi-structured funnel format (Kerlinger and Lee 2000; Krueger 2000) and contained three parts: broad, leading-in questions for un-cued memories; specific questions for cued memories (Baddeley, Eysenck, and Anderson 2009), especially reflection on meanings, interpretations, and the three kinds of AMFs (Liddicoat and Krasny 2014); and supplemental questions for complementary data. Questions representative of those asked in the interviews are presented in Table 1.

Interviewees were team leaders or core members of their respective groups. Most of them were participants who had attended the NSF program in 2011, 2012, or 2013. In 2015, the first author sent an invitation letter to each team by email, stating the purpose and process of the research. After this stage, the second-round invitation was issued to unresponsive teams through QQ or WeChat (two kinds of instant messaging software). Thirty-one interviewees were recruited. In 2017, the first author invited members of teams who had attended the NSF program in 2014 to participate in this research. Three other interviewees were recruited. All 34 interviewees

Table 1. Interview outline used to construct AMFs of NSF program experiences.

Leading-in
1. When did you participate in the NSF program? What role did you play in it?
2. What were your overall reactions and general feelings during this program?
3. Have you ever done similar things before participation in this program? Why did you decide to take part in this program? Have you done anything similar since completing the program?
4. How do you regard your experience of the program? What does it mean to you?
Environmental aspects
5. What influence and how did the experience have on your understanding or knowledge regarding sharks/oceans? On your skills for protecting them? *[Directive AMFs: Environmental Awareness, Knowledge, Skills]*
6. What influence and how did the experience have on your views or opinions regarding nature/ecosystems/the environment and environmental issues? On your views or opinions regarding environmental protection? On your environmental behaviors? *[Directive AMFs: Environmental Sensitivity, Attitudes, Behaviors]*
Social aspects
7. What influence and how did the experience have on your social interactions and interpersonal communication? Could you make friends through the program? *[Directive AMFs: Social Skills]*
8. How often did you contemplate or discuss your experiences regarding this program? For what reasons? With whom? With participants? With nonparticipants? Have you ever contemplated or discussed your environmental or scientific experiences from this program with others? *[Social AMFs: Reminiscing, Sharing]*
Self aspects
9. What influence and how did the experience have on your hobbies? On your academic interests? On your ideals, career development, or life planning? *[Self AMFs: Hobbies, Visions]*
10. What influence and how did the experience have on your personal development, self-knowledge, such as your capacities/self-confidence, self-evaluation/self-esteem/self-worth/self-image, and character/personality? *[Self AMFs: Self-efficacy, Self-esteem, Traits]*
Supplement
11. If the experience affected you, was it during, immediately after, or after completion of the program?
12. Can you identify an experience you had in this program for which you hope current participants will or will not experience? Something that you did or learned in this program that you are still doing or using today?
13. What influence and how did the experiences have on your views regarding R&S/NGOs? What are your thoughts regarding the future of this program?

voluntarily participated in the interview and signed a consent form. The interview was conducted by telephone, QQ, or WeChat. The duration of each interview was 30 to 90 min. All interviews were recorded with permission and transcribed verbatim.

3.3. Data analysis

The first author read, reread, and coded interview transcripts using grounded theory analytical procedures (Strauss and Corbin 1998; Boeije 2009) through NVivo 11 to construct (Charmaz 2014) themes underpinning participant AMFs related to the NSF program. All our authors discussed and agreed upon the analysis and arguments generated by the first author.

By open coding we assigned emergent conceptual codes to transcripts, and refined them when new insights emerged. Through axial coding we formed connections between concepts to organize them into higher-order categorical themes and specified properties and dimensions of themes. In selective coding we established an interrelationship between selected core themes and other themes (Strauss and Corbin 1998; Boeije 2009). Throughout the analytic process, we employed constant comparison (Glaser and Strauss 1967) and theoretical sensitivity (Glaser 1978), comparing new instances in the data, coded excerpts, and theoretical insights from relevant literature to develop and refine the meaning, label, properties, dimensions of each concept, and relationships between themes.

We used our predefined theoretical framework and outcomes as tentative points of departure to enhance our theoretical sensitivity for understanding and theorizing, but did not impose them on our data (Charmaz 2014). Considering that we hope to grasp outcomes approved or defined by participants themselves in a grounded emancipatory posture, we executed 'coding with gerunds' (Glaser 1978) to immerse us into the data as this heuristic device 'helps to define implicit meanings and actions, gives researchers directions to explore, spurs making comparisons

between data, and suggests emergent links between processes in the data to pursue and check' (Charmaz 2014, 180).

3.4. Results presentation

Our purpose is to provide an emancipatory framework which contains a set of integrated conceptual claims constructed around core categories (Glaser 2003, 2) to evaluate EE outcomes. Accordingly, the writing style seems more appropriate in a conceptual way of 'making theoretical statements about the relationships between concepts, not writing descriptive statements about people' (Glaser 1978, 133), by relating 'concept to concept instead of concept to people' (Glaser 1998, 197). Indeed, a grounded theory is not concerned with accurate descriptions and thus there is no requirement to provide data that acts as 'evidence' or 'proof of the theory' (Glaser 2003, 135). Hence, our concentration in writing main text is not on presentation of evocatively descriptive accounts of data emphasizing participants' voice (Jones and Kriflik 2006).

However, we provided supplementary material containing more detailed information on data excerpts and corresponding arguments (Holliday 2016) underpinning and illustrating each theme, with an aim of facilitating comprehension and application of the evaluation approach we constructed (Glaser 2003).

4. Results and discussion

Our interpretation suggested that AMs of participating in an EE program (NSF) did perform directive, social, and self functions, as three overarching themes arose from our analysis, respectively corresponding to the three AMFs. Each theme contained several different aspects (subthemes) (Table 2–4 or Supplementary Table A1–A3), of which some are new and can complement the previous ROEE study (Liddicoat and Krasny 2014), implying that the value of AMFs as an evaluation method was enhanced.

4.1. Directive function: reflecting the five broad outcomes of EE

We constructed six directive AMFs. The first five aspects reflected the NSF EE objectives; learners became aware of environmental concerns, acquired environmental knowledge and skills, formed

Table 2. Themes of Directive AMFs Emerged from NSF program experiences.

Environmental awareness
Becoming aware of relevant issues
Becoming sensitive to relevant issues
Environmental knowledge
Gaining knowledge about sharks and the shark-finning problem
Environmental skills
Acquiring environmental-action skills
Improving environmental-action skills
Environmental attitudes
Properly valuing sharks and shark fins
Feeling the severity of shark decline, and realizing the necessity of shark protection
Environmental behaviors
Rejecting consumption of shark fins
Rejecting consumption of even other wildlife products
Restraining other behaviors in one's own daily life
Persuading others
Social skills
Learning teamwork skills
Practicing communication skills
Enhancing pre-existing interpersonal networks
Expanding interpersonal networks

Table 3. Themes of Social AMFs Emerged from NSF program experiences.

Reminiscing with teammates
Recalling content learned or social interactions experienced
Post-program social interactions as triggers for reminiscing
Post-program encounters with relevant environmental information as triggers for reminiscing
Social circle changes as obstacles for reminiscing
Sharing with nonparticipants
Post-program social interactions as triggers for sharing referable design forms
Post-program social interactions as triggers for sharing program contents
Post-program encounters with relevant environmental information as triggers for sharing program contents
Changing social norms towards personal practices of abstaining from shark-fin consumption
Changing social norms towards environmental actions of educating others

Table 4. Themes of Self AMFs Emerged from NSF program experiences.

Building self-efficacy
Gaining confidence for organization, advocacy, cooperation, and communication skills
Obtaining more confidence in initiating other projects in future
Confidence as an augmenter for intention
Boosting self-esteem
Experiencing a sense of accomplishment
Reaffirming self-value
Modifying the criteria for evaluating self-value
Exhibiting and shaping one's positive self-image
Changing traits
Becoming more outgoing
Becoming more energetic
Expanding hobbies
Developing new interests in conducting projects
Establishing initial interest in public welfare activities
Broadening pre-existing interest in environmental-protection activities
Renewing visions
Increasing intentions of participating in environmental activities, but having no influence on career plans
Integrating environmental concerns in pre-existing career goals
Redirecting career ideals

environmental attitudes towards sharks and shark conservation, and expressed corresponding environmental behaviors or intentions. The sixth aspect was social skills, which was distinct from the five environmental aspects (Table 2).

Directive AMFs of NSF not only guided changes in the environmental knowledge, attitudes, and behaviors of participants in accordance with the findings of other studies (Liddicoat and Krasny 2014), but also improved the environmental awareness and skills of participants. Altogether, these results reflected the five broad outcomes of EE (UNESCO/UNEP. 1978; Paul and Byron 2014). The reason why our work revealed two more outcomes than other studies might be that we explicitly invited our interviewees to think about these topics so that they would not omit them. These functions also reflected the vision of the Beijing office of R&S 'to educate youths about knowledge of nature, animals, and humans, to cultivate youths skill of living in harmony with them, and to encourage youths to take initiative with an attitude of concern for the environment, animals, and community' (Wong 2014).

We found that all respondents reported a refusal to eat shark fins and many of them mentioned a willingness or even took post-program actions to persuade others, reflecting a remarkable change in desired environmental behaviors. The reason for this can be speculated on through the central route to attitude change in the elaboration likelihood model (Petty and Cacioppo 1986; Powell et al. 2018; Stern 2018): under the condition that participants are motivated and able to elaborate an issue and its relevant arguments presented, the more valid and compelling the arguments are, the more likely the participants are to be persuaded, developing relatively accessible and stable attitudes in their cognitive structure, which are more predictive of behavior.

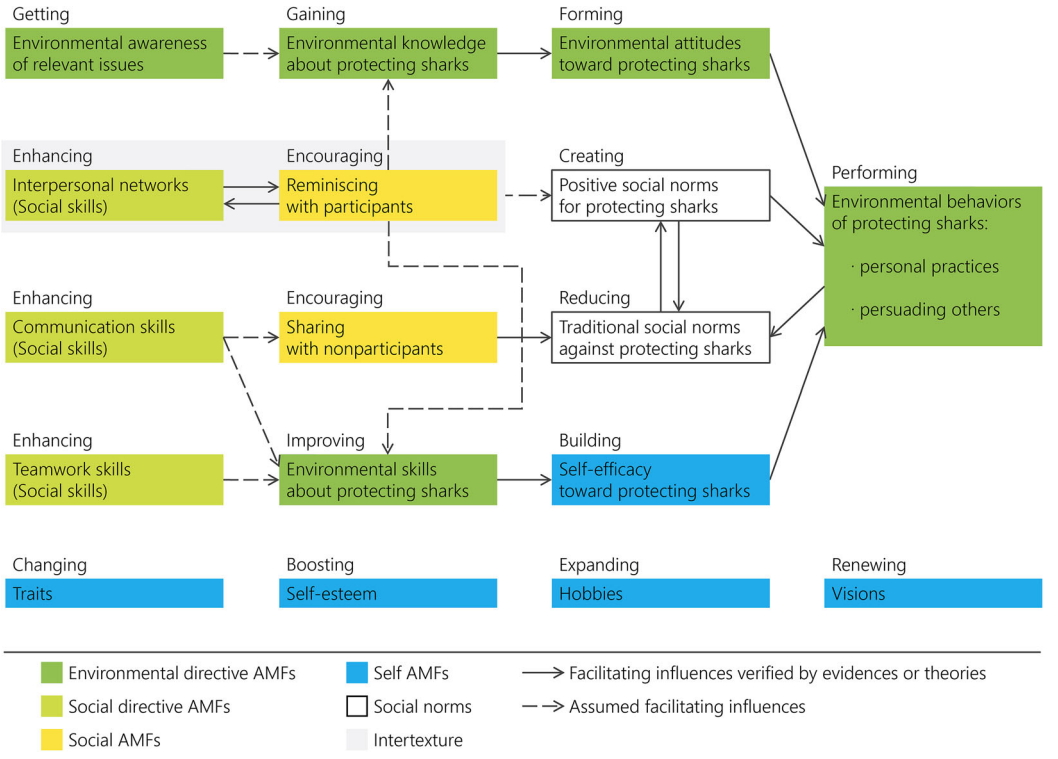

Figure 1. Relationships between AMFs of NSF Program Experiences.

It seemed obvious that our participants had the ability to make sense of relevant information about sharks that they needed to prepare and understand before their advocacy actions, while the will to succeed in persuading the public to commit to shark protection both demanded and motivated them to elaborate these information. In preparatory stage, for gathering and understanding information that they intended to interpret to their audiences, motivated participants might be encouraged to learn through self-explanation, which could promote their elaboration (Roscoe 2014; Chi et al. 1989; Chi 2000; Chi et al. 1994). In persuading stage, for responding to audiences' challenges or for posing hook-questions for audiences, participants might be spurred to recognise and resolve gaps in their own arguments, build quality explanations for others, and then reflectively construct a more in-depth understanding for themselves (Webb 1989; Roscoe and Chi 2007; Duran 2017) through which their elaboration on shark protection was promoted again. We speculate that, with the motivation and ability above to collect, deliberate, evaluate, and present arguments relevant to shark protection, our participants went into the 'central route' on self-persuasion, resulting in a robust attitude towards 'protecting sharks,' with corresponding behaviors that tended to be relatively predictable and salient (Heimlich, Adams, and Stern 2017) (Figure 1).

Traditional social norms toward shark-fin consumption (i.e. others' approvals or behaviors of consuming shark fins) and low self-efficacy toward protecting sharks also may have hindered behavior performances (Ajzen 1991, 2002). However, NSF encouraged and supported participants to persuade the public, signifying an opportunity to change social norms and improve the ability of participants to facilitate the change. (Indeed, a lot of our participants mentioned that they acquired or improved skills of organizing advocacy activities and public dissemination.) Thus, we presume that the restrictions imposed by traditional social norms on behavior performances in participants might be overcome psychologically. Moreover, newly formed positive social norms towards protecting sharks, which developed during NSF through R&S's supporting, participants'

team-building, inter-team communication, and successful persuasion, may facilitate participants' behaviors (Figure 1). Regarding to self-efficacy, it might not be difficult for individuals to control their consumption of shark fins. Also, participants might obtain self-efficacy on persuasion accompanied by environmental-action skills improvement through vicarious experience (Bandura 1997) contained in action examples offered by R&S and through mastery experience (Bandura 1997) in their own NSF actions. Therefore, self-efficacy might not impede but facilitate behavior performances (Figure 1).

The above transformative praxis contexts that we speculated in NSF for learners' behavior changes is in line with the emancipatory perspective. Instrumental EE models (Hungerford and Volk 1990; Kollmuss and Agyeman 2002; Brody 2005; Bamberg and Möser 2007; Heimlich and Ardoin 2008; McDonald 2014; Morren and Grinstein 2016) attempt to change predetermined behaviors by manipulating audiences (Wals et al. 2008). In contrast, emancipatory EE programs emphasize on encouraging learners' elaborations and supporting their autonomy in adapting their behaviors (Wals 2010; Schusler and Krasny 2010; Mayer and Tschapka 2008; Jickling and Wals 2008). Our NSF participants were facilitated to give thoughtful considerations to an environmental issue (i.e. shark-fin consumption), make choice based upon their considerations, behave in accordance with their own will rather than external dominations, and even remove these dominations (i.e. traditional social norms) through persuading others. Indeed, R&S stated that they pursue a vision that participants take the initiative to 'study environmental issues, seek solutions, and bring about changes' (Wong 2014). Consequently, these participants performed EE outcomes, especially changed their behaviors, in a deliberate, autonomous, and emancipatory way.

As an evaluation method, the five environmental learning aspects of directive AMFs seemed able to capture the emancipative performances of NSF and simultaneously represent them in a way aligned with the pattern of typical EE outcomes, suggesting the appropriateness of the method for EE outcome evaluation.

Social skills was considered as another aspect of directive AMFs in Liddicoat and Krasny's (2014) research. We constructed similar results from our interviewees' responses. The enhancement of NSF participants' teamwork skills, communication skills, and interpersonal networks was probably attributed to guidance provided by R&S that modelled these skills and opportunities offered and justified by the program for participants to practice them and build relationships with other people, such as teammates, other teams, R&S staffs, and their audiences.

Although social skills may not have been the primary consideration of many programs focused on typical EE objectives, these achievements may facilitate the behavior change objective (Figure 1). Positive social norms for protecting sharks may be created or aroused in newly-formed or strengthened interpersonal networks which may constitute an important reference group for our participants (Paluck and Ball 2010; Mackie et al. 2015). The networks will have lasting effects on social norms if they remain strong after program completion. Self-efficacy toward protecting sharks may be enhanced, since communication and teamwork skills may synergize with their environmental skills about organizing advocacy projects, resulting in more effective persuasion for reducing traditional social norms against protecting sharks (Bandura 1997). As a result, the participants' environmental behaviors may be promoted (Ajzen 1991, 2002). Thus, social skills may also worth considering in outcome evaluation of EE programs.

These social aspects of directive AMFs may reflect the perspective of emancipatory EE because they can be rather general objectives and the processes to develop them have the potential to be as emancipatory as possible (Wals et al. 2008). In our NSF case, the achievements of social skills were non-predetermined outcomes. Specific activities that were able to provide opportunities for the development of them were mainly created by each team itself respectively in the progress of each project rather than established beforehand by external experts (Wals et al. 2008). The participants had the control of what social skills they would learn and how they would learn it.

4.2. Social function: creating lasting impacts and changing social norms

Unlike directing social skills, social AMFs refer to the individual's use of experiences as material for conversations with others. Our interviewees mentioned that NSF experiences were reminisced in their conversations with other participants and shared in their conversations with nonparticipants (Table 3), revealing two types of social AMFs (Alea and Bluck 2003) (i.e. reminiscing and sharing) in our results.

In contrast to the valuable revelation that recalled content in reminiscence is centered on the social interactions implicit in the program (Liddicoat and Krasny 2014), we found that interviewees also discussed the environmental aspect of NSF, such as the lessons on environmental-action skills learned through practice. We suspect that the reason our respondents mentioned both social and environmental content is that NSF more closely linked learning and EE objectives to peer interactions than did the ROEE programs referenced by Liddicoat and Krasny (2014). This was thought to be the case because NSF urged participants to learn and conduct environmental-action projects cooperatively and intensively over the course of one academic year rather than just experience or practice them over the course of a few days.

Reminiscence of shared memories may have enhanced the two lasting effects of NSF for participants (Figure 1). First, the collective reflection of participants on the benefits of NSF may have sustained or deepened their understanding of their acquired knowledge and skills, which may have enhanced their attitudes (Petty and Cacioppo 1986) and self-efficacy (Bandura 1997) and influenced their related behaviors (Ajzen 1991, 2002). Second, recalling memories as a group may have helped them to maintain social bonds (Williams, Conway, and Cohen 2008; Alea and Bluck 2003; Kihlstrom 2009), ensuring the maintenance of positive social norms (Paluck and Ball 2010; Mackie et al. 2015) and promoting related behaviors (Ajzen 1991, 2002). Reminiscing may need to be considered in EE program design and evaluation, in order to enhance and show program effects.

As for the process of reminiscence, we found not only that post-program social interaction (i.e. contact between team members) could trigger the recall of shared memories (Liddicoat and Krasny 2014), but also that post-program encounters with relevant environmental information (e.g. sharks or oceans) might trigger memories serving as motivations for participants to contact one another and reminisce together. However, further thinking and planning are required to answer the questions of how to remove obstacles produced through changes to living surroundings and social circles, how to orchestrate opportunities for post-program social interactions, and how to provide relevant environmental information, such as post-program action resources (Ballantyne and Packer 2011; Bueddefeld and Van Winkle 2018, 2017) and souvenirs (Swanson and Timothy 2012) for triggering social interactions.

Liddicoat and Krasny (2014) reported that participants shared their experiences either through their role as a professional teacher or to encourage others to participate. Our respondents also mentioned these uses of their memory; however, they educated others in some daily conversation rather than only in planned educational settings, indicating a broader and more active use of memories. The reason seemed to be that 'sharing,' which in most situations can be equal to an environmental-action behavior of educating others[1], might be promoted by participants' intention or desire to protect sharks, which was supported by their positive attitudes, social norms, and self-efficacy towards shark protection formed and raised through NSF (Ajzen 1991, 2002).

From participants' descriptions of the responses of their listeners, we found that this type of active sharing could lead to positive changes in the attitudes and behaviors of people in the social circles of participants, thus forming positive social norms. According to the TPB (Ajzen 1991, 2002), these positive social norms promote the environmental behaviors (i.e. personal practices of abstaining from shark-fin consumption, and environmental actions of educating others) modeled by the participants (Figure 1). EE programs that considered 'sharing with nonparticipants' in design and evaluation, may more effectively influence participants and alter the attitudes and behaviors of nonparticipants, and will show more effectiveness than those that ignore this aspect.

Additionally, the Beijing office of R&S hoped that their participants would 'communicate the positive information they received [in R&S] to their relatives and friends, gradually expanding the influence of R&S EE program' (Wong 2014). Sharing experiences reflects this non-obsessive vision, which may increase the applicability of this evaluation method.

Similar to the process of reminiscing, we found that social interaction (i.e. encountered chats about environmental-protection programs or shark fins) could trigger the sharing of NSF memories and that encounters with relevant environmental information on sharks might trigger memories serving as motivations for participants to start conversations on this issue with nonparticipants. Likewise, further thinking and planning are required to answer the questions of what can be done to encourage such social interactions or how to provide relevant environmental information, such as post-program action resources (Ballantyne and Packer 2011; Bueddefeld and Van Winkle 2018, 2017) and souvenirs (Swanson and Timothy 2012) for triggering these social interactions.

The reminiscence and sharing by participants might be outcomes aligned with the perspective of emancipatory EE, because they were the autonomous and self-determined actions of participants (Jickling and Wals 2008) reacting to post-program social interactions or environmental-information cues.

4.3. Self function: promoting multiple self-growth

Self AMFs refer to contributions of AMs to an individual's understanding of themself. Self AMFs (Bluck et al. 2005; Conway 2001) were not revealed in the previous ROEE study (Liddicoat and Krasny 2014). Conversely, we found that our participants used their NSF memories to reflect on their self-efficacy (Bandura 1997; Pavlou and Fygenson 2006), self-esteem (Campbell and Lavallee 1993; Spencer and Markstrom-Adams 1990; Wigfield, Byrnes, and Eccles 2006; Roeser, Peck, and Nasir 2006), personal traits (Ashton 2013; Ashton and Lee 2007; Ashton, Lee, and De Vries 2014), hobbies (Hidi 1990; Hidi and Baird 1986; Hidi and Renninger 2006), and life visions (Markus and Nurius 1986; Taber and Blankemeyer 2015; Oyserman and James 2011). Under the influence of NSF experiences, participants might gain confidence, realize their self-value, change their character, expand their interests, and renew their life plans (Table 4),[2] thus manifesting the two self AMFs: the self-examination of life changes and progress towards goals (Bluck et al. 2005; Conway 2001).

We discerned several possible reasons for this difference. First, our participants were adults (college students) who were more capable of self-reflection than those high school students chosen by Liddicoat and Krasny (2014). Second, NSF had a relatively long duration (one school year), which might have had a more profound effect on participants than would a 3-day ROEE program. Third, our interviews occurred 1 to 4 years after program completion, when participant impressions were fresher and easier to reflect upon than they would have been had interviews been conducted 5 years after completion, as was the case in the study conducted by Liddicoat and Krasny (2014). Finally, we explicitly mentioned confidence, self-worth, character, hobbies, and ideals in our interview outline, affording our interviewees more cues for recalling these aspects.

One aspect of self AMFs is the increase in self-efficacy associated with operating projects, advocating, working within a team, and communicating. According to the TPB (Ajzen 1991, 2002; Pavlou and Fygenson 2006), increased self-efficacy for project operation and teamwork might strengthen the intention of participants to engage in similar environmental-action projects. In fact, some interviewees mentioned that their increased confidence in organizing activities made them more willing to attempt similar projects. According to the TPB (Ajzen 1991, 2002; Pavlou and Fygenson 2006), increasing the self-efficacy of advocacy and communication might increase the intention as well as the behavior of participants to persuade others to protect sharks. The persuasion may incite change in the social norms surrounding shark-fin consumption. Traditional social norms for consuming shark fins may be reduced, while positive social norms for protecting

sharks may be formed or raised. The altered social norms may help participants to maintain or enhance their modeled behaviors of protecting sharks (i.e. refusing and persuading others from shark-fin consumption) (Ajzen 1991, 2002) (Figure 1). Therefore, if a practitioner hopes to more effectively encourage the environmental behavior of participants, including self-efficacy in the EE program objectives may be necessary, and AMFs can capture these aspects.

Another four aspects of self AMFs may also introduce new insights into the actual effects generated by an EE program that are meaningful to environmental protection. For example, the inclusion of social contribution in self-value evaluation standards, development of new hobbies related to environmental protection, or consideration of an environmental career may encourage participants to protect the environment after completion of an EE program. Considering these aspects in program evaluation may produce more comprehensive and deeper insights into the influence of a program than solely focusing on intended objectives.

The self AMFs may reflect the vision of the Beijing office of R&S that their programs be an established supplement to quality school education (Wong 2014), facilitating the self-growth and positive development of participants. Although the NSF program has no explicitly defined objectives for affecting participant self-efficacy, self-esteem, traits, hobbies, and visions, the assessment can reflect these outcomes, which may increase the evaluative value of AMFs.

These non-predetermined outcomes or by-products may align with the perspective of emancipatory EE because they were changes that participants considered to be desirable in an opportunity (NSF) for positive development and active dialogues (Wals et al. 2008; Schusler and Krasny 2010), which reflects that AMFs might be an appropriate method for evaluating emancipatory EE outcomes.

5. Conclusion

Echoing other research (Liddicoat and Krasny 2014), we evaluated how participants used their memories of an EE program through the model of AMFs and found that the process of NSF allowed participants to:

1. become more sensitive to related topics, acquire relevant knowledge and skills, form attitudes of protecting the environment, and demonstrate corresponding environmental-protection behaviors;
2. recall past events with renewed effects and share experiences to change social norms;
3. increase confidence in their abilities, understand their self-values, improve their character, expand their interests, and even trigger changes in life paths.

Moreover, we analyzed how the three AMFs echoed the ultimate objective of EE to change learner behaviors. We found that directive AMFs can be matched with the five typical objectives of EE and that social AMFs may establish the lasting effect of a program on its participants and alter the social norms of the people in their social circles to promote their modeled pro-environmental behaviors. Additionally, we revealed that self AMFs may lead to diverse self-growth and the adoption of more related behaviors by increasing self-efficacy and the motivation and interests of participants to pursue personal goals related to environmental protection in the future.

EE program evaluations are usually focused on environmental awareness, knowledge, skills, attitudes, and behaviors, which may ignore the social norms and self-efficacy that also affect personal behaviors. Moreover, focusing on instrumental outcomes often disregards the emancipatory potential of EE, such as the facilitation of personal development. By using AMFs to evaluate EE programs, these underestimated outcomes may emerge and provide us with a more comprehensive interpretation of the effects of EE.

We propose that this method can be transferred to other EE programs because every program can be treated as participant AMs, thus enabling comparisons between programs. Further

insights and inspirations for additional research could be developed by comparing the features of diverse EE programs and hence promoting the development of the field.

Notes

1. 'Sharing with nonparticipants' may partially overlap with 'environmental behaviors' as it sometimes can be seen as a persuading behavior belonging to environmental actions. However, the difference is that 'sharing with nonparticipants' emphasizes 'talking about the experience', while 'environmental behaviors' may and may not use participants' program experience as materials for educating others. Moreover, environmental-action behaviors emphasize 'doings' that contain more than persuading behaviors, such as participating in or establishing environmental groups, organizing or signing petitions, donating money or materials, and improving physical environment or community development (Alisat and Riemer 2015; Larson et al. 2015; Schusler and Krasny 2010).
2. Both introversion and extraversion have its own advantages and disadvantages based on its context of the moment (Davidson, Gillies, and Pelletier 2015; Grant, Gino, and Hofmann 2011; Matthews, Deary, and Whiteman 2009). Thus here we did not mean that becoming more outgoing is universally good but wanted to point that it might be good for these participants in their situation from their point of view.

Acknowledgements

We would like to thank the following people: the interviewees for participating in the research; Roots & Shoots Beijing Office's staff members, interns, and volunteers for assisting the process of the study; and the anonymous reviewers for their detailed and helpful comments towards improving our manuscript. Finally, special thanks to Prof. Yu-Chan Chiu for her supportive courses on qualitative research methods.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by Xishuangbanna Tropical Botanical Garden of Chinese Academy of Sciences under Grant #Y3ZK061B01 and Ministry of Science and Technology, Taiwan under Grant 106-2511-S-002-012-MY2.

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