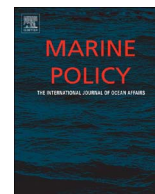




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Turning the tide on trash: Empowering European educators and school students to tackle marine litter

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ABSTRACT

Marine litter is a global environmental problem, and working with educators and school students has much potential to facilitate greater public understanding of the solutions and to enable action. This research examined two new educational activities designed to empower European educators and school students to engage with the topic of marine litter, particularly focusing on behavior and on known determinants of behavior rather than knowledge alone. In Study 1, 120 educators participated in an online training course on marine litter, and completed a pre- and post-course questionnaire to assess change. After participating in the course, educators felt significantly more skillful and confident to incorporate marine litter education into their future teaching. In Study 2, 341 school students (7–18 years old) participated in an educational video competition on marine litter, and completed a pre-post questionnaire to assess change. Following the educational activity, students were more concerned about marine litter, had a better understanding of the issue, causes and impacts, and reported performing more waste-reduction behaviors. This research brings together educational and behavioral literatures and demonstrates how educational activities can be documented and evaluated systematically in the quest of tackling marine litter.

1. Introduction

Litter is prevalent in marine and coastal environments globally and is increasingly attracting academic, policy and media attention due to its considerable negative ecological and socio-economic impacts [1–3]. Many sectors of society contribute to marine litter, from industry to fishing and tourism, and tackling the problem must involve concerted efforts across nations, disciplines and with all stakeholders. Human behavior is a major factor contributing to marine litter, and behavioral change all along the supply chain has the potential to reduce the problem [4,5]. This paper focuses on the role of the education sector as an important agent of social change [6]. It investigates change in perceptions and behavioral indicators (behavioral intentions and self-reported behavior) following two educational activities and seeks to contribute to good educational practice regarding the issue of marine litter. In particular the focus is on known determinants of behavior such as concern, perceived control and confidence, rather than knowledge alone. In the next section, the relevant environmental, psychological

and educational literatures are reviewed which provides the conceptual basis of the research. This is followed by the methodology and results for Study 1 and Study 2, and finally a discussion of the findings, contribution and limitations of the work.

2. Literature review and conceptual basis of the paper

Education is essential for the advancement of sustainable development (e.g., United Nations Decade of ESD - UNESCO, 2014 [6]). Indeed, in the last decade, there has been more emphasis towards developing ownership, empowerment and action in learners, in addition to solely increasing knowledge and awareness [7]. This research seeks to understand how teachers and students can be empowered to deal with marine litter (with empowerment indicating feelings of confidence, control, competence and readiness to act), which will ultimately encourage more responsible behaviors. In terms of content, such transformative pedagogies involve participatory teaching and learning methods to promote change in behaviors, and life-skills such as critical

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thinking, imagining future scenarios and collaborative decision-making [8]. These methods are focused on harnessing intrinsic motivation and deep engagement with the issues. However, the need for more research, integration with behavioral science and environmental psychology approaches, monitoring and evaluation to assess the effectiveness of good practice has been identified as a key priority [6].

Environmental psychology provides a rich body of research on individuals' perceptions of different environmental challenges, such as climate change and energy use. Various theories and approaches describe and test a range of determinants of environmentally relevant behavior [9–14]. Such determinants and factors include knowledge and awareness, concern, personality, perceived control (also often referred to as self-efficacy or feelings of confidence and competence to act), values, attitudes and worldviews, personal responsibility, moral norms and demographic variables (e.g., age, gender, education level) (for a review see [11]). These factors are likely to apply equally in the present context. For example, knowledge of and concern about litter, and perceived competence and confidence, are expected to correlate with both educators' willingness to incorporate marine litter education into their teaching on the one side, and school students' willingness to take action to reduce marine litter on the other side. Indeed, examining these factors among educators and students in this novel context can help identify barriers to, and opportunity for, guiding effective educational policy and practice.

2.1. Research on environmental and sustainability education

Research with *educators* suggests that they are keen to implement environmental and sustainability education but lack the confidence, skills and understanding to do so, particularly in an already overcrowded curriculum [15–17]. Therefore, educators may need better training and support, and materials that are ready for implementation in educational practice. Although teacher training on specific topics is available, it is not standard practice to evaluate the effects of such training courses systematically. Some feedback is typically requested after the activity, but this is often focused on what participants have learnt in terms of content (knowledge) and on how satisfied they were (e.g., [18,19]), rather than on evaluating the factors reviewed above that are known to predict action (such as awareness, concern, perceived control or responsibility).

Research with *school students* suggests that young people are aware of environmental problems [20,21], can behave in an ecologically responsible manner [22], and can shape the perceptions and behaviors of others [23,24]. Several systematic reviews have been conducted on environmental education programs but none specifically on marine litter (see [25–27]). Overall, these reviews suggest that participation in environmental education activities can improve children's environmental knowledge and attitudes. However, again the majority of studies focus on assessing a change in knowledge or attitude after the activity, rather than assessing changes in behavioral determinants (as reviewed above) or behavioral indicators (e.g., behavioral intentions, self-reported behavior). Substantial research on human behavior recognizes that knowledge gain is not typically sufficient for (or a direct cause of) behavior change [28–30]. Therefore, evaluation should include factors beyond knowledge, as reviewed above such as concern, perceived control, responsibility, and self-reported behavior or behavioral intentions, which are known to be linked to actual behavior.

In summary, it is evident that there is a lack of research into environmental education on marine litter, with little to no assessment of the impact these have on the target audience. To our knowledge, only two published studies have employed an environmental education activity to raise school students' awareness and engagement in actions to help solve the problem. Hidalgo-Ruz and Thiel (2013) [31] used the opportunity of a citizen science project to engage students (aged 8–16 years) with the topic of microplastics in the marine environment. They worked with 983 students in Chile who sampled, sorted and counted

small plastic pieces on local beaches, and entered their data into an interactive website. After the activity, students reported that they found the project interesting and fun, and that they would be likely to participate in other environmental activities in the future. Hartley, Thompson, and Pahl (2015) [32] implemented an environmental education activity with 176 British schoolchildren aged 7–18 years and assessed their level of concern, understanding and self-reported behavior regarding marine litter before and after engaging in the activity. After the educational activity, children were significantly more concerned about marine litter, had a better understanding of the causes and negative impacts, and reported improved behavior. However, more work is needed on engaging teachers, and on engagement methods that allow the children more freedom and creativity to explore the topic, such as creating their own materials rather than a predetermined program of education, in line with transformative pedagogy.

2.2. The present research

This research set out to (1) develop two educational activities designed to increase understanding and empower educators and school students to engage with the topic of marine litter and take action, and (2) assess the impact of each activity on learners' understanding, perceptions and behavior. Specifically, Study 1 employed and evaluated an online training course for educators across Europe in 2015 in terms of the educators' level of understanding, confidence, perceived skills and competence, sense of responsibility and intentions to integrate marine litter education into their teaching, using a before-after design. It was predicted that after the course, educators would feel that they had a greater understanding and knowledge of the topic, feel significantly more competent, skillful and confident to teach about marine litter, and that they would have positive behavioral intentions following the course, for example offering more lessons and activities about the topic, and encouraging other educators.

Study 2 implemented and evaluated an environmental education activity in the form of a video competition with European schoolchildren in 2014 and examined perceptions and behavior regarding marine litter before and after participating in the activity. It was predicted that after participating in the educational activity, students would be significantly more concerned about marine litter, have a better understanding of the causes and negative impacts, and report engaging in more actions to help tackle the problem.

3. Methodology

3.1. Participants & recruitment

In Study 1, a total of 120 educators (99 females, 21 males) aged 19–62 years (Mean age = 35.39, SD = 9.77) participated from 18 countries across Europe (Greece, Romania, UK, Ireland, Italy, Portugal, Cyprus, Germany, Turkey, Spain, Denmark, France, Netherlands, Bulgaria, Croatia, Malta, Sweden and Switzerland). Participants included 26 individuals working in formal education (e.g., school teachers), 46 in non-formal education (e.g., NGO and museum staff, activists), 29 in both formal and non-formal education, and 19 who specified another field (e.g., university). The online training course was advertised through educational networks, in newsletters and social media. Educators registered via an online platform, provided consent to participate in the study, and later received a debrief with more information.

In Study 2, a total of 341 school students (200 girls, 141 boys) aged 7–18 years ($M_{age} = 13.54$, $SD = 2.63$) participated from 12 countries across Europe (Portugal, France, UK, Netherlands, Cyprus, Germany, Italy, Slovenia, Ireland, Turkey, Romania and Spain). School students were recruited for the video contest via educational networks, newsletters and social media, and also through directly contacting school boards and teachers. School teachers and other educators facilitated

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