The purpose of this desk research is to support the consortium partners in the process of selection, creation, development and exploitation of the curriculum contents under the *umbrella* of the ZERO WASTE= SUSTAINABLE WORLD project, dealing with the development of practical materials, i.e.

- writing the text for the curriculum;
- highlighting the rationale of the materials to be used in the curriculum production;
- planning and constructing the worksheets for students related to the learning materials;
- deploying of practical exercises, tests, evaluation tools for all the teaching/learning units.

It consists of different sections, all equally significant to its aim:

1. The philosophy of the ZERO WASTE= SUSTAINABLE WORLD project together with its pedagogical foundations.
2. The methodology and the structure to be used in selecting, creating and develop teaching/learning units of the curriculum;
3. Need analysis in each country
4. State of art
5. Operative guide to the curriculum contents.

Section 1

The philosophy of the ZERO WASTE= SUSTAINABLE WORLD project

Empowering young learners to create a sustainable future is critical in the process of preserving the planet and in educating future responsible citizens.

The "**ZERO WASTE= SUSTAINABLE WORLD**" project aims to……..

It is important to implement teaching methods including both autonomous learning and instructional activities, and to vary the level of openness of experimental tasks. The implementation of problem-based active learning models has positive effects on students' achievements and their attitudes to courses, while implementation of problem-based learning and group investigation encourages students to think critically through planning, arguing, stating questions and problems, and providing solutions to environmental problems.

To improve STEAM education in schools, the current idea is to devote more attention to develop practical skills. This agrees with current trends in education, that emphasize the need for a progressive switch toward student-centred approaches in which students should participate actively in the learning processes. Active learning is a methodology based on the idea that knowledge is acquired by the students through active learning accomplishments rather than by being directly transmitted by the

teacher. Inquiry-, Project-, Discovery-based teaching strategies, which promote an involvement in activities similar to those carried out by scientists, can provide the students with opportunities to deepen their understanding on how scientific knowledge is produced in real research contexts. The active learning experience should replace the transmissive lecture as a dominant mode including laboratory activities, internships, and collaborative/cooperative learning Student's educational experience should "build inquiry, sense of wonder, and excitement of discovery. "Learning by doing" activities have a strong potential in producing and assessing a constructivist learning methodology.

This generation of consumers and manufacturers is responsible for climate change, but the rectification of this mistake can happen ONLY if we go "green" in possibly all sectors.

The present environmental issues have created awareness of the kind of impact that it will have on future generations. This has initiated the necessity of going green and being sustainable which has created an increased demand for green services and products. Going green is important and crucial especially for the developing economies because of its population and natural wastage. It is very crucial to create a sustainable future.

Education services are working towards achieving green and being environmentally friendly. Green pedagogy asserts learning will only take place in an environment which is opportune for development in children's life. Teachers need to incorporate awareness and adoption of environmentally friendly practices in the learning process. The culture of earth conservation has to be an integral part of the curriculum. Eco-friendly tools, techniques, and equipment have to be used in the teaching-learning process. Future generations should be able to understand and protect natural resources and, in that process, protect human health.

Education systems have a responsibility for alternative thinking and creating new ideas and challenging the old school of thoughts. This will lead to different thinking amongst the students and help them in any kind of social interaction. When such an education culture is brought in it leads to transformation thinking in society. Students need to understand the links between the environment, conserving energy, ecology, and economy. Sustainability challenges in the community should be addressed. Students are to be provided with the opportunity to study and apply concepts, methods of applying green in all functional areas. If they have an understanding of the issues, it will help in the future to apply solutions.

Our project is within the *umbrella* of the Green Education, i.e. all about creating knowledge, skills, attitudes and values related to the environment. A final aim is to promote collaborative work and exchange of knowledge and ideas among teachers and students, creating a community of green education in Europe more aware of concepts very relevant for our future as sustainability, waste management green technology, biodiversity, self-regulation, social behavior, and development. The teachers have a great role in keeping updated and informed and in transferring knowledge in an innovative way.

Pedagogy should include the real world learning experiences so that the learning is very fruitful. The environment provides typical challenges to the current and future generation in terms of climate

change, resources getting depleted, water issues, waste management poverty, food and war issues, environment caused diseases and pollution.

Learning activities should be driven by the needs of students and teachers.

Students need modules to enhance their learning of green concepts, build their confidence in applying these concepts, and prepare and inspire them. Teachers need modules to be safe for use in the classrooms, inexpensive, relevant to concepts taught in physical, chemical and biological curricula and closely linked to the national science standards and benchmarks.

This project also includes enhancing student knowledge in using green technology. Green technology is described as the development of clean technologies, "to minimize potential environmental and human health risks associated with the manufacture and use of technology products, and to encourage replacement of existing products with new products that are more environmentally friendly throughout their lifecycle. Green technology is the study of how technology can benefit the environment, such as by using less energy during the manufacturing process, the ability to manage waste and recycle products after use, and using eco-friendly materials.

Table 1: Comparison of conventional education with green /sustainable education

S.No	Conventional Education	Green/Sustainable Education
1	Only profit orientation	People, profit and planet orientation
2	Out dated pedagogy	Modern pedagogy
3	Demand for formal graduates decreasing	Demand for green jobs are high
4	Traditional approach	Contemporary approach
5	Usage of technology which is outdated	Green technology is being adopted
6	Environment gets degraded	Environment is upgraded

Section 2

The methodology and the structure to be used in selecting, creating and developing teaching/learning units of the curriculum


ZERO WASTE= SUSTAINABLE WORLD with the core contents including environmental education can be considered as sustainable development education which is based particularly on environmental and ecological sciences. It encourages students to critically reflect on the ideas of sustainable development and the values that underlie them, and to create solutions to achieve concrete goals in a variety of unpredictable situations. These kinds of contents exist especially in the fields of ecology, biodiversity, conservation, and system biology. Biological phenomena connected to socio-scientific issues, such as climate change, need to have an integrative and interdisciplinary approach to be thoroughly taught and learned. When biology education is given in connection with SE (Sustainability Education), teaching methods such as experiential, collaborative, process-based, and problem-based experimental learning and computer-assisted methods can be useful. Biodiversity, climate change, the sustainable use of natural resources, health, cultural heritage, multiculturalism, and global welfare are important contents in the planning of a sustainable future. The effects of students' own behaviours should be discussed, and sustainable actions practiced in local surroundings. An important goal is to learn negotiation, problem solving, and decision-making skills through discussions about ecological, social, economic, and ethical principles concerning local and global responsibility in their own life. Through memorable, experiential, and active processes, students learn to discuss their own value selection and to evaluate phenomena and sources of information critically.

Section 5

Operative guide to the curriculum contents

Sustainable development is a development that fulfils the needs of the present generation without compromising the needs of the future generation. Without the achievement of the environmental sustainability, sustainable development cannot be achieved. Reduce, Recycle, Reuse should be the three terms mostly used by every individual.

Pedagogical Strategy : Students through direct interaction inside or outside the classroom learn greening through experience and hands-on approach. Environmental education helps build creative thinking and relationship skills and fosters leadership qualities.

With the project, we would try to engage our students in learning about:
-The resources their schools consume -- and involve them in making consumption more sustainable

-Toxics issues in and around schools -- and involve them in minimizing their use

-Gardens and food systems -- and involve them in growing their own food.

If we teach our children these lessons in precaution and sustainability, they can play an integral role in making our schools, communities, and planet more sustainable and healthy.

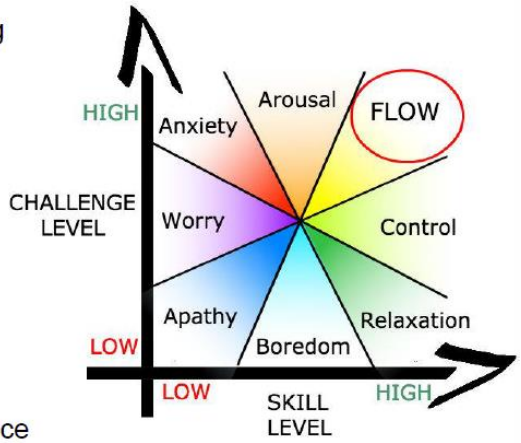
Our innovative approaches should motivate teachers in the creation of flexible personalized teaching/learning paths, increase students' interest and involvement, to capture the students' imagination and motivation, due to the innovative methodology of their learning.

The activities should be carried out with everyday material by the students in order for them to be able to follow. Detailed descriptions will also help (possibly including partially video-based tutorials).

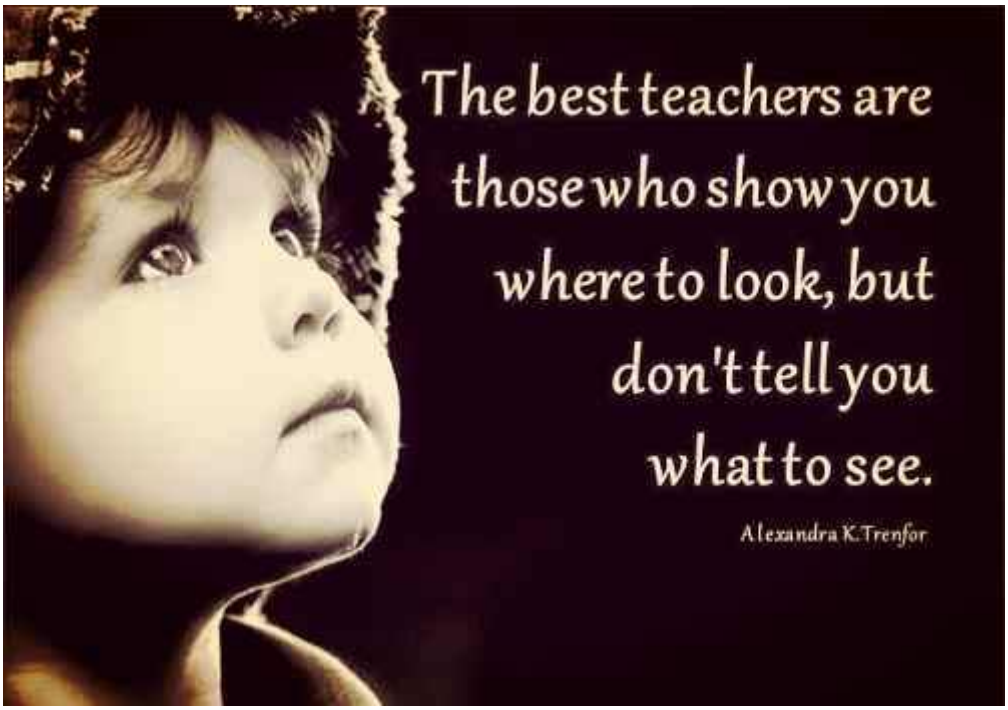
Thanks to the application of the educational method of acquiring knowledge through experience, it is possible to develop in learners the enthusiasm for acquiring knowledge and a willingness to learn in practice.

What to keep in mind?

- Students are different and their learning styles are different
- Students want to know the connection with real life
- Fun and learn in the same time
- Not too easy and not too difficult
- Flow
- Meaningful feedback
- Test it before starting with wider audience



Implementation of innovative methods in the school environment



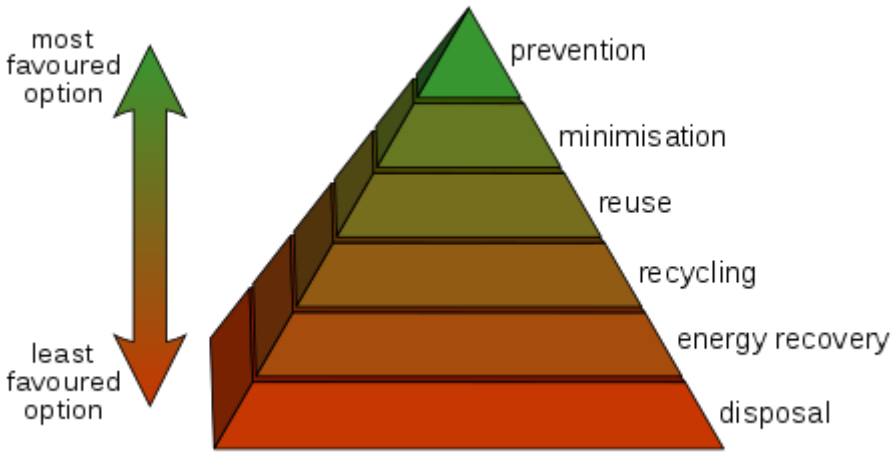
The biggest challenge for any teacher is capturing each student's attention, and conveying ideas effectively enough to create a lasting impression.

The education field is changing so fast that we need to keep up and adapt to the more modern strategies. Furthermore, in the last three years, the world has seen a shift to online classrooms and hybrid learning. However, staring at laptop screens means it's easier for students to be lost and do something else while honing nothing but their skills in pretending to concentrate. However, it's the teacher's responsibility not to give dull and dry lessons that make students fed up. Teaching them more practical skills, enhancing their problems solving capabilities can help. Infusing real-world experiences into instruction will make teaching moments fresh and enrich classroom learning. Relating and demonstrating through real-life situations will make the material easy to understand and easy to learn. It will spark learner interest and get the pupils excited and involved. If a teacher is passionate about his subject and finds interesting ways to explain a topic, students will start to follow and think out of the box. So, teachers need to change their mindsets and think of students as leaders too. Teachers should make the class more interactive and innovative. This is what we call innovative teaching. Innovative teaching methods aren't just about using the most cutting-edge technology in class or constantly catching up with the latest education trends! They're all about using new teaching strategies that focus more on students. These innovative ones encourage students to join proactively and interact with their classmates and the teacher during lessons. Students will have to work more, but in a way that meets their needs better and can help them grow faster. Unlike traditional teaching, which mainly focuses on how much knowledge you can pass on to your students, innovative ways of teaching dig deep into what students truly take away from what you're teaching during lectures.

According to the National Education Association, Dawn Dupriest in the paper "Creativity in the Classroom," claims: "*Is there anything more satisfying than making something creative? A quilt, a webpage, a decoration,an invention? As a child, do you remember the pride you felt when you showed your parents a LEGO creation or a fairy house or even a mud pie? Creativity belongs everywhere, not just in childhood games and extracurriculars. It involves all of your senses and creates new knowledge that didn't exist before. Students of all ages need to learn by creating – it helps to synthesize information and bring joy and meaning into their educational experience*."

Indeed, one of the most positive examples of innovation in teaching and learning is helping students explore their creative aspects freely. If you're teaching a particular topic in the class, or a practical session is going on, let the students come up with their creative ideas. Bring aspects of creativity into all your subjects, be it mathematics, science, or history. Think of ways to develop their creative ideas. You can analyze the ideas and provide them with feedback. The more you encourage their creativity, the more powerful their imagination gets. Encourage different ideas, give them the freedom to explore. Make use of art activities. Irrespective of the topic being taught, *Creativity* gives room to the students to independently express their thoughts and feelings, explore the world beyond and master a true sense of self-awareness. In this imprisoned society with lots of prejudices still prevailing around, creative minds can take up the task to broaden the perspective of people dwelling here. It is important take the help of tools to stimulate creativity, i.e. to include playful games or forms of visual exercises that will excite young minds and capture their interest. Art can help students develop creativity, critical thinking, and problem-solving skills. One way to incorporate art is to use visual aids, such as pictures or diagrams, to help explain complex concepts. Another way is to allow students to create art as a way to explore and express their understanding of a topic. This can be in the form of drawing, painting, sculpting, or even digital art. Lastly, encouraging students to collaborate on art projects can help them learn how to work together, communicate effectively, and build relationships with their peers.

Waste management and circular economy

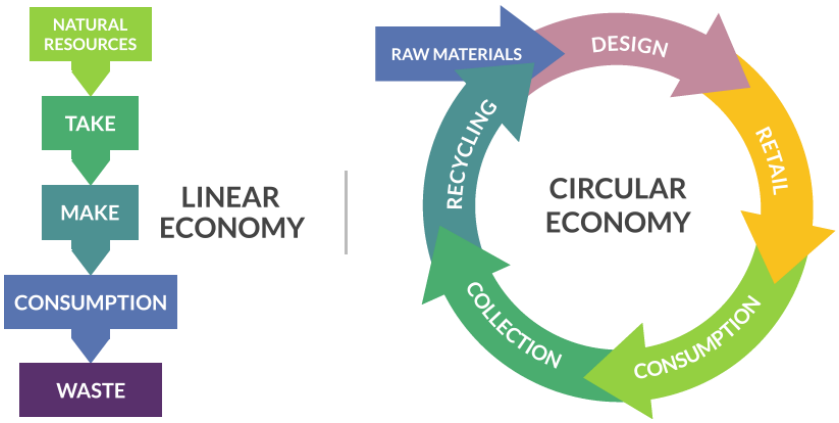


Waste hierarchy

Linear economy is a wasteful system: many valuable materials are "lost" to landfills, and the products that are manufactured are consistently under-utilized.

Waste management (WM) represents a challenge for public authorities due to increased waste generation following urban population growth, economic burdens imposed on the municipal budget, and nuisances inevitably caused to the environment and local inhabitants.

In contrast to a linear economy, a circular economy aims to decouple growth from finite resource consumption and is restorative and regenerative by design.



The transition towards a circular economy is challenging as only 9 percent of the goods and product of the global economy loop in one or the other way. Such a multi-disciplinary and multi-facets process inherently needs evidence-based and scientific sound information on the potential consequences of the decisions made.

Simultaneously with industrial growth, increasing population, rapid urbanization and improved community living standards, enormous quantities of materials are being wasted in the European Union (EU) in the last decades. EU statistics illustrate that up to 2.6 billion tons of waste (specified by Directive 2008/98/EC) was generated in 2014, of which most originates from economic activities

such as construction (34.7%), mining (28.2%) and manufacturing (10.2%), while households contributed for 8.3%. Consumption patterns, economic wealth in combination with the projected population growth will likely lead to an increased amount of municipal solid waste in the near future. Overall, waste generation indicates the limited ability to use primary resources efficiently. The linear economy is a basic structured model that relies on the extraction of raw materials and their processing into products and potential by-products which, after usage, are treated as waste and mainly disposed of into landfills or dumpsites. In the past, this model has been considered as a successful and effective approach, able to manufacture products at competitive prices, boosting the economies of developing and industrialized countries, and encouraging human consumption.

However, concerns about the depletion of natural biotic and abiotic resources (coal, minerals, metals, wood, etc.), with consequent challenges in supply, have brought increased attention to the way we should manage the available resources. In this respect, waste disposal not only results in significant losses of materials but also incurs significant impacts on the environment finally reducing the quality of life. Ultimately, this may lead to exceed certain environmental thresholds or tipping points, affecting the current ecosystem irreversibly. Therefore, waste should be managed so that it does not poses risks to air, water, soil, plant and animals e.g., by the release of methane or leachate, eventually leading to impacts on human health and well-being which is absolutely to be avoided. Therefore, changing this linearity of material flows is high on the agenda as it is one of the profound challenges the EU is facing today. The linear "take-make-dispose" model of economic growth we relied on in the past is no longer suited for the needs of today's socio-economic European system. A shift towards a circular economy as an industrial system that is restorative or regenerative will increase resource efficiency and reduce waste significantly. Furthermore, the circular economy model aims to create secure jobs in Europe, to boost innovations giving competitive advantages to EU industry and to provide increased level of protection to humans and the environment. It should also provide consumers with more durable and innovative products that provide monetary savings in a life cycle perspective and a better quality of life.

Consumables in the circular economy should be largely made of biological ingredients or "nutrients" that are at least non-toxic and possibly even beneficial, and can safely be returned to the biosphere, either directly or in a cascade of consecutive uses. This could contribute greatly to reduction of waste, when done in a safe and smart manner. Reconceptualization and re-design of products and processes is paramount, enabling materials to be used and reused at their highest utility for the intended performance, while either circulating through manmade systems as long as possible or through natural systems in pure, shorter and longer cycles.

Let's reflect together:

Although multiple waste policies and targets have been established since the 1990s, in practice the status of the EU economy remains far from being circular or sustainable. Clearly, optimizing waste management alone does not solve the linear economy problem—to "close the loop" and achieve a circular economy, it is equally important for example to examine product designs, production systems, and consumption habits.

UN17 Village to be built in Copenhagen with recycled materials (https://www.dezeen.com/2018/12/10/un17-village-eco-housing-copenhagen-lendager-group-arstiderne-arkitekter/)

The state of art in the different countries of our Consortium:

Czech Republic

Plan of environmental education

1) **Use of the MRKEVprogramme**
   - Our school has been registered among the network of schools with interest in education in ekology (MRKEV – acronym for methodology and realization of complex ecological education which means CARROT in English ☺)
   - MRKEV regularly sends us methodological and information materials which are related to education in ekology and regularly informs us about events which our students or teachers may participate in

2) "PLAYING WITH RECYCLING" TASKS
   - "Playing with recycling" is a program shielded by the Ministry of Education in the Czech Republic; its task is to deepen the students´ knowledge in separating and recycling waste and enable the students to have personal experience with collecting batteries and small electrical appliances

3) Use of Educational programmes on SEVER (center of ecological education adn ethics in Rýchory – close to Trutnov, Czech Republic).

4) "Meduňka" ("Lemmon Balm"¨)

   - Network of class representatives for education in ecology
   - Each class elects two representatives who help organizing events related to ecological education

5) Preparing the project "Earth Day"
   - Field trip to waste water treatment plant in Bohuslavice – June 2023
   - Helping to the KRNAP (Krkonoše National Park) in the event "Cleaning the Meadows" – in May 2023

6) Topic: "Global Warming"
   - Include the BIO topic into regular school lessons
   - Show documents shot by the organization "People in Need" and ecological center Veronika
   - Workshop with an expert

7) School Garden
   - In autumn and spring – maintain the school garden
   - Each plant is provided with a tag with its name (tags are stored inside in winter)
   - Create a list of plants grown in the garden; it includes its picture, description and its place in the system
   - Use the school garden for unusual forms of education – especially in warm months toward the end of a school year
   - Use the school garden while teaching/ studying botany (1st year students – plants, 2nd year students - invertebrates)

8) Separating waste and recycling within the school buildings
   - Continue in separating – plastics and paper

- Collecting batteries and small electrical appliances for further recycling