



# An interdisciplinary approach to environmental and sustainability education: developing geography students' understandings of sustainable development using poetry

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## ABSTRACT

Education for sustainable development (ESD) persists as an important concept within international policy and yet, despite considerable debate, there remains a lack of consensus as to a pedagogy for ESD in schools. This paper presents findings from a study investigating how an interdisciplinary approach to ESD in England developed one class of 16- and 17-year-old geography students' understandings of sustainability. The research used students' drawings of sustainable cities alongside questionnaires and semi-structured interviews to explore their understanding of sustainable development within a constructivist, case study framework. The study found that the use of poetry within a geography lesson developed students' appreciation of the social and economic dimensions of sustainability, although their focus persisted around the environmental. As such, it is argued that an interdisciplinary approach to ESD encourages students to engage more critically and affectively with the concept of sustainable development, thereby developing a more holistic appreciation of it.

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## Introduction

Sustainability persists as an important concept within education and, following the United Nations (UN) Decade of Education for Sustainable Development (DESD 2005–2014: UNESCO 2005), is now being promoted globally through the UN's Transforming our World: the 2030 Agenda for Sustainable Development (UN 2015). However, despite this continued *global* focus on education for sustainable development (ESD), since the general election in 2010 in England there has been significantly less policy emphasis on sustainable development which has 'inhibited the wider adoption of good practice in ESD' (UNESCO 2013). UNESCO argue that although good practice in ESD exists in England, there is no coherent view at policy or practice level about how it can most appropriately be experienced by learners and how it can contribute to improved learner outcomes. In this way, there is a need to better establish and share a pedagogy for ESD which gives students a stronger, more critical understanding of sustainable development and sustainability issues.

Going some way to address this, the UN's Transforming our World is heralded a plan of action for people, planet and prosperity and contains 17 sustainable development goals which aim to build on the Millennium Development Goals (2015). These, the agenda states, are 'integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental'. However, despite the

UN's clear focus on the three dimensions of sustainable development, previous research undertaken with Geography students in English schools has shown that although they are aware of these 'three pillars' of sustainability, they often have only a superficial appreciation of anything beyond the environment (e.g. Walshe 2008; Dunphy 2009). Further, even when they are able to develop a broader and more nuanced understanding of the dimensions of sustainability, they are still often unable (or unwilling) to recognise its relevance to their own lives (Walshe 2013a, 2013b). It appears then that there is still a need to establish a pedagogy for developing a more holistic understanding of sustainability within our students in schools. With this and the criticisms of UNESCO in mind, I undertook research for this study with the aim of exploring how an interdisciplinary approach to ESD can support a class of Year 12 (16- and 17-year old) geography students' critical engagement with and understandings of sustainable development.

## Conceptualising sustainable development

It is widely known that the concept of sustainable development was first conceived at the 1972 United Nations Conference on the Human Environment in Stockholm when, although it was not specifically referred to, governments agreed that development and the environment should be managed in a mutually beneficial manner (SDC 2009). One of the first and certainly the most widely used definition in schools was constructed by the World Commission on Environment and Development (WCED) in 1987 and was a product of a report entitled 'Our Common Future'. This produced the 'Brundtland definition' that describes sustainable development as progress which, '... meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED 1987, 43). Our Common Future speaks of two concerns that should be reconciled, development and the environment; today, however, sustainability is almost always seen in terms of three dimensions or pillars: the environment, society and the economy (Kuhlman and Farrington 2010). However, despite the prevalence of this representation of sustainable development in Government policy and educational practice, there has been considerable debate and discussion as to its theoretical underpinning and the discourse it pursues. For example, Bonnett argues that it reflects a neo-liberal approach to development, rather than a genuine concern for the environment:

Brundtland-type definitions of sustainable development reflect highly anthropocentric and economist motives that lead to nature being seen essentially as a resource – an object to be intellectually possessed and physically manipulated and exploited in whatever ways are perceived to suit (someone's version of) human needs and wants. (2007, 710)

Further, there are competing and conflicting views over what the term sustainable development means, what is to be sustained, by whom, for whom, and what is the most desirable means of achieving this goal (e.g. Agyeman and Evans 2004; Lipscombe 2008). Others, such as Barraza, Duque-Aristizábal, and Rebolledo (2003) or Manteaw (2012) question how we might measure sustainability in different cultural contexts or how 'needs' are defined in different cultures; they argue that one of the reasons why the concept of sustainable development is so full of tensions is because different people identify the objects of sustainability differently, and meeting some people's 'needs' effectively excludes the needs of others. Agyeman builds on this argument suggesting that what he terms an 'equity deficit' pervades much environmental sustainability theory and practice (2005, 44). He sees the focus on the environmental as being problematic, in particular arguing that sustainability

cannot be simply a 'green', or 'environmental' concern, important though 'environmental' aspects of sustainability are. A truly sustainable society is one where wider questions of social needs and welfare, and economic opportunity are integrally related to environmental limits imposed by supporting ecosystems. (Agyeman, Bullard and Evans 2002, 78)

In response to this concern, Agyeman developed the concept of *just sustainabilities* which fully integrates the notion of social justice with sustainability, as well as acknowledging its culturally and place-bound nature (2013). Unlike the Brundtland definition in which justice and equity are at best implicit, Agyeman argues that just sustainabilities moves away from the dominant orientation of 'environmental sustainability' to represent a more balanced approach including an explicit focus on justice, equity and environment together.

## Student understandings of sustainability: a focus on the environmental

As this academic debate concerning the nature of sustainable development continues, there is increasingly an expectation that young people are able to engage with the concept of sustainable development as something which is relevant to their own lives. Despite this, there still appears to be a relative scarcity of research undertaken with the aim of exploring school students' understandings of sustainability (Rickinson 2006) and what research there has been has looked more generally at environmental education (e.g. Nagel 2004; Hopwood 2007). However, Walshe has undertaken two studies to explore students' understandings of sustainable development in schools in England. The first (2008) found that students predominantly understood sustainability as being centred around the 'three pillars' of sustainable development but with a strong foregrounding of environmental concerns at the expense of social and economic dimensions. The second (2013a, 2013b) was a longitudinal study which used dialogic diaries as a research and pedagogical method to develop students' understandings of sustainability; findings again suggested that while the use of dialogic diaries developed students' understandings of sustainable development, the discussion within them predominantly focused on environmental perspectives of sustainable development. Similar findings have emerged in smaller studies within schools (e.g. Dunphy 2009) and from research with students in higher education within the UK; for example, Kagawa (2007) found that students at the University of Plymouth strongly associate the concepts of sustainability and sustainable development with the environment as against social and economic aspects, whilst Summers, Corney, and Childs (2004) found that geography and science trainee teachers identified the environment as a focus for sustainable development. Previous studies at school and in higher education within the UK have, therefore, identified a need for research which further examines students' understandings of sustainability, particularly to explore how students might be helped to better consider a more just approach to sustainabilities. The next section goes on to consider how the literature suggests this might be done, through ESD.

## Education for sustainable development

Although the nature of sustainable development itself can be debated, it has been argued that education is the key to achieving sustainability (e.g. McKeown 2002; Green and Somerville 2015). As with the concept of sustainable development itself, there is discussion as to the purpose of ESD (e.g. Dawe, Jucker, and Martin 2005; Corney and Reid 2007; Van Poeck and Vandenabeele 2012); however, there is some consensus that its central focus is to support the younger generation in acquiring the knowledge, skills, attitudes and values necessary to shape a sustainable future (e.g. UNESCO 2005; De Haan 2006).

It has been suggested that there are two key aims of ESD which can facilitate its contribution to sustainable development (e.g. Bonnett 2002; McKeown 2002). The first is the instrumentalist view that ESD should actively promote the positive attitudes and pro-environmental behaviour that are the requirements for sustainable development (e.g. Dawe, Jucker, and Martin 2005; Fielding and Head 2012; Kopnina 2012). There is evidence to suggest that environmental knowledge is a correlate of environmentally responsible behaviour amongst young people; in this way, one argument for ESD is to educate young people about issues of sustainability so that they adopt a more sustainable lifestyle. However, there has been criticism of this aim of ESD from some who suggest that it reflects a cosmopolitan universalist or 'consensus' approach to sustainable development (e.g. Sund and Öhman 2014). They argue that with an instrumental view of ESD there is a risk that education will lead to a 'domestication' of citizens; that is, individuals learn a particular knowledge and the task of education is merely to reproduce the existing, neo-liberal political order (e.g. Biesta 2011).

The second aim of ESD is that it should develop students' critical understanding of sustainable development, thereby facilitating students' critical thinking about sustainability issues. This perspective of ESD is one which is becoming increasingly popular as authors such as Van Poeck and Vandenabeele (2012) emphasise the importance of presenting issues of sustainable development as matters of public concern instead of simply focusing on the acquisition of individual competences. This approach to ESD

(or environmental and sustainability education [ESE], as it is now increasingly known) encourages a more participatory and pluralistic approach which provides students with opportunities to actively take part in societal debate, rather than promoting a certain ideology which excludes other possibilities and, thus, leaves less space for action and autonomous thinking (e.g. Jickling and Wals 2008; Öhman and Öhman 2013). Participatory, rather than normative, approaches focus on the more democratic mission of an education that involves diverse interest groups, supports free opinion-making and enhances students' competences to act (e.g. Lundegård and Wickman 2007; Öhman 2009; Huckle and Wals 2015).

### **Defining a pedagogy for ESD**

In their final report on the DESD, UNESCO argue that it served to 'reorient education globally towards a central goal; to learn to live and work sustainably', and that it 'galvanized pedagogical innovation' (2014, 3). However, Huckle and Wals (2015) dispute this, arguing instead that the DESD represents 'business as usual in the end' and that educational institutions have largely given up 'training people capable of thinking about important political, environmental, economic and social issues of global order' (Huckle and Wals 2015, 493). But what should effective ESD look like, particularly within a school or classroom context?

Within the context of Higher Education (HE), Cotton et al. (2007) found that a significant proportion of lecturers studied identified a distinct pedagogy for teaching about sustainable development. Cotton and Winter (2010) support this suggesting that a number of alternative pedagogic approaches for ESD have emerged in HE which promote inclusive forms of communicating knowledge based primarily on dialogue and experience. They provide a list of potential teaching strategies which include role plays and simulation, group discussion (e.g. Cotton 2006), stimulus activities (such as watching a video or looking at poetry to initiate reflection or discussion: e.g. Oulton et al. 2004), debates, use of case studies, critical reading and writing (e.g. Stibbe 2008), problem-based learning and fieldwork (e.g. Scott and Gough 2003). Despite this, Sund and Öhman (2014) suggest that a central challenge for ESE practitioners remains how to create opportunities for students to get involved in discussions so that they can discover and experience the differences and conflicts that are embedded in issues related to sustainable development (after Lundegård and Wickman 2007, 2012; Rudsberg and Öhman 2010; Öhman and Öhman 2013). They go on to argue that democratic confrontation or discussion (e.g. through debate) can mobilise passion in students, thereby engendering an emotional response and bringing about *affective* learning, when knowing shifts from being something intellectual and detached to a personal and connected knowing (Rogers and Tough 1996). According to Hicks and Bord (2001), very little attention has been paid to the affective dimension of learning ESE issues, and yet it has been suggested that if students create an emotional relation to the world these can lead to them taking a stand for or against certain issues (Lundegård 2008). Although, within the context of teaching controversial issues in schools, Oulton et al. (2004) suggest caution when using potentially emotive pedagogies, arguing that they may polarise a debate by encouraging pupils to prematurely make up their minds on an issue, perhaps affective learning outside the context of more confrontational debate could form the basis of a pedagogical approach to ESD within schools.

This study was undertaken with the context of a geography lesson; Corney and Reid (2007) and Chalkley, Blumhof, and Ragnarsdóttir (2010) highlight the already widespread recognition of the major contribution of geography teaching to ESD within England. The subject matter of geography focuses on inter-relationships between people and their physical, economic and social environments, at different spatial and temporal scales. Perhaps more importantly, its pedagogy is often characterised by geographical enquiry (Taylor 2008; Roberts 2013), in turn based on constructivist approaches to learning which envisage students as active co-constructors rather than passive recipients of knowledge within and outside the classroom (Corney and Reid 2007). With this in mind, this study aims to incorporate pedagogies of critical thinking, debate and discussion with those provoking an emotional response and, thereby, learning in the affective dimension, in supporting its aims of developing students' critical understanding of sustainable development beyond the environmental dimension within the context of a geography lesson.

UNESCO suggest that addressing sustainability requires an holistic, interdisciplinary approach which brings together the different disciplines and institutions while retaining their distinct identities (1997, 2). This is supported by Jones, Selby and Sterling who argue that sustainability presents an

overarching and complex socio-economic-ecological context wherein interdisciplinarity – as a putative holistic model of understanding, organization of knowledge and inquiry – seems appropriate. (2010, 19)

The use of interdisciplinary teaching, therefore, might expose learners more explicitly to the plurality of thinking which Jickling suggests allows them to develop their own perspectives about sustainability (2003). However, Feng notes that although there is an extensive literature on interdisciplinarity, there has been relatively little investigation of the ways in which learners deal with and respond to this central aspect of sustainability education (2012). As such, this research goes some way to address this, taking an interdisciplinary pedagogical approach by using poetry (traditionally bounded within the disciplinary community of English) as a stimulus to critically engage with ideas of sustainability within the context of a geography lesson. The next section considers the specific context and methodology for this study.

## Context and methodology for the research

### *Context of the study*

This research was undertaken at a large, fully comprehensive 11–18 academy in England consisting of 1790 students. The school serves a relatively affluent rural area; few students are from ethnic minority groups or speak English as an additional language, and the number of students with special educational needs is in line with the national average (OFSTED 2013). A class of 16- and 17-year old students were used for the case within this research; the students had all opted to take Geography at AS (Advanced Subsidiary) Level which is the first part of their two-year A (Advanced) Level school leaving qualification. The Geography Department had selected to follow the AQA A Level Geography specification (AQA 2009). During the year the students completed Unit 1 of the specifications which comprised Rivers and flood management, Cold environments, Population change and Global health issues, as well as work for Unit 2, Geographical Skills. The research was undertaken shortly after the students sat their AS Level examinations and was based around a single lesson, a summary of which can be seen in Appendix 1; the focal activity during the lesson was an exploration of the poem 'A Vision' by Simon Armitage (2007).

Brannigan (2002, 10) argues that 'Literary texts help to give imaginative coherence to the city, to bring the city into consciousness as a navigable, readable space'. Although, as an approach to studying literature, ecocriticism has tended to focus on literature about 'natural' landscapes, it is increasingly argued that literary texts can support the process of understanding the city as a complex environment linked to nature and to global processes (e.g. Garrard 2004). This is something that has been considered by Rawling (2010) and Jones and Fitzgerald (2010) who argue the case more specifically for the use of poetry in geography, suggesting that it helps young people reflect on the way their own lives are intertwined with the places they inhabit. Building on these ideas, Matthewman considers how an eco-critical reading of Simon Armitage's poem 'A Vision' can be used to support students' understandings of sustainability (2011). 'A Vision' is a text about imagining the future of the city; on first reading themes of disparity between the utopian city plans and the lived realities of people's lives (with a particular focus on the environment) emerge from the text. However, the poem was commissioned by the Commission for Racial Equality and contains underlying issues of multiculturalism and diversity. In this way it illustrates the entanglement of social and environmental issues of sustainability and, as such, was seen as having the potential to develop in students a more holistic understanding of sustainability within this study.

### Methodology and methods

Barraza and Robottom suggest that there are good grounds for adopting a socially constructivist perspective in research in environmental education, arguing that not only are environmental issues clearly socially constructed (since issues often consist of a disagreement among social groups), but learners'

apprehensions of such issues are also matters of individual construction of meaning (2008). As such, this research was framed as an interpretive case study within a constructivist epistemology; an inductive exploration of a class of 16- and 17-year old geography students as they learned about sustainability (e.g. Stake 1995; Bassey 1999). In order to provide a wide-ranging data-set, a number of complementary data collection methods congruent with a (socially) constructivist approach to research were used both pre- and post-lesson: student drawings, questionnaires and interviews. There has been criticism that single group pre- and post-test design weakens internal validity (and, thereby, causal interpretation) of research as factors such as the contemporaneous effects of 'normal' educational experience or test effects are not controlled for (e.g. Marsden and Torgerson 2012). The purpose of this small, in-depth, inductive case study was not to generalise beyond the class, but to explore in detail how students' understandings and perceptions of sustainability developed over the course of one lesson. Any suggestions as to how this research may be relevant beyond this context will be made as fuzzy generalisations, kind of predictions that say something may happen, but without any measure of its probability (Bassey 1999). Bassey argues that these are possible within the context of a case study without reducing its external validity (1999).

### **Student drawings**

Students were asked to draw their representation of a sustainable city both pre- and post-lesson to provide a detailed understanding of their changing representations of sustainability (White and Gunstone 1992; Prosser 1998; Banks 2001). The analysis of drawings is a potentially robust, novel and useful tool for the field of environmental sciences (Barraza 1999), and while many children dislike answering questions, drawings can be completed quickly, easily and in an enjoyable way (Lewis and Greene 1983; Weber and Mitchell 1995). Further, the lack of structure within a drawing exercise can encourage participants to identify whatever component or issue most concerns or impacts them (Mitchell et al. 2011). For this reason, the use of drawings as a participatory visual research method provided a lens through which I could explore students' deeper understandings of sustainability beyond what they may be able to verbalise themselves within a questionnaire or interview alone.

Meyer (1991) argues there is a danger that drawings produced under conditions of little structure may be so far off target of the focus of the research as to be useless. For this reason, the concept of a sustainable city was chosen to support students in their thinking about sustainability by giving them a concrete concept on which to hang their knowledge, thereby also avoiding issues relating to description of more abstract concepts, such as sustainability (e.g. Walshe 2008). The use of the city context also provided the opportunity for students to more explicitly link learning from the lesson (through 'A Vision') to their developing understandings of sustainable development.

### **Interviews**

Within this research, drawing was used as a participatory research method that relies on researcher-participant collaboration to make meaning of the drawing (Burke and Prosser 2008; Mitchell et al. 2011). As such, five students were chosen for in-depth interviews with the aim of exploring ideas emerging from the drawings with the students, and further probing their experiences of the lesson. For this purposive sampling was used as the class teacher identified students across a range of academic abilities (according to their predicted AS level grades). These students were interviewed twice, once before and once immediately after the lesson. I used individual, semi-structured interviews comprising both direct questioning and discussion following unprompted comments. When exploring the drawings within the interviews the students were asked to 'talk through' their image, explaining first *what* they had included and then *why* they had chosen to do so. If necessary, they were prompted during this process to make links between what they had drawn and sustainable development: How did their drawings represent what sustainable development meant to them? In order to facilitate methodological analysis, students



were also asked to explain how and why their written definitions in questionnaires differed from their drawings, and which they felt best represented their understanding of sustainable development.

### **Questionnaires**

Both before and after the lesson, all students were given a questionnaire to complete. The initial questionnaire had the aim of exploring students' pre-existing understandings of sustainability, as well as their attitudes towards sustainable development and pro-sustainable behaviour; within it, students were asked to provide a definition of sustainable development. The questionnaire following the lesson asked students to redefine sustainable development and explored their understandings of sustainability in the context of the lesson; this second questionnaire also included questions to elicit student feelings about the lesson and how this supported their developing understandings of sustainability. In this way, the intention was that the second questionnaire would produce some of the metacognitive reflection developed in the interviews, giving me an understanding of how and why *all* students' perceptions of sustainability developed over the course of the lesson (not just those that were interviewed).

### **Data analysis**

Data analysis was achieved through open, manual coding combining a thematic and case-based approach to the data, and attempting to balance breadth and depth of focus, through the recursive processes of classifying, juxtaposing and reporting, based on ideas from Dey (1993). Analysis was undertaken blind as to whether pre-test or post-test to reduce potential bias in categories emerging. Through this process a set of classification categories emerging from the data (inductive content analysis) was used to follow through strands in learning across it, for example transport, healthcare and employment. These categories were then allocated to one of the three dimensions of sustainability: environment, society or economy. The aim of this was to explore how the focus of the students' representations of sustainability in relation to the three dimensions developed (or not) across the lesson. This was an iterative process undertaken a number of times to increase validity of the coding. Student drawings of sustainable cities and definitions of sustainable development given in questionnaires were analysed using this approach; for student drawings, images and text were given equal weighting in the coding process, and each could contribute to more than one category (e.g. 'playground' was allocated to both green spaces in environment and general society). Table 1 illustrates the set of categories emerging from the data, along with examples from each category. Interview data were not analysed using coding, but were used to give context to and help to explain information arising from the drawings and definitions.

### **Research questions**

Two research questions framed the empirical stage of this research:

- (1) What were student understandings of sustainability before the lesson? How were these understandings represented through sustainable cities?
- (2) In what ways and by what processes did the students' understandings and representations of sustainability change over the course of the lesson?

In this article, I will firstly provide some contextual information about findings from research question one. Then, I will focus on student representations of sustainable cities after the lesson, exploring any differences between these and the initial representations, and starting to explore the mechanisms which facilitated any change across the lesson. Finally, I will suggest some implications of the study for teaching about sustainability and sustainable development more generally.

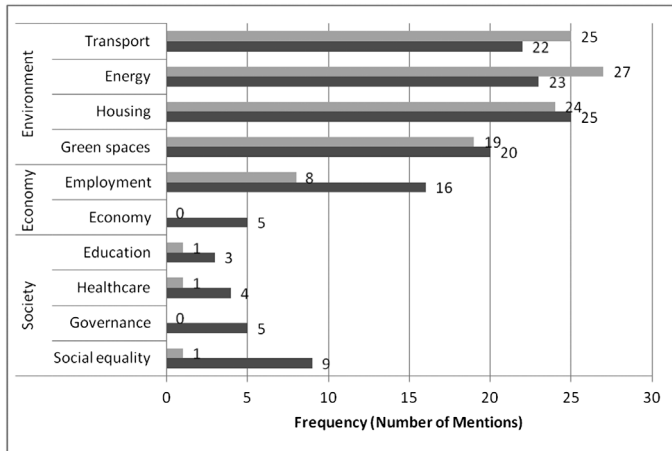
**Table 1.** Example text from student representations of a sustainable city for each category produced from inductive content analysis during open coding process. PRE is an example from a pre-lesson drawing, and POST is from a post-lesson drawing.

Dimension	Category	Sub-category	Text example	
Environment	General environmental		It is environmentally oriented (Emily PRE) In terms of the environment (Mollie POST)	
		Green spaces	Playground (Mollie PRE) Allotments to encourage own-grown produce and use of green space (Jade POST)	
		Animal habitats	Natural green spaces to allow for habitats (Mollie PRE) Lots of birds and animals (Georgia POST)	
		Water	Lake (Mollie PRE) River (Jake PRE)	
		Trees	Lots of trees to reduce CO <sub>2</sub> (Mollie PRE) Lots of trees (Elizabeth PRE)	
		Green space	Lots of green space (Elizabeth PRE) Area of grassland (Katrina POST)	
	Housing	General housing		Loft insulation, double glazing (Katrina PRE) Double glazed windows (Izzy PRE)
			Grass roof	Grass roof (Elizabeth PRE) Rooftop gardens (Emily POST)
		Recycling		Recycling centre (Mollie PRE) Recycling bins (Mia POST)
		Tall flats		Tall buildings maximise use of land (Mollie PRE) Skyscrapers (Izzy PRE)
	Energy	Other energy		Biofuel fields (Izzy PRE) Dam on river providing hydro-electricity for city (Jake PRE)
		Wind turbines		Wind farm (Mollie PRE) Wind farm (Emily POST)
		Solar energy		Solar panels (Mollie PRE) Solar panels (Jake PRE)
	Transport	Walking		Safe pavements to encourage people to use their cars less (Jade PRE) Walking (Phil PRE)
			Electric cars	
		Cycling		Bike parking (Mollie PRE) Encourage bikes (Kate POST)
		Public transport		Bus stops to encourage public transport (Mollie PRE) Sign showing trainlines all around city (Katrina PRE)
	Society	General society		Sustainability is divided into ... social sections (Charlotte POST) Social (Izzy)
		Social equality		Multi-faith worship place (Mollie POST) Drop in centres for people of all ages (Katrina POST)
		Governance		Democracy, freedom = happy (Mollie POST) Established governments (Emily POST)
Healthcare			Hospital (Mollie PRE) Hospitals/doctors (Emily POST)	
Education			Education = better life prospects (Mollie POST) School/educational facilities (Charlotte POST)	
Economy	General economy		Sustainability is to do with meeting the needs of citizens across a range of issues such as ... economically (Kate POST)	
	Economy		Bank (Charlotte POST) Economic sustainability (Jake POST)	
	Employment		Lots of local jobs (Mollie PRE) Large offices/headquarters to increase access to employment and employment rate (Jade POST)	

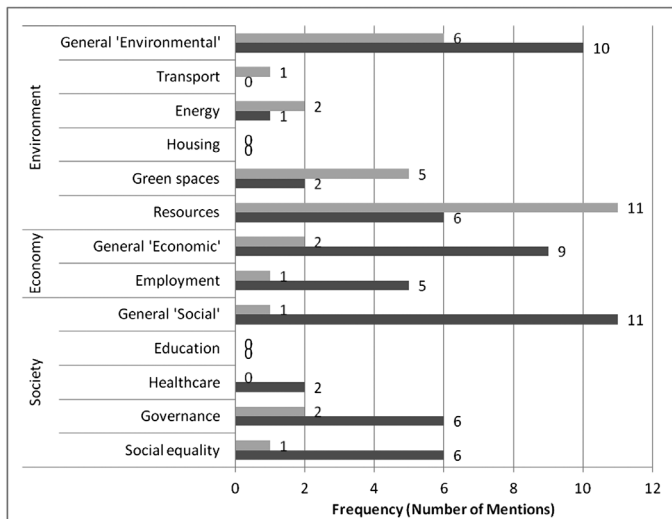
## Findings

This section explores the patterns of students' understandings of sustainable development as emerging from analysis of both student drawings and definitions within questionnaires before and after the lesson. Interview data will also be used, where appropriate, to support analysis and interpretation of data. Figures 1 and 2 show the number of mentions for categories within the three dimensions of





**Figure 1.** Bar chart showing frequency (number of mentions) for categories within the three dimensions of environmental, economic and social aspects of sustainability, as emerging from student representations of sustainable cities before (light grey) and after (dark grey) the lesson. Sub-categories (see Table 1) are not given here as it aims to give a broad overview of representations.



**Figure 2.** Bar chart showing frequency (number of mentions) for categories within the three dimensions of environmental, economic and social aspects of sustainability, as emerging from student definitions of sustainable development within the questionnaires before (light grey) and after (dark grey) the lesson. Sub-categories (see Table 1) are not given here as it aims to give a broad overview of student definitions.

environmental, economic and social aspects of sustainability, as emerging from student representations of sustainable cities and definitions within questionnaire data respectively.

***What were student understandings of sustainability before the lesson?***

***Student drawings***

Figure 3 shows an example of a student drawing undertaken by Mollie before the lesson. This representation of a sustainable city is typical of pre-lesson drawings in that it includes a range of buildings (some high rise), roads and transport (Béneker et al.'s 'big, busy city': 2010). Mollie's drawing is also

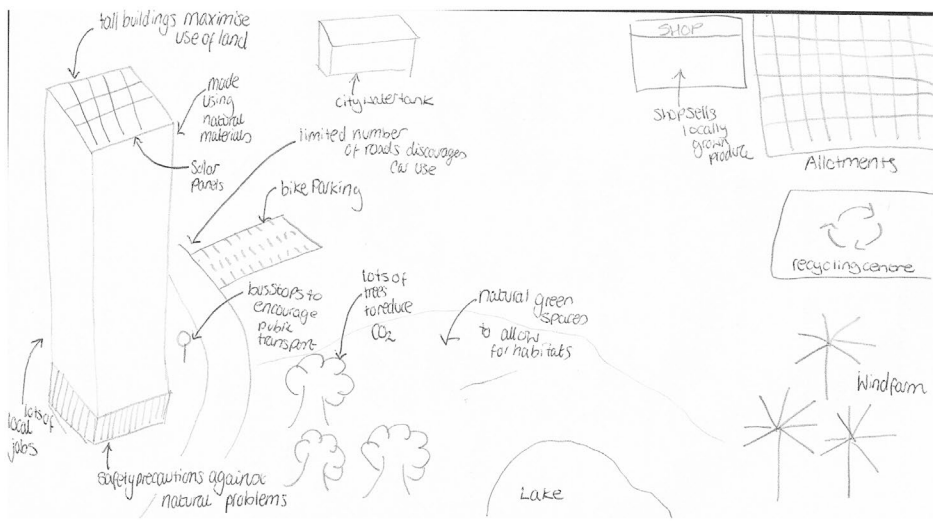


Figure 3. Pre-lesson representation of a sustainable city drawn by Mollie.

representative of the group's as its focus is almost entirely on environmental aspects, for example representations of renewable energy (through solar panels and wind farm), sustainable transport (such as bike parking and bus stops to encourage public transport), and green spaces (in this case as natural green spaces, trees and an allotment). The only representation of socio-economic dimensions of sustainability is one which mentions 'lots of local jobs', although the fact that they are 'local' suggests an environmental rationale as they would reduce the need for transport to other settlements, in doing so reducing the environmental impact.

The frequency of occurrence of sub-concepts of the three key perspectives (environmental, social and economic) of sustainable development illustrated in student drawings before and after the lesson is illustrated in Figure 1. Before the lesson, overwhelmingly the most frequently represented perspective is that pertaining to the environment (90%), with the social and economic perspectives comprising 3 and 7% of mentions respectively. This is supported by evidence from interviews; for example, Katrina suggests that sustainable development is 'protecting things ... like the environment, habitats and ecosystems and stuff'. Within the more anthropocentric perspectives, it is the economy which is more commonly represented, particularly through drawings of offices implicitly portraying opportunities for employment. Perhaps surprisingly, there is almost no representation of society within the initial drawings, with just one mention across the class for each of healthcare, education and social justice.

### Questionnaires

Analysis of students' definitions of sustainable development within the questionnaires was undertaken alongside that of the drawings to enable triangulation between different methods of data collection. The frequency of occurrence of each of the three key perspectives (environmental, social or economic) before and after the lesson is illustrated in Figure 2. As with student drawings, the most frequently mentioned perspective before the lesson is that pertaining to the environment (78%), although the social and economic perspectives comprise slightly more mentions than in drawings at 13 and 9% of mentions respectively.

Within the questionnaire, students were asked to define sustainability in as much detail as they could; this was purposefully an open request which allowed them to structure and exemplify their definition as they wished. The majority of the definitions given by the students before the lesson were extremely reminiscent of that of the Brundtland Report (WCED 1987); in this way they frequently referred to inter-generality or the notion of meeting the needs of today without compromising the needs of future

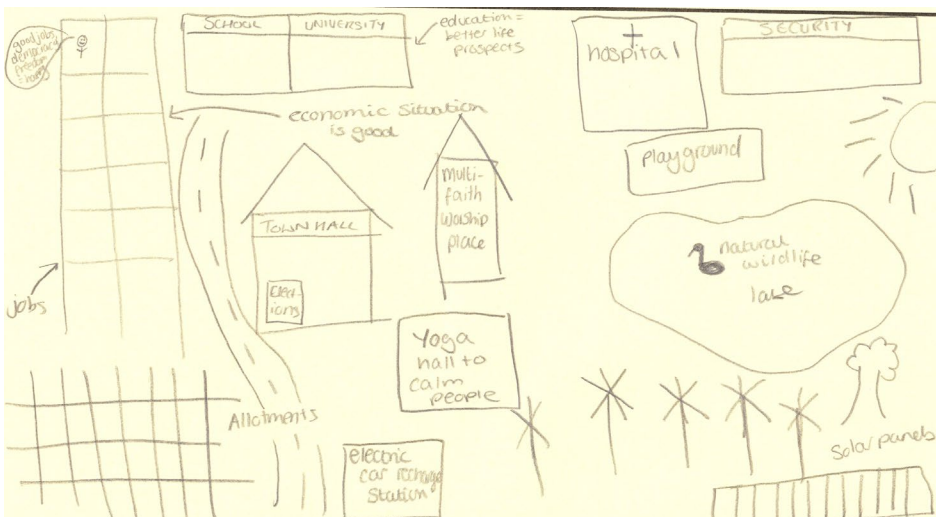
generations. For example, Louise wrote 'Sustainability is meeting the needs of the current generation without compromising the needs of future generations', whilst Mollie similarly defined 'Sustainability is meeting the needs of the present day, without hindering the provision for future generations'. In the majority of definitions, there was no development of the definition to consider *what* was being sustained for future generations, or indeed what either generation's needs were. However, a significant number of students included reference to 'resources' within their definition. For example, Katrina wrote 'Sustainability is all about protecting and preserving natural resources in order to make them last for as long as possible as they are often finite resources and thus vulnerable to damage'. Again there is little detail given as to what resources this might mean; in fact almost all student definitions contained very little exemplification beyond the initial definition.

### ***In what way did student understandings and representations of sustainable development change over the lesson?***

#### ***Student drawings***

Figure 4 shows an example of a student drawing undertaken by Mollie after the lesson. This representation of a sustainable city is again relatively typical of post-lesson drawings in that while it still contains a number of references to environmental sustainability, for example the playground and natural wildlife in the lake, it also includes significant reference to social and economic dimensions. In particular, Mollie draws a range of images pertaining to social justice and equity; for example, a multi-faith place of worship, a town hall in which elections are taking place, and a building entitled 'security'.

Figure 1 shows that, as exemplified by Mollie's drawing, students' representations of sustainable cities showed a much broader range of concepts following the lesson, and although there was still an emphasis on the environmental dimension of sustainability (at 68% of mentions), representations of social and economic dimensions significantly increased to 16 and 16% respectively. Within the environmental dimension, reference to different categories remained broadly similar, although there were slightly fewer representations of transport and energy overall. The most notable change was that within the housing category which, in the post-lesson representations, contained nine drawings of grass roofs. This is likely to be because the image of Bogotá presented to students within the lesson contained high-rise buildings with grass roofs and demonstrates the considerable impact visual images can have on students' learning.



**Figure 4.** Post-lesson representation of a sustainable city drawn by Mollie.

Within the social and economic dimensions, the most noticeable changes were within the category of employment whose number of mentions doubled from eight to sixteen; this was predominantly through general comments, such as Izzy's mention of 'jobs' or Louise's comment 'office building – jobs'. Within the social dimension, the concept of governance was noted in five representations post-lesson, as opposed to no mentions in pre-lesson drawings. Representations of governance were relatively diverse, ranging from ideas of elections in Mollie's drawing, through to text labelling 'democratic' not particularly referring to a specific (or readily identifiable) object. Finally, the sub-concept social equity increased significantly in its relative importance across the lesson within many post-lesson representations of sustainability. For example, Isla writes 'fair housing for all', not exemplifying what this might mean (or who the all might be), but perhaps being aware that there should be equity in access to housing. A few students refer more specifically to different groups; for example, Katrina refers to a 'healthcare drop in for people of all ages', whilst Mollie includes a multi-faith church. These changes reflect discussions around social justice and equity stimulated through the poem in the lesson and so begin to suggest that its use developed students' understandings of sustainability.

### **Questionnaires**

As with the representations of sustainable development through the students' drawings, their definitions following the lesson gave much broader consideration of sustainability, with a greater number in particular referring to the political and socio-cultural importance of sustainability (Figure 2). Only 33% of students' post-lesson definition mentions related to the environment, and instead the most commonly referenced dimension was society with 43%, with the economy comprising 24% of mentions. This suggests students had a significantly more holistic understanding of sustainable development following the lesson, and whilst they continued to recognise and stress environmental sustainability, they began to identify socio-cultural and economic sustainability as being important.

Looking at the definitions in more detail, some students continued to structure their definition around that of the Brundtland Report, just adding to it or refocusing the emphasis. For example, Jake wrote sustainable development is 'Meeting the needs of today's society without compromising that of the future's, in terms of the economy, socially and also environmentally'. This is supported by his interview in which he defined sustainable development: 'it's still meeting the needs of today without compromising the needs of the future generations, but also in terms of the economy and the social, like, the people as well not just environmentally'. This may suggest that the familiarity of this definition gives students a structure on which to build their definition; alternatively it may be that the emphasis on this definition across the school curriculum means that it is difficult for students to reconstruct. Despite this, many students did not simply add mention of the three dimensions within their post-lesson definitions as Jake did, but instead started to exemplify further. For example, Kate states 'Sustainability is to do with meeting the needs of citizens and the environment, across a range of issues such as socially (somewhere is democratic), economically (job opportunities) and environmentally'. Other very specific examples are given by Jade who adds 'making sure that racial equality is achieved through sustainability' to her definition, suggesting that she has a more nuanced understanding of issues associated with social justice and sustainable development. Again, this is supported by her interview in which she comments 'I'm now aware that there are three types of sustainability, so like economic, environmental and political and then how racial equality links in with it as well. So my definition's become longer and more broader'.

Within the post-lesson questionnaires, students were asked to reflect on how they felt their definition had changed since their first attempt and almost all commented on the fact that their understanding had broadened beyond the environmental dimension of sustainability; for example, Mollie comments 'I don't think I had really considered the extent of it'. Another student, Katrina echoes the thoughts of many students when she writes

Initially I thought that sustainability was about the environment e.g. saving water and electricity because this is publicised so much. Since having the lesson I've learnt that there are economic and social sides too ..... I think that the majority of people would think that sustainability was just about the environment due to advertisements for eco products on the TV/radio etc.

Within this metacognitive reflection, Katrina is starting to consider why her (and others') understanding focuses so much on the environmental, noting that the eco-focus is prevalent in the media through advertisements for environmentally friendly products. This will be considered in more detail in the discussion below.

## Discussion

### *Representations of sustainable development*

Within both students' pre- and post-lesson representations of sustainable cities, there is significant emphasis on the environmental dimension of sustainability (Figure 1). It could be argued that this is encouraged by the method of drawing a representation of a sustainable city which may lend itself to thinking about environmental issues, rather than socio-economic factors. For example, when Bénéker et al. (2010) asked students in England to draw a city they found that 60% of drawings had no people in them; they went on to suggest that it is perhaps easier to draw environmental issues (such as vehicle exhaust pollution) rather than social issues. However, data from students' definitions of sustainable development within their questionnaires and interviews had similar results suggesting that despite some concerns in the literature that the growing focus on sustainable development has resulted in a more anthropocentric-based education for sustainability (e.g. Kopnina 2012), it is actually environmental issues which remained at the forefront of this group of students' understandings, echoing findings by Walshe (2008, 2013b) and Dunphy (2009).

Why then, as illustrated in successive studies, are students foregrounding the environmental dimension of sustainable development? This study, along with those of Walshe (2008, 2013a) and Dunphy (2009) was completed within the context of a geography lesson; it could therefore be assumed that students will prioritise information which they believe to be inherently geographical within it. As noted before, the subject matter of geography focuses on inter-relationships between people and their physical, social and economic environments. As such, there is a significant emphasis on issues-based geography which considers socio-economic causes, effects or approaches to management of a wide range of phenomena; for example, the impacts of a volcanic eruption or rebranding a city. In this way, students should be familiar with exploring issues of society and economy within the context of a geography lesson, which makes their focus on the environment perhaps even more surprising. It is possible then that this reflects the equity deficit that Agyeman suggests pervades environmental sustainability practice (2005); do the environmental concerns of sustainability override those of social justice and economic opportunity within the practice of ESD?

However, perhaps there is an alternative explanation for students' emphasis on the environmental. Within student drawings there is a significant focus on 'the local' across a number of categories; for example, 'lots of local jobs' and 'shop sells locally grown produce'. Further, there are many references to environmentally more sustainable forms of transport; for example, Katrina's 'fuel station with electric hook ups for electric cars, biofuels, bike hire centre, zip cars and hybrids for hire'. Bénéker et al. (2010) suggest that information within representational drawings is likely to come from both direct experiences and indirectly through mediated images (see also Matthews 1992; Ono 2003). In focusing on the local, students may automatically identify aspects of sustainability that are within their lived experience, drawing on their direct experience and transferring it into the context of a city. For many of these, their personal or day-to-day experiences of sustainability relate to the environmental, rather than social or economic dimension; for example, Charlotte states at interview 'I cycle to school every day, so that's probably quite sustainable'. This is, therefore, what they express within their drawings.

Given the prevalence of an environmental focus in students' understandings of sustainable development, it is perhaps also important to reflect further on *how* the environmental dimension is represented by students. Looking at their drawings in more detail, green spaces were generally represented through images such as allotments or parks (e.g. in Figure 3). It could be argued that these images represent an anthropocentric, instrumentalist viewpoint of nature (e.g. Pointon 2014), echoing Quinn, Castéra,

and Clément's (2015) suggestion that people often have utilitarian conceptions of the environment. It may be the case that the very act of drawing a sustainable *city* might have encouraged this anthropocentric view of nature, thereby simply being the result of what Marsden and Torgerson identify as test effects (2012). However, for Bonnett (2004), alienation from nature and a utilitarian or anthropocentric attitude to the environment is key to our ability to knowingly despoil the environment. Perhaps then, for the purposes of ESD, it is not simply how frequently students refer to the environment within their drawings and definitions, but what the nature of those references are. In the case of these students, although their focus is on the environment, is it through an instrumentalist lens that they are interpreting the environmental? If so, do we need to develop this to a more holistic appreciate of nature and the environment (after Bonnett 2007) as a mechanism for developing a more nuanced understanding of sustainable development? I suggest that further research is now needed to explore not just student perceptions and understandings of sustainability, but more specifically the nature of their understandings of the environmental dimension (within the context of sustainable development). In particular, use of other concrete concepts around which students can contextualise their understanding would be useful to further consider the impact of framing understanding around a sustainable city. Finally, a more longitudinal study would enable better understanding as to whether or not these apparent changes in students' understandings are sustained over a longer period of time.

### ***An interdisciplinary approach to a pedagogy for ESD***

Matthewman and Morgan argue that interdisciplinary collaboration between Geography and English has the potential to facilitate better exploration of a range of different views of environmental issues in the classroom (2006). Within this study, poetry was used to develop students' perceptions of the nature of sustainable development. Although, as discussed above, students appeared to develop a more holistic understanding of sustainable development across the lesson, it is important to consider the extent to which the use of poetry supported that learning.

Disciplinary knowledge is characterised by a bounded way of understanding the world through shared language, rules and epistemological commitments (Petts, Owens, and Bulkeley 2008); the boundaries and procedures established by disciplinary communities are central to the legitimisation of the knowledge produced by and within that community (Greckhamer et al. 2008). In contrast, Feng argues that *interdisciplinarity* encourages learners to make links between individual disciplines and generate cooperation between themselves as learners, becoming in the process 'a community of learning' (2012). Students in this study were asked how they felt about the lesson pedagogy within both the questionnaires and at interview, in particular its interdisciplinary nature (the use of poetry within the context of a geography lesson). A number of students stated they felt uncomfortable with the poetry, finding it difficult to fit within their geographical pre-suppositions. For example, Isla wrote 'I felt it was more of an English lesson ... more time was spent on analysing the poem than learning the geography'; and Jade commented 'I find it difficult to analyse poems and therefore it was difficult'. This appears to support Feng's observation that students who are used to uni-disciplinary teaching and learning may find it difficult to learn in an interdisciplinary way (2012). She suggests that the linguistic idioms associated with different disciplinary discourses can create forms of 'cognitive dissonance' that students find difficult to handle. It is possible that some students in this class were experiencing this cognitive dissonance being reluctant to step out of the comfort zone of the traditional single discipline of geography. Becher and Trowler argue that individual disciplines have recognisable identities and particular cultural attributes (2001); these constructions of socially-derived, disciplinary epistemology, they suggest, are at least as important as 'real' differences in the knowledge characteristics of the disciplines. Within this small study, some students' perceptions of the epistemology and subsequent pedagogy of the two disciplines (geography and English) appear to have affected their engagement with the lesson. This was particularly the case if students had preconceived ideas about the discipline of English that were negative (they 'did not like' English) as these appeared to impact their openness to exploring activities that they perceived as being related to it.



However, despite some students' discomfort with the interdisciplinary nature of the lesson, more commonly students were enthusiastic about the use of poetry, seeing it as a mechanism to support their learning in several ways. Firstly, students described being 'taken out of their comfort zone', which added a level of cognitive challenge. For example Jake commented at interview

I thought it was very challenging ... because there was a lot to think, a lot to take in ... it was, like, slightly out of my comfort zone, but I enjoyed it because it was out of my comfort zone ... I learnt and took in a lot from it.

Further, because the poem required in-depth engagement with its meaning, students felt that it developed their higher level thinking; as Katrina writes 'It has helped me to become a more in-depth and analytical thinker'. Jade supports this in her interview commenting

It was good in the way that you got us to analyse it and then learn about the different types of sustainability ... you wouldn't normally expect that I suppose. And you got us to look at ... really closely at the poem and then you pick out things that you didn't see the first time, and the more you did it you picked out more and more.

In this way, in-depth analysis of the poem supported students' critical engagement with sustainable development as a complex concept. I suggest that this is significant as it gives geography teachers a tool with which to engage students critically with other 'wicked problems', such as climate change or global overpopulation (Cantor et al. 2015), as well as preparing students to engage more critically with the content and message of other texts, whether formal literary texts or reports from the media.

Finally, in triggering an emotional response to the subject matter, the use of poetry also appeared to move learning beyond the cognitive and into the affective dimension (Hicks and Bord 2001; Sund and Öhman 2014). For example, Charlotte comments

Poems are quite engaging I think, and I felt more involved in the lesson ... [They] are emotive, and involve you in the lesson. So I felt more like ... I was one of the people in the town that was like ruining it. So yeah I feel like I should be more sustainable now. (Charlotte)

In this way, the use of this interdisciplinary model went beyond the functional, it facilitated reflection and contemplation not only around what sustainability is, but also how it is represented through different texts. Moreover, it gave students time and space to reflect not only on what was being presented to them, but also to connect this with and make sense of their existing knowledge. Ultimately, it then has the wider potential to become the transformative sustainability learning that Morrell and O'Connor suggest involves 'a deep structural shift' that changes understandings of the self in relation 'with other humans and with the natural world' (2002, xvii); as a result, it may result in a more considered behaviour relating to sustainable development. Further research is now needed to explore why some students appear more able to transverse disciplinary boundaries; would this be less problematic were the learning framed within an interdisciplinary context, for example a lesson on sustainability which draws on a number of disciplines, rather than a geography lesson which uses poetry? Further, how might this be developed over a sequence of lessons, rather than a single lesson context? Becher and Trowler suggest that geographers are more open to interdisciplinary work than some other disciplines as they more readily absorb ideas and techniques from neighbouring intellectual territories (what they term 'divergent' disciplinary groups, 2001). Further research might also consider firstly how students within the context of an English lesson respond to similar activities and then go on to explore other interdisciplinary pedagogies.

### ***Drawing as a methodology for exploring student understandings of sustainability***

Béneker et al. (2010) suggest that it is important to recognise the types of information for which drawings are a useful source. In this case, student drawings of sustainable cities were extremely helpful in allowing students to demonstrate their understanding of what different features might be present within a sustainable city. Although Béneker et al. found that to truly understand young people's experiences in cities additional information was needed from questionnaires or quizzes, for the purposes of this research data emerging from open coding of drawings and definitions in questionnaires seemed to give similar patterns in terms of its depiction of environmental, social and economic dimensions of

sustainability. However, unlike definitions within questionnaires, drawings were considerably richer in detail and exemplification of these dimensions of sustainability; for example, they did not just mention 'environmental sustainability' but exemplified through minutiae, from energy-saving light bulbs, through to congestion charges and solar panels for energy. Drawings of sustainable *cities* gave students a context with which to consider sustainability, as well as allowing them to build on themes considered within the lesson through 'A Vision'. Although evaluation of artwork can be more challenging than more traditional methods of data capture (e.g. Flowers et al. 2015), I suggest that using them within a participatory research framework alongside interviews has the potential to help researchers and practitioners better understand students' cognitive grasp of complex issues, such as sustainability, through creative expression.

## Conclusions

It has been suggested that management of wicked problems, such as sustainable development, requires imaginative thinking that goes beyond the bounds of any one discipline (e.g. Brown, Harris, and Russell 2010; Cantor et al. 2015). The substantive findings of this article suggest that an interdisciplinary approach to ESE within the context of a geography lesson supported students' learning about sustainable development, particularly developing their understanding of its social and economic dimensions: or a more *just* sustainability (Agyeman and Evans 2004). However, despite having a more holistic appreciation of sustainable development, pre- and post-lesson drawings and questionnaire data showed that students' emphasis remained on the environmental dimension. This is perhaps surprising within the context of a geography lesson in England within which students are regularly asked to consider social, economic and political arguments surrounding contemporary geographical issues. However, one reason for this might be that students are drawing on their direct, lived experiences when considering the concept of sustainability and applying these to the context of a sustainable city. In this way, their ability to walk or cycle rather than using the car, or to recycle, overrides geographical knowledge learnt within a more formal learning environment. It is also possible that the impact of media is influencing students' conceptions of what a sustainable lifestyle might look like; it may be that their exposure to rhetoric surrounding living a 'green lifestyle' is far more considerable (or explicit) than that of issues of social justice or economic wellbeing, which means that they more readily associate them with sustainable development. This has implications for ESD within the context of schools and particularly school subjects as they attempt to support students' learning. For this reason, I suggest it is more important than ever for students to be given the opportunity to question, reflect, debate and critically engage with the concept of sustainability or sustainable development within schools in order for them to better understand its nature and purpose.

This study suggests that an interdisciplinary approach, in this case using poetry within the context of a geography lesson, has significant potential to provide students with the opportunity to engage critically and affectively with issues of sustainability, thereby, giving them a more holistic and pluralistic understanding of it as a concept. There are number of difficulties, however, in promoting interdisciplinarity the school context. Firstly, as identified by Max-Neef (2005) within the higher education context, the current structure of schools is not conducive to interdisciplinary studies. The culture of high accountability and performativity (e.g. Ball 2003) means that curriculum time is often focused exclusively around exam preparation for inevitably uni-disciplinary competences at the expense of other learning (Rasmussen 2016). Although teachers may recognise that interdisciplinarity supports learning in sustainability education, it is school senior leaders and ultimately educational policy-makers who are best placed to facilitate increased interdisciplinarity within schools; more empirical evidence for its impact on learning may bring it to their attention. Secondly, truly interdisciplinary teaching requires individual teachers to adapt their specific subject pedagogy. Becher and Trowler (2001) found that academics' understanding of their disciplinary subject matter influences the approach they take to teaching it. Perhaps then more interdisciplinary pedagogy needs to be incorporated into teacher training to give teachers the confidence and skill-set to practice it? Finally, this study also supports

Feng's findings that students who are used to uni-disciplinary teaching and learning may find it difficult to learn in an interdisciplinary way (2012). Further consideration is, therefore, needed to consider how we can support students in breaking down their conceptions of disciplinary boundaries within and beyond traditional classroom contexts to support their engagement with issues of the environment and sustainable development in school.

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No potential conflict of interest was reported by the author.

## Notes on contributor

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## Appendix 1.

	Lesson title
Photograph analysis of Bogotá, Columbia	Using post-it notes, students add two labels each to the photograph on the board to annotate how and why they think that it is sustainable
Poetry analysis: 'A Vision' by Simon Armitage (adapted from Matthewman (2011))	<ul style="list-style-type: none"> <li>• Teacher reads the poem, students write down five words that come to mind after the poem and compare with partner</li> <li>• Play online version of the poem spoken by the author, students add two words to their list and discuss with partner (Armitage 2013)</li> <li>• Students given transcripts of the poem and complete choral reading task (e.g. Trousdale, Bach, and Willis 2010)</li> <li>• Students explore the poem in more detail in triads using A3 frames (with guided questions relating to themes of poem and its comment on the sustainability of cities). Questions relate to the <i>theme</i> of the poem (What is the poem about? What is the vision in the poem to which the title refers? How does the poem comment on sustainability of cities?) and the <i>voice</i> of the poem (Who wrote the poem? What was the author's intention in writing the poem? From whose point of view is the poem written? Is there any evidence to suggest the author agrees/disagrees with the voice in the poem?)</li> <li>• Teacher introduces the idea of <i>just</i> sustainability and students re-explore poem in the light of this</li> </ul>
Photograph analysis of Bogotá, Columbia	Students add comments or questions on post-it notes to photograph on the board – evidence for broader sustainability or questions we need to know to determine its sustainability

A summary of the lesson across which students' understandings of sustainability were explored.



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