

SUBTOPICS OF THE SUBJECT TOPIC	NATURAL HISTORY 2.3. II stage of study 2.3.2.3. Diversity of life on Earth. 2.3.2.5. Rivers and lakes. Water as a living environment. 2.3.2.6. Water as a substance, water use. 2.3.2.17. Nature and environmental protection in Estonia. 2.4. III stage of study 2.4.2.5. Solid, liquid, gaseous matter. 2.4.2.7. Heat transfer. 2.4.2.8. Change of substance states. 3. BIOLOGY 3.2. III stage of study 3.2.1.7. The traits and life processes of invertebrate animals. 3.2.1.9. Ecology and environmental protection. 4. GEOGRAPHY 4.2. III stage of study 4.2.2.1. Cartography. 5. PHYSICS 5.2. III stage of study 5.2.4.3. Change of substance states. Heat engineering applications. National upper secondary school curriculum on the basis of § 15 Section 2 of Basic Schools and Upper Secondary Schools Act. 3. GEOGRAPHY 3.4.2. Water and water-related problems. The active learning programme is related to the development plan of the Saadjärve Nature Centre.
GRADE/STAGE OF STUDY	4 th –12 th grade
PROGRAMME TITLE	Lake as a living environment.
THE AIM OF THE PROGRAMME	Studying lakes and the specificity of lake biomes, food chains, and natural relations (navigation, map and compass, azimuth, classification of lakes, the formation and development of lakes, the study and measurement of the properties of lake water, measurement of water temperature and oxygen content, water circulation, studying the properties of ice, measuring lake depth, getting to know lake plants, getting to know invertebrates and vertebrates, lake model, food chains, the use of lakes and issues in nature protection, relations in nature).
STUDY SKILLS TO BE ACQUIRED	The use of classification tables, studying organisms without harming them, observation, description, comparison, measurement, data processing, analysis; acquisition of group work skills in nature; learning the terminology of natural sciences; using tools and equipment.
THE CONCEPTS HANDLED	Closed lake, source lake, flow-through lake; glacial lakes, bog and marsh lakes, lagoon, artificial lake etc.; eutrophic and oligotrophic lakes; autumnal circulation, spring circulation, stratification, oxygen concentration, temperature, transparency; lake ageing; coastal plants, coastal water plants, floating-leaf plants, submerged plants, plankton, algae, algal bloom; invertebrates, larva, imago; predatory fish, non-predatory fish; amphibian; swimming duck, diving duck etc.
STUDENTS' PRIOR KNOWLEDGE AND SKILLS	Knowing how to behave in nature, on the shore of a water body, on the lake and lake ice with a raft, group work skills. Clothes suitable for the weather.
PRIOR ACTIVITIES	Introducing teaching aids, collection of teaching aids, introducing work methods, presentation of safety requirements.
MATERIALS AND AIDS NECESSARY FOR THE CLASS	Worksheets, pens, clipboards, maps, compasses, thermometers, oxygen gas analysers, secchi disks, depth measuring instrument, rubber boots, net bags, sieves, plastic bases, tweezers, spoons, transportation aquaria, classification tables, magnifiers, snowshoes, ice borers, instruments for measuring ice and snow thickness, sleds.

MODULE	DURATION	DESCRIPTION OF THE LEARNING MODULE TEACHING AIDS AND ACTIVITIES
Navigation. On the lake shore or a raft 4 th –12 th grade	30 min	Introduction, overview of work methods and equipment. Map and compass, worksheet. Getting to know map and compass, cardinal points, directions, positioning on map, determining the azimuth, bearing, wind and wind directions. Recording data on the worksheet. Checking the study assignment, conclusions.
Internal waters. On the lake shore, a raft or in the classroom. 4 th –12 th grade	15 min	Distribution of internal waters. General overview of Estonian lakes. Lake nutrition, water exchange, circulation of lake water. Annual cycle of water bodies, light in water bodies.
Measurements from a raft, processing and analysing data in the classroom. 10 th –12 th grade	3 h	Introduction, overview of work methods and equipment. Thermometer, oxygen gas analyser, secchi disk, depth measuring instrument, worksheet, clipboard, pen. Collecting data about the lake. Measuring water depth at different observation points. Measuring water temperature, transparency and oxygen concentration at different depths and different measurement points. Processing and analysing data in the classroom of the nature centre. Transferring data to the blackboard lake model, analysing the created schematic. Checking the study assignment, conclusions.
Measurements from a raft. 4 th –9 th grade	1.5 h	Introduction, overview of work methods and equipment. Thermometer, oxygen gas analyser, secchi disk, depth measuring instrument, worksheet, clipboard, pen. Collecting data about the lake. Measuring water depth at different observation points. Measuring water temperature, transparency and oxygen concentration at different depths and different measurement points. Transferring data to the worksheet. Analysis of data. Checking the study assignment, conclusions.
Measurements on ice, processing and analysing data in the classroom. 10 th –12 th grade	3 h	Introduction, overview of work methods and equipment. Snow shoes, ice borer, measuring instrument for ice and snow thickness, thermometer, oxygen gas analyser, depth measuring instrument, sled, worksheet, clipboard, pen. Collecting data on the lake ice. Measuring water depth at different observation points. Measuring water temperature and oxygen concentration at different depths and different measurement points. Transferring data to the worksheet. Processing data in the classroom of the nature centre. Transferring data to the blackboard lake model, analysing the created schematic. Checking the study assignment, conclusions.
Studying plants from a raft. 4 th –12 th grade	30 min	Introduction, overview of work methods and equipment. Plant hook, dishes, buckets, classification table, worksheet, clipboard, pen. Catching submerged plants from the lake, observation, study, classification of plants. Observation, study, classification of coastal

		water plants. Observation, study, classification of floating-leaf plants. The importance of plants in the lake, relations in the lake. Transferring data to the worksheet. Checking the study assignment, conclusions.
Studying plants on the shore. 4 th –12 th grade	30 min	Introduction, overview of work methods and equipment. Classification table, dishes, buckets, worksheet, clipboard, pen. Observation, study, classification of coast water plants. Observation, study, classification of floating-leaf plants. Searching submerged plants on the wave bank, observation, study, classification. The importance of plants in the lake, relations in the lake. Transferring data to the worksheet. Checking the study assignment, conclusions.
Catching invertebrates in coastal water and classifying them. 4 th –12 th grade	2 h	Introduction, overview of work methods and equipment. Rubber boots, net bags, sieves, dishes, buckets, tweezers, spoons, transportation aquaria, classification table, magnifiers, worksheet, clipboard, pen. Catching invertebrates in coastal water, observation, study, classification. The importance of invertebrates in the lake, food chain, relations in the lake. Transferring data to the worksheet. Checking the study assignment, conclusions.
Studying fish. In the classroom or the lake shore. 4 th –12 th grade	2 h	Introduction, overview of work methods and equipment. Supplied (dead) fish, worksheet, clipboard, pen. Estonian fish on the example of Lake Saadjärv. Measuring, weighing, dissecting fish, studying the guts, studying and comparing the scales. Determining the gender and age of fish. Food chain, relations in the lake. Transferring data to the worksheet. Checking the study assignment, conclusions.
Model of a lake biome. In the classroom. 4 th –6 th grade	30 min	Introduction, overview of the structure of the teaching aid and the study assignment. The active learning aid for the classroom. Creating a model of the lake biome using the active learning aid. Checking the study assignment, conclusions.

Environmental active learning programme “Lake as a Living Environment”.

General overview

The active learning programme on the subject of lake biomes is adaptable to all age groups, from pupils to adults.

The active learning programme “Lake as a Living Environment” comprises modules of experiential and discovery learning.

- Navigation. 4th–12th grade
On the lake shore or a raft
- Internal waters. 4th–12th grade
- On the lake shore or a raft.
- Measurements on ice. 10th–12th grade
On lake ice; processing and analysing data in the classroom
- Measurements from a raft. 10th–12th grade
Processing and analysing data in the classroom
- Measurements from a raft. 4th–9th grade
- Studying plants on the shore. 4th–12th grade
- Studying plants from a raft. 4th–12th grade
- Invertebrates. 4th–12th grade
In the coastal water of the lake.
- Fish. 4th–12th grade
On the lake shore or in the classroom.
- Model of a lake biome. 4th–6th grade
In the classroom.
- Food chains. 7th–12th grade
In the classroom.

New knowledge is acquired and consolidated using methods of experiential, discovery and inquiry learning. Classes are maximally conducted in real environments: on the shore of Lake Saadjärv, on a barge, on the ice of Lake Saadjärv and if necessary, in the classrooms of the Saadjärve Nature Centre, observing, experiencing and understanding natural relations.

The best-suited programme for getting to know the living environment of a lake is prepared for each study group from experiential and discovery learning modules in accordance with the season and weather conditions and in consideration of the specific needs of the study group. The programme can be taken either as a full 5 h study day or as separate modules.

This teaching form reduces the seasonal nature of natural education and allows covering the subject either in spring, summer, autumn or midwinter.