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Innovatively investing
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Action 15: Case study of the learning results in the NEED study module ‘Koli Landscape’

Study modules in the NEED project

The Northern Environmental Education Development (NEED) project is a transnational cooperation between Finland, Norway, Iceland and Ireland as part of the Northern Periphery Programme 2007-2013. The NEED project is designed to improve the educational use of geo-scientific knowledge in tourist sites such as national parks' visitor centers. The project's idea is to develop these out-of-school learning environments so that visitors can have fun learning new things about geology and its importance to mankind and society.

One focus of the NEED project has been to design study modules concerning geological knowledge which are to be carried out in these centres. Each NEED partner country has developed geo-science education modules under five common themes: (1) Elements of geology; (2) Landscape; (3) Natural hazards; (4) Geological materials in society and their sustainable use; and (5) Climate change. The modules are intended to help us better understand the story of the Earth, the places and landscapes in which we live, and the natural resources on which we depend (www.uef.fi/need/study-modules).

Koli Landscape module

This case study relates to one of the NEED study modules, namely ‘Koli Landscape’, which was designed for use in the Koli National Park and its Visitor Centre Ukko. The module comes under the theme Landscape, but it also interfaces with the theme Elements of geology. It is mainly directed to school groups. In this study module, focusing especially on the landscape of Koli, pupils learn about landscapes, how they form and change both by geological processes and as a result of human activity.

Koli is one of the most famous landscapes in Finland. It is considered to be a National landscape, a landscape unity which has national significance or status. Koli is located on the western shore of Lake Pielinen in Northern Karelia, eastern Finland. It is famous for its hills, which are remnants of the ancient mountain chain, the Karelids. The Karelids were formed 2 000 million years ago, when sandstone deposits petrified and folded as the continental plates collided. Quartzite formed during that time has survived the erosion caused by the Ice Age, better than its surroundings have. The highest point of this hill chain, as well as of the whole of southern Finland, is Ukko-Koli Hill, which rises to 347 m above sea-level and 253 m above Lake Pielinen.

Overview of the module

The Koli Landscape module deals very widely with the topic of landscape. The main focus of the module is on geology, but the module also includes the human impact on landscape. Understanding

landscapes is important in helping us to appreciate our past interdependence and future relationships with our landscape. By understanding the features and systems of landscapes, we can make informed decisions on how to manage and conserve them (www.geoneed.org).

The module has been designed to fit in to the school curriculum. It relates to environmental and natural studies (grades 1-4), biology and geography (grades 5-6), and geography (grades 7-9). The topics of landscape and geological processes connected with the formation of landscape are dealt with in these subjects. At the beginning of the NEED development work, the national core curriculum was analysed and the study module was designed to follow these subjects' objectives and core content. As a result, in addition to the theme of landscape, the study module includes practising moving about in the natural environment, and observing and investigating nature outdoors. Pupils also interpret maps and use pictures as sources of geographic information. Pupils' environmental literacy is developed in this module.

The module relies on the principles of the socio-cultural theory of learning. In the constructivist learning theory, authentic problems are the starting point of the learning process in which learning is not seen as passively receiving information but as a cognitive activity of the learner in which he/she constructs knowledge (see e.g. Harris 1994, Tynjälä, 1999). This is taken into account in the Koli Landscape module by developing activities which are interactive, problem based and hands-on, the guideline being to offer interesting challenges and problems and to include independent and collective problem-solving in the tasks given. Since the NEED project deals with environmental education, the module takes into account the viewpoint of sustainable development and responsible behaviour.

Structure of the module

The Koli Landscape study module includes a study visit to Koli National Park. The visit is meant to be carried out as a school camp programme, so that Koli guides run the instruction during the stay at Koli. The module is mainly directed towards grades 5-6 and 9, which normally arrange school camps and trips to visitor centres and other out-of-school learning environments.

The Koli Landscape module consists of 20 tasks. The first seven are recommended to be carried out at school before visiting Koli National Park. Six of these are planned to be alternative and optional; the teacher may choose suitable exercises for his/her class, depending on pupils' previous studies. The tasks intended prior to the visit, act as orientation to the topic of landscape. These tasks deal with the elements of landscape, the concept of landscape, Finnish landscapes, aesthetic values of landscapes, and national landscapes such as Koli.

The next eleven remaining tasks will be carried out during a supervised program by Koli guides at Koli National Park and its Visitor Centre. Tasks at Koli include interpreting maps and pictures, and problem-solving exercises through an investigative approach. The main problem to be solved is 'How and why landscapes form and change?' Pupils will initially study the natural and geological processes shaping the landscape, and after that focus on the human impact on landscape. A series of cards representing the evolution of Koli landscape (Figure 1) will be used to investigate the natural processes shaping the landscape. Through their use, pupils will study how the Koli landscape has formed and how it has been reshaped as a result of geological processes. Huge time spans are illustrated with a rope which symbolizes the age of the Earth, linking them to the events of evolution which have taken place at Koli.

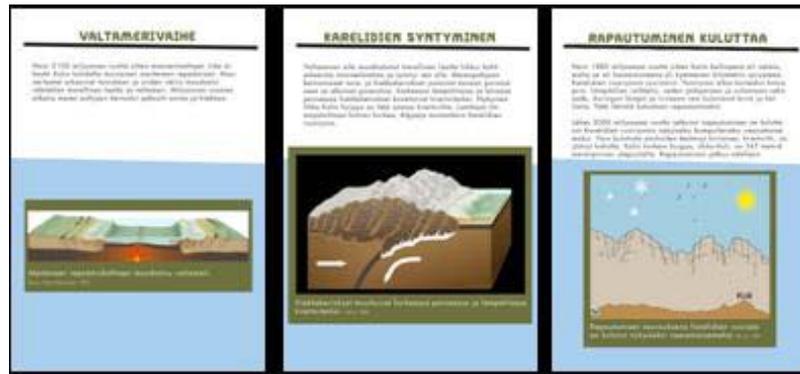


Figure 1. A series of cards (9 in number) developed in co-operation with the Geological Survey of Finland, designed to aid understanding of the formation of landscape.

Another main issue under study is how the human being changes the landscape. Photos taken from Koli will be examined by pupils looking for man-made marks and impact on the landscapes. They will also compare recent photos with those taken a long time ago and analyse the changes in the landscape. The older photos have been taken in 1930's. The Koli guides have taken new photos from the same places, enabling comparison and thus discovering the changes in landscapes.

After considering the historical part of the evolution of Koli landscape, the pupils will turn to the future and think about how Koli landscape will look in 100 years' time, discussing moral values and nature protection issues with the guide. The aim of these activities is that pupils will learn to understand to see themselves as future citizens.

The guided field trip in the national park will follow the indoor activities at the visitor centre. The geological processes and events of evolution concerning Koli landscape are repeated during the field trip. Pupils investigate how events and processes can be seen in the landscape; this task is designed to develop pupils' environmental literacy. In addition to the landscapes, pupils will interpret geological maps and figures, making observations about changes in the landscape and taking into account those made both by humans and nature. The field trip will also give pupils the opportunity to experience the Koli national landscape, and the tasks will help them to develop a positive relationship with the environment.

Two tasks belonging to the learning process are to be performed at school after the visit to Koli. The first combines visual arts to the theme, through asking pupils to draw Koli landscapes and their memories of it. Finally, pupils consider the theme of landscape from the local viewpoint, examining landscapes from their home region. In short, this aims to develop pupils' respect for their own home region.

Background to the case study

In this case study we are interested in pupils' perceptions about the factors shaping landscapes, and how these perceptions change while studying the Koli Landscape module. The main objective of the module is that the pupil learns how and why landscapes form and change. Although the focus is on the landscape of Koli, the objective is to understand the formation and change of landscapes in general.

This case study was carried out during the piloting of the study module. The pilot groups were classes from schools from the project's target area. Altogether 87 pupils from 5 classes tested the module and acted as piloting groups. There were minor differences between piloting groups in the way the module was taught, due to that fact that the groups were supervised by different guides. The indoor exercises, carried out with new learning materials developed in the NEED project, were similar for all groups, only the oral sections differed slightly. Each guide has his/her own style, and also their knowledge of geological topics differed. The field trips had even more variation, because the situations varied. Despite these variations and differences, all groups studied the most important parts and geological topics of the module.

Method

In this case study, pupils' drawings act as research material and serve to reflect pupils' perceptions. Pupils were involved in the piloting by drawing pictures both at the beginning and the end of the module. The pupils' assignment was: *Draw a picture about the topic "Which factors shape the landscape?" Explain your drawing in writing.* This instruction was given to the teachers whose classes took part in the research. The teachers transmitted the instructions to the pupils.

The assignment was the same both at the beginning of the module, therefore before the study visit to Koli, and then after the visit, at the end of the module. Altogether 103 drawings were made, 56 before the study visit, and 47 after it. In this case study, one class was selected to be a research group; all 16 pupils of that class drew a 'before' and 'after' picture. This class was a combined class with pupils from the third to sixth grades.

The data was analysed using inductive content analysis (see Patton 1990). First, the drawings and writings attached to them were carefully read through in order to understand their content. Each feature of the drawing was coded, for example the presence of a house or a forest. The codes emerged directly from the data. The most commonly occurring codes were categorized into 21 themes; see Table 1.

Using drawings as research material may have many limitations (see e.g. Dove et al., 1999). According to Dove et al. (1999), studies suggested that what children draw is partly limited by their drawing ability; they perhaps leave something out because they cannot draw it. Researchers may also misinterpret the drawings. These limitations were taken into account in this case study and in interpretation of its results. Pupils were also asked to explain their drawing in writing, and this probably helped pupils to express themselves. In some cases, pupils mentioned some features in their writings but did not include them in the drawings. The attached writings also helped the researcher to interpret the drawings.

In addition to the drawings, in this case study the pupils' feedback is used in order to find out changes in pupils' perceptions. After studying the module, pupils filled in a feedback questionnaire, in which they gave their opinion about the module.

Results

Almost every pupil's drawings included the effects caused both by human actions and nature. Some pupils also included effects caused by animals, namely cutting down trees and building nests. The typical effects caused by human actions which were included in the drawings were construction (mostly houses, but also roads, quays, and fences), cultivation and forestry, mainly the cutting down of trees. Only in a few drawings was the human impact on landscapes non-existent. When

comparing the drawings before and after the study visit, there were no significant changes in pupils' perceptions concerning the human impact on landscape.

There was more variety mentioned concerning effects caused by nature. Before the study visit, pupils mentioned wind and storms, water and water systems, forest, forest fires, weathering, swamps and swamp formation, as well as sun and rocks, as factors which shape the landscape. The most common were wind and storms, and water and water systems. After the study visit, all the factors mentioned above existed in the drawings, except swamp formation. In addition to this, there were several new factors mentioned, such as the ice age, volcanoes and crown snow load. Also tectonic plates, topography and lake formation were included in the post-module drawings. In the Koli Landscape module, all these factors are to be studied. Weathering as a factor, was mentioned by two pupils before studying the module and three after it. However, these three pupils were not the same ones who mentioned it beforehand.

Table 1. Categorizations of the codes found in pupils' drawings.

Category	'Before' drawings	'After' drawings	Total before	Total after
Natural phenomena and processes				
Wind, storm	1, 5, 6, 7, 8, 9, 10, 11, 14	1, 2, 8, 9, 10, 12, 14, 15	9	8
Water (water, rain, snow)	1, 2, 3, 7, 8, 14	1, 2, 13	6	3
Water system	3, 4, 5, 10, 13, 16	4, 6, 8, 13	6	4
Forest	3, 4, 5	3, 4, 6	3	3
Forest fire	1, 6, 13	1	3	1
Weathering	6, 11	13, 15, 16	2	3
Swamps, swamp formation	3, 13		2	0
Sun	2, 4	4	2	1
Rock (cliff)	6	4	1	1
Ice age, ice sheet		6, 7, 14	0	3
Volcanoes		1, 7	0	2
Topography		6	0	1
Tectonic plates		14	0	1
Crown snow load		7, 14	0	2
Avalanche		1	0	1
Formation of lake		6	0	1
Human activities				
Construction	2, 4, 5, 6, 7, 8, 9, 12, 13, 14, 15, 16	2, 5, 6, 9, 11, 12, 15, 16	12	8
Cultivation	5, 6, 13, 14	6	4	1
Forestry	2, 6, 9, 10, 11	1, 2, 5, 6, 7, 10, 13	5	7
Human impact in general		3, 4, 6, 8	0	4
Other: animals				
Animals	8, 11, 13, 14, 15	13	5	1

In the feedback questionnaire, pupils rated what they thought of the different tasks in the module, and what they felt that they had learnt. There were both open and structured questions in the questionnaire. The open questions were the following:

Which task of the module did you like the most? Why?

Which task of the module did you like the least? Why?

What have you learnt from this module?

Pupils liked the outdoor section the most. According to pupils' answers, the outdoor section was the best, because pupils liked to be outdoors, walk in nature, see beautiful landscapes, but also because “..There it was possible to hear about the period when the ice sheet existed in Koli”, and “because I learnt so much about Koli there [on the field trip]”.

According to pupils' answers, they didn't like sitting down and listening. This part is intended to be very limited in the module. The idea is to emphasize hands-on exercises.

To the question *What have you learnt from this module*, pupils answered e.g. the following:

“That nature has changed so much in 100 years.” (number 15, a third grader)

“What the landscape is like.” (numbers 5 and 7, both sixth graders)

“What the landscape consists of.” (number 6, a sixth grader)

The Koli Landscape module is intended for the fifth to sixth grades, and the ninth grade. Pupils' answers showed that the module seems to be suitable for fifth and sixth graders. The pupils from these grades were able to specify the factors shaping landscapes in a diverse way. It seems that they were able to draw and write the topics which they studied in the module, in other words, it seems that they understood the topics studied. Pupils' answers in the feedback questionnaires support this idea. Here are some examples of the fifth and sixth graders' post-module answers to the question *Which factors shape the landscape?*

“Water, tectonic plates, snow, winds. Snow and winds break down trees. Tectonic plates displace and cause landscape change. Water and ice disentangle pebbles and transport them.” (number 14, a fifth grader)

“Ice sheet transports rocks and makes dents and splits in them.” (number 7, a sixth grader)

“During the ice age, the tectonic plate sagged, and when the ice melted, a lake came.” (number 6, a sixth grader)

In the pre-module pictures, there was no mention of tectonic plates or ice as a factor of forming landscapes. Also some younger pupils, third to fourth graders, did mention some geological processes in their post-module drawings. For example: “A man has built a house. Mountains have become smaller because water makes them smaller” (number 16, a third grader). However, this sort of comment was only occasional amongst the younger pupils.

Conclusions and discussion

This case study shows that after studying the Koli Landscape study module, pupils' perceptions seem to move into the desired direction, and especially the fifth to sixth graders seem to learn some geological matters on the topic of changing landscapes. The pupils also enjoyed studying this module.

Teachers' feedback on the module also supports this opinion and those involved in piloting reported of it after the piloting had taken place. The teachers considered that the Koli Landscape module *deepened and diversified the teaching of the topic of landscape. It was a new, but a proper way of dealing with the topic. It gave some new viewpoints. It was altogether interesting and well-prepared. The material worked well.*

The study module was planned at the University of Eastern Finland in co-operation with the Finnish Forest Park service and Koli guides. Before piloting, guides received training on the study module, its pedagogical background, its exercises and material, and how to carry it out. However, because the module and its material were new to the guides, they ran it for the first time with piloting groups. From the viewpoint of the pupils' learning, the piloting situation was not the best for evaluating learning results, because the teaching methods had not yet been fully developed.

The starting point for this research has so many variables, that by using this method it's not possible to have "watertight" results about learning results. The role of teachers and their influence on pupils' drawings is not known. In addition to this, drawings are not the best method for evaluating the pupils' general view and understanding of the topic. Furthermore, in this case, the number of drawings analyzed was small.

There are of course multiple ways of studying the topics in question, and surely many ways to learn. This module offers a different way of learning, including supposedly more action, hands-on activities, and more personal experience than in traditional class-room learning. It expands learning possibilities for pupils with different learning styles and learning strategies and, as the curriculum points out, emphasizes the importance of pupils' own experiences of nature and moving about in natural environments. In the Koli Landscape module, this objective is linked to studying the topics of geology, in order to offer meaningful and target-oriented outdoor instruction.

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