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Environmental Education and the new curriculum for Wales: an evaluation of how a family of schools in a rural area used a Theory of Change approach

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ABSTRACT

This paper evaluates an Environmental Education programme where the barriers and opportunities for professional development, access to specialist resources, provision through technology and partnership are considered within the context of Wales and the demands of a new curriculum. The findings reflect on the first three years of an education programme that uses a Theory of Change framework to plan for learning with 9–11 year olds in Wales, UK. Drawing on qualitative individual and group interviews with teachers and pupils across six schools, the successes and challenges of this framework are presented. I suggest that combining a Theory of Change framework with a Capability Approach—focussing on values and agency—offers a more useful planning tool for curriculums developing strategies where teacher agency is encouraged—compared to using one approach alone.

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UK; qualitative; curriculum design; Theory of Change; Capability Approach; freedom

Introduction

A new curriculum for Wales and Environmental Education

Wales is a constituent part of the wider United Kingdom (UK). Through devolution of the UK's home nations (Scotland, Northern Ireland and Wales) in the 1990s, Wales has the authority to develop its own public services, enjoying a form of self-government via the Welsh Parliament (Reynolds 2008). As such, the Welsh Government is responsible for the oversight and delivery of all education and this responsibility has allowed policymakers in Wales to explore education policy resulting in considerable differences compared to the other UK home nations. Schools are funded through 22 local authorities who receive most of their funding from the annual local government budget of Welsh Government. In January 2020 there were approximately 1,225 primary schools in Wales (Welsh Government 2020b). In Evans (2022) reflection on education policy reform in Wales, it is noted that a history of failing to improve international standing relative to the Programme for International Student Assessment (PISA) tests saw Wales shift from a performance driven education system to one focussed on the learner (Organisation for Economic Development and Cooperation (OECD) 2020). Evans (2022) notes that in Wales there has been a softening of neoliberal ideology and a demand for more collegiate approaches to policy development.

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The *Successful Futures* report (Donaldson 2015) reviewed the education system for Wales. Supported by the Welsh Government, the report called for a shift towards more interdisciplinary and experiential education. This resulted in the proposal for significant reforms in curriculum content, teaching and learning for 3 to 16-year olds in Wales. This new curriculum's aims are formed around 'four purposes' where every child is seen as an ambitious capable learner; an enterprising, creative contributor; an ethical, informed citizen; and a healthy confident individual. Traditional disciplinary subjects categorised as either core or foundation subjects have been swapped for a curriculum organised around six Areas of Learning Experience (AoLE); Expressive Arts; Health and Wellbeing; Humanities; Languages, Literacy and Communication; Mathematics and Numeracy; and Science and Technology (see Figure 1 for a comparison of the new and old curriculum for Wales).

Within this new curriculum, it is the combination of Science as an AoLE and the core purpose of developing ethical citizenship that we find the place for Environmental Education embedded; combining a need for knowledge, skills and reflection on behaviour/behaviour change. This model discards what Wals et al. (2014) consider to be more traditional, and persistent assumptions that there is a linear relationship between knowledge and behaviour change. Instead, the new curriculum offers potential opportunities for developing learning processes in line with what Stevenson et al. (2013) consider more contemporary practice. That is, opportunities that enable learners to think in ways that critically, ethically and creatively consider different environmental issues; have the opportunity to develop and make informed decisions about these contexts and issues; and begin to establish a commitment (whether individually or as part of a collective) to mitigate environmental degradation.

The curriculum reforms of Wales, outlined above, became statutory in 2022. These reforms have seen both a radical shift in content and approach also on teacher expectation. Evans (2022) argues that this shift demands the education workforce to redefine roles in order to meet shifting expectations. Teachers in Wales are undertaking a process of, what Noordegraaf (2007) refers to as, 'reprofessionalisation'. Titley, Davies, and Atherton (2020) note that education professionals in Wales have had their agency eroded through earlier demands for performative practices against PISA test results. Teachers are now being asked to transform their practice and are encouraged to be flexible and autonomous in their approach to curriculum content and pedagogy. Titley, Davies, and Atherton (2020) note that teachers may not be prepared for this. This paper will consider not only the new curriculum in Wales, but its implementation in rural areas. A recent special edition of The Curriculum Journal (volume 31, part 2, 2020) focused on the challenges of developing the new Curriculum for Wales. Within this, Chapman (2020) notes that Wales has nine local authorities identified as 'rural', and considers how geographical location will impact the delivery of the curriculum. She comments that there needs to be creative solutions to enable staff and pupils in remote schools to participate fully. With an emphasis on schools having to develop their curriculum in response to their local catchment and geographical location, an 'off the peg' approach to curriculum planning is not appropriate.

Knowing that the changes to the curriculum have been developing since 2015, schools have been encouraged to (re)consider their curriculum and begin to plan the changes.

Poverty, school funding and geographic isolation are just some of the complex challenges schools in rural locations often face—all of which can impact on the quality of education learners receive (Chand and Mohan 2019; Lingam and Lingam 2013; Ogbugo-Ololube 2016). Rural and more remote schools are often associated with lower educational outcomes (Ford and Fitzpatrick 2019). In part, this is the result of resource constraints not experienced in more geographically connected areas (Steinmayr, Dinger, and Spinath 2010)—for example, more isolated areas can have difficulty recruiting highly qualified and experienced teachers (Demi, Coleman-Jensen, and Snyder 2010). Rural and remote schools are also often small and, due to their location, more likely to experience teacher shortages (OECD 2013). Geographical location also impacts on the potential links that might be made with external partners (Mohan 2016;

The Old Curriculum in Wales	The New Curriculum in Wales
Content driven	Purpose driven
Centred around: • Promoting spiritual, moral, cultural, mental and physical development of pupils at the school and of society • Preparing pupils for the opportunities, responsibilities and experiences of later life.	Centred around Four Purposes: • Ambitious, capable learners, ready to learn throughout their lives • Enterprising, creative contributors, ready to play a full part in life and work • Ethical, informed citizens of Wales and the world • Healthy, confident individuals, ready to lead fulfilling lives as valued members of society
Subjects taught: *Core subjects*: • Mathematics • English • Science • Welsh (in Welsh speaking schools) *Foundation subjects:* • Design and technology • Information and communication technology • Physical education • History • Geography • Art and design • Music • Welsh (in non-Welsh speaking schools)	Subjects are divided into six Areas of Learning and Experience: • Expressive Arts • Health and well-being • Humanities • Languages, literacy and communication • Mathematics and numeracy • Science and technology
Place of Environmental Education: Guidance provided for Education for Sustainable Development and Global Citizenship (Welsh Assembly Government, 2008). Explicit reference to giving learners opportunities to explore: • Natural environment • Consumption and waste • Climate change Explicit reference to environmental issues is seen in guidance for: • Geography • Science	Place of Environmental Education: Children should be taught about issues relating to Environmental Education throughout all Areas of Learning as schools embed the four Purposes (namely ethically informed citizens) Explicit reference to environmental issues is seen in guidance for: • Science and Technology • Humanities (with specific reference to Geographical learning). Schools to develop their own curriculum in response to their locality.

Welsh Assembly Government, (2008) Education for Sustainable Development and Global Citizenship: a common understanding https://hwb.gov.wales/api/storage/eaf467e6-30fe-45c9-93ef-cb30f31f1c90/common-understanding-for-school.pdf (accessed 22.07.22)

Figure 1. Table to show differences between the new and old curriculum for Wales.

Stoll et al. 2006). Broadley (2012) also considers how collaboration may be difficult between rural and remote schools in comparison to partnerships that schools in urban settings develop with their easier access to transport and technology (Lingam and Lingam 2013; Stoll et al. 2006). Lamb, Glover, and Walstab (2014) summarises the effects of location on schools and teachers

in three points: limited opportunities for professional exchange and development; restricted access to support systems, such as specialist resources; and restricted access to resource provision.

This paper focuses on an Environmental Education programme in a rural location of Wales, UK—at a time when classroom practice in Wales was on the brink of implementing the new statutory curriculum of 2022 (Welsh Government 2017). This policy expects a more individualised, autonomous and locally defined school curriculum that invites schools to enjoy a 'freedom' that previous incarnations denied (Welsh Government 2020a). I will consider the context of the curriculum for Wales and how a programme, offered by an educational charity—the Darwin Experience—fits with this vision.

Within this context, the overarching research questions to be considered in this paper are:

- What and how can resources in a rural location be utilised for the best possible Environmental Education for stakeholders (including teachers and learners)?
- Are there lessons to be learnt for wider application and dissemination?

After outlining the case study approach to evaluation and qualitative methods used, I will then present results based on three themes drawn from the Theory of Change approach and data: changes in confidence, understanding and enjoyment. I will then reflect on lessons learned from using this Theory of Change framework and consider how we might reconceptualise rural and remote Environmental Education planning in combination with a Capability Approach—focussing on agency rather than deficits in resources.

Wales in context

Welsh Government (2017) states the national education mission is that every learner, 'wherever they live has the right to benefit from high quality education'. Education has, for a number of years, been committed to the annual testing of English and maths from year 2 (6–7 year olds). Due to this focus, there has been a lack of opportunities to undertake continued professional development within other subject areas. Dale (2016) notes that in recent years there has been a deskilling of the education workforce in Wales. Teacher subject knowledge of Science, for example, is low, as is confidence in teaching the subject (Dale 2016). Even with this deficit teachers are expected to design and develop their own curricula. The Welsh Government (2020a) claim this gives the profession 'freedom'. Evans (2022) notes that for teachers in Wales to 'reprofessionalise' when there is already the expectation that they have the ability to design and develop their own curricula, any form of professional development needs to be framed as non-threatening and voluntary. Evans (2022) also notes that this professional development must be demonstrably beneficial. To support this, over the last seven years of national curricula development, a network of Pioneer Schools was established in Wales. These schools worked together to design and develop the new curriculum. They also provided subject expertise and training support to other schools. This approach has been commended by education unions as it is seen to recognise the expertise that education professionals are able to bring to policy development (Evans 2015).

Evans (2022) notes that much of the new Curriculum for Wales is reliant on the capacity and capability of teachers: this is a challenge for all teachers, but may well be more of a challenge in some geographical regions. A recent report notes that, like other countries, there are multiple factors affecting education in rural and remote parts of Wales (Gruffudd et al. (2017) and while challenges of finance, workforce recruitment and retention, access to resources and digital technology are relevant to the context, rural and remote schools may benefit from other characteristics of this context when compared to their urban counterparts. For example, Barley and Beeslet (2007), Ford and Fitzpatrick (2019), and Ralph (2003) all concede that many rural schools

see positive relationships form between staff, parents and the local community. In this paper I explore how those relationships can develop. This is particularly pertinent, not only due to the global position we find ourselves in with regard the climate crises and continued need for Science related workforce, but also because of upcoming changes in the National Curriculum for Wales with regard to its focus on ethical citizenship. The rural context is directly mentioned, as it is noted that all partners need to work together in order to ensure 'smaller and rural schools are better supported to play their role in a collaborative self-improving system' (Welsh Government 2017).

Why focus on Environmental Education in this new curriculum?

The whole curriculum in Wales has been redesigned and becomes statutory in 2022 (Welsh Government 2017). However for the purpose of this paper I wish to focus on the design and delivery of Environmental Education and associated Science education. The new curriculum for Wales embeds a demand for Environmental Education through its third purpose: to develop ethically informed citizens. This provides an additional focus and interesting positioning of more traditional subjects such as Science and Technology AoLE.

Recent research (Jones and Beynon 2020) notes that young people of primary school age in rural counties of Wales have a desire to learn more about sustainability, themes of Environmental Education and links with science knowledge. In this context Wales sees a teacher workforce that has a gap in confidence. Simultaneously there is more pressure from pupils for greater input into these subjects and the introduction of a new curriculum that expects schools to develop an autonomous curriculum with a greater emphasis on freedom of approach.

In this paper I will reflect on how a group of six schools (one of which was a Pioneer school) in Pembrokeshire, Wales, has built a curriculum programme with Environmental Education at its heart. This was made possible through the collaboration of industry partnership, an education charity and the local authority. This research coincided with the run up to the statutory introduction of the new curriculum (in 2022), at a time when schools were preparing for the policy changes and were exploring approaches to the new demands for a more autonomous curriculum that encouraged a greater sense of 'freedom' for teachers and schools to explore.

I will reflect on the first phase of a six-year case study with schools informed by Theory of Change. Focussing on the challenges Lamb, Glover, and Walstab (2014) identified, I will consider how opportunities for professional development, access to specialist resources and provision through technology and partnership have been enabled. Following this I will present reflections on how this approach may be considered to facilitate teachers' 'freedom' with regard to developing more autonomous curriculums design in the face of the new Curriculum for Wales and suggest that focussing on positive attributes rather than access to resources may be a helpful focus to consider.

What is Theory of Change?

If teachers are to become more confident in their curriculum making, then change is required. Theory of Change offers a framework through thinking about how this change may be enabled.

The term Theory of Change was popularised in the 1990s by Weiss (1995). It is a useful evaluative tool that clearly articulates the underlying assumptions of a project/process and allows stakeholders the space to discuss and form consensus of what these assumptions are. Put simply, the relationship between intention, implementation and outcome is articulated in a narrative or more commonly a diagram (or both) and the team works backwards in their planning—starting from the intended outcome and evidencing guidance on how this will be enabled through various steps of engagement. Diagrams can be as simple as a few boxes with

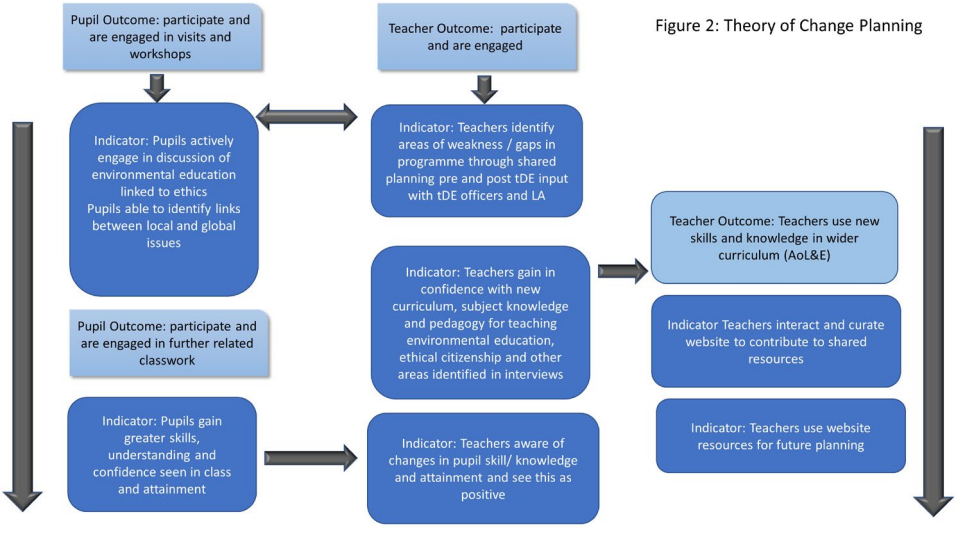

Figure 2: Theory of Change Planning

Figure 2. Theory of Change planning.

one or two connections, through to large, complex maps with numerous boxes, connection and detailed legends, annotation and supporting text. These diagrams, whatever the scale, attempt to explain the 'logic' or the 'theory' of the activity/intervention (see Figure 2 for an example of this). Each element of the intervention is linked with its outcome. This outcome is associated with one or more indicators that will provide the evidence to help determine success (Barbrook-Johnson and Penn 2022).

If teachers are to be change agents, then using a Theory of Change framework to plan new curriculums may allow for better understanding of what and why implementation is as it is. When using this framework, Reinholz and Andrews (2020) reminds us that context is essential to consider, as evaluation is not merely asking whether the project/process worked, but instead, under what conditions it worked and for whom (Pawson and Tilley 1997)—again, with the demand of the new curriculum calling for autonomous planning, such a framework may be helpful. As such, this approach allows for both the evaluation of a single project and identification of characteristics that might be transferrable. It allows for consideration of what and how resources are utilised for the best possible outcome relating to the delivery of Environmental Education that supports learners in becoming ethical citizens.

What is the Capability Approach?

A Capability Approach has a long history. Robeyns and Byskov (2020) note that this flexible and multi-purpose framework can be traced back to aspects of the work of Aristotle, Adam Smith and Karl Marx. However, it was Amartya Sen and Martha Nussbaum, along with a growing number of scholars in the humanities and social sciences, that have developed it more recently. The Capability Approach has been used to frame development ethics (Drydyk and Kelehr, 2008); human development (Fukuda-Parr 2011; Keleher and Kosko 2019; Byskov 2018); public health and health justice (Venkatapuram 2011; Nielsen 2015; Wynne Bannister and Venkatapuram 2020); environmental ethics and social justice (Gutwald et al. 2014; Holland 2014; Voget-Kleschin 2013); and the right to education and social justice (Walker 2006; Unterhalter 2013).

Whilst a Theory of Change framework articulates the link between intention and implementation, the capability approach brings clarity to the objective in relation to supporting and expanding 'freedom' of those people—people who are usually disenfranchised (Alkire 2005). In

this way the framework considers how participants have access to resources that allow them to make the choices that matter to them. Within a context of education this is not necessarily driven by academic progress and results (a standard political/economic approach) but an approach where individuals recognise the value of the work they do. The underlying assumption is that empowerment leads to the expansion of human capabilities and as a result enables flourishing lives (Lambert, Solem, and Tani 2015).

Of interest in this paper is the unique link being made between the proposed 'freedom' of curriculum design offered by Welsh Government and the access to opportunities that may enact these opportunities and facilitate Environmental Education becoming rightfully embedded within the new curriculum.

Specialist provision and partnership: The Darwin Experience as project experts

Kelley and Knowles (2016) note that young learners have often been found to be disinterested in traditional Science. Lessons can be isolated and disjointed, missing connections to crosscutting concepts and real-world applications—where more ethical implications might be discussed and explored. The remit of the Darwin Experience (tDE), an education charity based in Pembrokeshire, Wales, has always been to engage and enthuse young people in learning that is connected to their locality. As such, this organisation fits well with the demands of the new curriculum for Wales and its requirement that schools develop their own curriculum that reflect the individuality of their geographical context. The tDE School Officers have expertise in marine biology, Science communication and education. They aim to relate learning to young people's experiences in their local context, and in doing so, normalise complex theories and languages surrounding Environmental Education and Science for both learners and teachers (Jones 2017). Just as the new curriculum demands change in teachers' approach to planning, the tDE officers look for change in learners.

Local partnership is integral to the success of The Darwin Experience and their access to schools. As a charity it is funded in part by the local authority and in part by a locally situated, global, private company reliant on Science professionals. Dragon LNG is a re-gasifing terminal integral to the energy production of the UK, and major employer of the area. With Dragon LNGs financial support, tDE have worked with every school in the county, every year for over a decade in order to support learning at both primary and secondary phases. Dragon LNG paid for the development of resources, the transportation for pupils and teachers for all field trips and time of tDE officers across the three years. In personal communications the tDE officer confirmed that tDE is responsible for the content of the workshops and fieldtrips with no influence from this sponsor. Dragon LNG do not censor the content of tDE and officers are free to educate on all matters, including the negative impacts of fossil fuels and the need for alternatives. Apart from schools releasing teachers to join meetings in order to collaborate on the development of the resources (largely in sessions after school), this programme was free to schools.

For the purpose of this paper, I will reflect on a new programme of support tDE offered from 2016–2019: an annual programme of support over three years that was provided to a cluster of six primary schools. This programme evolved in response to ongoing updates regarding the new demands of the Curriculum for Wales and regular meetings between teachers and the tDE Officers. These were integral to the ongoing evaluation and revision of the programme through a Theory of Change framework.

Theory of Change is a planning tool that describes how desired change is expected to happen within a particular context (Taplin and Clark 2012); in this instance, the case of tDE and six schools. Knowing the desired outcome, a collaborative approach between tDE and schools was able to describe the links between activities, ongoing achievements and the long-term goals.

Teachers and tDE Officers had the opportunity to identify and articulate routes to outcomes through ongoing meetings and evaluative discussions. The initial process has been presented in Figure 1 as a causal framework. This shows the relationship between learner and teacher on this journey to normalise complex language and theories thus improving confidence and skills in teachers and learners, and attainment by learners against the requirements of the new Curriculum for Wales with its demands for both subject expertise and the development of ethical citizenship.

Regular progress and evaluation meetings were supported by the Local Authority who identified an officer to work with schools and assist with collaboration and feedback channels, chair meetings etc.

The intervention began with pupils in year 4 (age 8–9) and followed the same three stage process for three years with the same cohort: classes undertook preparatory work in the classroom with the teacher (using a bespoke workbook created for the project in consultation with teachers). The workbooks were drafted and shared with teachers prior to use in class. These were then edited based on teacher feedback. Workbooks were distributed to schools so that preparatory activities could be undertaken. A fieldtrip followed by a workshop in the classroom was led by subject specific experts from tDE. Finally, the workbook provided a variety of follow up activities for teachers to implement back in the classroom and was then further developed through feedback with teachers.

In the first year of the project (2016–2017), year 4 (8–9 year olds) followed the three stage sequence of activities on the theme of 'The Motion of the Ocean'. Classes undertook preparatory work, exploring how to interpret weather data and make simple field sketches. Each class went on a fieldtrip to a local beach where the groups learned about tides, local weather and collected litter from the beach. The workshop in the classroom saw learners sorting the litter, researching the sources of this litter, tracking its journey, and discussing the issues surrounding ocean waste. Follow up activities were provided and undertaken at the teacher's discretion.

In the second year of the project (2017–2018), pupils moving into Year 5 (age 9–10 years) undertook 'Project Freshwater'. Classes were introduced to the topic through the bespoke workbook and then visited a freshwater river and explored the biotic index, identified the fauna of the river, measured river speed using scientific methods and took more detailed field sketches. After the fieldtrip, pupils explored different world rivers and the impact of pollution on these systems in a workshop led by tDE. Teachers, once again had a workbook to support follow up learning.

The third year of the intervention saw pupils (2018–2019), now in Year 6 (10–11 years) undertake the 'Explore the Rocky Shore' project. The three-stage intervention was repeated. Learners were supported in their enquiries about rock formation and life cycles in the classroom prior to the fieldtrip. The final fieldtrip was undertaken to a local beach where rock pools could be explored. Pupils were able to collect and identify marine flora and fauna. After the fieldtrip, pupils returned to school for tDE led workshop where they had the opportunity to use microscopes to observe and identify marine life and consider the importance of phytoplankton and crab lifecycles in more detail. Once again, a workbook was used to support teachers with ideas and plans for further learning.

In addition to this annual cycle of events in the classroom, tDE also provided collaborative events. Twice a year, teachers chose twenty-two, Year 6 pupils to spend time in the Science laboratories of the local senior school. Pupils were chosen for their interest in the themes and topics explored. At the senior school they worked with scientists and members of the school's Science team on two projects: analysing the vitamin C content of various fruits and vegetables and undertaking a squid dissection. Whilst dissection is not a compulsory aspect of the curriculum it is a suggested activity by the school's examining board (WJEC 2019). It is noted that when designing and planning the Science aspects of the curriculum, schools should facilitate learning through active and practical experiences and look to develop fine motor movements

leading to accuracy and precision—which dissection would help to fulfil. Squid for these procedures were procured in pickled form from a company with high animal welfare ratings. The tDE also held an annual event called Science–Aglow where each of the schools in the project was invited to send pupils to communicate their experiences and learning over the year with peers from other schools. Once again, pupils were chosen by schools based on their interest in the subject areas and willingness to contribute to the event. The gatherings had a variety of Science and Environmental Education related, hands on activities, led by local experts. These further encouraged pupils' enquiry skills and reflection on the skills and methods they used on fieldtrips and workshops. Specific reference to a variety of employment opportunities in environmentally related disciplines and Science was made in these sessions—explicitly encouraging young people to think about the breadth of employment this arena afforded.

To promote exchange and communication between pupils and teachers in the project, a private group website was created. Here, teachers were invited to post experiences, examples of pupil work and share activities with schools on the project as ideas from the workbooks evolved. As part of the programme a company with digital expertise developed websites for each of the schools involved in the case study and the Digital Competency Framework (a new aspect of the developing new Curriculum for Wales that was introduced during the research period) was linked as an interactive document. Teachers had the ability to ask a question regarding this, to the development company and/or another teacher, e.g. How do you use metadata in your project? Or how do I teach…?

Teachers were invited to a training session to learn how to generate content for a word press website—in order to upload blogs, pictures, etc.—and use a Local Authority developed database developed for each of the fieldtrips. Here, teachers and pupils could share work and resources.

Method

While tDE work with schools across the county, undertaking a focussed project with so many schools was impossible. tDE invited a cluster of six primary schools to take part in the programme. These schools were identified by the Local Authority. As tDE was a well-established and known organisation in the area, with the support of the Local Authority, all schools agreed to participate. A case study approach was initiated in 2016. Creswell (2003) defines case study research as being a single bounded entity, which is studied in detail using a variety of methods. In this instance, case study methodology allowed me to gain an in-depth and multi-faceted understanding of the impact tDE programme, how it was understood and operationalised within schools using multiple sources of evidence. My justification for using a single case for this research was that the findings were likely to be broadly applicable beyond these schools, which matched my critical realist philosophy of uncovering tendencies rather than making predictions.

Ethics permission was obtained from the University of the West of England, Bristol in line with British Educational Research Association (BERA 2018) guidelines (approval number ACE.18.07.073). Consent was then gained from all teaching staff, parents of pupils and pupils involved in the data collection and the local authority.

Over the three years a mixed method approach was initiated. This included observations of fieldwork, pupil and staff questionnaires, 1:1 and group interviews and analysis of pupil attainment data in maths, English and Science. For the purpose of this paper data will be drawn from:

- Three group interviews with pupils (6 pupils in each group—chosen by the teacher from those with consent, c.30 minutes in length and recorded for transcription) from three of the schools. Pupils were asked to reflect on their experiences of the whole programme

from year 4–6, what they felt they had learned and gained from the experiences and identify any barriers or challenges to the learning. Photographic images from the fieldtrip were used as prompts.

- 1 group interview (c. 40 minutes) with teachers from all schools followed by in-depth 1:1 semi structured interviews with three, year 6 teachers (c. 30 minutes) to evaluate and reflect on experiences and confidence in teaching over the course of the initiative.

To support anonymity all participants and schools were coded (school, participant). All interviews were recorded, transcribed and coded using content analysis as defined by Patton (2002, 43). A thematic approach to qualitative data analysis followed Braun and Clarke (2006) five step system. This began with (re) reading and becoming familiar with the data; generating initial codes; searching for themes; reviewing the themes; refining the themes; and looking for commonalities and complexities. Themes identified were: changes in confidence, skills, understanding and enjoyment. Triangulation of themes between the data sets was then undertaken and reviewed by a second member of the research team in order to verify the domains. Quotes used in this paper are indicative of those themes and comments made by others.

Limitations and scope

The qualitative nature of the methods has provided a depth and richness to insights from participants. However, a limitation to this study was the small sample size, particularly within a small geographical location. Due to restrictions of time, feedback loops to inform the ongoing development of workbooks were provided only by teachers. Future sessions with young people are planned in phase 2.

Results

Thematic analysis identified three, inter-related elements that had been articulated through the Theory of Change planning. That is to say that, in order to see change towards the normalisation of complex language and theories relating to issues of Environmental Education and ethical citizenship, changes in confidence, understanding and skills, and enjoyment were thought necessary. These themes were matched in the data and used to structure this section.

Changes in confidence

Teacher's also recognised that through the process of working with tDE their own confidence in teaching Science and Environmental Education to inform ethical citizenship increased. The highest Science qualification teachers in the group had was GCSE (usually completed at age 16 and a prerequisite for training as a teacher in the UK). While all teachers in the project stated that they 'liked' or 'enjoyed' teaching environmental issues, all reported that their expertise and subject knowledge needed improvement—comments included:

> I haven't really had any Science training and none about specifically teaching the environment since I qualified and that's a few years ago now. (06/T1)

> I like Science, I find it really interesting, but I just don't have the depth of knowledge about the environment so I'm just not that confident. (05/T1)

> I get most of my Science and knowledge about the environment from watching Blue Planet, and that's just not enough. (02/T1)

All teachers reflected that it was beneficial to observe experts (tDE officers) teach their own class:

> It's great to be able to stand back and watch your class engage with an expert. I learn so much about the children, as well as pick up loads of new information and tips from the Darwin Team. (06/T1)

> What's really useful is seeing how the Officer (tDE) works with the children and talks to them at such a high level. I learn loads. (04/T1)

Teachers observing their own classes being questioned and challenged in ways they did not consider possible provided them with the confidence to ask more difficult questions and use new equipment themselves. Teachers recognised the growth in confidence of their pupils, which was equally identified by the young people themselves. All pupils in the group interviews reported an increase in confidence as a result of the project, especially with regard the skills needed to use scientific equipment and methodology. Pupils, unprompted, were able to confidently refer to methods used in fieldwork across the three-year programme (measuring litter, kick sampling, pond dipping, measuring the speed of a river, using an anemometer and microscope). Participants talked about how they had 'felt nervous', 'unsure' and even 'a bit scared' when it came to river sampling and investigating rocky shore habitats. However, they spoke of how these feelings changed after the work with tDE officers. Comments included: feeling 'more confident', 'it was easier than I thought', 'I could do it', 'it was no problem', 'now I can do Science'.

One teacher also commented that the sessions with tDE team also inspired them to develop their own understanding further:

> After the sessions I'd go off and do my own research. They really inspired me to find out more and then I could support the children. Really push them. Once they start working at that level, you want them to stay there. (04/T1)

All teachers interviewed reflected on how their confidence had increased. They felt that having observed how tDE had arranged and implemented the fieldwork and workshops they would be able to deliver the trips independently, or with reduced support, in the coming years:

Now I've seen how the trips work and what to do and talk about I can do it myself. (02/T1)

I'd not have known where to start, but having been on the trip I'll be able to take the class myself next year. (04/T1)

It's been great seeing the different trips over the years, I've learned loads and will definitely be able to do something similar on my own. (01/T1)

All teachers reported that they would be using the workbooks designed for the programme in future academic years, and explore the different activities further. Teachers from four of the schools talked about how they had extended the amount of time they had initially set aside for the programme. They referred to the programme as offering 'more than expected' and 'linking with so many other subjects'. These teachers all identified how the content of the programme was an approach that fitted with the new Curriculum for Wales. For example:

> The cross-curriculum approach is just what we're looking to develop with the new Curriculum. It's difficult to sometimes see how the subjects fit with the Purposes, but these projects really pull out the ethical citizenship development. (01/T1)

> There are explicit links (in the programme) to the new frameworks and the new Purposes of the curriculum, sometimes you just don't know where to start and this programme helps with that. It's really useful. (03/T1)

> The new Curriculum is challenging, but Darwin made some really explicit links to subjects and the purpose of children becoming more ethical in thinking and doing—this is going to be really useful. Next year I'll be spending a whole term on the project as I can see how we could do so much more. (04/T1)

Whilst the use of the co-produced workbooks was seen very positively, the use of web support provided by the digital development company was not used. None of the teachers in the

programme engaged with the training and the collective site, where work and ideas could be shared, was not used consistently. When asked about this the majority of teachers reflected that they 'hadn't got round to it', it 'just isn't a priority', 'it's well down my list of jobs'. These comments indicate that time was in short supply and the professional development afforded by such exchange was a low priority. The limit on time was also noted when considering the challenges that undertaking training to use the platforms required. Again, all teachers spoke of not having enough time, being 'too busy' and having 'other priorities'. There was no reference to difficulties of internet connection, broadband width and access to hardware which a rural location may suggest.

All teachers spoke of the high level of engagement of the pupils while working with tDE team and commented on how learners were 'challenged' and 'pushed' with regard their understandings, as one teacher commented:

> From the very beginning the children are working at a very, very high level (with tDE team) … straight away they (pupils) upped their levels from where they were working. (01/T1)

When asked why they felt this was possible, all teachers reflected that the expertise of tDE team meant that pupils saw them as figures of knowledge authority that could be trusted:

> the children know that they (tDE team) really know they're stuff so they listen and trust them. (01/T1)

> kids in my class hear me all the time. Having the Darwin team in means that they get an expert in the field and the children, they know that. You can see them sit up and take notice. They suck it all in. (07/T1)

> The Darwin Team are experts and the children know they can ask them all sorts of questions that I just wouldn't know the answer to. It just gives the children the chance to ask more questions and get really insightful responses … they really trust what they say. (02/T1)

Teacher's also commented on the nature of the project and how they felt their voices were heard and incorporated into the process. Phrases such as feeling 'part of' the process, 'enjoying being able to give feedback' and being able to 'see improvements year on year' with regard the content of workbooks were noted in all conversations. Three teachers explicitly reflected on how they felt this process was important to the success of the project:

> It was great to give feedback and then see changes being made. Especially to the workbooks. As we learned more about what this new curriculum demanded, Darwin was able to listen to our needs and make amendments. That was great. (01/T1)

> What we were given by Darwin initially was good, but then you start to use it and realise that a few changes would be great. Like, links to the Digital Competency Framework. That would have taken me ages, but working together, we pointed it out and then it was done! (02/T1)

> The relationship we have with Darwin meant that we were able to well, work together and sort out what we really needed. Having the opportunity to give feedback along the way was a real bonus. (03/T1)

This relationship of planning together and then having opportunities for feedback that enable more successful change towards shared goals indicates a confidence on both the part of teachers and tDE Officers, and the success of the Theory of Change model.

Changes in understanding and skills

In 1:1 interviews all teachers reflected on the use of subject specific, scientific language pupils were able to use after the sessions with tDE and how this 'exceeded expectations', 'was really impressive', 'blew me away', 'beyond what I thought the children could do'. one theme teachers spoke about with this regard was the topic of ocean acidification. When talking with pupils in group interviews participants confidently explained some of the processes occurring that they had explored during the programme.

> (02/C3) We done one project on ocean acidification. The use of cars and other industry using fossil fuels recently, basically release carbon dioxide and we've now got a carbon sink in the ocean. This carbon dioxide turns into a gas. I've forgotten what it's called.?
>
> (02/C5) It's carbonic acid.
>
> (02/C3) Yes, that's right, and that then turns into hydrogen ions and it's that that damages the shells of sea creatures because the sea becomes more acidic.

Pupils talked about how there was an expectation of doing work at a higher level with tDE making comments such as:

> (tDE Officer) will ask 'does anyone know what a hydrogen ion is?' and if anyone does they will put their hand up. But if they don't then he'll tell us. We're quite used to it because we've been on trips with him for three years. (01/C4)
>
> (The Officers) know so much stuff and we just use and understand the vocabulary. It's just what we do with them. (03/C1)

The use of phrases such as 'quite used to', 'normally' and 'just what we do' indicates that the objective of normalising complex concepts around Environmental Education have been successful.

Data also indicates that the three-year programme had developed subject knowledge for both teachers and pupils in the project. It identified practical skills that pupils had the opportunity to develop—using scientific equipment in relation to weather data capture and using microscopes (a skill not usually available until key stage 3 (11–14 years) as only the senior school has access to this equipment).

Changes in enjoyment

All pupils in the group interviews reported that they enjoyed lessons in school more as a result of the project. There were enthusiastic nods when asked and examples of responses include:

> The work we've done in year 5 and 6 with Darwin has really changed my mind about Science, how it links with other subjects, how it's important to learn about how we look after the planet. I really love it now. (01/C3)

Similarly, all teachers reported a growing enjoyment of not only teaching Science and issues relating to ethical citizenship and Environmental Education, but also outdoor education pedagogies. The enthusiasm for the sessions is linked with building of confidence, understanding and skills, reoccurring themes identified throughout analysis.

Discussion

The data gathered from this study suggests that, through a Theory of Change framework, stakeholders were able to plan, implement and take part in curriculum events that were able to develop Environmental Education in a way that enabled teachers and learners' opportunities to develop scientific knowledge and skills as well as more ethical citizenship towards the environment and specifically their locality. In this case study I have identified how a local authority, partnering with an education charity and private industry, were able to promote and partner with schools to develop a programme that was appropriate to the location—taking into account teacher and learner needs as well as access to local landscape that the new Curriculum for Wales demands. The familiarity and trust in stakeholders (in this case the Local Authority supporting the scheme, a well-respected industry partner and a known and trusted education charity) supported the process—thus the local socio-political—economic partnerships of the rural locale were beneficial. Like Ford and Fitzpatrick (2019), I would suggest that it is the

closeness of the (rural) partnerships rather than an imagined (rural) remoteness that have allowed for such enterprises to develop.

The use of a Theory of Change approach enabled teachers and tDE Officers to plan, implement and evaluate change as a community; recognising the purposefulness of action while developing a sustained ethos of partnership and collaboration through ongoing meetings. Having the feedback loops where teachers could provide insights into the use and content of the programme, and see the changes implemented over the three years was seen as a positive. While not all outcomes were realised—for example with regard the use of web-based resources and storage facilities—the process of transparent evaluation towards an agreed outcome, was, in this case study, recognised as positive.

The data indicates that initiatives such as this do have the ability to have an impact on teaching and learning. Both teachers and pupils recognised the benefits of having access to local support from tDE Officers and their expertise in developing ethical citizenship through Environmental Education. These specialists brought with them not only their personal knowledge and authority, but also, through partnerships supported by the Local Authority, access to the senior school and equipment they would otherwise not have had opportunities to use—all of which supported 'unofficial' professional development. While teachers were not attending more traditional courses or workshops to develop their subject and pedagogical skills for teaching new areas of the curriculum, they identified personal development opportunities from their observation of tDE Officer led sessions and networking. In these instances, teachers learned and were inspired to learn more.

I would argue that this personal development and a partnership approach relies on the identification of the value that different stakeholders derive from it. Teachers recognised the value of the programme to their own development and the value to learners. Learners recognised the value to their academic progress and enjoyment of school. The themes of confidence, skills, understanding and enjoyment that were identified in the data could be considered as the reasons participants valued the programme.

This identification of the value that education brings to each stakeholder is indicative of Freire's notion of freedom (Freire 1994). Freedom here is not the act of being able to do whatever you like without constraint, but the act of identifying, as an individual and collective, the purpose of education for that individual/group. Set within these terms, this case study offers an example of how the more autonomous and 'free' curriculum planning desired by Welsh Government may be enabled and a journey of authentic self direction accomplished. Stiglitz *et al*. (2009, 151) note that 'sometimes more freedom of choice can bemuse and befuddle, and make one's life more wretched'. The Theory of Change framework identified the journey to outcomes through process.

Here I have begun to consider the resources people are presented with and how they are used to enable the successful implementation of the new Curriculum for Wales. However, I have also begun to identify the values teachers and pupils identify in developing learning opportunities that meet the requirements of this curriculum. The success of these resources is dependent on relationships with others; relationships with other schools, with the state (in this example the local authority) and other institutions (in this case tDE). The success in establishing these useful resources is also dependent on a shared vision of **value** between teachers and pupils. In this case that increased confidence, enjoyment and enhanced skills were valued attributes of project outcomes. In this sense, I consider that the Theory of Change framework that was initially used, could be combined with a Capability Approach.

Sen argues that capabilities are the real freedoms people have to achieve their potential with regard the actions we are able to undertake (referred to as 'doings') and the kind of people we are able to be (referred to as 'beings'). In this sense it is not the freedom to do something but the significant opportunity/ies to achieve it. Rural and remote locations have their inequalities framed through means (the resources available and the ease of access to

them). The Capability Approach shifts this focus. After all, goods and access to resources alone do not amount to schools being able to engage and enable Environmental Education and support learners in becoming ethical citizens as the new curriculum for Wales demands. Just because two urban/connected schools have similar access to resources they may well achieve very different ends. A Capability Approach allows us to move beyond the focus on goods and resources and focus on what we do with the resources and the value we place on those actions.

While Egessa and Liyala's (2018) call on researchers to develop a greater synthesis between the Capability Approach and Theory of Change in Information and Communication Technology, I call for similar work to be undertaken that would not only explore the development of Environmental Education, but new curriculum planning more widely. This combination may be a suitable framework for evaluating new curriculum enabled interventions (relating to Environmental Education and beyond) from an end-user perspective. One that will be more accessible and usable to teachers, education organisations and policy-makers.

By adding a Capability Approach layer to the original Theory of Change diagrams identifies the value of those involved in the process. This puts teacher and pupil agency at centre stage. As such, a more insightful planning and evaluation tool is offered. Here then I suggest that the combination of a Theory or Change framework with a Capability Approach can support networks of stakeholders in identifying and utilising resources for the best possible outcomes (see Figure 3 for a combined diagram of this).

The first phase of this programme, as pupils leave their primary school setting, is now over. Phase two of this research plans to follow the progress of this cohort through key stage three and into key stage 4—GCSE choices and attainment (12–16 years). This extension of the enquiry will provide much needed insight into the longer-term impacts of such programmes in rural areas, and how the new Curriculum for Wales is implemented—critical if lessons are to be learned from: practice that identifies values; practice that enables agency for change; curriculums that demand locational insight and explicit support for learners to develop ethical citizenship. This could allow for what (Banerjee et al., 2017) recommends: financially supporting those activities that have been identified and are known to provide positive outcome while thus becoming more strategic and developing cost-effective education. With Welsh Government demanding a more autonomous approach to curriculum design, the activities and associated

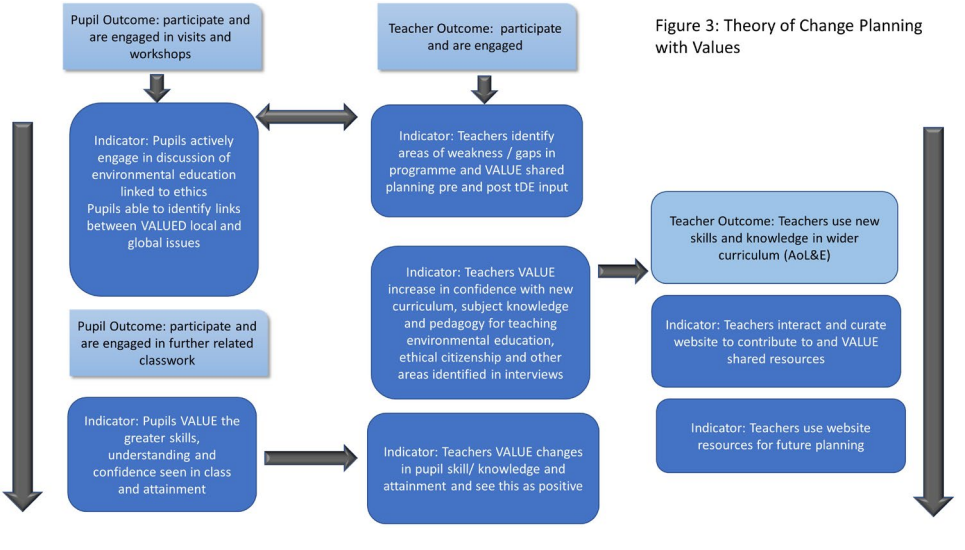

Figure 3: Theory of Change Planning with Values

Figure 3. Theory of Change planning with values.

value of those activities may be unique to each area. However, taking a careful design process that uses both Theory of Change and Capability Approach will be useful to identify if there are patterns of success that can be shared amongst and beyond locations and can be used as a framework for schools on their journey to implement the new education policies. Phase two of the research promises interesting future discussion, as the cohort of learners moves into senior school and the support offered by tDE, local industry and local authority continues.

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