Evaluating the outcomes of Exmoor National Park’s primary school *Moorland Classroom* education programme

www.exmoor-nationalpark.gov.uk/learning/the-moorland-classroom

A case study of the pupils of Willow Class at South Molton Church of England Junior School, Devon.

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Abstract
The national picture of systematic evaluative research into the impact on children of environmental education programmes such as The Moorland Classroom produced by Exmoor National Park is a very limited one. This is because very few assessment tools take account in a systematic, rather than an anecdotal manner, of changes in behaviour and attitudes and values as well as of knowledge and understanding. To evaluate the impact of The Moorland Classroom programme a range of formative and summative assessment methods were designed and delivered in a complementary manner to provide a comprehensive and trustworthy insight into the effectiveness of the development work. To ensure trustworthiness through triangulation a selection of data generation methods were designed and implemented that combined qualitative (interpretivist and subjectivist) approaches with a number of quantitative (positivist and objectivist) data generation methods. The study suggests a number of credible findings. For example, the quantifiable data revealed statistically significant increases in the participating children's knowledge and understanding of Exmoor along with their general environmental awareness and likelihood to behave in more sustainable way; whilst qualitative approaches revealed, amongst other things, how the inclusion of critical thinking skills can underpin intellectual progression and achievement above the level expected for children of the participants stage of primary education.

Chapter 1: Introduction
1.1. Background
The Moorland Classroom project is part of the Heart of Exmoor Scheme, funded by the Heritage Lottery Fund, the Exmoor Trust and Exmoor National Park’s Sustainable Development Fund. During 2012 The Moorland Classroom project team created an online suite of bespoke and freely available, cross-curricular learning and teaching enquiries, which challenge and support primary pupils as they follow key question led investigations into themes and issues of great importance to Exmoor National Park Authority (ENPA). Each enquiry is introduced through a short introductory film and a wealth of engaging online resources, with carefully planned continuity, progression and differentiation is then available to learners as each investigation unfolds. Detailed schemes of work and associated support materials ensure that teachers are fully equipped with the necessary knowledge and documentation, wherever they are located in the UK and overseas, to enable them to focus fully on the learning of all of their pupils.

A unique feature of The Moorland Classroom is that each key question led enquiry includes relevant and meaningful learning outside the classroom, through carefully planned and easy to follow fieldwork investigations at some of Exmoor’s very special places. Comprehensive support including training and access to specialist staff for guidance on every aspect of delivering each enquiry is
available to teachers. Interactive learning and the application of higher order thinking skills characterises the exploration of key themes and issues such as the sustainable management of iconic moorland landscapes, including its wildlife; the impact of climatic, economic and social change on the environment; managing visitors; the legacy of the past in the landscape and the challenge of contemporary climate change.

The first six Moorland Classroom learning enquiries went live at www.exmoor-nationalpark.gov.uk/learning/the-moorland-classroom on November 23rd 2012 with the remaining four to be fully functional by December 2013.

1.2: Rationale and objectives of the evaluative study

Right from the inception of the Moorland Classroom education programme it was an objective, once complete, to systematically evaluate the outcomes of development work undertaken. In literal terms, evaluation means making an assessment of what something is worth and/or the effect that it has. In the precise context of the Moorland Classroom project, evaluation of outcomes is seen as ‘the systematic assessment of the achievements or changes brought about by a programme, project or activity that, although potentially short-term provide a supportive context or infrastructure for longer term cumulative effects, or impacts’ (Stokking, van Aert, Meijberg and Kaskens (1999 p.172) compared to a set of explicit criteria or learning objectives established at the outset (Weiss 1998 and Scott and Gough 2004). Thompson and Hoffman (2003 p.9) refer to the evaluation process as answering the question 'What is the change' that has occurred to people as a result of participating in the programme i.e. what effects can be seen, heard, read etc., that suggests that progress is being made towards achieving the objectives? The national picture of rigorous evaluation focused research into the impact of development education programmes such as the Moorland Classroom is a limited one with ‘much more descriptive and speculative writing about impact than empirical research’ (Lee and Williams 2001 p.37). Wals (2004) describes how the field of development education has been somewhat slow in developing an expertise in evaluating outcomes and that more and better research is needed to reach conclusive results. Ballantyne, Packer and Everett (2005 p.23) emphasise that despite the increasing importance of, and interest in, documenting the outcomes of development education programmes, ‘few tools are currently available to measure young people’s environmental learning across all the dimensions of knowledge, skills, attitudes and behaviour'. Where they do exist Thompson and Hoffman (2003) found that they were often poorly understood by those who deliver environmental and development education programmes. This has resulted, as Edge, Frayman and Ben Jaafar (2008) point out, on an over reliance for many projects on anecdotal evidence to evaluate effectiveness rather than large-scale empirical research.
To avoid this and to carry out a systematic and empirically robust evaluative critique of the *Moorland Classroom* programme it was decided to focus, as a case study, on its impact on the learning of one group of young people at one school in north Devon. The school is South Molton Church of England Primary School and the pupils are members of the mixed Year 4 and 5 *Willow* class taught by Sam Simpson.

The aim of the research was to gather data in a systematic and intellectually rigorous manner that would then enable valid and trustworthy interpretations and conclusions to be drawn as to the efficacy of the *Moorland Classroom* learning and teaching programme in regard to its main objectives which are to:

- *Increase knowledge and understanding amongst pupils of the concept of National Parks in England and Wales in general and the environmental, social and economic characteristics of Exmoor National Park in particular*.

- *Enable pupils to acquire and apply a wide range of critical thinking skills, both in the classroom and through outdoor learning, when investigating the ten key question led enquiries into Exmoor National Park*.

- *Foster a sense of increased awareness, concern and responsibility for Exmoor National Park and for the environment in general*.

- *Increase the willingness of pupils to care for the environment and contribute to a lifestyle for a sustainable world.*

The purpose of the research was three fold. Firstly it to evaluate the outcomes of the *Moorland Classroom* programme for the young people involved against the explicit criteria identified in the objectives. These adhere closely to the knowledge-attitude-behaviour change model described by Matthews and Riley (1995) which holds that an increase in knowledge will lead to a change in attitude which in turn will influence behaviour. Secondly, the research aimed to generate data to improve the *Moorland Classroom* project planning and effectiveness in the future when it could be rolled out to other primary schools across the county and nationally. The final objective was to contribute to the body of knowledge and inform practice in relation to the evaluation of environmental and development education programmes and to provide a tool that might have the potential to improve the effectiveness of similar programmes, especially with regard to assessing the most challenging outcomes of values shift and behaviour change.
1.3 Research questions

The main research question which guided the study was:

*What were the outcomes for pupils of the Moorland Classroom curriculum development project at South Molton Church of England Junior School?*

Two ancillary research questions were:

*Which pedagogical approaches in the Moorland Classroom programme proved most effective in facilitating learning?*

*How can the use of specific critical thinking skills be identified when observing the interactions of pupils engaged in the Moorland Classroom learning and teaching activities?*

Chapter 2: Methodology and methods

An evaluative case-study methodology involving both qualitative and quantitative approaches to data generation, was been adopted for this investigation. A case study is a specific and unique instance that is frequently designed to illustrate a more general principle (Nisbet and Watt 1984 p.72) with the unique 'instance' in this case being a class of twenty eight children where 'complex dynamic and unfolding interactions of events, human relationships and other factors can be reported upon' (Cohen, Manion and Morrison 2000 p.181). It is an appropriate methodology for this investigation for a number of reasons. Bassey (1999) suggests that evaluative case study methodology should be the preferred research strategy when judging the merit and worth of programmes (such as The Moorland Classroom) and particularly when 'how', 'what' and 'why' research questions are being asked. Yin (1988) also purports that case studies have particular efficacy when investigations are being carried out of contemporary phenomenon within its real life context (e.g. impact of curriculum programmes in schools) and in which multiple sources of evidence are used – six sources involving qualitative descriptions and quantitative factually based approaches were used in this research to seek evidence of both the social construction of knowledge and understanding, attitudes and values as well as the identification of possible causal relationships.

The methods selected for generating data to answer the research question were largely those of phenomenological naturalistic evaluation designed to assess the worth of the Moorland Classroom programme from the participant's view of their social realities. In order to ensure a higher level of trustworthiness through triangulation as possible, a wide range of data generation methods were selected that combined mostly qualitative (interpretivist and subjectivist) approaches with a range of quantitative (positivist and objectivist) techniques. Careful consideration was given also to ensuring that both formative (conducted throughout the programme) and summative (conducted at the end of
the programme) evaluative methods were adopted. This was done to provide what Simmons (2004) recognises as the critical balance between being able to assess progress towards outcomes during implementation (and make changes if necessary) and gather information about participants knowledge, attitudes and behaviours at some point after programme completion.

2.1.1 Pre and post programme questionnaire

A short anonymous self-completion questionnaire was completed by all pupils at the very start of the programme before they had been introduced to any aspect of it (Appendix 1). It consisted of closed questions in four sections. These were related to eliciting baseline information about the knowledge and understanding, attitudes and values and disposition towards taking action for the environment and sustainability of the pupils. A slightly adapted version (Appendix 2) of the same questionnaire was answered by all pupils at the end of the programme in order to ascertain evidence through numerical analysis of any knowledge, attitudinal and behavioural shifts. Only structured multiple choices and rating scales closed questions were chosen for the questionnaire. This was done in order to generate quantifiable data to generate relatively quickly a baseline assessment within which patterns and comparisons could be made numerically e.g. through the use of a Likert Scale for pupil responses in two of the four sections. Each question was read in turn to the class before pupils were asked to respond to it and a Learning Support Assistant (LSA) worked as usual alongside some pupils with particular learning needs. This helped to reduce occurrences of misunderstanding amongst pupils.

2.1.2 Concept mapping

A concept map is essentially a graphical tool for organising and representing knowledge developed by Novak (1991) who concluded that 'meaningful learning involves the assimilation of new concepts and propositions into existing cognitive structures' (ibid p.45). A concept map consists of a large piece of paper with a central concept (in this case 'Exmoor National Park') around which pupils draw five to ten ideas that relate to that word. In time and with encouragement pupils can then take each of these new ideas and again draw in the five to ten main things that they associate with those ideas. Concept mapping was used throughout the duration of the Moorland Classroom programme with pupils being given weekly opportunities to update their maps as the work unfolded. Concept mapping can make an important contribution to assessing the impact of curriculum development work in relation to new knowledge creation and learner understanding of learning objectives, key concepts and the relationship amongst those concepts.
2.1.3 Work scrutiny

Within the Moorland Classroom evaluation pupil work samples were used to ascertain precisely that for which they are most commonly used in whole school self-evaluation i.e. to judge both what pupils are learning about and, most crucially, the intellectual level at which they are learning it. Progression through the primary and secondary National Curriculum is outlined in Appendix 3. For the pupils who
formed the sample cohort (Years 4-5) the expectation was that their work would exhibit evidence of achievement at Levels 3 through 5 to ensure that they are making nationally expected rates of progress i.e. *compare and contrast, reason, offer views and opinions using appropriate vocabulary* (Level 3); *demonstrate understanding through explanation using accurate and precise vocabulary* (Level 4) and *describe and explain links, patterns, processes and interrelationships and reach conclusions* (Level 5).

Two learning activities formed the basis of sampling for the work scrutiny. The first was section 6 of the enquiry: *The Holnicote Project* (Appendix 4). This was a classroom based enquiry focusing on the Holnicote water management project. The Environment Agency and the National Trust are collaborating in the three year Holnicote Project (funded by DEFRA with additional funding from EA and NT) to look at alternative and more sustainable solutions to reduce flood flows and flash flood risk which could impact downstream on villages such as Allerford. The most important objective of this enquiry was for the pupils to understand the concept of water management and be able to describe and explain a range of approaches being used to control water flow in the River Aller, particularly in times of heavy rain in the catchment area. Pupils explored a range of resources in class including photographs; architect diagrams; Ordnance Survey maps and two computer simulations showing the pattern of flooding which would occur as a result of a once in a 50 year event if nothing were done to manage the water compared with the impact that flood control measures would have. The planned learning outcomes included the pupils being able to identify; describe; compare and contrast; demonstrate understanding through explanation and reach conclusions in line with performance at attainment levels 3 through 5.
The second learning activity to be scrutinised as part of the evaluation was the river investigation which took place during the pupils work along the River Aller (Activity 6 of the ‘on location’ section of the scheme of work in Appendix 4) The objective of this particular activity was for the pupils to identify; describe; compare and contrast and explain the ways in which five characteristics of the river Aller i.e. bank width; water depth; channel width; water speed and the difference in height between the surface of the water and the river bank changed with distance downstream. This involved data collection in groups in the field followed by graphical presentation and analysis back in school.

2.1.4 Observational procedures: critical thinking skills

There is a growing consensus e.g. Howe and Warren (1989) and Kyburz-Graber, Wolfensberger and Hofer (2002) that environmental and sustainability education programmes such as the Moorland Classroom, should foster the ability to think independently and critically through active, participatory and enquiry based learning experiences about contested ideas. It is argues that only this will enable pupils to function effectively as informed and motivated advocates and practitioners of change both now and in the long term (Johnson and Mappin 2005) to develop workable solutions to environmental problems. With this in mind the learning and teaching activities of the The Moorland Classroom project were designed to incorporate both the principles of the personal, learning and thinking skills (PLTS) framework (QCA 2008) and intellectual progression through the National Curriculum
(Appendix 3) to draw up a hierarchy of critical thinking skills (Appendix 5) in order to provide an opportunity for pupils to be able to, amongst other things, ‘debate, evaluate, judge for themselves the relative merits of contesting positions’ (Jickling p.8).

Consequently the degree to which pupils exhibited critical thinking skills during pedagogical activities was used in conjunction with other measures of learning outcomes in relation to knowledge and understanding, skills, attitudes and values and behaviours to evaluate the impact of the programme. A semi-structured observational recording sheet (Appendix 6) was constructed, based on that designed by Ballantyne, Packer and Everett (2005). This combined recording on a rating scale of the frequency of occurrence of critical thinking skills by pupils during learning and teaching activities would inform the interpretation of the observational data and indicate whether progression occurred over time. It was decided that the observations would be conducted in a ‘participant as observer’ role where the researcher joins those they are observing to ‘record behaviours, interactions or events that occur and engage in the activities s/he is studying but the first priority is the observation’ (European Commission 2003 p.1). This was feasible because both the researcher and lead teacher conducting the observations were already very well known to the pupils, had worked with them interactively previously and consequently a very relaxed working relationship had already been established at the start of the programme. Subsequently, nine learning activities were observed by the researcher in collaboration with the lead teacher involving observations of the whole class, smaller groups of 3-6 pupils and pairs both inside the classroom and during outdoor learning episodes.

2.1.5 Curriculum and pedagogical considerations

In its planning, resourcing and delivery the Moorland Classroom programme was based upon the following curriculum and learning and teaching assumptions:

- The view of ‘curriculum as practice’ (Young p.27) in which knowledge is that which is generated through the collaborative work of teachers and pupils. This is opposed to the traditional ‘curriculum as fact’ with its fixed concepts of teaching, knowledge and ability and the constructivist role of teachers in underwriting a highly mechanistic view of the curriculum as something to be delivered and tested with knowledge external to the knower;

- Consequently, a real attempt was made to engage with the preferred learning styles of all pupils through multi-sensory stimulation, active learning and developing pupil interaction and reflection which represents a liberal/progressive ideology of schooling and the purposes of education (Kemmis 1983);
• Recognition of environmental education and EfS as the product of a social movement (environmentalism) that emerged in the late 1960s that focuses on values education as a means of shaping environmentally responsible behaviour.

• The adoption of the three stages of enquiry or investigative based learning (Appendix 7) as the principle pedagogical method used throughout the programme as exemplified by the indoor and outdoor learning activities in the key question enquiry: What is being done to save Allerford in which pupils were engaged over the period January to May 2013. This key question enquiry, as with all of the other Moorland Classroom investigations, was planned with a clear progression in the acquisition of increasingly more complex knowledge and conceptual understanding; the application of this knowledge through a wide range of subject based skills and the development of higher order intellectual thinking skills. It was important that the evaluation process enabled a judgement to be made as to whether what had been anticipated in the planning actually occurred in practice. The observation of critical thinking skills on eight occasions during the development of the enquiry would provide the evidence as to whether this was the case.

Chapter 3: Presentation of findings

3.1 Concept maps

Concept maps provide a visual two-dimensional representation of knowledge and as such are widely used as indicators of progressive levels of understanding in research studies as a way of capturing participants’ integration of existing and new knowledge. For the purposes of this study the portal or general concept of Exmoor was identified at the centre of the map. Over the period of the delivery of the key question What can be done to save Allerford?; pupils were given up to eight opportunities to add new knowledge and understanding about Exmoor to their map through the use of linking words or phrases joined by lines to more specific concepts. They were also encouraged to add annotated explanatory notes as desired to any of the links or concepts. The concept maps were analysed by coding all of the first two and last two entries made by each and aggregating the results into the three categories of linking words and phrases; annotated explanatory notes and specific concepts. In weeks one and two a total of 475 notations were made by pupils on their maps of which 438 (92%) were lower level linking words such as pony; sheep and flowers; 11 (3%) short annotated notes such as not many people; flooding can be bad here and the rare Exmoor butterfly and 23 (5%) were more advanced vocabulary or exhibited evidence of conceptual thinking such as: flooding; farming; transport and coasts. The last two entries made by pupils totalled 455 notations of which 267 (59%) were basic linking words and phrases; 53 (12%) were explanatory pieces and 135 (29%) were specific concepts.
or evidence of specialised subject knowledge and understanding including tourist attractions; retention ponds; flood management; environments; channel; retention ponds; swailing; turbines; narrow valleys; barrage; footpath erosion; flood plain; flash flooding; levees; tidal power; environment.

A clear progression in the development of pupil knowledge and understanding through the *Exmoor Classroom* enquiry is clearly discernible from this coding analysis undertaken of the concept maps. In particular there is evidence of many pupils using the maps as a vehicle or structured space (Abrams 2004) to clarify their ideas and conceptual understanding about *Exmoor* and to express these as the enquiry progressed through more general ideas rather than as discrete and largely descriptive and unrelated facts that characterised earlier entries. In addition, the explanatory notes attached by some pupils to specific concepts in their final entries illustrate admirable levels of conceptual understanding for pupils of this age:

*In Allerford the diggers have to make retention ponds to hold back the flash floods*

*On Exmoor footpath erosion is caused naturally but also by hikers and bikers*

*Making wet woods; levees; trees in streams and rivers and retention ponds are all ways of slowing water down to stop flooding on Exmoor*

*Exmoor has a very remote coastline*

*Exmoor ponies are the oldest breed of horse*

*22.5 billion litres of water fall on Exmoor each year when it rains*

*A tidal barrage is like a turbine upside down in the sea which is turned by the power of the tides moving to make electricity*

*Swailing is done to kill off gorse and to help the heather grow on Exmoor*

### 3.2 Pupil work samples

Scrutiny of the pupil’s work on the classroom based river management learning activity (compiling a river flow diagram to show flood control measures) identified that the majority of children exhibited the full range of planned outcomes in terms of being able to *identify; describe; compare and contrast* and *demonstrate understanding through explanation*. In addition the pupil’s use of basic; appropriate and specialised vocabulary through this activity was particularly significant. Most pupils were able to use the terms water management; retention; erosion; flash flood; flood plain and levee accurately and to be able to explain what each feature was. Overall in terms of both intellectual outcomes and the use of vocabulary, many of the pupils demonstrated a level of attainment in excess of national expectations for pupils at this stage of primary education.
The fieldwork day along the River Aller valley was very cold and wet! The pupils applied themselves exceptionally well to the task of data collection in and along the river, with each group very closely supervised by a member of staff and/or one of a number of Exmoor National Park education volunteers. Team work and thinking skills were well applied by each of the five groups as they agreed suitable approaches to gathering the data required. Over an hour was spent by each group collecting the information. Data summary sheets were completed (Appendix 8) and the information collated which involved the calculation of the average depth of the river (from up to 16 separate measurements) and the average speed of flow at each measurement point.

Back in class the pupils presented their data graphically using line graphs; bar graphs; histograms and divided proportional bars. After an initial modelling session the majority of pupils then worked confidently and independently to draw accurate graphs. A number of pupils required one to one support to complete all of the graphs. The annotated written explanation which each pupil was encouraged to notate to their graphs produced a number of exceptional outcomes for pupils at this stage of education. For example all of the following analyses were produced by Year 4 pupils:

*The width of the surface water is random (no clear pattern). At location 3 the river becomes wider because when water goes along a meander it speeds up on the outside so the faster a river flows then the more the river will erode* (alongside a labelled diagram)
The graph shows that the river is getting wider because of the streams flowing into it as it gets closer to the sea.

The graph shows that the river becomes wider because when the river loops the speed increases. The faster the river flows the more the river will erode, especially at a meander (alongside a correctly labelled diagram).

The graph shows that the distance between the surface and the river bank increases because the faster it flows it will cause erosion for example we walk on grass and that creates erosion and it is the same with a river.

The graph shows that the river is getting wider because the tributaries and streams are joining the river.

As the river gets closer to the sea it gets bigger because more rivers connect to it.

At location 3 the river becomes wider because we were measuring on a meander, so that it erodes because it’s flowing faster (the faster the river the more it erodes).
3.4 Pre and post programme questionnaire

To establish whether the Moorland Classroom programme had been successful in bringing about significant change in knowledge and understanding (Section B of questionnaire) and pupil attitudes and values (Section C) it was necessary to compare responses to identical questions and statements at the beginning and end of the Allerford enquiry. This was done through the application of a paired significance test. Since the sample of 29 pupils was both small and not normally distributed a non-parametric significance test had to be used. The Wilcoxon Signed Rank Sum Significance Test fulfils these criteria. Before the application of the Wilcoxon Test the pre and post Section B questionnaire results were calculated for each pupil. The number of correct answers to the same questions, out of a maximum of 16, before (Response A) and after (Response B) the Allerford enquiry is shown for boys; girls and collectively in Appendix 9. Percentage changes between the before and after responses for each question were also calculated and shown graphically. Similarly, for Section C, the pre and post programme mean value on the Likhert Scale for each pupil for each statement was calculated (Appendix 10). In order to obtain mean scores in Section C, pupil pre and post enquiry responses to each question were scored 1 to 5 with 1 equating to the least environmentally aware response and 5 to the most aware. In this way the responses of each pupil to each of the twenty statements was assigned a mean value. The Wilcoxon Test was then applied to the summarised data (Appendix 11).
The Wilcoxon Test calculates the difference between the pre and post programme scores for each pupil ranks them according to the magnitude of the difference and sums the ranks for individuals with negative and positive differences separately. If there is no difference between the pre and post programme scores then the expectation would be that these sums of ranks would be equal. The Wilcoxon Test assesses whether this could be true by calculating the probability (p-value) that the difference observed in the pre and post programme data could have been due to chance if there really was no difference. When the p-value is very small (less than 0.05) it is unlikely that the observed difference was due to chance and there is a significant probability that the changes were due to a successful intervention i.e. in this instance the delivery of the Moorland Classroom programme.

When comparing the pre and post programme questionnaire responses of the girls the Wilcoxon Test gives a p-value of 0.002. This provides robust evidence that the results obtained were unlikely to be due to chance (2% likelihood) and suggests strongly that the results were caused by the intervention of the Moorland Classroom programme. Similarly the equivalent p-value of 0.001 for the boys also indicates a very strong probability (99%) that the impact of the programme was significant and the changes observed were unlikely to be due to chance. For the combined pre and post programme responses for boys and girls the p-value figure of 0.001 provides a very strong indication that the very positive changes in knowledge; understanding; attitudes and values observed amongst the pupils were the result of the of the Moorland Classroom programme rather than of chance factors.

Since pupils answered adapted questions in Section D of the post programme questionnaire compared with the initial survey a comparative analysis of before and after results using a statistical significance test as in Sections B and C was not feasible. However, an analysis was made of the percentage of pupils (boys, girls and total) who felt that they were less likely or more likely to adopt the eighteen behaviours listed was possible and the results are presented in Appendix 12. In all of the behaviours both boys and girls indicated an increased likelihood of adopting more sustainable practices in the future as a result of their experiences of the Moorland Classroom programme. In fact only one of the eighteen behaviours registered a ‘less likely’ response with 5.9% of boys (one individual) indicating that they would now be less likely to pick up litter.

3.6 Observational procedures: critical thinking skills

The observation of the occurrence of critical thinking skills using the agreed schedule was undertaken on nine occasions during the programme with the participant sample size in each case ranging from 2 to 29 (whole class) pupils. The occurrence of a particular thinking skill from the hierarchy in Appendix 6 during an observed learning and teaching activity was scored on a five point scale which
ranged from 0 (signifying 'not present') to 4 (equating to 'present throughout') and the collated numerical data was subsequently used to construct a chronological frequency spread sheet to show the distribution of the application of critical thinking skills through the Allerford enquiry (Appendix 13). In addition and in order to analyse both the occurrence, continuity and progression of the separate critical thinking skills through the programme, individual data sets were used to compile discrete progression graphs with trend lines for each thinking skill (Figs 1-22, Appendix 14). Scrutiny of these graphs reveals the following salient points:

- The average score for the application of all 22 critical thinking skills over the three month period of observations shows a general increase (indicated by a trend line) which is in line with what would be expected if the planned progression through the enquiry manifested itself in the learning. For example, lower level thinking skills such as recognising and identifying, describing and observing were as expected, most frequently observed in the initial stages of the enquiry with higher order skills such as making substantiated judgements; applying; reflecting; critiquing and evaluating; decision making and problem solving and synthesising much more apparent in the latter stages of the enquiry.

- Every critical thinking skill was represented in the enquiry and all were also evident throughout at least one of the observed learning activities.

- Trend lines indicate appropriate progression through the programme in all but three of the thinking skills with the exceptions being classifying, categorising and analysing.

- As planned, several of the early learning and teaching activities in the enquiry e.g. flash flooding and the Lynmouth floods on 29/1/13 were clearly tightly focussed on the application of a relatively small range of lower order critical thinking skills other activities later in the enquiry such as the data presentation and interpretation of river fieldwork exercise on 19/3/2013 were much more focused on the application of higher order thinking skills.

Chapter 4: Discussion and evaluation of findings

4.1 Review of key research objectives

Increase knowledge and understanding amongst pupils of the concept of National Parks in England and Wales in general and the environmental, historical; social and economic characteristics of Exmoor National Park in particular;
The pre and post programme questionnaires revealed substantial improvements in the knowledge and understanding amongst both boys and girls and the application of the Wilcoxon Test identified a very high probability that these improvements were specifically due to the impact of the Moorland Classroom programme rather than to chance factors. A range of additional qualitative evidence, particularly from the analysis of pupil concept maps and work samples also identified many clear examples of intellectual progression in knowledge and understanding through the programme e.g. progression from discrete unconnected facts to broader concepts and general ideas evident in many of the pupil concept maps and examples of high level explanation to be found in the interpretation of river investigations. In addition to there being clear evidence of significant improvements in knowledge and understanding, the comparison of a range of pupil work samples to National Curriculum expectations also indicates that in many cases the level of knowledge and understanding demonstrated by pupils completing the programme is considerably above national expectations for pupils of this age particularly in regard to explaining (Level 4), making links and identifying relationships (Level 5) and reaching substantiated conclusions (Level 6).

Enable pupils to acquire and apply a wide range of critical thinking skills both in the classroom and through outdoor learning when investigating the key question led enquiries which comprise the Moorland Classroom programme

The data generated through pupil observations indicate the application of a range critical thinking skills through the Moorland Classroom programme with every critical thinking skill represented at some point and all ‘evident throughout’ at least in one of the observed activities. In part this is attributable to careful planning of the enquiries and related learning activities to ensure appropriate continuity and progression through the range of thinking skills in each investigation.

Foster a sense of increased concern and responsibility for Exmoor National Park and for the environment in general

In relation to their responses to the pre and post attitudinal statements in Section C of the questionnaire the mean score on the Likhert Scale for the girls rose from 3.33 to 3.77 (11.3%) whilst the mean score for the boys increased from 3.29 to 3.48 (10.6%). – both high on an environmental awareness scale extending from 1 through 5. It is interesting to note here that the base line scores of the pupils at the beginning of the Moorland Classroom enquiry were relatively high. One explanation for this is clearly the Christian ethos of the school and how it manifests itself in terms of developing through the curriculum and the broader experiences of the pupil community; which was identified by
Ofsted during the school's last inspection in 2012: provision for pupils' spiritual, moral, social and cultural development is very strong, with pupil's showing compassion for others and a strong sense of morality.

Increase the willingness of pupils to care for the environment and contribute to a lifestyle for a sustainable world.

Significant positive changes in the attitudes of pupils to the environment and sustainability as a result of the Moorland Classroom programme were evidenced, despite there being high existing base levels evident at the outset of the enquiry. There was a strong inclination amongst both boys and girls to do more for the environment and sustainability.

Chapter 5: Conclusion

Through the rigorous application and triangulation of a range of qualitative and quantitative techniques (to ensure trustworthiness for largely qualitative research), underpinned by a robust theoretical framework and research process together with a detailed presentation and analysis of results, this study has been able to suggest a number of credible findings in relation to outcomes of the Moorland Classroom curriculum development programme for the pupils involved. Strong evidence was generated during the study to suggest a statistical significant and positive impact on knowledge and understanding; attitudes and values and the propensity to behave in more environmentally sustainable ways as a direct consequence of the Allerford enquiry. It is in this context that the research presented in this study has both relevance and wider potential (and perhaps even appeal) for organisations such as other National Parks in England and Wales approaching the issue of how appropriately to evaluate the outcomes of environmental and development education programmes; which will almost certainly have to be case - study based and confined to one moment and place in time with a specified cohort of children and young people.

Bibliography


