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Let's Go GeoExploring

PROJECT SUMMARY AND RECOMMENDATIONS FOR NATIONAL EDUCATION SYSTEMS

Young European GeoExplorer

IMPROVING ENGLISH CONNECTED WITH NATURAL SCIENCES, GEODIVERSITY AND CULTURAL HERITAGE

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ERASMUS+: KA220-SCH- Cooperation partnerships in school education

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1. INTRODUCTION

Welcome to the Young European GeoExplorer project – an innovative initiative aimed at enhancing high school education by integrating natural science and language learning through the Content and Language Integrated Learning (CLIL) method. Co-financed by the EU Erasmus+ Programme, this project brings together partners from the UNESCO Global Geoparks Network and local schools to transform teaching practices and educational experiences.

The project's primary goal is to develop new services in geoparks and innovative teaching methods for teachers and staff in educational organizations. By harnessing the power of CLIL methodology, the project seeks to address the evolving needs of schools and teachers, offering an engaging approach to science and language education.

Through collaboration with schools, the project aims to highlight the importance of sustainable development and serve as a model for broader educational integration. By gathering information from teachers, studying existing curricula, and developing high-quality teaching tools and methodologies, the project strives to promote cross-curricular integration and enhance teacher competence and confidence.

Throughout this project, collaboration between UNESCO Global Geoparks, schools, project partners and stakeholders in the educational field has been instrumental in providing students with hands-on learning experiences. The project's results will be shared through various platforms, including the Erasmus+ Project Results Platform, eTwinning portal, and School Education Gateway, ensuring widespread dissemination and accessibility.

As we embark on this journey together, let us embrace the opportunities that the Young European GeoExplorer project presents to transform education and inspire the next generation of learners.

2. PRESENTATION OF PROJECT PARTNERS

2.1. Styrian Eisenwurzen UNESCO Global Geopark

The UNESCO Global Geopark is located in the north of the Austrian province of Styria. With an area of 586 km2 it is the largest Nature park of Styria. Geographically, it is part of the Northern Calcareous Alps which constitute the northernmost mountain chain of the Eastern Alps. The landscape is dominated by mountains up to 1000 m, broad valleys of the main rivers Enns and Salza and deep gorges of its tributaries. The Cretaceous to Paleogene rocks of the Gams Basin are famous for their fossils and exposures of the Cretaceous-Tertiary boundary which document one of the major catastrophes in the history of Earth. Rivers have cut deep gorges into the limestone and in the conglomerates deposited at the Great Ice Age. Water seeping along the fractures has dissolved the rocks leading to the formation of caves and of springs some of them having enormous capacity. Among the protected caves a large gypsum cave, an Ice cave and a cave which has yielded cave bear remains and some remarkable 30,000-year-old artefacts.

Figure 1: Map of Nature- and Geopark Styrian Eisenwurzen (light green) and surroundings (Design: most-media.at)

The Styrian Eisenwurzen UNESCO Global Geopark is located in the Northern Calcareous Alps which is the northernmost mountain chain of the Eastern Alps. The landscape is dominated by mountains up to 1000 m in elevation, broad valleys of the rivers Enns and Salza with deep gorges of their tributaries. More than half of the area is covered by forests.

Ongoing research since the first half of the 19th century has accumulated a wealth of geological data of the region. It is one of the key areas for the tectonic interpretation of the Northern Calcareous

Alps. Mesozoic limestones and dolomites are the main rock types. The Middle Triassic Anisian stage (245 - 237 million years ago) was established in 1895 within the UNESCO Global Geopark area. It was named after the Latin name of the near-by Enns river. Of international importance is also the Gams basin with its Cretaceous to Paleogene sequences (90 to 55 million years ago). The basin has yielded fossil faunas of corals and molluscs including ammonites, snails, bivalves. Remarkable fossils include also reefs of rudists, a kind of sessile bivalves. On the landscape, moraines and river terraces are witnesses of the Great Ice Age. Intense karstification has resulted in the formation of remarkable caves and springs which are a major source for the water supply of the City of Vienna.

Figure 2: In deep gorges, with impressive conglomerate walls, the beautiful water of the Salza has made its way over time (Photo: Stefan Leitner)

2.2. Weissenbach Middle School

The Weissenbach Middle School is located in the municipalityof St. Gallen in the centre of the Eisenwurzen. A region that connects three states, Styria, Upper Austria and Lower Austria of Austria through common history and the will to manage the challenges of the future.

Responsibility for a world worth living in is taken on as an Austrian ÖKOLOG school through sustainable ecological approaches and activities in the areas of environmental protection, consumption and lifestyle, health promotion and the school as a living space. Within the framework of school autonomy, a focus on computer science and technology is offered.

Experimenting and research-based learning are central aspects of it. The secondary school is a place of learning that is committed to lifelike and action-oriented learning in the Eisenwurzen region. As a Nature Park school, the focus is on nature conservation, regional development and practical life education.

Our school would be nothing without all the people that bring the spirit of learning, living and joy alive. Keeping the needs of learners and teachers in mind, connecting knowledge with the aim to protect our environment and beeing an active part and partner of our community is the guideline of our work.

Figure 3: Weissenbach Middle School (photo: Weissenbach Middle School archive)

2.3. Idrija UNESCO Global Geopark

The Idrija UNESCO Global Geopark is situated in the western part of Slovenia, approximately 60 km from Ljubljana. It is located at the junction of the Dinarides and Alps mountain ranges. This has resulted in exceptional geoheritage of deep gorges where a variety of rocks have been discovered in remarkable stratigraphic cross sections, tectonic phenomena and mineral and fossil deposits. In addition, water contributes to the variety of the terrain with numerous features and water courses.

Figure 4: Location of Idrija Geopark at the junction of the Alps and the Dinarides

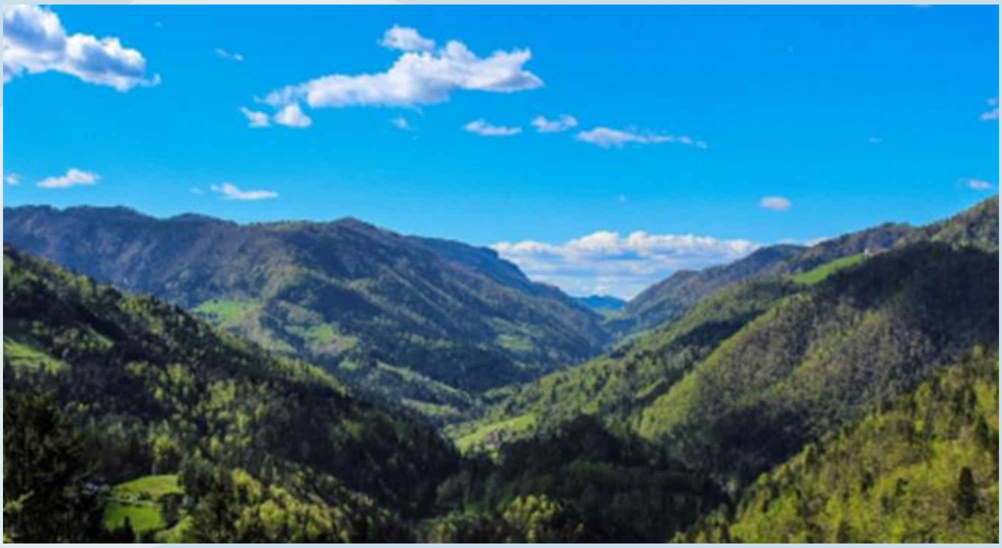

Figure 5: The Kanomljica Valley, which was formed along the Idrija Fault (Photo: Gregor Kacin, Idrija Tourism Board)

The extensive tectonic movements shaping the terrain within the Idrija UNESCO Global Geopark, began in the Anisian, lasting throughout the Triassic. The area's mercury ore deposits, supporting 500 years of mining, and now a UNESCO world heritage site, was formed during this period. Owing to complex tectonic events, the carbonate sedimentation was interrupted in the Upper Cretaceous, forming flysch rocks in the foreland basin. Due to extensive tectonics, the majority of contacts between the sequences of different Carboniferous to Paleocene-Eocene rock strata are tectonic. Most of the rocks are carbonates and clastic sedimentary rocks of Permian, Triassic and Cretaceous age. Outcrops due to Ladinian volcanism have been found in the western part of the UNESCO Global Geopark. Due to the pushing of the Adriatic microplate under the European plate in the Miocene, the terrain has a typical thrust structure.

Figure 6: Syngenetic sedimentary mercury ore (Photo: Jani Peternelj, Idrija Municipality)

2.4. Črni Vrh Elementary School

Črni Vrh Elementary School is situated on the scenic Črni Vrh plateau in the western part of Slovenia, near Idrija and Ajdovščina. Hosting 150 students from diverse regions within this karst highland, the school establishes a vibrant and successful learning environment.

The school's work is closely tied to its local environment, essential for fostering a strong and integrated community. With a dedicated staff of 30 professionals specializing in various fields, the school maintains a high standard of education. Through the compulsory school program, intertwined with various afternoon activities, students engage in extensive learning, contributing to their overall development.

Proudly part of the Slovenian Healthy Schools network, Črni Vrh Elementary School prioritizes the physical and mental well-being of its students. Holding the title of a Cultural School highlights its emphasis on cultural activities and artistic expression. Enriching school life with diverse activities, including astronomy, logic, history, Slovenian language, art, sports, natural sciences, and music, the school particularly excels in the cultural sphere.

The school's success stems from the dedicated efforts of its teachers, pooling their professional expertise to offer students a broad spectrum of knowledge and experiences. Beyond being an educational institution, Črni Vrh Elementary School serves as a community center, nurturing values, knowledge, and creativity, and fostering strong connections among teachers, students, and the local community.

Figure 7: Črni Vrh Elementary School (photo: Tadeja Bonča)

2.5. Magma UNESCO Global Geopark

Magma Geopark is situated in the south-western part of Norway consisting of 5 muncipalities: (Bjerkreim, Eigersund, Flekkefjord, Lund and Sokndal) in 2 counties (Agder og Rogaland). Magma Geopark has around 34.000 inhabitants and is 2327 square kilometers in size.

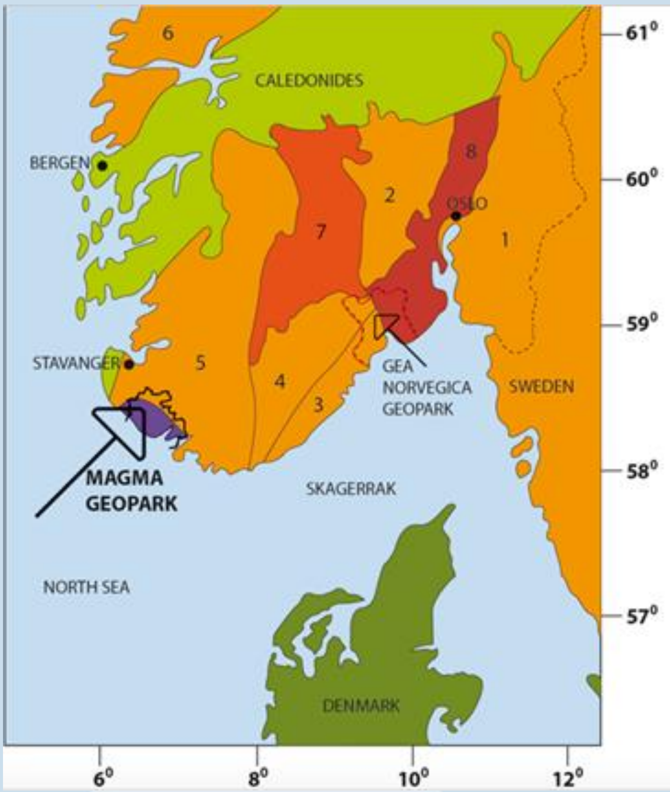

Figure 8: Magma Geopark is located along the southwestern coastline of Norway

The name Magma Geopark refers to the origin of most of the geology in this area, namely magma. The entire area has been shaped by molten rock, deep within the Earth approximately 930 million years ago! Large portions of this magma crystallized over an extended period, forming the rock type anorthosite. In an international context, this is a rare rock, yet everyone has seen it – that's because the bright parts of the moon consist precisely of anorthosite. Predominantly consisting of ancient igneous rocks formed about 930 million years ago, the area features unique geological formations, including large bodies of anorthosite.

The region underwent significant glaciation during the Quaternary, leaving diverse geological features, including the largest layered intrusion in Western Europe. The geological timeline spans the

Proterozoic Eon, with distinct eras and periods. The Magma Geopark also bears evidence of human history from the Stone Age to World War II, influencing its landscape.

The Geopark's classification includes "geosites" and "geopark localities," with 89 geosites and 58 geopark localities selected based on geological, cultural, and natural values. These are categorized by their regional, national, or international significance, primary use (Geotourism, Education, Science), protection status, accessibility, threats, and additional information.

Figure 9: Eigerøy Lighthouse with the North Sea as background is situated in caracteristic anorthosite landscape (photo: Magma Geopark Archive)

Figure 10: The Brufjell Cave is a popular geological destination (photo: Magma Geopark Archive)

2.6. Flekkefjord Upper Secondary School

Flekkefjord upper secondary school is located in the southern part of Norway. It is a medium size school with about 400 pupils from 16 - 19 of age. There are approximately 60 employees at the school. The school offer different professional educational alternatives us carpenter, industrial process, electrician, and aquaculture. Close to the school, we have the marine and maritime teaching hub from where the pupils can visit several aquaculture facilities both sea-based and on land. Flekkefjord is a town with about 4000 inhabitants. Many pupils are from the countryside around the town.

UNESCO Geopark Magma have recently established a collaboration with Jøssingfjord science museum, located 1 hour from the school, who offer insight into geological relevant teaching activities for the pupils.

In the aquaculture educational program, the goal is to give the pupils relevant teaching through close collaboration with businesses. The pupils are therefore weekly visiting professional actors. At the end of the studies around half of the pupils decide to go to work as a trainee, meanwhile the rest of the class often decide to continue with higher education proposal. Our success rate for pupils that start and fulfill upper secondary school in Flekkefjord are around 99%.

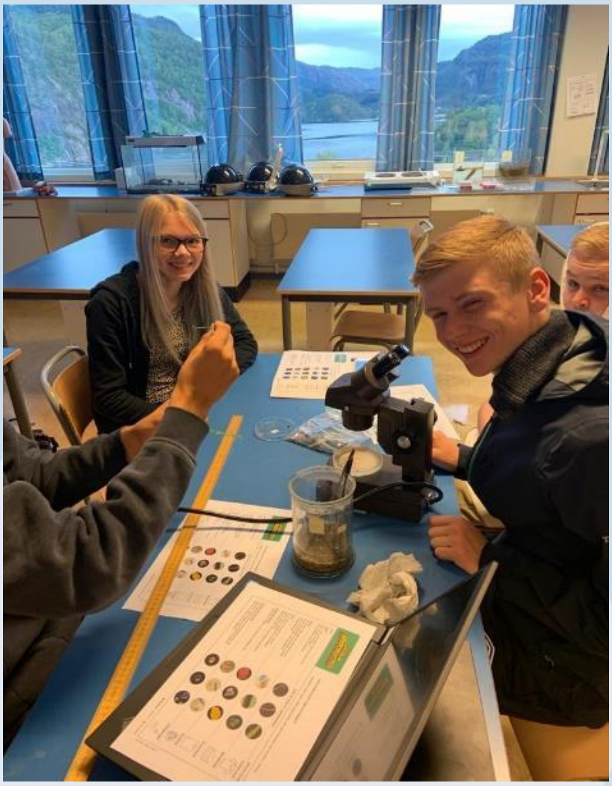

Figure 11, 12, 13: Flekkefjord upper secondary school (photo: Flekkefjord Upper Secondary School Archive)

2.7. Odsherred UNESCO Global Geopark

Odsherred is a region in Denmark, covering about 355 square kilometers. It's a bit more than an hour's drive from Copenhagen, the capital of Denmark. The area has three hilly parts, offering some of Denmark's most steepest hills. Other areas used to be covered by the sea. Odsherred is surrounded by sea on three sides, with bays, open water, and fjords, making beautiful beaches.

Figure 14: Vejrhøj, the top of Odsherred, 121 meters above sea level, sits at the top of an old terminal moraine (photo: Claus Starup)

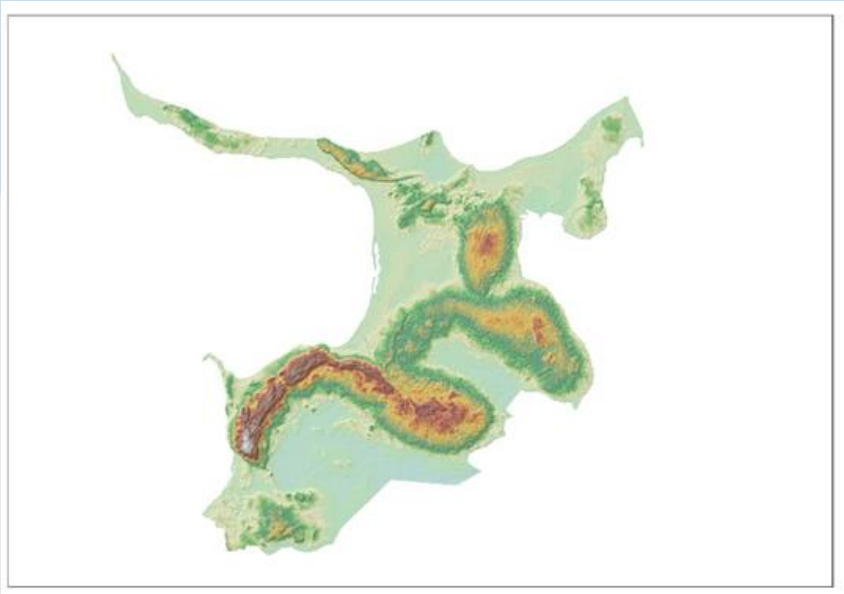

Figure 15: Terrain model of Odsherred, clearly showing the most dominant features of the area, especially the three major terminal moraines (photo: Gepark Odherred Archive)

Odsherred's deposits is mostly of recent geological periods. It has three major hills, forming huge arches. The biggest one is the Vejrhøj arch, near a flat area called Lammefjord. Coastal areas show active processes shaping the land, e.g. spits, isthmuses, and barrier islands. The area shows classic glacial landscapes with hills, depressions, meltwater outlets, and plains. Some places have unique geology that researchers are studying, like Klintebjerg, Trundholm Bog, and Sidinge Fjord. Odsherred used to be an archipelago, e.g. islands and a peninsula up until 150 years ago. It has a diverse landscape with low-lying and high-lying areas, creating a contrast near the sea. An interesting fact is that a part the Lammefjord area has the second lowest point in any reclaimed area in Northern Europe, almost 7.5 meters below sea level.

Figure 16: Ordrup Promontory yields true cliffs and geology older than mainland Odsherred (photo: Claus Starup)

2.8. Asnæs School

Asnaes School is located in the southern part of Odsherred. It is a medium size school with about 400 pupils from 6 - 16 of age. There are approximately 60 employees at the school. The school has two tracks from 0-9th grade and there are about 20 pupils in each class. Close to the school, we have different sport facilities. The town is nearby with its museums of art, library and a mall with all kinds of shops. Asnaes is a town with about 3000 inhabitants. Many pupils are from the countryside around the town.

Nature and Unesco Geopark Odsherred are close to the school and we can easily work with topics related to the geopark and get out in the field to do so.

Well-being, joy and diversity are the foundation of a learning environment, where we work to ensure that each child receives a high academic benefit and a broad, social and cultural understanding. At Asnaes School, learning and well-being go hand in hand.

At our school, the learning environment and interaction are characterized by recognition, mutual respect and co-determination between active and engaged students, parents and teachers.

Our most important task is to educate socially and academically competent children to become capable people who take responsibility for themselves and others.

Figure 17, 18: Asnaes School (photo: Asnaes School Archive)

3. PRESENTATION OF INTELLECTUAL OUTPUTS

3.1. Review of (cross-)curriculums, existing tools and materials used in natural science teaching

General introduction

This first output of *Young European GeoExplorer* has the role of creating a common framework for the development of a toolkit (IO2), cross-curriculum activities and new teaching methodologies implementation (CLIL) (IO3).

Methods

Different methods were used in order to provide the needed data, and the work package altogether comprised three different tasks. These tasks were carried out and implemented by each partner geopark in close cooperation with personnel from each of their partner schools. The tasks were:

- Desktop curriculum analyses
    - Four analyses were made. The analysis of Slovenia and Norway are a product of the project *ESTEAM Enhancement of school teaching methods*, whereas the analyses of Austria and Denmark have been made for this project
- Questionnaires
    - After close consideration, only one questionnaire was produced. This included the following topics
        - General introduction
        - Teaching method experience
        - Outdoor teaching and equipment
- Focus group interviews
    - Focus group interviews were conducted in four schools, one in every geopark involved in the project. Interviews were conducted in the local language and afterwards transcripts were translated into English

Conclusions and deliverables

The data provided from the different tasks provided deep understanding of teachers needs and (cross-)curriculums in a participating country, especially when it comes to differences in the existing curriculum and cross-curriculum integration, tools and props teachers use in-class and out-of-class for teaching natural science, English teachers view on the CLIL method and natural science topics, as well as it sheds new light on the teachers' needs, which again needed to be identified before the preparation of the project O2.

Output 1 ended up consisting of an array of tangible deliverables:

- 4 desk research report for the participating country

- 2 online questionnaires for science teachers and English teachers
- 2 short reports with the results of questionnaires for all partnership
- 4 national Focus groups report on the review the materials, tools and props for natural science teaching and languages
- 1 joint document with the

a) review of the curriculums
b) cross-curriculum integrations
c) review of the current tools and profs for natural science teaching
d) understanding of the acquaintance with CLIL methods in natural science

The different reviews and especially the cross-curriculum integrations seemed to indicate the following:

- Severe cultural differences
- Geoscience is under-prioritized
- Limitations to transferability
- National curricula do not equal reality
- Few true cross-curricula integrations
- Limiting factors are clear and well defined
- Lack of written didactic materials
- Need for structural change in schools for CLIL to be fully implemented

As for the methods of the output 1, as for the actual result and deliverables of the output; the magnifying glass seemed to be the one thing teachers across the lined asked for – in more sense than one; the word cloud made from results of the questionnaires clearly indicates that the need for instruments and materials are dire. But also, that the teachers, in their daily work, struggle to find a way to incorporate geology and geoscience. Many barriers collide with rules and everyday work and CLIL might be the solution, if properly incorporated.

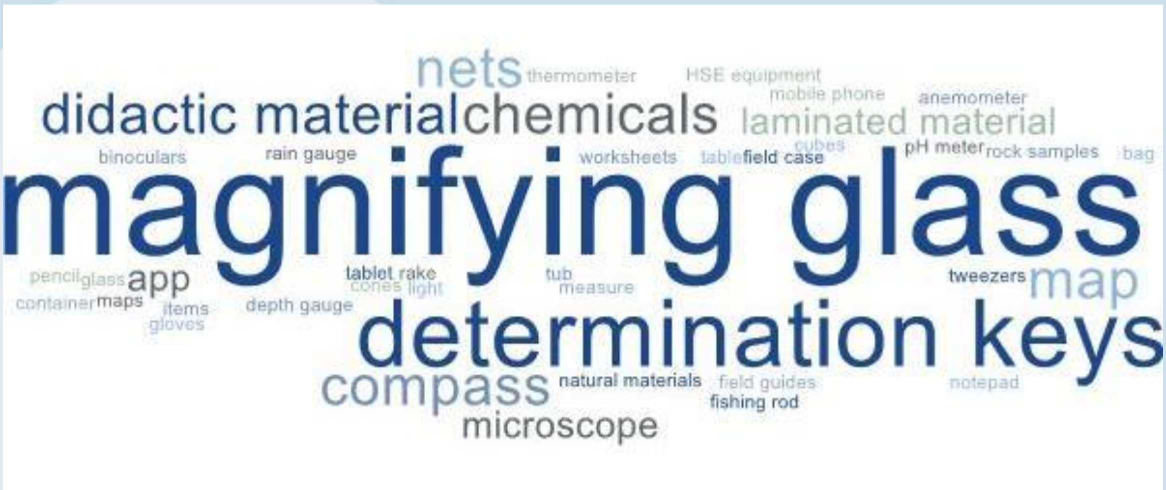

Figure 19: Word cloud -The most common tools used by teachers when they teach outdoor

3.2. Young European GeoExplorer Toolkit concept and examples

General introduction

The idea behind the second output was to develop the so called "GeoExplorer Toolkit". A box filled with all the materials and props necessary for good practical teaching of geology, incorporating natural science, geoscience and language teaching. Students should learn more about geoparks and their region as well as other examples from the other geopark partners. Teachers and guides can use the toolkit both in the field as well as in the classroom and find everything for a good thematic lesson preparation, excursion tools or classroom games. Four prototypes were assembled and are there at the geopark partners to be taken in action and other geoparks and schools can reproduce them.

Methods

Each of the four geopark project partners delivered a specific geopark description including important facts about the area, its nature and (earth) history. Further a short profile of UNESCO Global Geoparks complements the information of individual Geoparks. In a next, step questionnaires were collected from nature educators and geopark rangers, to evaluate the needs of this group in the field of geology teaching, comparable to teachers surveyed under Output 1. The process of the "GeoExplorer Toolkit" development was accompanied by workshops during project meetings including one workshop on nature education and 2 workshops to create a concept paper (Fig. 1). Finally, the concept was implemented with the production of 4 "GeoExplorer Toolkits" filled with the typical tools of a geologist, safety equipment, stone samples and teaching material in one trolley, divided in an outdoor and a classroom compartment.

Figure 20: Workshops on nature education and the toolkit concept were held.

Conclusions and deliverables

All Geoparks have their own specific earth and cultural history, a remarkable fauna and flora and unique geology. Through the description of the four partner geoparks they become a model for geology teaching and pupils in the respective area get connected with their region and learn general school topics with a lot more focus on their surroundings. Teachers, guides and students are more aware of the Global Geopark Network through the delivered material. The descriptions are the basis for further didactical and target group related documents in Output 3 including content and language integrated learning (CLIL) as well as in Output 4 in the recommendations for stakeholders.

Information on nature education was gathered by the partners. The survey among nature educators, rangers and guides of different protected areas and geoparks shed light on the needs of this target group when it comes to geology education. For instance, we found out that most commonly used tools of the participants are magnifying glasses, compasses, hammers, maps, hydrochloric acid and cups (Fig. 2). Next, they were asked which tools they would like to have in a geoscience toolkit with most responses for a rock identification key, second a map equal with a magnifying glass, followed by rock samples. The educational programs of the participants were gathered, clustered and associated with the fields of Geosciences, Biosciences and Humanities in a Venn diagram showing that participating nature educators, rangers and guides have many bioscientific programs, many of which incorporate geoscience and humanities (Fig. 2). A comparison to teachers (from Output 1) was drawn where applicable.

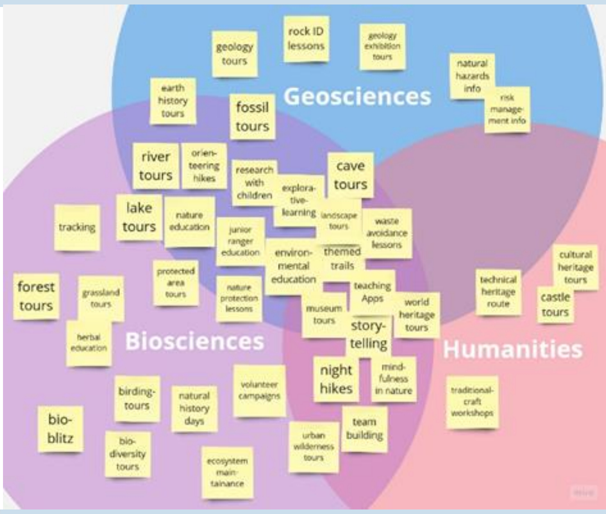

Figure 21, 22: Visualized survey results from nature educators, rangers and guides. Word cloud with tools used for their programs. Venn diagram with offered programs linked to biosciences, geosciences or humanities.

From the information gathered in both surveys, the workshops and project meetings the concept for a GeoExplorer Toolkit was developed. The kit itself was chosen as a trolley as it became clear that all the contents became too heavy for easy carrying. The trolley is further devided into two sections: An outdoor toolkit part, separable from the rest, ready for the field and a classroom or indoor toolkit with space for printing materials, educational games, didactical material and samples, easily rollable to the classroom. The outdoor toolkit contains safety measures (helmet, gloves, safety glasses) for fieldwork and as illustrative material of best practice for teachers/guides. It further includes a geological/paleontological hammer, a compass, magnifying glasses, a Geiger counter and a folding spade. The indoor toolkit in turn is filled with GeoExplorer memory games and an accompanying booklet about partner geoparks including culture, nature and landscape. A 50-meter measure tape as geological timeline called "GeoExplorer time meter", GeoExplorer stone samples (9 from the corresponding geoparks region, 3 samples from the other partner geoparks), material and instructions in printed form and on USB flash drives for further copying and reprinting. For studying and identification of own samples or the GeoExplorer stone samples, a USB-Microscope for children, UV-light, diluted acid, GeoExplorer rulers and a Moh's hardness scale are included. To conclude, with this kit on hand, tools and props are no limiting factor for good geological education anymore! The four prototype toolkits (Fig. 3) remain at the four geopark project partners and can be borrowed for free by schools and nature educators. The intention is to roll out the GeoExplorer toolkit to other schools and geoparks in other regions across Europe. All sources of contents are open for the public and are there for proliferation!

Figure 23: GeoExplorer Toolkit prototype (Eisenwurzen), the separable outdoor toolkit in the upper section, the classroom toolkit trolley with drawers below. Filled with stone samples, tools and teaching props.

Output 2 lead to following tangible deliverables:

- 4 geopark documents about specific regional geopark information
- 1 geopark document about general geopark information
- 4 documents about nature education in the representative geoparks and useful tools
- 1 joined document on the above-mentioned deliverables
- 2 meeting reports (one from the concept paper meeting and another from the nature education meeting
- 1 concept paper for the “GeoExplorer Toolkit”
- 4 completed toolkits with geology tools, stone samples, classroom props and teaching material

3.3. Young European GeoExplorer cross-curriculum activities and new teaching methodologies implementation (CLIL)

General introduction

Output 3 in Young European GeoExplorer has the role of creating so-called cross-curriculum activities based on the new teaching methodologies implementation (CLIL= Content and Language Integrated Learning). The main deliverables were therefore two guidelines per geopark with tours description, competence goal for English and natural science subjects and indication about the use of the GeoExplorer Toolkit developed during Output 2. The target groups for guidelines were the lower secondary school and upper secondary school pupils. For the geoparks the guidelines had as target group the geopark rangers and the visitor and tourists. The overall goal of those guidelines for teachers and geopark rangers were to stimulate outdoor multidisciplinary teaching locally and take in use the tools provided by the GeoExplorer Toolkit.

Methods

In the third output we developed exercises for outdoor activities where English was implemented in the teaching of nature sciences, geodiversity and cultural heritage. The exercises should be connected to the local (national) curriculum.

Each geopark developed minimum 2 outdoor activities together with the local schools involved in the project.

The activities should meet the following points (A1 – A5)

A1: Cross-curriculum material for pupils

A2: Guidelines for pupils

A3: Cross-curriculum material for Geopark management and teachers

A4: Guidelines for teachers and guides

A5: Cross curriculum connection

Geoparks and the local school representant started therefore to develop deliverables for A1 by reviewing school curricula relevant for the age and subjects relates to this project. After that Geopark made a template (Annex 1) implemented with all the relevant fields necessary to perform the guidelines. The templates were presented to all the project participants (geoparks and school teachers) in order to gain feedbacks and do the necessary adjustments.

After agreeing to the template for the cross-curricula activity we started a group work were geoparks and teachers was divided according to their geographical location with the task to brainstorm and fulfill the content of the two guidelines. Questions and needs for clarification that emerged during this work were shared during the workshops.

In this way we worked effectively and were able to share our experiences and thoughts in a constructive way. When cross-curricula activities guidelines were finalized the geopark in charge for this Output 3, Magma Geopark, quality checked the content of each delivered outputs and reported the status to the project manager.

Conclusions and deliverables

Experiences shared by teachers during the project workshop confirm that the biggest bottleneck for outdoor cross-curricula teaching is the effort necessary to prepare those educational activities. The output 3 served therefore as a catalysator to stimulate for those type of educational and dissemination activity by preparing in an easy understandable and relevant way the guidelines for local outdoors cross-curricula activity. Those guidelines should be seen as “living documents” that geopark rangers and teachers can update and implement in order to adapt to curricula changes and to sharpen the content accordingly to the experiences and feedback gained from visitors and pupils.

At the same time the output 3 overall goal were to give practice guidelines about how and when to use the new GeoExplorer Toolkit implemented in the Output 2. Each of the produced guidelines pinpoint therefore in a pragmatic way the role of those tools in the field activity and/or in the classroom activities at discretion of the teachers and geopark rangers.

The feedback from the users during the multiplier events will be a very important tool for quality assurance of the deliverables from the output 3 and the previous outputs and make the necessary adjustments. Those multiplier events raise also the opportunity to give ownership about the totality of the results from this project to other school teachers and geopark rangers.

The outcome 3 from this project is:

2 Guidelines pr Geopark (2x4) = 8 guidelines

4. DESCRIPTION OF GEOEXPLORER TOOLKIT

4.1. What is the GeoExplorer Toolkit?

The GeoExplorer Toolkit is a field trolley equipped with various educational aids designed for experiential learning of science and foreign languages. It can be used both for outdoor teaching and classroom activities. The GeoExplorer Toolkit is primarily intended for science and language teachers, employees in geoparks and anyone involved in conducting educational activities outdoors.

Figure 24: GeoExplorer Toolkit with tools and materials (photo: Irma Pivk, Idrija Tourism Board)

The field cart consists of two larger and two smaller drawers. The top drawer is detachable, allowing it to be used independently according to the needs of the task. The educational tools contained in the GeoExplorer Toolkit:

- mini collection of rocks with descriptions for teachers and students
- 10% HCl (hydrochloric acid)
- digital microscope
- geological hand lens
- geological hammer
- measuring tape
- geological compass
- geographical compass
- Mohs hardness scale
- Geiger counter
- safety helmet
- safety glasses
- memory game

The educational tools currently included in the GeoExplorer Toolkit are tailored to the content developed through the Young European GeoExplorer project. Each user can enhance the field cart with new educational aids according to their work needs. For example, a biology teacher could supplement it with tools necessary for conducting biological research, etc. Similarly, depending on the methodology of work, the field cart can be upgraded with content that integrates the learning of science and foreign languages.

When preparing content for activities using the field cart, it is recommended that the user utilize the form"Development of exercises for Geoexplorer outdoor activities" (priloga). This form guides users through all the key phases crucial for the successful implementation of activities. These include planning, execution, and evaluation of the activities.

4.2. Descriptions of educational tools

- MINI COLLECTION OF ROCKS

In a special box, there are 12 different samples of rocks from Idrija UNESCO Global Geopark, Oddshered UNESCO Global Geopark, Magma UNESCO Global Geopark and Styrian Eisenwurzen UNESCO Global Geopark collected. Descriptions of these rocks are included in the box, provided at two levels of difficulty – for students and for teachers.

The collection enables observation and study of rocks, understanding basic properties, and identifying them. When studying rocks, the following tools can be used: geological magnifying glass, microscope, hammer, 10% HCl (hydrochloric acid), ruler for measurement, etc.

Warning: When using the hammer and 10% HCl, it is necessary to observe safety regulations and use protective equipment (gloves, goggles, lab coat, etc.).

- 10% HCl (HYDROCLORIC ACID)

10% HCl (hydrochloric acid) is a solution of hydrochloric acid in water, with an acid concentration of 10%. Hydrochloric acid is a strong, colorless liquid with a very low pH and is highly corrosive.

10% HCl is commonly used in laboratory and industrial processes, such as the preparation of various chemicals, cleaning and removing oxidation from metal surfaces, and adjusting pH in different processes.

It is important to know that 10% HCl is a strong acid and can cause irritation to the skin, eyes, and respiratory tract. When handling it, appropriate safety measures should be observed, including wearing protective equipment, ensuring good ventilation, and handling it in accordance with safety guidelines.

- DIGITAL MICROSCOPE

A digital microscope is a modern version of the traditional microscope. Instead of looking through eyepieces, images of objects are displayed on the screen of a computer or other device. It operates by capturing light reflected from the object using a camera and converting it into a digital image. This image is then displayed on the screen, allowing for detailed observation.

A digital microscope also enables the storage of images and recording of videos for later use or analysis. Due to its ease of use and the capability of digital image capture, the digital microscope is popular in scientific research, medicine and education.

- GEOLOGICAL HAND LENS

A geological hand lens is a specialized tool used by geologists for detailed examination of small details of rocks, minerals and fossils. It resembles a small magnifying glass held in the hand. Geological hand lenses typically have strong magnification (10x), enabling geologists to see fine details. With the help of a geological hand lens geologists can identify different minerals, study rock textures and observe microscopic features.

- GEOLOGICAL HAMMER

A geological hammer is a specialized tool used by geologists for the study of rocks and minerals. It has a long handle typically made of a hard material such as steel or plastic and a heavy head at one end. The head is usually made of metal and has a sharp pointed part and a flat part for striking. Geologists use a hammer by striking rocks with the sharp end to break them up and study their interior. This helps them to determine the composition of the rocks, their age and other geological features.

- MEASURING TAPE

A measuring tape is a tool used for determining length. It consists of a tape wound within a housing. The tape is marked with units such as centimeters, meters, or feet, which are used to ascertain the length of an object or the distance between two points.

When measuring, the tape is extended from the housing and stretched to the desired length. The measuring tape is a simple and convenient tool that helps accurately measure distances in everyday life, construction, design, and other fields where precise measurement is required.

- GEIGER COUNTER

A Geiger counter is a device used to detect and measure ionizing radiation. It operates based on the ionization effect produced in a Geiger-Müller tube when radiation interacts with it. A Geiger counter is a device used for measuring radiation in the environment. It looks like a small handheld device with a numeric display. When turned on, the counter detects radiation particles in the environment.

As radiation particles pass through the counter, they create small electrical pulses that the counter counts. The display shows the number of detected particles per unit of time. Geiger counters are commonly used in various fields, including radiation protection, nuclear medicine, radiography, environmental monitoring, and geological exploration.

- GEOLOGİCAL COMPASS

A geological compass is a specialized tool used by geologists for fieldwork and geological mapping. It helps geologists determine the orientation, strike, and dip of geological features such as rock layers, faults, and joints.Typically, a geological compass consists of a magnetic needle that aligns with the Earth's magnetic field to indicate north, a compass housing with a rotating bezel marked in degrees for measuring direction, and a clinometer for measuring the dip angle of rock layers. Geological compasses may also include additional features such as a bubble level for ensuring the compass is held horizontally during measurements and a built-in magnifier for detailed examination of rock textures and structures.Overall, the geological compass is an essential tool for geologists conducting field surveys and mapping geological structures. It provides crucial data for understanding the geological history and processes in a particular area.

- GEOGRAPHICAL COMPASS

The compass is a simple tool used for determining direction on a map or in nature. It appears as a small disk with a rotating pointer that can move around its center. Typically, compasses are imprinted with letters representing the directions, such as north (N), south (S), east (E) and west (W).

You use the compass by holding it horizontally and aligning the pointer towards the north. Then you can read the directions indicated by the other letters on the compass. For instance, if the pointer is pointing north, east will be to your right, west to your left and south behind you.

The compass is a tool for orientation and navigation, especially during hiking, camping or exploring nature. It helps you to find your way and follow a specific direction, whether you're outdoors or studying a map.

What is the difference between a geological and a geographic compass?

Both the geological compass and the geographic compass are tools used for determining direction, but they have some key differences.

A geological compass is specifically designed for geological fieldwork and mapping. It is equipped with features such as a magnetic needle for determining north, a compass housing with a rotating bezel marked in degrees for measuring direction, and a clinometer for measuring the dip angle of rock layers. Geological compasses often include a bubble level for ensuring horizontal orientation during measurements and a magnifier for detailed examination of rock textures and structures. Geologists use geological compasses to determine the orientation, strike, and dip of geological features like rock layers, faults, and joints.

A geographic compass, commonly known as a standard compass, is used for general navigation and orientation purposes. It typically consists of a magnetic needle that aligns with the Earth's magnetic field to indicate north and a compass housing with a rotating bezel marked in degrees for measuring direction.Geographic compasses are used by travelers, hikers, and outdoor enthusiasts to navigate and determine cardinal directions while hiking, camping, or exploring.

In summary, while both types of compasses utilize magnetic needles to determine direction, a geological compass is specialized for geological fieldwork and mapping, whereas a geographic compass is more commonly used for general navigation and outdoor activities.

- MOHS HARDNESS SCALE

The Mohs hardness scale is a qualitative scale used to determine the scratch resistance of minerals. It was developed by German mineralogist Friedrich Mohs in 1812 and is based on the ability of one mineral to scratch another.

The scale is relative, meaning that a mineral higher on the scale can scratch any mineral lower on the scale. For example, a mineral with a hardness of 7, such as quartz, can scratch minerals with a hardness of 6 or lower, but it can be scratched by minerals with a hardness greater than 7.

The Mohs hardness scale is widely used in geology, mineralogy, and materials science to assess the hardness of minerals and to identify unknown minerals based on their scratch resistance.

The scale consists of ten minerals, arranged in increasing order of hardness:

1. Talc (hardness 1) - very soft mineral that can be easily scratched with a fingernail.
2. Gypsum (hardness 2) - soft mineral that can be scratched with a fingernail.
3. Calcite (hardness 3) - mineral that can be scratched with copper or a coin.
4. Fluorite (hardness 4) - mineral that can be scratched with a knife.
5. Apatite (hardness 5) - mineral that can be scratched with a knife but not easily.
6. Orthoclase (hardness 6) - mineral that can be scratched with steel.
7. Quartz (hardness 7) - mineral that can scratch glass.
8. Topaz (hardness 8) - hard mineral that can scratch quartz.
9. Corundum (hardness 9) - very hard mineral that can scratch most other minerals.
10. Diamond (hardness 10) - the hardest mineral on the Mohs scale, capable of scratching all other minerals.

- SAFETY HELMET

A safety helmet, also known as a hard hat, is a type of headgear designed to protect the wearer's head from injury in workplaces where there is a risk of falling objects, impact from fixed objects, or electrical shock.

Safety helmets typically consist of a hard outer shell made of durable plastic or fiberglass, which absorbs and deflects impacts, and an inner suspension system or padding that provides cushioning and helps distribute the force of impacts. Some helmets also feature adjustable chin straps to ensure a secure fit.

Safety helmets are commonly worn in construction, mining, manufacturing, and other industrial settings, as well as in activities such as rock climbing and cycling. They play a crucial role in preventing head injuries and ensuring the safety of workers and individuals engaging in potentially hazardous activities.

- SAFETY GLASSES

A safety glasses or safety goggles, are eyewear designed to protect the eyes from hazards such as flying debris, splashes of chemicals or intense light. Protective glasses typically feature impact-resistant lenses made of materials such as polycarbonate or tempered glass, which are capable of withstanding high-velocity impacts without shattering. The frames are often made of lightweight and durable materials like plastic or metal. Protective glasses are worn by workers in construction, manufacturing, laboratories, and other industrial settings, as well as by individuals participating in activities such as woodworking, shooting sports, or cycling. They are crucial for preventing eye injuries and ensuring the safety of the wearer in potentially hazardous environments.

- MEMORY GAME

The memory game in the the Young European GeoExplorer Toolkit consists of two parts: a booklet and cards.

Within the booklet, in addition to descriptions of the images on the cards for the classic Memory game, there are also:

- A description of the Young European GeoExplorer project
- An overview of UNESCO Global Geoparks
- Descriptions of project partners (UNESCO Global Geoparks and schools)
- Game instructions

Memory, as envisioned in the Young European GeoExplorer project, provides three gameplay options: classic memory, sorting, and quiz.

Incorporating Content and Language Integrated Learning (CLIL) into the educational process, we intentionally prepared certain sections of the book in five languages (English, Slovenian, German, Danish, and Norwegian), while others are available in only two languages (the language of the geopark and English). For example, the quiz is provided only in English. This approach aims to promote foreign language learning (specifically English) across all four partner UNESCO Global Geoparks.

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4.3. Estimated cost of GeoExplorer Toolkit

Educational tool	Price including VAT
TOOLBOX	158,33 eur 177,27 eur
SORTING BOX FOR MINI COLLECTION OF ROCKS	7,95 eur 9,49 eur
GEOLOGICAL HAMMER	76,50 eur 86,70 eur
GEOLOGICAL HAND LENS	16,80 eur 21,96 eur
GEOLOGICAL COMPASS	153,60 eur
GEOGRAFICAL COMPASS	21,23 eur 29,99 eur
10 % HCl	1,61 eur
GEIGER COUNTER	68,99 eur
SAFETY GLASSES	3,79 eur 7,95 eur
SAFETY HALMET	26,49 eur 27,99 eur
MEASURING TAPE 50 M	28,99 eur 29,80 eur
DIGITAL MICROSCOPE	68,84 eur
BOX OF MINERALS	60,00 eur
MEMORY GAME (10 PIECES)	150,00 eur
GEOEXPLORER FIELD RULERS (10 PIECES)	11,5 eur
TOTAL	**854,62 eur – 905,69 eur**

Cheaper offer
More expensive offer

Price analysis was made for comparable products in Slovenia on January 30, 2024.
The price analysis does not include any potential delivery or shipping costs.

5. GUIDELINES FOR USING GEOEXPLORER TOOLKIT

The GeoExplorer Toolkit offers a versatile set of tools and resources to support outdoor learning and exploration. Whether you're a teacher, geopark staff or educatior working in the field outdoor education, effectively utilizing the GeoExplorer Toolkit can enhance your outdoor activities and engage participants in meaningful learning experiences.

5.1. How to use the GeoExplorer Toolkit effectively?

Guidelines for using the GeoExplorer Toolkit:

- **Familiarize Yourself with the GeoExplorer Toolkit**
  Before implementing activities with the GeoExplorer Toolkit, take the time to familiarize yourself with its features, functionalities, and capabilities. Familiarity with the toolkit will enhance your confidence and proficiency in facilitating outdoor learning experiences.

- **Tailor Activities to Learning Objectives**
  Align activities with specific learning objectives to ensure that they effectively support educational goals. Consider the concepts, skills or knowledge areas you want students to explore and design activities that target those objectives. Use the features of the GeoExplorer Toolkit creatively to create engaging and immersive learning experiences that promote exploration, critical thinking and environmental awareness.

- **Provide Clear Instructions and Support**
  When introducing activities with the GeoExplorer Toolkit, provide clear and concise instructions to participants, including how to use the toolkit's features effectively. Demonstrate key functionalities to ensure participants understand how to use them. Offer ongoing support and guidance throughout the activity to address any questions or challenges participants may encounter.

- **Foster Collaboration and Inquiry**
  Encourage collaboration and inquiry among students by designing activities that promote teamwork, communication, and problem-solving. Incorporate elements of inquiry-based learning, where participants are encouraged to ask questions, make observations and formulate hypotheses. Use the GeoExplorer Toolkit as a tool for facilitating group exploration and discovery, fostering a collaborative learning environment.

- **Reflect and Iterate**
  After completing activities with the GeoExplorer Toolkit, take time to reflect on the experience and gather feedback from participants. Encourage participants to share their thoughts, observations, and insights about the activity. Use this feedback to evaluate the effectiveness of the activity and identify areas for improvement. Iterate on the activity based on feedback received, making adjustments as needed to enhance future implementations.

5.2. Development of Exercises with using GeoExplorer Toolkit

The GeoExplorer Toolkit offers a range of resources and tools to enhance outdoor learning experiences. By designing exercises with the GeoExplorer Toolkit, educators can create engaging activities that promote exploration, critical thinking, and environmental awareness.

The process of developing exercises with the GeoExplorer Toolkit in three steps:

1. step
DEFINE LEARNING OBJECTIVES

- Begin by clearly defining the learning objectives you aim to achieve through the learning experience. Consider the specific concepts, skills or knowledge areas you want students to engage with and understand. Ensure that the objectives are aligned with educational standards and curriculum goals.

2. step
DESIGN ENGAGING ACTIVITIES

- Create engaging activities that leverage the features of the GeoExplorer Toolkit to facilitate hands-on exploration and discovery. Develop activities that encourage critical thinking, problem-solving, and collaboration among participants.

3. step
PROVIDE CLEAR INSTRUCTIONS

- Communicate clear and concise instructions for each activity, including how to use the GeoExplorer Toolkit effectively. Ensure that participants understand the purpose of each activity, as well as the steps they need to take to complete it successfully. Offer guidance and support as needed to facilitate participant engagement and learning.

5.3. Examples of Exercises with using GeoExplorer Toolkit

EXERCISE 1: Rock Observation

INTRODUCTION:

Rock observation is a fundamental aspect of geological study, involving the careful examination and analysis of rock formations to understand Earth's history, processes, and composition. By observing rocks, geologists can decipher clues about past environments, tectonic activity, and the forces that have shaped our planet over millions of years. This introductory exploration into rock observation will highlight key techniques and principles used by geologists to interpret the rich story embedded within Earth's rocky layers.

TOOLS:

- Mini collection of rocks with descriptions for teachers and students
- Hydrochloric acid solution (10% HCl)
- Ruler
- Pot with water
- Safety Gloves
- Safety goggles
- Lab coat

INSTRUCTIONS:

1. From the mini collection of rocks select three samples of rocks and determine their characteristics.
2. Label them with numbers from 1 to 3.
3. Explore the characteristic of the selected rocks. Record your findings in the table.

NAME OF THE ROCK - Name the selected rock samples. Use descriptions from the GeoExplorer Toolkit for assistance.

ROCK COLOR - Determine the color of the selected rock samples. How many different colors do you see? Which one predominates?

NUMBER OF MINERALS - Count the minerals in the selected rock samples and write down their colors.

GRAIN SHAPE - Carefully observe the rock samples and determine the shape of the grains. Are the grains rounded or angular?

ROCK WEIGHT - Hold the selected rock samples in your hand. Are they equally heavy? Try to sort them from heaviest to lightest.

GRAIN SIZE - Take a ruler from the GeoExplorer ToolKit and measure the grain size of the selected rock samples.

ROCK SURFACE - Observe the surface of the rock and determine whether it is sharp, rough or smooth.

ROCK BUOYANCY - Take a container from the GeoExplorer ToolKit and fill it with water. Test if the selected rock samples float on water.

REACTION WITH ACID - Take hydrochloric acid solution (10% HCl), gloves, safety goggles, and a lab coat from the GeoExplorer ToolKit. Drop a few drops of hydrochloric acid onto each of the selected rock samples. Observe what happens on the rock surface.

FOSSILS IN THE ROCK - Carefully observe the rock samples. Do you notice any fossils in them?

ROCK TYPE - Determine the type of the selected rocks based on their formation. Are they igneous, metamorphic, or sedimentary rocks?

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Worksheet for students

	Sample 1	Sample 2	Sample3
NAME OF THE ROCK			
ROCK COLOR			
NUMBER OF MINERALS			
GRAIN SHAPE			
GRAIN SIZE			
ROCK WEIGHT			
ROCK SURFACE			
ROCK BUOYANCY			
REACTION WITH ACID			
FOSSILS IN THE ROCK			
ROCK TYPE			

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Young European GeoExplorer

Funded by the European Union

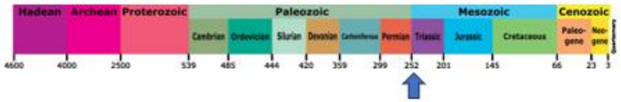
OOLITIC LIMESTONE

Description for teachers and upper secondary level

Oolitic limestone bear witness to life and environment some 252 million years ago (Lower Triassic) in a tidal or subtidal coastal environment and a morphologically diverse subtidal shelf (continental shelf = a submerged area around the continents, which is covered by a sea between 100 and 200 m deep. i.e. shelf sea).

Oolitic limestone consists of limestone grains less than 2 mm in diameter. We call them **ooids**, which are spherical-subspherical grains, consisting of one or more regular concentric lamellae around a nucleous. They were formed when a particle of sand or other nucleus is coated with concentric layers of calcite, wave-agitated marine water. The ooids could have remained in the coastal sea, or they could have been transported by sea currents to deeper parts of the sea shelf, where they were deposited with other rocks. If the rock consists mainly of ooids, it is called **oolite**, or **oolitic limestone**. Ooids can be observed in rocks with the naked eye, or more easily with a magnifying glass. Their structure is best seen under a microscope.

In Idrija area, they can be seen in the area from the Ledinska plateau to the Idrijca valley and in many places on both slopes above the Kanomljica valley and in smaller patches around Idrija.



Numbers on the timeline above are million years and can also be measured as centimetres on the 50-meter measure tape of the GeoExplorer Toolkit!

1

Young European GeoExplorer

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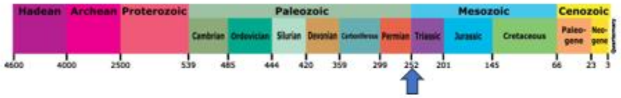
OOLITIC LIMESTONE

Description for pupils

I was formed by the excretion of limestone (calcite) in the form of concentric layers (lamellae) around the core in agitated intertidal waters on the coastal belt **252 million years ago**. If I am composed of mainly limestone grains of less than 2 millimetres in diameter, I'm called **oolitic limestone**. The individual grains are called **ooids**. In the rock, you can see me with the naked eye, but to a greater extent with a magnifying glass or under a microscope (see photo on previous p.)



You can find me if you measure 252 cm on the GeoExplorer Toolkit's measure tape!

2

EXERCISE 2: Determining the hardness of minerals and other materials using Mohs hardness scale

INTRODUCTION:

Assessing mineral hardness is essential in geology and material science. The Mohs hardness scale, devised by Friedrich Mohs in 1812, provides a simple yet effective method for determining the relative hardness of minerals. This scale ranges from 1 to 10, with talc being the softest (rated 1) and diamond the hardest (rated 10). By scratching one mineral against another and comparing the resulting scratches, geologists can quickly assess mineral hardness and infer valuable information about mineral composition and geological processes.

TOOLS:

- box with minerals
- piece of plastic
- wood
- glass
- copper coin
- hammer

INSTRUCTIONS:

1. Take the box of minerals from the GeoExplorer Toolkit and familiarize yourself with the levels of hardness. Test the hardness of each material in the box by attempting to scratch its surface with another material. Remember that each subsequent mineral scratches the previous one.
2. Based on the results, arrange the minerals in the box according to their hardness on the Mohs scale from 1 (softest) to 10 (hardest). You can verify the correct solution in the description of the Mohs hardness scale.
3. Now, focus on the prepared materials and substances: piece of plastic, wood, glass, copper coin, and hammer. Test the hardness of each material by attempting to scratch its surface with another material.
4. Based on the results, classify the materials according to their hardness on the Mohs scale from softest to hardest. Use the list below for classification.
5. Scratch each prepared material with minerals from the Mohs hardness scale (easiest done by starting with the softest, talc). The hardness of the material is the hardness of the last mineral that does not scratch the material.

The Mohs hardness scale:

Mohs relative hardness	Mineral example	Scratch test
1	Talc	Scratch with fingernail
2	Gypsum	Scratch with fingernail
3	Calcite	Scratch with copper penny
4	Fluorite	Easily scratch with knife
5	Apatite	Scratch with knife blade
6	Orthoclase	Scratch with steel file
7	Quartz	Scratch with window glass
8	Topaz	Scratches quartz
9	Corundum	Scratches topaz
10	Diamond	Scratches corundum

Worksheet for students

Mineral or other material	DOES NOT SCRATCH THE MINERAL/MATERIAL	SCRATCH THE MINERAL/MATERIAL	HARDNESS OF MINERAL/MATERIAL
for example: glass	talc, gypsum, calcite, fluorite, apatite, orthoclase	Quartz, topaz, corundum, diamond	7

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Worksheet for students

Classify the materials according to their hardness on the Mohs scale from softest to hardest.

SOFTEST ⟷ **HARDEST**

Young European GeoExplorer

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EXERCISE 3: Orientation with geografical compass

INTRODUCTION:

Embark on a thrilling adventure of exploration and discovery with the timeless art of orientation using a compass. A compass is more than just a simple tool; it's a gateway to understanding the world around us. In this journey, we'll learn how to navigate through unfamiliar terrain, deciphering the language of cardinal directions and unlocking the secrets of navigation. So, grab your compass and get ready to embark on an exhilarating journey of orientation and discovery.

TOOLS:

- Geographical compass
- Map of the Idrija Geopark

INSTRUCTIONS:

- From the GeoExplorer Toolkit, take the geographical compass and the map of the Idrija Geopark. Place the map on the table or another flat surface. Position the compass on the edge of the Idrija Geopark map. Rotate the map along with the compass until the arrow points north (N). At that point, the map will be oriented northward, and you will be correctly oriented.
- In the table, indicate the direction from the current point to the landmarks of the Idrija Geopark

Name of natural or cultural heritage	**Cardinal directions and intercardinal directions**
HABEČKOVO BREZNO (Habečk Chasm)	
DIVJE JEZERO (Wild Lake)	
DINOZAVROVE STOPINJE (Dinosaur footprints) HRVATOVA JAMA (Hrvat Cave)	
IDRIJSKE KLAVŽE (Idrija klavže - water barriers)	
JAVORNIK (highes mountain in municipality)	

6. RECCOMENDATION FOR OUTDOOR LEARNING WITH GEOEXPLORER TOOLKIT

6.1. What is outdoor learning?

Outdoor learning takes students out of their usual indoor environment and immerses them in the natural world. Whether it's a hike through the forest, a visit to a local park, or conducting experiments in a school garden, outdoor learning provides hands-on experiences that engage all the senses and foster a deeper connection with the environment.

> Outdoor learning is any organized learning that takes place outside of school buildings.
>
> Outdoor learning refers to the philosophy, theory, and practice of experiential learning and environmental education.

(Skribe Dimec, 2013)

Outdoor learning, also known as outdoor education or experiential learning, involves educational activities conducted outside of traditional indoor classroom settings. It utilizes the natural environment as a learning resource and typically involves activities such as field trips, nature walks, gardening, adventure activities, and environmental studies.

Outdoor education takes place outside the classroom in various locations (Skribe Dimec, 2013):

- in the vicinity of the school
- in nature
- in urban environments (streets, various institutions)
- on farms
- in institutions specializing in outdoor education (Forest School Network, geoparks, outdoor museums, etc.)

6.2. The advantages of outdoor learning

In recent years, there has been a growing recognition of the profound benefits that outdoor learning offers to learners of all ages. Stepping outside the traditional confines of the classroom opens up a world of opportunities, providing a dynamic and immersive educational experience unlike any other.

Firstly, outdoor learning fosters a deep connection with nature. By immersing oneself in natural environments, students develop a sense of appreciation and respect for the world around them. Moreover, outdoor learning cultivates holistic development. Unlike traditional classroom settings, outdoor environments offer diverse opportunities for physical, emotional, and social growth. From conquering challenging ropes courses to collaborating with peers on team-building exercises, students develop resilience, communication skills, and a strong sense of self-confidence. Moreover, outdoor learning stimulates experiential learning, allowing students to engage in hands-on experiences that bring academic concepts to life. Outdoor learning promotes adventure and exploration, offering a refreshing escape from technology overload and igniting a sense of wonder and curiosity. Overall, while classroom learning provides structure and theoretical foundations, outdoor learning offers a dynamic and immersive experience that fosters holistic development and deeper connections with the natural world.

Comparison of learning in the classroom and outdoor learning:

IN THE CLASSROOM	OUTDOOR LEARNING
Structured environment with desks, chairs, and whiteboards.	Takes place in natural or diverse environments.
Emphasis on theoretical knowledge delivery.	Encourages hands-on, experiential learning.
Limited physical movement and interaction with natural surroundings.	Opportunities for physical activity, exploration, and sensory engagement.
Often focuses on passive learning through lectures and textbooks.	Facilitates interdisciplinary learning and problem-solving in real-world contexts.
Controlled conditions with minimal exposure to real-world challenges.	Enhanced connection with nature and appreciation for the environment.
Potential distractions from technology and classroom dynamics.	Builds resilience, teamwork, and critical thinking skills through exposure to challenges.
	Allows for creativity and adaptability in learning approaches.

Povzeto po: Novak, N. et. Al. (2022)

6.3. Incorporating CLIL Methodology into Outdoor Learning

Content and Language Integrated Learning (CLIL) is an educational approach that integrates the learning of subject content with the acquisition of a second language. When applied to outdoor learning, CLIL methodology offers a powerful framework for engaging students in hands-on exploration while simultaneously developing their language skills.

Outdoor learning provides a unique opportunity for students to explore the natural world while enhancing their language skills. By immersing students in authentic outdoor environments, educators can create rich learning experiences that foster language acquisition in meaningful contexts. Whether identifying plant species, studying geological formations or conducting environmental experiments, students engage in language-rich activities that deepen their understanding of both subject content and language.

CLIL methodology encourages inquiry-based learning, where students are actively involved in asking questions, making observations, and investigating phenomena. In outdoor settings, students have the opportunity to explore real-world problems and phenomena, fostering curiosity and critical thinking skills. Through hands-on exploration and experimentation, students develop a deeper understanding of scientific concepts while honing their language skills through meaningful communication and collaboration.

Outdoor learning naturally lends itself to interdisciplinary connections, where students explore the intersections between different subject areas. By integrating science, mathematics, language, arts and other disciplines, educators can create holistic learning experiences that deepen students' understanding of subject content while promoting language development. Whether conducting ecological surveys, analyzing environmental data or writing reflective essays, students engage in cross-curricular activities that enhance their knowledge and language proficiency.

Incorporating CLIL methodology into outdoor learning experiences fosters environmental awareness among students. By immersing students in nature and encouraging them to explore their surroundings, educators instill a sense of responsibility and respect for the environment. Through activities such as nature walks, ecological restoration projects, and wildlife observation, students develop a deeper connection to the natural world while practicing language skills in authentic contexts.

6.4. The phases of outdoor learning

For quality outdoor learning several characteristics are essential. Ouality outdoor learning is (Moravec, 2024):

- **Well-Planned**: Outdoor learning activities should be meticulously planned, taking into account factors such as location, safety and the specific learning objectives to be achieved.
- **Meaningful**: The activities should be purposeful and directly aligned with the learning goals. They should aim to enhance understanding through direct observation and hands-on experience, ensuring that students gain insights and knowledge relevant to their academic development.
- **Evaluation and Transfer of Knowledge**: Evaluation of the outdoor learning experience is crucial to assess its effectiveness and identify areas for improvement. Additionally, the knowledge and skills acquired during outdoor activities should be transferable to other contexts, allowing students to apply what they have learned in different situations beyond the outdoor setting.

These characteristics ensure that outdoor learning is not only engaging and enjoyable but also effective in achieving educational objectives and fostering students' overall development.

The phases of outdoor teaching include the following steps (Moravec, 2024):

PLANNING

- In this phase, teachers thoroughly plan learning activities to be conducted outdoors. This involves setting learning objectives, selecting suitable locations, preparing necessary materials and equipment, and assessing potential risks and safety measures.

IMPLEMENTATION

- Once planning is complete, learning activities are carried out according to the prepared plan. Students go outside and engage in activities such as nature observation, exploration of the surroundings, conducting experiments, or fieldwork.

CONCLUSIONS AND EVALUATION

- After the activities are completed, a conclusion with evaluation takes place. Teachers and students reflect together on their experiences, achievements, and challenges, and assess whether the objectives were met. Evaluation also allows for identifying possible improvements for future outdoor learning sessions.

The phases of outdoor learning provide a structured framework for experiential education in natural settings. By following these phases, students can engage in meaningful exploration, develop a deeper understanding of the natural world and cultivate a lifelong appreciation for environmental responsibility.

1. Phase: Planning

DETERMINATION OF LEARNING GOALS, STANDARDS AND PERFORMANCE CRITERIA	• determining standards and objectives from the curriculum, • meaningfully planning cross-curriculum activities, • specifying which knowledge will be assessed and how.
DETERMINATION OF A APPROPRIATE TEACHING APPROACH, FIELD ACTIVITIES AND TEACHING METHODOLOGY	• teaching methods adapted to students' prior knowledge, • forms of work tailored to objectives and standards.
DETERMINATION OF DURATION AND LOCATION OF ACTIVITY, RISK ASSESSMENT	• determining the duration of actvity, • checking the location (distance from the school, suitability for implementation, anticipated hazards and risks).
PREPARATION OF DIDACTIC MATERIALS AND TOOLS	• meaningful incorporation of worksheets, filling out worksheets should not be the main activity of outdoor learning, • preparing the list of educational tools, apps etc.

2. Phase: Implementation

PREPARING STUDENTS FOR OUTDOOR ACTIVITIES	• assessesment of students prior knowledge, • teacher informs students about success criteria, • determination of instructions and tasks of students in the field • rules of behaviour in nature
IMPLEMENTATION OF OUTDOOR ACTIVITIES	• the teacher monitors, encourages, advises, and guides the students.

3. Phase: Conclusion with Evaluation

DATA ANALYSIS	• it takes place in the classroom, after the conclusion of fieldwork • students appropriately supplement the data and formulate conclusions from the field findings
DATA PRESENTATION AND FEEDBACK	• students present their findings and conclusions • students receive quality feedback from the teacher and their peers
EVALUATION	• the teacher and students verify whether they have achieved learning goals and success criteria. • Students self-evaluate their work and identify areas for improvement

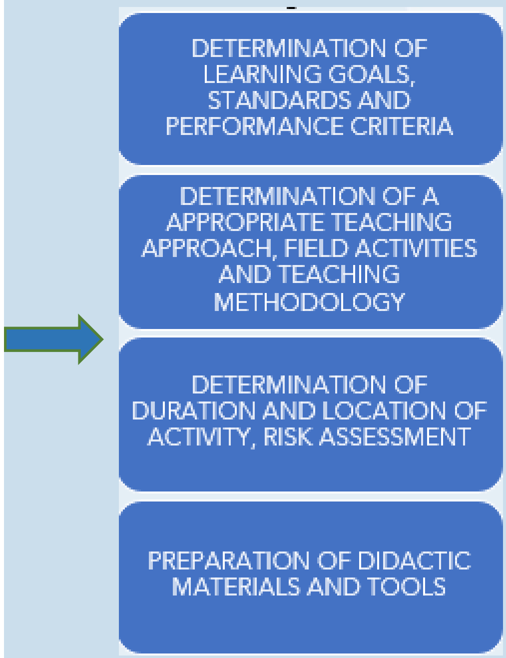
6.5. Example of outdoor learning with using the GeoExplorer Toolkit

Below is an example of an outdoor lesson using the GeoExplorer Toolkit, which follows the recommendations for high-quality outdoor learning. For lesson preparation, the template "Development of GeoExplorer exercises for outdoor activities" was utilized, which was developed as part of the Young European GeoExplorer project. This template is intended for teachers, geopark staff, and all employees in organizations involved in conducting outdoor activities (Annex 1).

The described activities take place on the Karst Forest Educational Trail. The educational trail was formed years ago for learning about karst phenomena, getting familiar with flora, and forest management in our environment. The planned activities can be implemented with worksheets or with educational app TurfHunt (geolocation game which allows teachers to create their own exercises, add a number of multi-sensory contents and to enrich their usual classroom work with a classroom in nature).

1. Phase: Planning

Selected theme	X_ **Geology** __ Ecology __Men and biosphere
Subthemes	Rocks and fossils, (karst) landforms
Class	6., 7. Class (Primary school) 11- to 13-year-old pupils
Learning goals (English and natural science/biology/geography).	- Observing nature and the environment - Learning to recognise typical karst landforms - Learning to recognise sedimentary, metamorphic and igneous rocks according to their typical features - Learning about the rock cycle - Learning the processes of changing rocks - Learning about fossils - Learning new English words
Working methodology	X_ **Frontal** X_ **Group Work** __ Pairwork __ Individual work
Learning methodology	X_ **Observing** X_**CLIL (Content and Language Integrated learning)** X_**Listening to the teacher or a guide** __ Taking pictures X_**Experimental** __ Playing educational games, role play __ Self-learning __ Contest X_ **Orientation** X_ **Collecting samples and analysing** X_ **Use of maps and navigation** X_ **Investigative performance** __Other. Please, specify:
Additional knowledge, skills and competences	X_ **Teamwork** __ Problem solving __ Decision making X_ **Development of independent thinking** __ Other. Please, specify: ________________
Multi-sensory contents	Visual, auditive, kinaesthetic
Teaching aids	Map, working list, magnifying glass, rock samples, rock ID key, geological cycle, ruler, gloves, helmet, meter stick, microscope, hammer, 10% HCl
New English vocabulary items	Fossil, limestone, dolomite, acid, sedimentary, metamorphic and igneous rocks, rock cycle, erosion, weathering, heat and pressure, karst landforms (caves, dolines, stalagmites, stalactites).

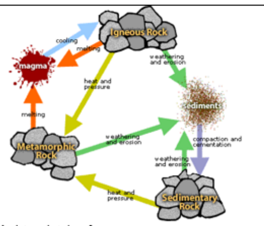


2. Phase: Implementation

Pre-fieldwork activities	**Students' activity:** - In the classroom, pupils review the GeoExplorer Toolkit and familiarise themselves with the items it contains. - Pupils review what they have already learned about the rocks, rock cycle and karst phenomena before. - Pupils examine the box with stone samples and describe each one. - Pupils find the start of the route on a map and decide how to get there. **Teacher/guide guidelines:** - Bring the GeoExplorer Toolkit into the classroom and go through what it contains with your pupils. - Aks the pupils which items in the GeoExplorer Toolkit they already know and whether they have used any of them. - Check what pupils already know about rocks, rock cycle and karst phenomena. - Together with the pupils go through the box with stone samples, let the pupils look at them, feel them, do the acid experiment. - Distribute the route maps to your pupils and help them find the right route. 

PREPARING STUDENTS FOR OUTDOOR ACTIVITIES

IMPLEMENTATION OF OUTDOOR ACTIVITIES

	Students' activity	Teacher/guide guidelines
Task 1: At the beginning of the Karst Forest Educational Trail **N 45°55'29''** **E 14°03'58''**	Look at the rock samples from your GeoExplorer Toolkit and try to classify them as sedimentary, metamorphic or igneous. Which rocks are dominant here?	Show rock samples from GeoExplorer Toolkit to pupils and explain to them how to classify rocks. Use the magnifying glass, microscope, hammer, 10% HCl and rock ID key.
Task 2: **At the beginning of the Karst Forest Educational Trail** **N 45°55'29''** **E 14°03'58''**	 A picture is taken from: http://www.cotf.edu/ete/modules/msese/earthsysflr/rock.html Answer the questions below (TRUE or FALSE): 1. Which of these statements is true? a.) Rocks never change. ____ b.) Rocks can change from one type to another. ____ c.) Rocks can only change on the Earth surface. ____ 2. Rocks affected by WEATHERING AND EROSION can change into: a.) Lava ____ b.) Magma ____ c.) sediments ____ 3. Which geologic process can change any type of rock into a sediment? a.) Cooling _____ b.) Weathering and erosion _____ c.) Heat and pressure _____ d.) Melting _____	Explain the rock cycle to your pupils and help them with questions. Solutions to questions: 1. a) F b) T c) F 2. a) F b) F c) T 3. a) F b) T c) F d) F
Task 3: **Along the Karst Forest Educational Trail** **N 45°55'23''** **E 14°04'07''**	How many karst phenomena do you know? Show them in your surroundings then draw them. Which karst phenomena is shown in the picture below? a) Stalagmite b) Cave c) Karren 	
Task 4: **Fossils of rudists** **N 45°55'20''** **E 14°04'16''**	Look at the picture below. Try to find a similar form in your surroundings. Do you already know what it is? a) Traces of trilobite b) Fossilised rudists c) Stromatolites (fossilized evidence of algae and cyanobacteria and carbonate particles) 	Explain to your pupils what fossils are and how they are formed. Help them find the fossilised rudists in their surroundings.
Task 5: **At the cave Hrvatova jama** **N 45°55'31''** **E 14°04'11''**	This limestone karst cave was formed where water seeped through a crack and dissolved the bedrock. Take a look inside the cave and find typical karst phenomena. Name the karst phenomena shown in the photos below:  ________  ________	Guide your pupils into the cave and help them recognise typical karst phenomena.

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3. Phase: Conclusion with Evaluation

Student activity:

- students complete the worksheets in the classroom
- students compare the data
- students prepare
- describe what new knowledge they have acquired in the field

Teacher/guide guidelines:

- Talk to your pupils about experience in the field, let them talk about it
- Make a short test for pupils with questions about the rock cycle and karst phenomena

→

DATA ANALYSIS

DATA PRESENTATION AND FEEDBACK

EVALUATION

6.6. How to effectively incorporate the GeoExplorer Toolkit into outdoor learning experiences – RECCOMENDATIONS FOR NATIONAL EDUCATION SYSTEMS (Annex 2)?

- **Funding and Resources**: Allocate dedicated funding and resources to support outdoor learning initiatives. Provide grants, subsidies, and infrastructure investments to schools, community organizations and other organisations to facilitate outdoor education programs.
- **Curriculum Integration**: Encourage the integration of outdoor learning into educational curricula at all levels. Work with educational stakeholders to develop guidelines, standards and resources that promote the incorporation of outdoor experiences into teaching and learning practices.
- **Professional Development**: Invest in professional development opportunities for educators to enhance their skills in outdoor education pedagogy. Offer training programs, workshops, and certifications focused on outdoor learning methodologies, safety protocols and environmental literacy.
- **Partnerships and Collaboration**: Facilitate partnerships and collaboration among government agencies, educational institutions, environmental organizations, geoparks and community groups to support outdoor learning initiatives. Foster networks of support and coordination to maximize resources and expertise.
- **Access and Equity**: Ensure equitable access to outdoor learning opportunities for all students, regardless of socioeconomic status or geographic location. Develop strategies to address barriers to participation, such as transportation, funding and cultural considerations.
- **Environmental Protection and Conservation**: Promote environmental responsibility and conservation education as integral components of outdoor learning. Support initiatives that connect students with local ecosystems, biodiversity and natural resources to foster a sense of responsibility and care for the environment.
- **Research and Evaluation**: Invest in research and evaluation efforts to assess the impact of outdoor learning on student outcomes, academic achievement and environmental attitudes. Use evidence-based findings to inform policy decisions and programmatic investments.
- **Public Awareness and Advocacy**: Raise public awareness about the benefits of outdoor learning and advocate for its inclusion in educational policies and practices. Engage stakeholders, policymakers and the broader community in discussions about the importance of outdoor education for holistic student development.
- **Sustainability and Resilience**: Promote outdoor learning practices that prioritize sustainability, resilience and environmental justice.
- **Long-Term Commitment**: Demonstrate long-term commitment to supporting outdoor learning as an essential component of education policy and practice. Establish clear goals, benchmarks, and accountability measures to ensure the sustained growth and effectiveness of outdoor learning initiatives.

7. CONCLUSION

The Young European GeoExplorer project, co-financed by the EU Erasmus+ Programme, aims to improve high school education by integrating natural science and language learning through the Content and Language Integrated Learning (CLIL) method.

Through collaboration with UNESCO Geoparks, local schools and educational stakeholders, the project aimed to develop new services in geoparks and innovative teaching methods for teachers, geopark staff and other employees in the field of education. By harnessing the power of the CLIL methodology, we aim to address the evolving needs of schools and teachers, offering an engaging approach to science and language education.

The GeoExplorer Toolkit, main result of this project, provides educators with valuable resources and tools to enhance outdoor learning experiences. By following the guidelines outlined for effectively incorporating the toolkit into outdoor learning, teachers can create engaging and meaningful activities that foster exploration, inquiry, and hands-on learning. By embracing nature, prioritizing safety, aligning activities with curriculum objectives, and encouraging exploration and reflection, educators can create transformative learning experiences for their students.

In conclusion, the advancement of outdoor learning necessitates a comprehensive approach addressing various aspects. It is imperative to allocate dedicated funding and resources, encourage curriculum integration, and invest in professional development for educators. Additionally, fostering partnerships, ensuring access and equity, and promoting environmental protection are essential. Research and evaluation efforts should be prioritized to assess impacts, while public awareness and advocacy efforts should advocate for outdoor learning's benefits. Sustainability, resilience, and long-term commitment are key principles to uphold for the continued success of outdoor education initiatives. Through collaboration, reflection and continuous professional development, we can ensure the success and sustainability of the Young European GeoExplorer project, inspiring future generations to explore, discover, and connect with the natural world.

8. Literature

- Moravec, B. (2024). Naj narava (p)ostane najboljša učilnica in učiteljica. Multiplikacijski dogodek projekta Young European GeoExplorer. Zavod Republike Slovenije za šolstvo, OE Koper

- Novak, N. et. al. (2022). Pouk na prostem: priročnik za učitelje in učiteljice razrednega pouka. Zavod RS za šolstvo. Ljubljana.

- Skribe Dimec, D. (2013). Pouk na prostem. Pouk na prostem, Raznovrstnost pristopov in razvijanje naravoslovnega mišljenja.

9. Annexes

Annex 1: Development of GeoExplorer exercises for outdoor activities – template

Development of exercises for outdoor activities – Teachers, pupils and guides template

Selected theme		
Subthemes		
Class		
Learning goals (English and natural science/biology/geography).		
Working methodology	___ Frontal ___Group Work __ Pairwork __ Individual work	
Learning methodology	__ Observing ___CLIL (Content and Language Integrated learning) ___Listening to the teacher or a guide __ Taking pictures ___Experimental __ Playing educational games, role play __ Self-learning __ Contest	__ Orientation __ Collecting samples and analysing __ Use of maps and navigation __ Investigative performance __Other. Please, specify:
Additional knowledge, skills and competences	__ Teamwork __ Problem solving __ Decision making	__ Development of independent thinking __ Other. Please, specify: ______________________________
Multi-sensory contents		
Teaching aids		
New English vocabulary items		

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Description of exercise:

Before fieldwork:

During fieldwork:

<table>
<tr><td rowspan="2">Task 1:</td><td rowspan="2"></td><td>Teacher/guide guidelines:</td></tr>
<tr><td>Student activity:</td></tr>
<tr><td rowspan="2">Task 2:</td><td rowspan="2"></td><td>Teacher/guide guidelines:</td></tr>
<tr><td>Student activity:</td></tr>
<tr><td rowspan="2">Task 3:</td><td rowspan="2"></td><td>Teacher/guide guidelines:</td></tr>
<tr><td>Student activity:</td></tr>
</table>

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After fieldwork:

Evaluation of the pupil's engagement and competence skills:

Feedback from the pupils about the activity:

Annex 2: How to effectively incorporate the GeoExplorer Toolkit into outdoor learning experiences? leaflet