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Amplifying John Muir's Life: a third sector intervention in providing alternative narrative resources to secondary schools

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Abstract

In 2014, Scottish Book Trust (SBT) published and distributed classroom sets of a graphic novel about the life of pioneering environmental activist John Muir to all secondary schools in Scotland, where he is still relatively unknown. This paper outlines the collaborative process SBT used in producing the graphic novel and sets out to trace the impact of this intervention through teacher and pupil surveys. The former survey reveals that not all teachers were able to make use of the classroom sets but that those who did found it useful in bringing up environmental issues in a range of disciplinary and cross-disciplinary contexts. The book served as a narrative resource for some teachers in designing lesson plans and even in designing entire courses. The pupil survey found significant mean shifts in the New Environmental Paradigm Scale for Children (NEP-C) and the Inclusion of Nature in Self Scale (INS) in participating classes and across all classes. Building on insights from narrative therapy and narrative ethics, we argue that shifting attitudes and values requires new narratives alongside new experiences and the space in which to dialogue about the two in community. Further research into reading and environmental education is advocated.

Keywords: reading; environmental attitudes; values; narrative ethics; John Muir; graphic novel

The idea that books better people and societies has been around for centuries. Authors such as Charles Dickens and George Eliot believed in the power of novels to extend people's circles of sympathies (Oatley 1992). Even Adam Smith was an advocate, asserting that reading strengthens the glue that holds society together (Oatley 2005).

Some of the most pressing problems societies face today are environmental ones. As has been argued elsewhere, these problems need not just practical but cultural solutions, ones that pay attention to the narratives that people are exposed to and which they adapt and adopt to inform their own lives (Willis 2011). In order to explore what narrative resources can accomplish when released into the wilds of the social world, in this paper we examine a book-based, nation-wide intervention and its impact on secondary school classes in Scotland. This intervention was led by a third sector literacy organization, Scottish Book Trust (SBT), which had not previously been involved directly in environmental education.

Background

Scottish Book Trust is a non-governmental organisation that promotes literature, reading and writing in Scotland. Prior to the project discussed here, staff had produced and published a graphic novel concerned with money literacy by facilitating collaborative work between an author, an illustrator and members of the target reader audience. The intention behind working this way was to create a book directly relevant to readers and to gain buy-in at conception from the organisations destined to work with it. Having had success with their first graphic novel, SBT sought other issues to engage with, settling on the environment and John Muir, who is still largely unknown in his country of birth, Scotland.

From 2013 to 2014, staff of SBT, writer Julie Bretagna and illustrator William Goldsmith worked with six secondary schools in the Central Belt of Scotland and East Lothian (the region where Muir was born) to develop the graphic novel: John Muir, Earth – Planet - Universe. Classes were given information about John Muir's life and were asked to provide feedback about which episodes most engaged their interest. The author and illustrator prepared a draft of chapters of the graphic novel, which was then workshopped with the pupils, who shared what resonated with and interested them and made suggestions for changes.

Once the book was finalised and printed, SBT sent a classroom set to each of the 578 secondary schools in Scotland (16,000 books). Activities were included in the book's appendices and on a companion web-site. In keeping with the Scottish Government's Curriculum for Excellence, which emphasizes working across disciplinary boundaries (Education Scotland, 2016), SBT encouraged teachers of all subject areas to make use of the book and to do so in ways that suited their own classroom approaches. That there would be a diversity of uses and contexts for the book was built into SBT's intervention from its inception.

SBT staff have practical experience in the potential of books to inform discussions of personal and civic importance and had the intuition that books might usefully support individuals in transitioning to more environmental worldviews. As we will see below, their experiences and intuitions are supported by the literature. This intervention was ambitious in scope, encompassing all secondary schools in Scotland, while taking a hands-off approach. In a field used to the study of interventions at the scale of individual classrooms and programme deliveries, this project could be seen as too broad and uncontrolled an experiment to warrant examination. However, even closely controlled educational interventions eventually need to be rolled out into the world of practice, where variables are unlikely to be the same as in the original study. Here, we lay out what we found through our study of this intervention in its actual, uncontrolled usage.

Becoming an Environmentalist Through Books

Just as it is unusual for a book and literacy charity to engage with environmental issues, it appears to be uncommon for environmental education researchers to examine the role played by books. Nevertheless, reading and books did emerge as significant factors in early studies in the field.

Foundational studies of the factors and experiences shaping pro-environmental attitudes and behaviours found that books were reported as influential by 29% of environmental activists

(Tanner 1980) and 18% of environmental educators (Peterson 1982; cited in Chawla 1998). These small US studies were followed by Sia et al's (1986), which found that participants who exhibited high levels of environmental behaviour rated books and authors more highly as influences than did those exhibiting low levels of environmental behaviour. They were unable to establish causation, however, as it is possible people already engaging in such behaviours are more likely to be interested in such books.

The findings of Palmer's UK study (1993) reflected the American ones; 15% of her respondents mentioned a book as influential on their development as environmentally concerned individuals. Palmer categorized the books discussed as 'positive books', exemplified by 'natural history', and 'negative books', linked to 'effects of human activity' including 'Silent Spring' (Palmer and Suggate 1996: 112 and 113). Finally, 20% of environmentalists in the U.S. and Norway mentioned books or an author as important influences in a study by Chawla (1999).

Studies done with children support the idea that reading influences environmental attitudes. Eagles and Demare (1999) found in their study of sixth graders in Canada that reading about the environment was one of three statistically significant correlates with 'concern for the environment as a system' and 'concern for the right and wrong treatment of animals'. These findings built on earlier ones by Eagles and Muffitt (1990), which found more pronounced environmental attitudes in children watching environmental films and reading environmental literature.

All of the studies reviewed thus far looked at a range of factors and did not focus specifically on books. Despite this, consistently across a number of countries and over a 19 years period, books were found to be important and significant in people's development in relation to environmentalism.¹

We only found two studies that focused specifically on literature and creative non-fiction in environmental education. In an effort to develop a more detailed understanding of how literature might contribute to environmental education, Soetaert et al (1996) used action research to investigate the use of a number of texts, including Robinson Crusoe and Lord of the Flies, in one twelfth grade class in Belgium. They found that including literature facilitated discussions about complex issues involved in environmental problems that are often overlooked in knowledge-based approaches to education.

The second, and the most recent study we were able to find, was undertaken by Mobley et al. (2010), who investigated whether reading three influential environmental books – Walden Pond, A Sand County Almanac, and Silent Spring – had an impact on environmentally responsible behaviour. Using data from a large-scale internet survey with more than 7000 respondents, they were able to show that reading environmental literature remained a strong predictor of behaviour even when other measures of environmental attitudes and concern were controlled for. They postulated that reading such books led to changes in behavior by increasing knowledge and awareness, as well as through developing environmental concern and sensitivity. However, because of the survey design, they were unable to determine whether the behaviour resulted from reading pro-environmental literature, or whether individuals with pro-environmental attitudes seek out such books and then reinforce previously held convictions.

Research in other fields including empirical studies of reading, narrative therapy and narrative ethics indicates that reading can transform understandings of experiences, the emotions readers attach to them and the meaning they assign to them (Miall and Kuiken 2002, Kuiken et al. 2004 Dijkic et al., 2009). Reading helps people to solve problems (Oatley 2005) to decide what to do in the face of uncertainty (Bruner 1990), and to reshape their identities (Polkinghorne

2001).

The potential of graphic novels to provide stimulating and multi-dimensional educational experiences for a wide set of readers is increasingly recognised by both teachers and researchers. Graphic novels – especially through their close association with comics – have long been regarded as low-quality literature and are often advocated as a way to engage pupils struggling with literacy. However, Sabeti's (2011) research amongst high-achieving secondary pupils concludes that reading graphic novels demands a sophisticated ability to decode visual-textual information, a notion supported by both Goldsmith (2002) and Hoover (2012).

The multi-layered and non-linear structure of graphic novels sits well with interpretations of human experience that allow for complexity, open-endedness and the taking of multiple perspectives (Cromer & Clark, 2007), thereby encouraging a rich engagement with the narrative and protagonists' realities. Indeed, Keen (2011) suggests that graphic novels might provide a 'fast track' to empathy, since images appeal to the emotional section of the human brain and elicit a pre-cognitive response. Thus, the combination of text and image might target readers' emotions in a way that purely textual novels cannot.

The excavation and amplification of alternative narratives to those that dominate societies is an important task, because stories provide people with the templates to understand their lives and give meaning to their experiences (Frank, 2002). Literacy organisations like SBT, with their track record in producing targeted narrative resources, are well-placed to amplify stories that may be under-represented in pupils' school and extra-curricular lives.

Research Methods

The book had already been published when we began our research. However, we were given access to the summary notes from the draft graphic novel school workshops. To aid our understanding of the collaborative process, these were supplemented with an interview with the illustrator and with detailed email correspondence with the project manager from SBT, who attended these workshops. While we summarise our findings from this stage of the process, the bulk of this paper focuses on what happened after the book was published.

To get an overview of how the book was being used across Scottish secondary schools and to obtain feedback on its utility as an intervention, teachers were invited to participate in an online survey via an emailed link sent to all secondary school EcoSchool coordinators by Keep Scotland Beautiful, who for privacy reasons could not share this email list with us directly. As the books were disseminated through this same network, we hoped to reach all teachers who had received a class set. The first email was sent out one month after the books were delivered (June), with a reminder sent again six months later (December).

The survey contained a mix of Likert-type questions that asked teachers to rate the extent to which they agreed or disagreed with a number of statements relating to SBT's aims, which were

- To contribute to pupils' understanding of the natural environment and how this can be addressed through a variety of subjects: literacy, expressive arts, health and wellbeing, sciences, social studies, technology, and Religion and Ethics.
- To increase pupils' awareness of the value of the natural environment.

- To encourage attitudes, values and dispositions relevant to responsible behaviour around enjoying, respecting and preserving our natural environment.
- To encourage pupils to become actively involved in the protection and restoration of wild places.

Open-ended questions were included to gather information about how the book and associated activities² were used, and why respondents had answered the Likert-type questions in the way that they had. Teachers who had not used the book were invited to tell us why.

In total, 62 teachers completed the survey, including 9 teachers who participated in the pupil survey (described below). The results were summarised into an overview of teacher agreement or disagreement with the evaluative statements. Responses to the open-ended questions were collated and grouped thematically.

Two weeks after the books had been mailed out, a random selection of 100 schools was sent a mail package explaining our study and asking if the school would like to participate. Twelve schools volunteered to do so. These schools were located across the length and breadth of Scotland and represented both rural and urban settings. Both fee-paying and non-fee-paying schools were included. In eleven schools, one class participated. However, the twelfth school provided completed questionnaires for four classes. Class sizes ranged from 8 to 28 students.

The package contained classroom sets of questionnaires consisting of two scales: The New Environmental Paradigm Scale for Children (NEP-C) (Manoli et al. 2007) and the Inclusion of Nature in Self Scale (INS) (Schultz 2001). NEP-C is considered to be a valid tool for measuring children's worldviews related to the environment and is sensitive enough to pick up changes facilitated through environmental education interventions (Manoli et al. 2007).

The INS Scale is a single question scale consisting of seven sets of two concentric circles representing self and nature, which change from not overlapping at all to overlapping completely. According to this approach, the more closely nature is included in a person's representation of self, the more nature is valued. Schultz suggests that higher inclusion scores (higher overlap) correlate with greater concern for plants and animals, more care for nature, and more environmentally-friendly behaviours (Schultz 2001). While enough research using the INS has accumulated since 2001 to support its content validity, as a single-item scale there are limits to measuring its reliability, it may be more susceptible to measurement error and may have less predictive validity than multi-item scales (Martin and Czellar 2016). However, for the purposes of surveying school pupils, we felt that the advantages of a simple, quick one-item scale outweighed these potential weaknesses.

Teachers had their pupils fill out these questionnaires before they engaged with the book. In line with University of Edinburgh ethics policies, information sheets explaining the research to parents were included, as was an opt-out. Pupils could opt out by not filling in the questionnaire.

Participating pupils repeated the questionnaire after they finished working with the book. As is discussed below, teachers used the graphic novel in a diversity of teaching contexts and over differing lengths of time. In total, we received 282 sets of before and after questionnaires (a total of 564 individual questionnaires) across 15 classes at 12 schools. An additional 72 questionnaires could not be used because there was no matching before or after questionnaire or because a questionnaire had been spoiled, most often through a failure to answer all the questions.

Of the twelve schools who submitted questionnaires, seven provided contact information.

Four of these teachers participated in semi-structured interviews with us (either in person or by phone) and three more responded to questions via email.

Findings and Discussion

Collaborative Process

Ninety-nine pupils and nine school staff members participated in the development of the book. Ages of pupils ranged from 11 to 17. Two of these classes were comprised of 'less able' students, as one of the goals for the book was to make it as accessible as possible. In another school, it was the Eco-schools pupil committee, rather than a class, that collaborated.

Initial workshops involved either the artist or the author or both presenting their thoughts on the approach to take for the graphic novel. Using materials provided by SBT, the author compiled a number of events from John Muir's life into a story that she told the pupils. Pupil reaction to these episodes shaped the narrative in the published book. For example, one child pointed out the resonance between two incidents in which John rescued someone else, first his brother and later a dog. In the final text, the author included both events and further emphasized their links between by providing a flashback.

The artist presented initial water colour sketches. A pupil at one of the workshops responded that although this style reflected the emphasis on nature, he didn't feel it would appeal to boys, like himself, who were into comics. The artist subsequently added in black outlines to give more of a 'comic book feel'.

Participation in feeding back around draft pages was high. Out of 123 feed-back sheets handed out during later workshops (two schools did three workshops, the other four schools did only two), 91 were returned with suggestions. Most pupils reported enjoying the graphic novel overall, although some made suggestions around changes to the colour, lightness or darkness of the pictures.

A few of these suggestions were directly used. However, the illustrator reports that the feedback also influenced his process in subtle ways, with pupils' contributions sparking further ideas in his mind.

The process of creating the book, from development workshops through writing, illustrating and printing took just over a year. The remainder of this paper concerns teacher and pupil responses to the book, once it was distributed around Scotland.

Teacher Survey

Of the 62 respondents to the teacher survey, roughly one quarter (15) had not used the book seven months after the class sets had been distributed. Eleven of these teachers provided further information. Four wrote that they were planning to use the book, but had not been able to fit it into already set lesson plans. Although some schools described May and June, when pupils finish one grade and move up to the next, as flexible months and were able to incorporate the book quite quickly, other schools reported less flexibility and longer planning horizons.

Four teachers stated that they did not use the book because of issues of taste and personal judgement. Three respondents had not yet used the book because they had not heard about it by the time the survey request reached their in-boxes. This was usually expressed as some variation on "our school never received the books". Both the books and the survey emails were sent

directly to Eco-Schools coordinators. However, in some schools, there seems to have been challenges in getting the books and research instruments into the hands of relevant teachers.

The majority of the teachers surveyed had used the book (54 out of 62). Of these, 43 completed the Likert-style questions. Teachers reported using the book with secondary school levels S1 to S4 (ages 12 to 16) in the following subjects: geography, environmental science, biology, religious education and ethics, English, enrichment and interdisciplinary learning. Teachers were asked if classes had engaged in any other environmental education activities alongside their use of the book. Twenty-four checked the box to say they had, eighteen checked the box for no and twenty did not respond.

Most teachers responded that they would use the book again and would recommend it to other teachers (40 and 38 out of 43). Forty teachers agreed, or strongly agreed, that children enjoyed reading the book. Teachers were almost unanimous in their agreement that the graphic novel works well with Scotland's Curriculum for Excellence (41). One wrote: "I have emailed all [senior school management team] and staff about the novel and its potential in the curriculum."

The book was used by the teachers who filled out the survey in a range of ways, most of which fell into the categories of:

- Reading, literature and literacy
- Outdoor education
- Environmental education

Ten schools used the graphic novel to focus on reading, comprehension and discussion in class. Of those, two also studied the graphic novel genre as part of their work. Literacy likewise was a central focus for two teachers who used the book in an interdisciplinary manner, one in Interdisciplinary Learning, one in Literacy in Science. It was also used by a class to study the Scots language. One teacher noted that the book proved engaging to pupils with diverse learning difficulties thanks to its combination of text and image, and two other teachers experienced increased interest from otherwise reluctant readers and writers, "I noticed that pupils who would not usually be happy to write were very busy writing a few sentences" during a writing exercise about the book.

Seventeen teachers used the graphic novel as part of the John Muir Award, an outdoor education programme administered by the John Muir Trust. This award scheme requires school groups (or individuals) to "Discover a wild Place. Explore it. Conserve it. And share your experiences." (<https://www.johnmuirtrust.org/john-muir-award>, accessed 14/02/2017). In one instance, it was the school's John Muir Group that used the book, rather than a formal class. Two other teachers reported using the graphic novel to reinforce aspects of outdoor learning.

Educating themselves (1) or others (4) about the life of John Muir was another use mentioned for the book. Five schools used the graphic novel within their extra-curricular Eco-schools Groups rather than in a class. Given the ways in which the book is being used, it is not surprising that 36 teachers (out of 43) agreed or strongly agreed with the statement "the graphic novel provided an engaging way to raise environmental issues in the classroom". One teacher wrote "The graphic novel was an excellent way of engaging all our learners, even the objectionable [sic] ones."

Given the findings outlined so far, it is clear that in most cases the book was used in association with a range of other activities. Specific activities mentioned include beach cleans, picking up litter, recycling, gardening, composting, pond dipping, moth catching, renewable energy competition, uprooting invasive species in a woodland, forest and marine conservation, visits from conservation organisations, learning how to build a responsible cooking fire outdoors,

and conservation of/managing school grounds.

Teachers who participated in the pupil survey also completed the teacher questionnaire and are included in the findings discussed above. However, we were able to interview or correspond with seven of them and so have more details about their uses of the graphic novel. In this sub-group, the book was used in English literature, an “Environment Matters” enrichment course, biology, geography, and religion and ethics.

For the teacher at School E, John Muir is “a big personal hero”. She had seen emails about the book and had kept an eye out for it to arrive. She used it a month after receiving it, structuring 12 lessons around it for an S3 geography class, culminating with a field trip to John Muir’s Birthplace Museum in Dunbar and a walk along one of the beaches John Muir would have walked. In the interview, she emphasized that combining the book with outdoor activities made the experience more tangible for pupils.

The teacher in School B used the book to introduce an “Environment Matters” course. Other topics and activities covered during this course were moorland, Antarctica, climate change, food webs, Global and Carbon Footprints, packaging and waste, litter picking, collecting paper for recycling across the school, leaf clearing and composting.

The teacher in School F was not expecting the books. However, when they arrived her religion and ethics class was already discussing the environment, values and personal actions, so she was able to immediately integrate the book into two discussion sessions of this class.

School D discussed the topic of proactive conservation with reference to the graphic novel and to John Muir's life and work. The teacher of this class went on to structure an entire month of classes based around the graphic novel. The teacher in School H, used the book with her geography class, structuring a four-week unit around them. She has actively looked for a woodland area in which to do some associated activities next year. Because of the small size of her school, classes must accommodate the full range of abilities in pupils. She praised the book for engaging all her pupils from those with autism, to those with dyslexia through to gifted.

Finally, we return to the overall survey for some last thoughts from teachers about the impact the book had on their pupils, an area they were generally less positive about. Thirty-one teachers (out of 42) agreed or strongly agreed with the statement: "the graphic novel increased pupils' awareness of the value of the natural world", but just over half (22) agreed that the graphic novel impacted on pupils' sense of connection with the natural world (4 disagreed and 16 were unsure). Moreover, only a quarter (10) agreed with the statement ‘Engaging with the graphic novel led to a noticeable increase in pupils exhibiting environmental behaviours such as recycling, composting and picking up litter’. An additional 10 disagreed with this statement and 23 were not sure. Teachers were also unsure as to whether the book increased pupils’ connectedness to place, with 17 agreeing, 4 disagreeing and 20 unsure.

While we sent out two invitations to participate in the survey only a small percentage responded, limiting the generalisability of these findings. More problematically, a number of the teachers who did respond were not aware of the resource. For a third sector organisation wishing to impact on environmental education within a particular jurisdiction, actually getting resources to relevant teachers and accessing those teachers in follow-up may be one of the first challenges encountered.

A second challenge might be in getting the resource incorporated into class plans. While the Curriculum for Excellence is meant to be flexible enough for teachers to respond quickly to opportunities, such as the one presented by SBT’s distribution of books, in practice responses show that some schools/teachers had become somewhat inflexible in their lesson planning,

something that has been observed more broadly and is in the process of being addressed (Education Scotland 2016).

Teachers using the book were generally positive and were using it in a range of disciplines, mostly in association with other activities. Responding teachers felt that the book contributed towards increasing awareness and connection with the natural world. However, they were not convinced that the book changed behaviours and were unsure whether it helped connect pupils to their local places. For a better understanding of the book’s impact on pupils, we turn now to the pupil surveys.

Pupil Surveys

Our null hypotheses were that there would be no change in pupils’ NEP-C or INS over the period in which they were working with the graphic novel. Manoli et al. (2007) found a significant mean difference of 0.39 on the NEP-C after children went on a week’s environmental camp. However, they did not provide the standard deviation (*sd*) of change across participants. For the sake of computing the power of the test, we assumed an *sd* of the same size as the mean. Using GLIMMPSE we established a minimum sample size of 11 would be required.

For INS, we could not find a comparable mean change in the literature, so we estimated a mean change of approximately one quarter of NEP-C, 0.10 to reflect the smaller range of the scale. We established that a minimum sample size of 8 would have sufficient power at both a mean change of 0.10 or 0.20, with an *sd* of the same size or smaller.

Therefore, we were able to run paired *t* tests for most classes. In order to explore the impact of working with the book across the entire sample of schools, we could not assume that individual students constituted independent observations. We know teachers used the books in different ways, over varying amounts of time and in association with a range of other activities. Therefore, we treated classes as the individual observations, running a paired *t* test using the before and after means for each class.

Looking across all the classes (see Table 1), there is an apparent trend towards a positive change in NEP-C, with only 3 of the 15 classes demonstrating a decrease in NEP-C, and those decreases being relatively small compared to positive ones. Moreover, three classes showed significant positive changes (A 2.09, Lii 2.17 and Liv 1.17)

Table 1: New Environmental Paradigm for Children Results

	n	NEP Scale		t statistic	p value	Mean difference	95% confidence interval	
		Mean before	Mean after				min diff	max diff
School A	22	37.09	37.09	0.000	1.000	0.000	-1.284	1.284
School B	22	35.23	37.32	-2.545	0.019	2.090	0.382	3.798
School C	17	34.59	35.47	-0.824	0.422	0.882	-1.387	3.152
School D	14	37.00	36.79	0.318	0.755	-0.214	-1.668	1.239
School E	8	32.38	33.75	NA	NA	1.375	NA	NA
School F	28	35.18	36.21	-1.177	0.249	1.036	-0.769	2.841
School G	14	35.79	35.64	0.176	0.863	-0.143	-1.895	1.609

School H	20	35.25	35.65	-0.398	0.695	0.400	-1.706	2.506
School I	14	35.86	36.14	-0.290	0.776	0.286	-1.844	2.415
School J	13	36.08	37.58	-1.318	0.212	1.500	-0.979	3.979
School K	11	33.18	34.36	-1.027	0.328	1.182	-1.382	3.746
School Li	23	35.80	35.52	0.410	0.686	-0.283	-1.712	1.147
School Lii	23	36.43	38.61	-5.562	0.000	2.174	1.363	2.985
School Liii	18	37.17	37.44	-0.492	0.629	0.278	-0.914	1.469
School Liv	21	33.52	35.24	-2.775	0.012	1.714	0.426	3.003

Across 11 of the 15 classes, there was a positive shift in INS, two of which were statistically significant, 0.44 and 0.39, both in biology classes at the same school (see Table 2). One of these classes also had a significant positive shift in NEP-C (Lii). However, one of the classes with no mean change in INS was one of the ones that demonstrated a strong, statistically significant positive change in NEP-C, so changes in INS did not necessarily mirror those in NEP-C in this study.

Table 2: Inclusion of Nature in Self Results

	n	INS Scale		t statistic	p value	Mean difference	95% confidence interval	
		mean before	mean after				min diff	max diff
School A	22	3.95	4.00	-0.295	0.770	0.045	-0.274	0.366
School B	22	5.00	5.00	0.000	1.000	0.000	0.000	0.000
School C	17	4.06	4.41	-2.073	0.055	0.353	-0.008	0.714
School D	14	3.14	3.43	-1.750	0.104	0.286	-0.067	0.639
School E	8	4.13	4.88	-1.820	0.111	0.750	-0.224	1.724
School F	28	3.61	4.07	-1.722	0.096	0.464	-0.089	1.018
School G	14	4.00	4.14	-0.618	0.547	0.143	-0.356	0.642
School H	20	3.75	3.75	0.000	1.000	0.000	-0.456	0.456
School I	14	3.43	3.86	-1.104	0.290	0.428	-0.410	1.267
School J	13	4.69	4.46	1.389	0.190	-0.231	-0.593	0.131
School K	11	3.82	3.45	0.649	0.531	-0.364	-1.612	0.885
School Li	23	4.39	4.83	-3.148	0.005	0.435	0.148	0.721
School Lii	23	4.35	4.74	-2.598	0.016	0.391	0.079	0.704
School Liii	18	4.17	4.39	-1.719	0.104	0.222	-0.050	0.495
School Liv	21	3.90	4.10	-1.164	0.258	0.190	-0.151	0.532

In our analysis across classes, we found an overall mean shift of 0.82 on the NEP-C (0.35-1.28 95% confidence interval) with a t statistic of 3.78 and a p-value of 0.001; and a mean

positive shift of 0.21 in INS (0.05-0.37 95% confidence intervals), with a *t* statistic of 2.80 and a *p*-value of 0.014. Therefore, the observed positive trends in tables 1 and 2 are significant.

So how can we make sense of these findings? Of the three classes that had statistically significant mean shifts in NEP-C, two were biology classes (Lii and Liv) and one was an “Environment Matters Enrichment” cross-curricular class (B). The latter class was optional, so pupils electing to take it might be assumed to be already interested in the environment. Although their NEP-C mean pre-score was average compared to the other classes, this class had the highest pre-test INS score (5 out of 7), a score that did not change. This could indicate that working with the book might be helpful for pupils who value and identify strongly with nature, but who have not spent much time working on or thinking about environmental issues.

We had questionnaires from four biology classes in the same school. Although one demonstrated the single largest mean shift on NEP-C (Lii 0.39), two others had negligible changes (Liii 0.28 and Li -0.28). The latter of these two classes (Li) had a reasonably large and significant change in INS (0.44).

Shifts in English classes were generally lower than in other disciplines, with negligible changes in NEP-C observed (G -0.14 and I 0.29). Class G read the book alongside researching John Muir and the latter used the book to study graphic media. However, English class I had a mean change of 0.43 on the INS, which is one of the highest.

The one class (A) that simply read the book, with the pupils doing the pre-test and post-test on the same day, immediately before and after the reading, had negligible mean shifts on the NEP-C and the INS, which may indicate that simply reading the book without the opportunity to reflect on and discuss it and with no additional activities may not shift environmental attitudes or values.

The class that used the book in religion and ethics, and then discussed the book (F), had a positive mean shift of 1.04 on the NEP-C, higher than the two classes that read the book in conjunction with environmental activities either being self-led (H 0.40) or taking place outwith that class (C 0.88). The utility of not just reading, but discussing what has been read, relates to the conclusions of Eagles and Demare (1999) who wrote that exposure to media (including books) with an environmental theme over the long-term within a family context that valued and discussed the environment, nurtured environmental attitudes in children.

Two other classes that had fairly high mean shifts in the NEP-C were another enriched environmental class, which specifically mentioned discussing the book (J 1.50) and the geography class that involved 12 lessons using the book and a visit to John Muir’s birthplace (E 1.38). Despite the positive shift, before and after reading the book, this class continued to have the lowest mean score on NEP-C. Because of the small size, we could not run a *t* test. This latter class did have the largest mean shift in INS of 0.75 and the second highest mean INS score after the book. Finally, the class that simply used the book to introduce spending a day outdoors (K) had a mean shift of 1.18 on the NEP-C and -0.36 on the INS.

Overall, the book appears to have had the most impact when it was integrated with experiences emerging out of outdoor or environmental education activities or when it was discussed in a reflective manner. When the graphic novel was simply read or analysed as a piece of art or writing, it did not have as much impact.

Impact of a Book-Based Environmental Education Intervention

The findings of our research point to the potential that a third sector led, book-based

intervention can have for amplifying an alternative story in relation to shifting worldviews on environmental issues, shifting identities and increasing the valuing of nature.

Involving pupils with a range of abilities and backgrounds in the development of the book may have contributed to making it accessible and engaging, as did producing it in graphic novel format. The majority of teachers who worked with the book believed it provided an engaging way to raise environmental issues across abilities and class topics. While many used the books in association with disciplines and activities commonly associated with environmental education, a range of disciplines were represented in responses, highlighting the potential of books to expand environmental education into the broader curriculum.

Because of the limited number of responses to the teacher survey, it is not possible to say how widespread engagement with the book is across Scotland, nor how generalizable these responses are. Nevertheless, we know that at least some teachers are using the resource and of these, the majority see benefit in relation to raising environmental issues.

Shifts in pupils' NEP-C and INS for the most part matched what we expected. We theorise that fiction, such as the John Muir graphic novel, provides pupils with narrative resources that can be used to re-story their experiences and give new meaning to the natural world. Providing them concurrently with experiences to which these narrative understandings can be applied would be expected to reinforce shifts in worldview and even in identity (Willis 2011).

Reflective discussions with others can also be expected to make these new storied worldviews more intelligible as well as give students the opportunity to try out new ways of giving meaning to experiences (Polkinghorne 2001). When carefully selected books are discussed in already established, ongoing communities, in association with new experiences, we would expect the impact of environmental education to be strengthened. Resulting changes will manifest in the stories pupils tell about themselves, their own experiences and the world around them, a subject for subsequent research.

One of the most encouraging observations from this study in relation to the potential of an intervention like this is that teachers themselves used the book as a narrative resource. Some read the book to inform themselves about John Muir's story and some were inspired to integrate the book into their classes, sometimes even structuring months' worth of lesson plans around it and the narrative it contains. For the pupils of these teachers, the discussions they had and the activities they engaged in were changed by the existence of this narrative resource. From this perspective, we can conclude that the distribution of classroom sets of the graphic novel has impacted on education in at least some Scottish schools and that this impact on education can be linked to shifts in worldview, identity and values amongst pupils.

Literacy is a priority area in Scotland, one which is gaining in funding while other areas of education have seen cuts. While SBT's project did encounter challenges, this research has demonstrated that third sector organisations which focus on literacy and can access literacy funding, can do so while also contributing to environmental education. The varied uses and diverse disciplines using, *John Muir, Earth - Planet Universe*, demonstrate that initiatives like SBT's can widen the exposure of pupils to environmentally-oriented narrative resources.

Though pointing to the potentially important role that narrative literature may serve in environmental education, our study remains largely exploratory and a great deal more research is needed in this area at all scales from the experiences of individual readers, through classroom interventions to further studies of the amplification and circulation of alternative narrative resources in society.

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¹ Our overview of these studies ends in the late 1990s because we did not find subsequent studies that included books and authors as part of broad-based research into what influences people into becoming environmentalists, environmental educators or to engage in environmental behaviours.

² Activities are not discussed in this paper, see Willis and Schmidt (2015).