

A comparative analysis between learning opportunities provided by Finnish target areas and the National Core Curricula

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1. Introduction

The NEED project will produce study modules and educational materials, and will develop inspiring learning environments based on geo-scientific knowledge. Each NEED partner country is developing geo-science education modules under common themes. These themes are the following:

- Basics of geology (e.g. Earth's origin and structure, Earth processes, rock cycle, rocks..)
- Landscape
- Natural hazards
- Geological materials in society and their sustainable use
- Climate change

The theme 'landscape' includes both geological foundation of the landscape and the human impacts on it, and also (at least in NEED-Finland) it includes the topic of cultural heritage. This concept of cultural heritage is related also to the traditions of stone industry, which is another important topic in the focus in NEED-Finland. Also sustainable development and responsible behaviour is emphasized, because the project deals with environmental education.

This analysis concentrates on those contents of the curricula which are relevant to the subject matter of the NEED project. Only those parts of the curricula which are linked to the themes of the project are included to this analysis.

This analysis introduces two pilot visitor centers and their existing learning opportunities (the Finnish Stone Center and Koli national park and its' visitor centre Ukko). In total there are four visitor centers acting as pilot learning environments in NEED-Finland. The other two are Leivonmäki national park and Linnansaari national park, both managed by Metsähallitus. These mentioned four visitor centers will be developed in NEED both by their learning opportunities (study modules, Work Package 3) and physical aspects (learning environments, Work Package 4). This analysis acts as a basis for the development work.

2) Summary of national core curricula

2a) Curriculum for basic education

Underlying values of basic education

Finnish basic educational system has many underlying values. The basis of instruction in basic education is Finnish culture. In the instruction, special national and local attributes must be taken into consideration. The instruction should help to support the formation of the pupil's own cultural identity, and his or her part in Finnish society and a globalizing world.

What comes further to the values specified in the curriculum, natural diversity and preservation of environmental viability are mentioned to be important values. According to the curriculum, basic education promotes responsibility and a sense of community.

The conception of learning

In the curriculum, learning is seen as an individual and communal process of building knowledge and skills. Through this process, cultural involvement is created. Learning takes place as purposeful study in a variety of situations: independently, under a teacher's guidance, and in interaction with the teacher and peer group. In addition to new knowledge and skills, both learning and work habits are to be learned that will serve as tools of lifelong learning.

Learning results from the pupils' active and purposeful activity, in which they process and interpret the material to be learned on the basis of their existing structure of knowledge. Learning that occurs through interactive cooperation aids individual learning. In all its forms, learning is an active and goal-oriented process that includes independent or collective problem-solving. Learning is situational, so special attention must be given to the diversity of the learning environment. In learning, new possibilities open up for understanding culture and the meanings that culture contains, and for participating in social activity.

Learning environment

The term learning environment refers to the entirety of the learning-related physical environment, psychological factors and social relationships. In this setting, study and learning take place. In particular, the physical learning environment consists of the buildings and facilities, the instructional tools and the learning materials. It also includes the wider constructed environment and the surrounding natural environment. The study tools and facilities must be designed and organized so as to allow the employment of diverse study methods and working approaches. Attention also has to be given to the aesthetic qualities of the physical learning environment.

The learning environment must support the pupil's growth and learning. The objective is to increase pupils' curiosity and motivation to learn, and to promote their activeness, self-direction, and creativity by offering interesting challenges and problems. The learning environment must guide pupils in setting their own objectives and evaluating their own actions.

The learning environment must also support interaction between teacher and pupil, and among the pupils. It must promote dialogue and guide the pupils in working as members of a group. The objective is an open, encouraging, unhurried, positive atmosphere, for whose maintenance the teacher and the pupils share responsibility.

Working approaches

In instruction, methods characteristic of the subject are to be used, as are versatile working approaches that help support and guide the pupil's learning. The function of the working approaches is to develop social, learning, thinking, working, and problem-solving skills, and to foster active participation. The approaches must further the development of skills with information and communication technology. They must also provide opportunities for the creative activity, experiences, and play characteristic of the age group in question. The pupils' various learning styles and backgrounds, as well as the developmental differences between boys and girls and among individuals generally, must receive consideration.

Learning objectives and core contents of education

Thus basic education forms an integral whole, the instruction bases on subjects. The subjects dealing most with the NEED themes (e.g. geology and environment) are environmental and natural studies (grades 1-4), biology and geography (grades 5-6), and geography (grades 7-9). There are links to the NEED themes in other subjects too, like in physics, chemistry and even history and visual arts.

Environmental and natural studies is an integrated subject group for the grades 1-4. It comprises the fields of biology, geography, physics, chemistry, and health education. Instruction in the subject group includes the perspective of sustainable development. The objective of instruction is that the pupils get to know and understand nature and the built environment, themselves and other people, human diversity, and health and disease.

Instruction in environmental and natural studies relies on an investigative, problem-centred approach in which the starting points are the pupils' existing knowledge, skills, and experiences; and things, phenomena, and events connected to the pupils' environment and the pupils themselves. With the aid of experiential instruction, the pupil develops a positive relationship with nature and the environment.

According to the objectives of this subject, the pupils will

- get to know the natural and built environments in their neighbourhood and to observe the changes happening therein
- learn to obtain information about nature and the environment by observing, investigating, and using a variety of source materials
- learn to make observations using the different senses and simple research tools, and to describe, compare, and classify their observations
- learn to perform simple scientific experiments
- learn to read and draft simple maps
- learn to represent information about the environment and its phenomena by different means
- learn to use the concepts by which the environment and the phenomena and subjects embraced by those concepts are described and explained
- learn to protect the nature and to save the natural resources.

One of the core contents of environmental and natural studies is "One's immediate environment and home region, and the world as a human living environment". This includes the topics like "Map and main features of the terrain" and "Home region and

province: their natural conditions, landscapes, built environment, and human activity”. Also the topic “Substances around us” has some points of contact with the themes of the NEED. This topic’s content is “substances and materials that are part of everyday life; their recycling and conservative use”.

To summarize the core contents of environmental and natural studies, out of NEED-themes there are both landscape and raw materials (like stone) included.

In the grades of 5-6, the themes relating to geology are presented in subjects of biology and geography (combined) and physics.

In *geography*, the instruction must help the pupil to understand phenomena associated with the activity of human beings and the natural world, and the interaction of those phenomena in different regions. The instruction is provided so that the pupil gets a sense of the richness of natural and cultural environments around the world and learns to appreciate them.

Instruction in combined subject of biology and geography is to emphasize responsibility, the protection of nature, and the preservation of living environments. It must also support the pupil's growth as an active citizen committed to a sustainable lifestyle.

The objectives in biology and geography instruction are that pupils will e.g.

- learn to move about in the natural environment and observe and investigate nature outdoors
- develop their environmental literacy, act in an environmentally friendly way, care for their local environment, and protect nature
- take responsibility for their own actions and take other people into consideration
- draw and interpret maps, and use statistics, diagrams, pictures, and electronic messages as sources of geographic information
- understand the dependence of human activity on the possibilities that the environment offers on earth.

Also *physics* has some links to the geology in the 5-6 grades. One of the core contents of physics in 5-6 grades is Substances around us. In this topic, the following things are included: “Classification of substances from the soil and methods of separation”, and “Origin, utilization, and recycling of products and materials belonging to the living environment”. The starting point for instruction in physics and chemistry are the pupils' prior knowledge, skills and experiences, as well as their observations and investigations of natural phenomena, objects, and materials.

In the grades of 7-9, the themes related to NEED subjects are presented mostly in *geography*. Instruction in geography is to develop the pupil's geographical conception of the world, and the regional foundation of that conception. Instruction has to serve as a bridge between natural-science and social-science thinking. One objective in 7-9 grade's geography is to come to understand the effect on the landscape of factors that reshape the earth's surface. Also understanding of the interaction between natural and human activity is mentioned as an objective. Among the core contents of geography there is “Finland's map view and landscape” included.

In *chemistry* of 7-9 grades, there are some links to the NEED themes too. In learning objectives there is mention of learning about processes associated with the cycle of substances and the life-cycles of products. In the core contents there is topic called “Raw materials and products”, which include key elements and compounds to be found in the earth’s crust and their properties, and the manufacture, use, sufficiency, and recyclability of products.

There may be found some links in subject of *history* too. One of the objectives in history instruction in 5-6 grades is to learn to recognize changes in the history of home region. This may include the changes in natural environment due to geological phenomena, although in history the focus is more on human activity than natural phenomena. Stone age is included in the contents of history too. Also interpreting the meaning of recollections, writings, objects, images and the constructed environment is mentioned.

In the subject of *visual arts*, there is a mention of introduction to and depiction of nature, buildings, and the building heritage and recognition of changes in the environment.

In addition to the separate subjects, there are *cross-curricular themes* in the curriculum which are valid to all grades 1-9. With the help of these themes, the instruction is integrated. The objective of integrating instruction is to guide pupils in examining phenomena from the perspectives of different fields of knowledge. Cross-curricular themes represent central emphases of the educational and teaching work. Their objectives and contents should be incorporated into numerous subjects. Through them, the educational challenges of the time are met.

There are seven cross-curricular themes in the curriculum for the basic education. The themes which have links to the topics of NEED, are the following:

- Responsibility for the environment, well-being, and a sustainable future
- Cultural identity and internationalism
- Participatory citizenship and entrepreneurship
- Technology and the individual.

The links with the first one are quite obvious. One of the objectives of basic education is to raise environmentally conscious citizens who are committed to a sustainable way of life. This theme of sustainable development has such core contents as “Ecologically, economically, culturally and socially sustainable development in one's own school and living environment” and “Eco-efficiency in production, society, and everyday ways of acting; product life-cycles and consumer behaviour”. These mentioned contents relate both to nature (geology) and to sustainable use of raw materials.

Other cross-curricular themes mentioned link to the NEED topics as follows:

- Cultural identity and internationalism. The goal is that the pupils will come to know and appreciate their respective cultural inheritances, spiritual and material, and come to understand the roots and diversity of their own cultures. This relates to local attributes, which may base e.g. on geological features or traditions in stone industry.
- Participatory citizenship and entrepreneurship. One content of this theme is to come to know working life and entrepreneurial activity. This relates working e.g. in the stone industry or in tourism section relating to geo-science.

- Technology and the individual. The goal of this theme is to help the pupil both to understand the individual's relationship to technology, and to see the importance of technology in our daily lives. One of the core contents is technology in everyday life, society, and local industrial life. This relates e.g. to technology used in stone industry.

2b) Curriculum for upper secondary school

The values of education in upper secondary school are congruent with those ones of basic education. According to the upper secondary school curriculum, the basic values of instruction are built on Finnish cultural history, which is part of Nordic and European cultural heritage. At upper secondary school, students should learn how to treasure, assess and renew their cultural heritage.

Educational work will place emphasis on co-operation, encouraging interaction and honesty. Students are seen to be the constructors of their own learning, competence and views of the world. Instruction must take into account the fact that human beings observe and analyse reality using all their senses. The aim is for students to grow to assume adult responsibility for their own choices and actions. Upper secondary school must highlight the principles of sustainable development and provide capabilities to face the challenges posed by the changing world.

The conception of learning is similar to the one in basic education. It states that learning is a result of a student's active and focused actions aimed to process and interpret received information in interaction with other students, teachers and the environment and on the basis of his or her existing knowledge structures.

When considering the learning environment and learning approaches, the role of setting own objectives for learning is emphasized. Also personal learning types are stressed more than in basic education. The skills of acquiring and producing of knowledge are pointed out strongly. At upper secondary school, the aim is to use the curriculum as the basis to create an operational culture that highlights the responsibility of the members of the community as a whole and is open to co-operation and interaction with society.

The learning objectives and core contents of education

The upper secondary school studies consist of compulsory, specialisation and applied courses. Specialisation courses are elective courses relating to compulsory courses in the same subject. The courses which relate to the NEED themes locate into the subject of geography. Instruction in geography must guide students to become aware of the interdependencies between nature and human activity. Geography instruction integrates themes of the natural and social sciences. The objective of instruction is for students to become capable of analysing spatial features of environmental issues and of searching for solutions consistent with sustainable development. Geography instruction at upper secondary school must help students to understand global, regional and local phenomena and problems and potential solutions to such problems.

There are two compulsory geography courses and one optional course which are relevant to the themes of geology and environment. The courses are called "The blue planet", "A

common world” and “A world of hazards”. The aims and the contents of these courses are introduced in the following.

The blue planet

One objective in this course is to understand how and why natural landscapes change and know how to interpret the structures, origins and development of natural landscapes using images and maps. In the core contents there is topic called “The variable topography of the Earth”, which includes the structure of the Earth and endogenous and exogenous events shaping the Earth’s surface.

A common world

One of the objectives of this course is to be able to assess the effects of opportunities provided by natural resources and the environment on human activity in different regions and understand the significance of ecologically and economically sustainable development. In the core contents of this course there is topic called Industry and energy, which includes raw materials and sources of energy, location of industry and principles of sustainable industry and energy economy

A world of hazards

The objective of this optional course is to familiarize with hazards related to natural phenomena, human activity and interaction between human beings and nature on the globe. In natural hazards, the endogenous processes and hazards like plate tectonics, earthquakes and volcanism are introduced. Climate change is also included as an environmental hazard.

There are also *cross-curricular themes* in upper secondary school. According to the curriculum, “cross-curricular themes are educational challenges with social significance. At the same time, they are current statements on values.” In practical terms, cross-curricular themes are policies that structure the upper secondary school’s operational culture and priority areas that cross subject boundaries and integrate education. They deal with issues concerning the way of life as a whole.

The cross-curricular themes common to all upper secondary schools are:

- active citizenship and entrepreneurship
- safety and well-being
- sustainable development
- cultural identity and knowledge of cultures
- technology and society
- communication and media competence

In addition to these cross-curricular themes, education providers may also accept other cross curricular themes for their own curricula.

The theme of sustainable development includes e.g. the following objectives

- be familiar with the key factors of the ecological, economic, social and cultural dimensions of sustainable development and understand that it is only the simultaneous fulfilment of all these dimensions that leads to sustainable development
- know how to measure, assess and analyse changes occurring in both the natural environment and the cultural and social environments

- reflect on what constitutes a sustainable lifestyle, an environmentally friendly and eco-efficient production and community, a community and society reinforcing its social capital and a culture caring for its natural heritage in a transgenerational fashion.

Students should learn to examine the challenges to sustainable development from several points of view: (a) exploring the effects of human activity on the environment and changes that have occurred in the way human beings adapt their environments during cultural evolution, (b) analysing global environmental hazards and their causes as well as means to correct the course of development, (c) assessing the cycles of substances and energy in the environment and production systems, (d) studying business enterprises and technologies that fulfil the principles of sustainable development and learning how to exercise the means of influence available to consumers, and (e) determining the ways in which human activities can be adjusted to their environments with respect for cultural heritage and without endangering natural diversity. Examples of successful practices will be incorporated into instruction and the upper secondary school's everyday life.

3. Introduction to the pilot environments

3a) Introduction to the Finnish Stone Center

The Finnish Stone Center is situated in Juuka municipality in Northern Karelia. The Finnish Stone Center is built by the Stone Museum and Stone Village Foundation of Juuka. The Finnish Stone Center has training and business facilities, laboratories and the Geo Knowledge Center, which is the most significant part of the center when considered the educational viewpoints. There are also some supporting services like soapstone museum, stone park, restaurant and souvenir shops in the Finnish Stone Center area. Just next door there is Tulikivi company, which is (together with its subsidiaries) the world's largest manufacturer of heat-retaining fireplaces. The Tulikivi group is known for its soapstone fireplaces and natural stone products as well as its tiled stoves and utility ceramics. There is also a soapstone quarry close to the Stone Center.

The Geo Knowledge Center with permanent exhibition of geology is located on the ground floor of the Stone Center. The stone exhibition was planned and implemented by the Geological Survey of Finland. On the first floor there are some changing theme exhibitions, mainly art exhibitions, of which some considered world-famous. Some of the changing exhibitions relates to geology and thereby support the content and the educational objectives of the Geo Knowledge Center.

The area of the Geoexhibition is over 400 m². Situated in the entrance and the exhibition cells are seven subject matters derived from the theme "stone". The seven themes are: (1) The origins of stone, (2) History of the use of stone, (3) Stone as raw material, (4) Stone as construction material, (5) Stones as valuables, (6) Stone as a research subject and (7) Stone through the eyes of children.

The contents of the seven themes mentioned above are shortly introduced next.

The origins of stone

This section introduces the basic geological knowledge and concepts. It includes for example knowledge of the structure of the Earth (Fig 1), main geological processes and the stone type classification (igneous rocks, sedimentary rocks and metamorphic rocks). The age and origin of the Finnish bedrock is also presented.

In the middle of the Geo Knowledge Center, there are three rotating stone spheres on a thin film of water. The spheres are made of three different stone materials and they illustrate different phenomena, for example continental movements of Fennoscandia during ages. Close to the stone spheres there are information posters about selected interesting geological phenomena like diamonds and meteorites. Also minerals and fossils are introduced here together with numerous samples of rocks. At the entrance hall, there is a dramatized multimedia program about natural catastrophes. The multimedia is available in certain times.



Figure 1



Figure 2

History of the use of stone

This part of the exhibition presents the role of the stone in history and in different cultures. This section concerns the use of stone relating human development and early stages of stone technology. One of the main points here is that cultural history is written in stone. Cave art and rock paintings are presented in this section.

Information is presented mostly via posters and showcases. The photographs on the wall represent some major stone structures and buildings around the world. Pictures give the idea of significance of stone to humankind and culture and also the skills that humans have mastered in working the stone. There is also a small dark room (reminding a cave) for multimedia presentation. Presentation lasts about 10 minutes and tells about the cave art of Central Europe and Finnish rock paintings. Visitors can start the presentation themselves.

In this section, there is also a diorama dominating one room (Fig 2). It illustrates a cremation during the early bronze age. According to the guiding texts, “dead people, even artificial, bring a human touch to the otherwise lifeless items of the showcases, and in a symbolic way represents one link in a chain of generations”.

In the showcases, there is information e.g. about the biology of human evolution, the early stages of stones technology, Finnish stone age and the processing methods of stone. Also ‘normal weekday of the stone age’ is presented.

Stone as raw material

This theme presents the Finnish mining industry and natural stone production. The exhibition cell of Finnish mining industry is divided into metals and industrial minerals. In this part, Finnish metal and industrial mineral resources are specified. Several maps are used to illustrate the resources, mines, quarries and companies.

According to this section, “industry determines the final importance and value of raw stone material”. In industrial processing, the mined ore is transformed into products. The showcases have some examples of these products (Fig 3). The important message of this section is that stone products play a dominant role in our everyday environment even if we do not necessarily realize it. The whole exhibition emphasizes the fact that geological materials are essential to humankind. It’s also pointed out that it is question of non-renewable natural resources.

This part of the exhibition also presents natural stone production and Finland’s role as a producer of natural stones. For example in the soapstone industry Finland is the market leader. Besides the posters, there is also a multimedia program which introduces the production and process of natural stones.

Another important subject in this section is the technology used and needed in stone industry. To illustrate the heavy technology used during the industrial processes, some diamond-strengthened tools are situated in one room (Fig 4). Also Finnish stone business based on trained and skilful staff is highlighted at this point.

In addition to the posters and tools, there are also five multimedia presentations (duration about 2 minutes of each) dealing with the topics of products of the stone industry, technology and professional skills.



Figure 3



Figure 4

Stone as construction material

This theme introduces the natural stones produced in Finland. The main focus is that the Finnish natural stone industry processes domestic raw material for example into paving stones, flat paving stones, stairs, kerbstones, tops and bollards. Besides the posters, there are some triangle pillars introducing the types of stone produced in Finland. Three different surface treatments for each stone type are presented (like polishing, mat sanding, and burning).

Stones as valuables

This section presents stones role as valuables: pieces of art, jewellery and treasures. The collection contains for example copies of the world's largest rough diamonds and some of the most beautiful and famous cut diamonds. In addition to the showcases with the objects, there are some posters introducing for example the gold rush of Lapland.

Stone as research subject

This part introduces mainly the Geological Survey of Finland and their know-how. The role of the expertise and research is presented also by introducing the environmental point of view. When exploiting natural resources and using technology, miscalculations can result an irreversible environmental damage. According to the guiding texts, only valid research will help to deal with the different issues of the Earth's surface in a sustainable way and without unnecessarily endangering natural resources.

Stone through the eyes of children

The exhibition has also something interesting for the small children. There is a lava cave, which is built to resemble a volcanic cave. The lava cave is said to be "a part of the larger empire of the Folks of the Mountain, which has been conquered by the trolls". In the cave there are many items and trinkets collected or made by trolls. In the central part of the cave, there is a cavity where children can play some games on a table or a monitor. Children can also read some literature and draw pictures.

The educational programs offered by the Finnish Stone Center

The Finnish Stone Center arranges educational programs and study visits for school groups. The teachers can build up the study visit by choosing between several alternative services like a guided tour, exercises led by a guide or teacher himself/herself, video programs and getting to know the exhibitions and the soapstone museum by oneselves. Also visits to Tulikivi company and the soapstone quarry can be organized.

The Stone Center has lot of exercises for school groups dealing with the subject matter of geology. These exercises are developed together with educational specialists. The exercises are directed to the 3–9 grades and they are free to download in Finnish Stone Center's website. They enable teachers to deal with the subject of stones very widely.

The exercises are divided into 9 themes so that every section in the exhibition has its own exercises. The themes are the following

- Geology, the origin of stone, A
- Geology, the origin of stone, B
- History of using stone, A
- History of using stone, B
- Stone as raw material
- Stone in construction (inner spaces and frontages)
- Stone in construction (environmental constructions)
- Stone as valuables
- Stone as research subject

In addition to this, there are exercises concerning stone handicrafts with ideas how to carry out stone handicrafts at school. For groups of small children, there are some exercises to carry out in the lava cave.

Each of the mentioned themes has several exercises. These exercises are presented more exactly in a part four in this report. The exercises can be used before, during or after the visit. With the help of this wide range of exercises, it's possible to arrange a long learning event by acquainting oneself with the topic in advance, deepening the knowledge while visiting the center, and finally, summarising the topic after the visit. It's also possible for a school group to go and visit the center without any advance preparations. In that case the guides of the center will organise learning opportunities by dealing out some tasks and exercises.

3b) Introduction to Koli national park and its Visitor Centre Ukko

Koli National Park

Koli national park is located on the western shore of Lake Pielinen in Northern Karelia, eastern Finland, within the municipalities of Lieksa, Kontiolahti and Joensuu. Koli national park (np) is established in 1991 and now managed by Metsähallitus. Koli national park's area is 30 square kilometres, and it is the national park of forested hills. Some rare geological features, diverse fauna and countless plant species are characteristics of the Koli np.

Koli is famous for its hills. The area's hills 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 weathered 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.

Koli has also a lot to offer in cultural heritage. It has once been a sacrificial site and after that was used for slash-and-burn agriculture. Traditional agricultural heritage is cherished in Koli. A part of the fields are slashed, burnt and re-cultivated and hay is cut each year. Traditional Finnish livestock breeds, cows and sheep, graze in the national park's meadows. Koli was also a "pilgrimage destination" for Carelianist artists of the turn of the 19th and 20th century.

There are a lot of recreational and nature tourism services in Koli area. For example, Koli has a vast network of trails; their lengths vary from 2,5 kilometres to 40 kilometres. All in all, there are about 70 kilometres of signposted trails.

Approximately 110 000 nature tourists visit the Koli National Park, annually. Tourism and conservation have both been taken into account in the park's care and management plan. The National Park's main purposes are to function as a place of research and nature education. In 2007 Koli National Park was awarded a certificate called the European Charter for Sustainable Tourism in Protected Areas, which is issued by the Europarc Federation. The charter is valid for 5 years.

The Visitor Centre Ukko and its permanent exhibition

The Visitor Centre Ukko was opened in year 2000 and is managed by Metsähallitus. The visitor centre provides a permanent exhibition and some changing exhibitions (mostly art exhibitions) and guided group tours in permanent exhibition. In addition to this, there are also multimedia and CD-rom presentations which can be used in an auditorium (seating 200) or in a mediastudio (for small groups). There are also tourist services like information centre and a shop specialised in natural products and local handicrafts.

In serving visitors, Metsähallitus is assisted by Friends of Ukko-Koli, the organisation supporting the visitor centre. This association organizes guided tours and school camp services.

The permanent exhibition at Ukko deals with the Koli region's geology, nature and culture. In the following, there is the core contents of the exhibition mentioned:

- Koli – a national park dedicated to the preservation of highland nature
- How did Koli become Koli? (The geological events which resulted the formation of Koli hills and area)
- Milestones in geological history
 - Foundation for vegetation
 - Rocks resistant to weathering
 - Soil fractions
 - Rocky peaks, valleys, cliffs
 - Ice age footprints, e.g. esker islands
- Biodiversity of the nature of Koli
 - Packed snow
 - Warm slopes with rock outcrops
 - Luxuriant herb-rich forests
 - Esker islands
 - Birchwoods of former swidden sites
 - Valuable flora of forest clearings
 - Old, near-natural forests
 - Finer points of local climate
 - Koli's location in terms of plant geography
 - Natural treasures of Koli (flora & fauna)
 - Tracking down animals

- Time journey “through millions of years”
 - Geological history
 - Settling the Koli
 - Way of life on Koli
 - Heritage landscape
 - Conservation
 - Tourism

The exhibition consists mainly of information boards and posters. There are lot of maps, for example about bedrock and soil (Fig 5), and colourful figures illustrating geological phenomena (Fig 6). There are also photos and some samples of rocks shown (Fig 7). The amount of information is huge.

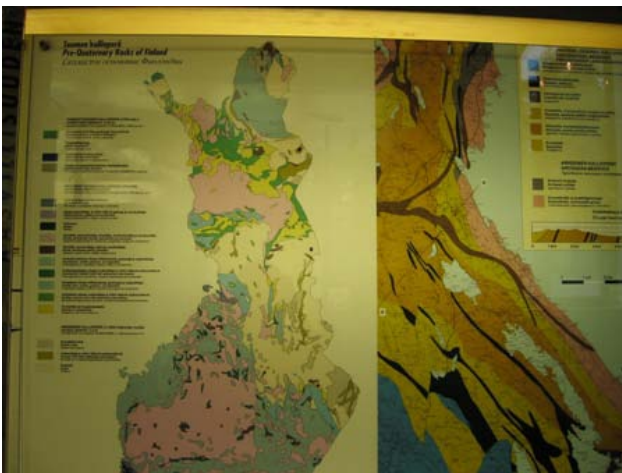


Figure 5



Figure 6



Figure 7

Educational programmes for school groups

In addition to the services in visitor centre Ukko, there are several educational programs for the school groups in Koli. The school groups can choose between 25-30 different guided school camp programs, which are organised by several local companies and also the association Friends of Ukko-Koli. There is a school camp coordinating service, which helps teachers to plan and organize a study visit or a school camp. In Koli area there are many supporting services available, like accommodation, restaurant services and nature activities.

Some of the school camp programs involves adventure and sports (like wilderness survival skills or traditional games, riding, downhill skiing or rapids shooting), while some of them deals with the contents of geology, history and culture. For example, "Koli as seen by artists" features Koli national landscape through the eyes of Finnish artists. According to the Koli websites, the programs "are interactive and include games and stories, observation and recognition".

In addition to the guided programs, there are four different educational trails in Koli. These thematic trails are the following:

- Kolinuuro circuit, 3,5 km, with the theme of geology
- Slash-and-burn circuit, 5 km, with the theme of burn-beating
- Shepherd's trail, 2,6 km, with the theme of groves and forests
- Nature restoration trail, 3 km, with the theme of protection and management.

For each trail, there are educational materials like trail guides, teacher's guides and exercises for students. The exercises exist both for students of basic school and upper secondary school. The materials are free to download in the internet.

The trail and the program doing most the geology is Kolinuuro circuit, called also as "Geological Time Travel in the National Landscape". The trail features how the Koli national landscape has been formed by geological phenomena. The areas different rock types are also identified. It's possible to take a guided tour (about 3 hours) or to walk the trail without a guide. Besides the educational materials for schools groups, there is on sale a map and a guide booklet of the geological trail.

The Kolinuuro circuit trail follows the Koli geological route, and there are 13 information boards along it. The information boards give visitors an overview of the bedrock and soil in the Koli area. There is also information about the nature of the area. The topics of the information boards are the following:

1. Snowy hilltops (e.g. taiga forest zone, crown snow)
2. Crown snow load shapes the landscape of the hills (e.g. snow damages)
3. Chronicles of the landscape (e.g. the Karelids, bedrock, quartzite, esker islands)
4. The circle of life and death (e.g. the fauna)
5. Kolinuuro – a former natural meadow between the hills (e.g. peat, Natura 2000)
6. Pieni-Koli hill and the ancient upheavals (e.g. archaic rocks, dyke rocks, ravine valley)
7. Kolinuuro – a natural mire (e.g. bogs, peatland types, restoration of natural areas)
8. Rich moraine and slash-and-burn soil (e.g. moraine, drumlin, slash-and-burn agriculture)
9. Erosion – a threat to the trails on the hills (trail structures and erosion)

10. The birth of the Koli bedrock (e.g. folding, weathering, cyanite)
11. Paha-Koli hill and the court stones (e.g. sacrificial crack, court stones)
12. Traces of a glacier in the rock (e.g. ice ages, glaciation, traces of a glacier)
13. The national landscape of Koli – elements of nature (e.g. lichens, Karelianism, national landscape)

In the teacher's guide there is information about these mentioned themes, and in addition some information about national parks in general. There are questions ready to settle to the students in the teacher's guide. By using the information contents of the teacher's guide, a teacher can organize a study visit to the geological trail Kolinuuro circuit.

4. The comparison between learning opportunities provided by pilot learning environments and the national core curricula

Since the NEED-project encompasses the environment and geological knowledge, the curricula's value of preservation of environmental viability is in the focus also in the project. In NEED this environmental viability includes nature conservation and environmental protection, but besides that, it goes further towards to the sustainable development, where both ecological, economical and social attributes are taken into account. Promoting responsibility is also important in NEED, after all the project deals with environmental education.

When considering the other underlying values of the education, we can see the pilot visitor centers as useful tools to transfer cultural tradition, to augment knowledge and to increase awareness of the values and ways of acting that form the foundation in society.

The special local attributes mentioned in the curricula are important especially in Juuka municipality, where the stone industry and culture of working with stones are in a significant role. In Juuka there are traditions for soapstone fireplaces and also for ceramics with the speciality of "ceramic lace". This cultural heritage is visible also in the upper secondary school of Juuka, which has been specialized in art and design since 2001. A student can take up to 12 different courses in which for example stone, clay, birch bark and soapstone are used as material. This is an example of transferring cultural tradition, and creating new culture.

The upper secondary school has also cooperation with Tulikivi Corporation. There is one new multidisciplinary course developed dealing with stone, especially soapstone. The course is directed to all students and it's organized together with the Tulikivi company. The course combines the subjects of visual arts, geography, physics and history. Also social studies and knowledge of working life are included. This special course proves that stone has special cultural and heritage points in Juuka municipality.

Cultural identity and cultural heritage relates strongly also to Koli. The view from Koli hills is one of the national landscapes of Finland, and its role in constructioning the national spirit has been significant, especially in the turn of the 19th and 20th centuries. At that time, Koli was a source of inspiration for several national artists like Jean Sibelius (composer), Eero Järnefelt (painter) and I.K. Inha (photographer). In Koli, information about this cultural

tradition and heritage is presented in the Ukko's exhibition and in the educational programs. One of the educational programs has the theme of art and cultural heritage.

The learning conception presented in the curricula and the definition of learning environment give the frame and ideas how learning in the pilot learning environments should be organised. They also give some framework to building or renewing the learning environment itself.

According to the curricula, the objective is that learning environment increases pupils' curiosity and motivation to learn, and promotes their activeness, self-direction, and creativity by offering interesting challenges and problems. The learning environment must also support interaction between teacher and pupil, and among the pupils. It must promote dialogue and guide the pupils in working as members of a group. The objective is an open, encouraging, unhurried, positive atmosphere, for whose maintenance the teacher and the pupils share responsibility.

The both target visitor centers offer interesting challenges to increase the pupils' curiosity and motivation to learn. Comparing to normal class room, both places multiply the diversity of the learning environments by offering different constructed learning environments. For example, they fulfill the idea that in the learning environment attention must be given to the aesthetic qualities. The exhibition of Finnish Stone Center is colorful and varied. The special atmosphere is made by using lights and different furnishing materials, especially in the cave for multimedia presentations and in the lava cave. In addition to the exhibition, Koli national park offers also the natural environment with lot of open space, nature, geological features and a national landscape with a famous view.

What comes to the point that learning environment should promote activeness by offering interesting challenges and problems, these target environments have still something to improve. The curricula emphasize interactivity, and also cooperative interactivity. Both in Stone Center's Geo Knowledge Center and in Koli's visitor centre, taking into account these mentioned approaches is one of the main tasks in the future. The exhibitions in both visitor centers are mainly based on the posters on walls. As mentioned earlier, especially concerning the exhibition in Koli, the amount of information is huge. The enormous amount of knowledge doesn't make learning and information seeking very easy. As pilot visitor centers offer lot of information, they could be named as information environments. In addition to knowledge, in learning there should be also skills and experiences involved. In the Stone Center there are lot of objects in order to illustrate the themes, and both places have several multimedia presentations, but the rate of interactivity in exhibitions is low.

These mentioned characteristics of learning environments relate also to working approaches and methods. In this context, the exercises provided by pilot visitor centers are considered. The curricula emphasize an investigative and problem-centred approach, especially in environmental and natural studies. Learning should be an active and goal-oriented process that includes independent or collective problem-solving.

The exercises of the geological trail in Koli base on filling a worksheet. Most of the exercises are multiple choice questions, also those which are directed to the upper secondary school students. Thus they don't motivate much to problem solving or processing the knowledge. There are only few open questions. The answers are found by reading the information boards or are being taught by the teacher.

With a guided tour in pilot visitor centers, the learning experience is more satisfying. Both the Finnish Stone Center and Koli national park have educational programs, which include tasks for pupils to make. In these exercises, the curriculum's principles of learning approaches come true more surely.

When considering the contents of the curricula and the pilot visitor centers, their compatibility is good. The exhibitions in both visitor centers have themes that are included in the curricula. The NEED themes link easily to both visitor centers. In Koli, the theme of landscape is the most obvious, while in Stone Center the theme of geological materials in society is the most relevant. Also rocks and geological processes and phenomena connect clearly to both visitor centers. Also the theme of climate change can be included in both places.

The structure and the content of the curricula are particularly taken into account in the Finnish Stone Center's exercises. The Stone Center has a wide range of exercises which are widely linked to the subjects of basic education. Besides geology, there are for example environmental and natural studies, history, physics and arts involved in the exercises. The exercises foster also transferring cultural tradition, cultural identity, internationalism and environmental awareness. Also the skills like acquisition and processing of information are contributed. The links to the subjects and the national core curriculum are shown clearly in the exercises in order to help a teacher to connect the study visit and exercises to normal school work.

In order to illustrate the Stone Center's exercises' multiple links to the different subjects, here are some examples about the exercises of the theme 'History of using stones':

<u>Subjects to link or skills to contribute</u>	<u>Exercises</u>
History + art	Watch the video about the rock paintings. To where, why, how and when these paintings were made? What kind of figures there are? Sketch some figures.
Architecture + history + internationalism + acquisition and processing of information	What are nowadays globally the most well-known stone buildings and structures made of stone? Make a presentation or exhibition about the buildings.
Future education, problem-solving	Design an important international stone building for the needs of the future. Think first what are the needs of the future.

To improve still the learning opportunities in target environments, the idea of including interactivity also into exhibitions is expressed. Among the staff of Koli national park, there are desires and ideas to revise the Ukko's permanent exhibition but not yet any concrete plans or funding. There are also some needs to develop existing exercises, especially in Koli. In Stone Center it might be useful to have some more detailed instructions or guides to teachers and also some worksheets for students. These are the main things to concentrate on in the NEED project's WP3 and WP4.

Appendix: Comparison between National Core Curriculum for basic education and study modules developed by University of Joensuu, NEED-Finland

A) Study module “Rocks around us”

Activities / tasks in the learning process:

Topic orientation: use of rocks

1. Mind-map about the use of rocks
2. Observation: The use of rocks in everyday life environment
3. Stone buildings and monuments
4. Rocks in interior decoration

What kinds of rocks exist?

5. Inquiry: Examining the structure and exterior features of rocks
6. Deduction: Rock types

What are minerals?

7. Inquiry: Examining the features of minerals
8. Problem-solving: The use of minerals

Where are rocks used and what is their significance?

9. Problem-solving: The use and deposits of soapstone and granite
10. Problem-solving: Defining the use of geological materials
11. Sustainable use of geological materials
12. Geology as a career: What does a geologist do
13. Cultural aspects, rock paintings
14. Rocks and geological materials belonging to the home area

Summary and assessment

15. Summary of the use of rocks
16. Self assessment

Activities 1-2 are to be made at school, activities 3-10 at the Finnish Stone Center, 11-13 at school **or** at the Finnish Stone Center, and 14-16 at school. Activity no. 3 is started at the Finnish Stone Center and finished at school.

Study module Rocks around us

NEED themes:

4) Geological materials and their sustainable use: activities 1-4, 8-15

1) Elements of geology: activities 5, 6, 7

Target group: 5-6 graders, 9 graders

Subjects: Physics and chemistry (5-6 grades), Chemistry (7-9 grades), Geography (7-9 grades)

Curriculum competence by subjects and grades:

Curriculum competence	Subject	Grade	Activities
Substances around us: Origin, utilization, and recycling of products and materials belonging to the living environment	P & C	5-6	2, 3, 4, 6, 8, 9, 10, 11, 14, 15
Making observations and measurements, looking for information on the subject of study, and to weighing the reliability of the information	P & C	5-6	2, 3, 5, 7, 13, 14
Making conclusions about one's observations and measurements and recognizing the causal relationships associated with the properties of natural phenomena and objects	P & C	5-6	4, 6, 8, 9
Carrying out simple scientific experiments clarifying the properties of phenomena, organisms, substances, and objects	P & C	5-6	5, 7
Raw materials and products: key elements and compounds to be found in the earth's crust and their properties, and the manufacture, use, sufficiency, and recyclability of products	C	7-9	10, 11
Earth - the human being's home planet: the planet's internal and external events	G	7-9	6
The common environment: the human being as a consumer of natural resources	G	7-9	2, 3, 4, 8, 9, 10, 11, 13, 14, 15
Supporting the pupils' growth as active citizens committed to a sustainable way of life	G	7-9	11
Cross-curricular theme Responsibility for the environment, well-being, and a sustainable future		1-9	11
Cross-curricular theme Cultural identity and internationalism		1-9	13
Learning skills		5-6, 7-9	1, 16
Working skills (simple scientific experiments)		5-6, 7-9	5, 7
Problem-solving skills		5-6, 7-9	8, 9, 10
Visual thinking and expression skills		5-6, 7-9	4
Social and group working skills		5-6, 7-9	5, 6, 7, 8, 9, 10

B) Study module “Koli landscape”

Activities / tasks in the learning process:

Topic orientation at school before the visit:

1. Picture analysis: Elements of the landscape
2. Finnish landscapes
3. Different landscapes in different parts of Finland
4. Classifying landscapes, concept of landscape
5. Aesthetic values of landscapes
6. National landscapes
7. Koli as a national landscape

At the Visitor Centre of Koli National Park

8. Short orientation on the topic of landscape
9. Maps representing landscapes
10. Problem-solving: How and why landscapes form and change?
 - a) Natural processes shaping the landscape
11. Illustrating geological time using a rope
12. How and why landscapes form and change?
 - b) Humans changing the landscape
13. Looking to the future: Koli landscape in 100 years' time

Guided field trip at Koli

14. Repeating geological processes that form, reshape or change landscape, investigating how they can be seen in the landscape
15. Interpreting geological maps and figures
16. Making observations about changes in the landscape
17. Developing a positive relationship with the environment
18. Koli National landscape

At school after the visit

19. Visual arts: Koli landscape, memories of Koli
20. Landscapes of the home region

Activities 1-6 are alternative and optional. The teacher may choose suitable exercises for his/her class, depending on previous studies.

Study module Koli landscape

NEED themes:

2) Landscape: activities 1-9, 12-14, 16-20

1) Elements of geology: activities 10, 11, 14, 15

Target groups: 5-6 graders, 7-9 graders

Subjects: Biology and Geography (5-6 grades), Geography (7-9 grades)

Curriculum competence by subjects and grades:

Curriculum competence	Subject	Grade	Activities
Learning to move about in the natural environment and observing and investigating nature outdoors	B & G	5-6	14, 15, 16, 17, 18
Developing pupil's environmental literacy	B & G	5-6	12, 14, 16
Interpreting maps	B & G	5-6	9, 15
Using pictures as sources of geographic information	B & G	5-6	1, 2, 3, 4, 9, 12, 20
Learning to use and interpret physical and thematic maps and to use other sources of geographic information, such as photographs	G	7-9	1, 2, 3, 4, 9, 12, 15, 20
Coming to understand the effect on the landscape of factors that reshape the earth's surface	G	7-9	10, 14, 15, 16
Finland's map view and landscape	G	7-9	2, 3, 6
Coming to know and value Finland's natural and built environments; learning to perceive one's own regional identity	G	7-9	2, 3, 5, 6, 18, 20
Cross-curricular theme Cultural identity and internationalism		1-9	6
Problem solving skills		5-6, 7-9	10, 11
Visual thinking and expression skills		5-6, 7-9	19
Group working skills		5-6, 7-9	1, 4, 7, 9 -12, 20
Skills to evaluate the environment from the aesthetic perspective		5-6, 7-9	5
Supporting the formation of the pupil's own cultural identity		5-6, 7-9	2, 3, 6, 7, 18, 20