

# THEMED STEAM EDUCATION: LESSONS PLAN

MOVING THE STEAM  
APPROACH FORWARD  
THROUGH TEACHER-  
LED COOPERATION



**STEAM**  
ing ahead

Fostering critical thinking,  
problem-solving and creativity

**MARCH 2023**



Co-funded by  
the European Union

The following project product was produced in the scope of the project «**STEAMing Ahead: Moving the STEAM Approach forward through teacher-led cooperation**», an Erasmus+ KA220 – Cooperation partnerships in school education –, funding contract number 2021-1-PT01-KA220-SCH-000029409.

The contents of this publication are the sole responsibility of the STEAMing Ahead consortium and can in no way be taken to reflect the views of the European Union.

#### Editor

Ph.D. Bilge Has Erdoğan







#### Authors

Ph.D. Bilge Has Erdoğan, Ph.D. İlknur Efekan Ertaş, Ph.D. Elif Öznur Tokgöz, Derya Ceylan, Bekir Sevinç, Selim Saraçoğlu, Marco Bento, Robin Beecroft, José Miguel Sacramento, José Alberto Lencastre, Susana Ribeiro, Susi Leo & Raquel Ortega Martínez.

#### Translation

Derya Ceylan

This is the result of a common work of the following institutions:

<i>Institution / Contact person</i>	<i>Country</i>	<i>Institution / Contact person</i>	<i>Country</i>
<p><b>Colégio Santa Eulália</b> (E10222197 – Portugal) Coord. Marco Bento <a href="mailto:macbento@hotmail.com">macbento@hotmail.com</a></p>		<p><b>Searchlighter Services Ltd</b> (E10170954 – United Kingdom) Robin Beecroft <a href="mailto:rbeecroft@searchlighter.org">rbeecroft@searchlighter.org</a></p>	
<p><b>Sincan Şehit Abdullah Büyüksoy Bilim Ve Sanat Merkezi</b> (E10213804 – Turkey) Bilge Has Erdoğan <a href="mailto:bilgehas@windowslive.com">bilgehas@windowslive.com</a></p>		<p><b>Instituto Politécnico de Coimbra</b> (E10165348 – Portugal) José Miguel Sacramento <a href="mailto:jose@esec.pt">jose@esec.pt</a></p>	
<p><b>Istituto Comprensivo Battipaglia Salvemini</b> (E10201650 – Italy) Susi Leo <a href="mailto:susi.leo1972@gmail.com">susi.leo1972@gmail.com</a></p>		<p><b>Make It Pedagogical</b> (E10098912 – Portugal) José Alberto Lencastre <a href="mailto:josealbertolencastre@gmail.com">josealbertolencastre@gmail.com</a></p>	
<p><b>Centro Tecnológico del Mueble y la Madera de la Región de Murcia (CETEM)</b> (E10180735 – Spain) Raquel Ortega Martínez <a href="mailto:r.ortega@cetem.es">r.ortega@cetem.es</a></p>			

## Contents

<b><i>I.</i></b>	<b><i>INTRODUCTION</i></b> .....	<b>4</b>
	I. 1 JUSTIFICATION OF THE EDUCATIONAL PRACTICES .....	5
	I. 2 APPLICATION PROCESS OF LESSON PLANS .....	12
<b><i>II.</i></b>	<b><i>THEME 1: SAVING WATER</i></b> .....	<b>15</b>
	II. 1 THE IMPORTANCE OF WATER FOR ALL LIVING THINGS .....	16
	II. 2 HOW CAN WE MAKE ‘URBAN FARMING’? .....	20
	II. 3 TECHNOLOGIES FOR THE CORRECT USE OF WATER IN AGRICULTURE.....	36
	II. 4 WATER-RISING RESISTANT ARCHITECTURE.....	44
	II. 5 WATER AWARENESS WITH PANTOMIME.....	56
<b><i>III.</i></b>	<b><i>THEME 2: WAR</i></b> .....	<b>60</b>
	III. 1 PSYCHOLOGICAL, SOCIOLOGICAL AND ECONOMIC EFFECTS OF WAR .....	61
	III. 2 THE IMPORTANCE OF SHELTERS IN WARS .....	68
	III. 3 ECONOMIC EFFECTS OF WAR .....	77
	III. 4 PUBLIC ANNOUNCEMENT SERVICE.....	82

## I. INTRODUCTION

In our world where change and development are inevitable, raising individuals who can catch this speed and perhaps add positive momentum to this speed is one of the primary goals of every society. The realization of this goal, in a sense, is to raise students, the founder of tomorrow, as individuals who question, research, design, solve problems and show their creativity. Today, the STEAM approach is given great importance in terms of realizing these goals and research on the gains that can be obtained with the use of this approach are continued.

STEAM is an educational approach in which the initials of the disciplines Science (S), Technology (T), Engineering (E), Art (A) and Mathematics (M) are combined and named accordingly. It has also taken its place in the relevant literature, where this approach has changed and developed over time.

The term STEM was considered as the phase in which different disciplines were taught together at the same time at the very beginning but in time, it has turned into a structure in which one of the main components is considered as art; and creativity and design skills, which are based on problem solving generally involving real-life situations, come to the fore. With the addition of the art component, this building began to be called STEAM.

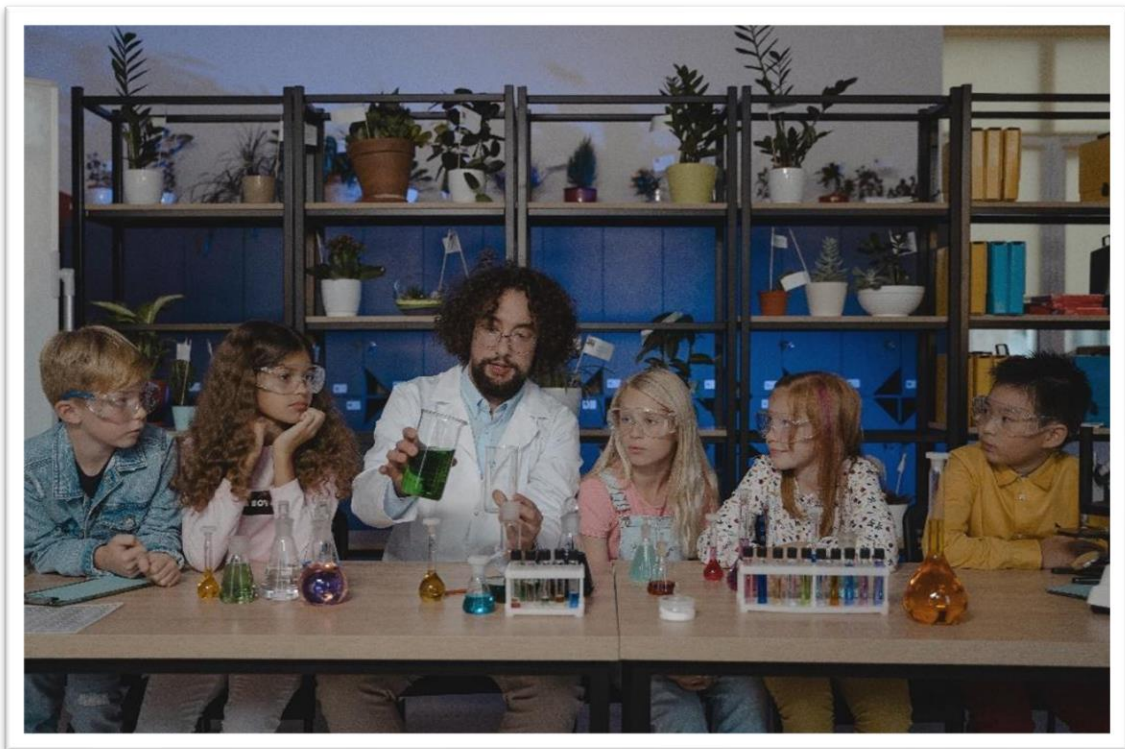


Image 1. Students in a Science class, by [Tima Miroshnichenko](#) via Pexels.

In many studies, positive results have been obtained that the STEAM approach increases students' problem-solving skills, creativity, design skills and basic course success. However, there are also studies showing that teachers have serious difficulties in designing lesson plans in order to use the STEAM approach in lessons. This study was carried out to represent an example and guide for teachers in this regard.

## I. 1 JUSTIFICATION OF THE EDUCATIONAL PRACTICES

### **1. The STEAM Approach: Interdisciplinarity and integration of knowledge**

STEAM (Science, Technology, Engineering, Arts, and Mathematics) education emerged as a new pedagogy in 2007, merging the arts with STEM subjects with the purpose of improving student engagement, creativity, innovation, problem-solving skills, and other cognitive benefits (Hetland & Winner, 2004; Liao, 2016; NAEA, 2016; Root-Bernstein, 2015, as cited in Perignat & Katz-Buonincontro, 2019).

Since STEAM education involves discipline integration and there are several types of discipline integration (cross-disciplinary, multidisciplinary, interdisciplinary, and transdisciplinary), Perignat and Katz-Buonincontro (2019), in a review of published articles, examined the definitions and interpretations of STEAM education, identifying diverse STEAM definitions considering the four main types of disciplinary integration, namely: *transdisciplinary STEAM education* which “includes fully merged disciplines without boundaries and lessons rooted in authentic problems or inquiry” (p. 34); *interdisciplinary STEAM education* that “brings several disciplines together under a common theme, but each discipline remains discrete” (pp. 34-35); *multidisciplinary STEAM education* which “includes collaboration among two or more disciplines but are not merged”(p. 35); *cross-disciplinary STEAM education* that “focuses on observing one discipline through the perspective of another, for example: the physics of music” (p. 35). In this project we are considering STEAM education as a teaching and learning methodology in which discipline integration is viewed as a progressive way from interdisciplinarity to transdisciplinarity.

### **2. The decisive role of soft skills**

According to the text *Exploring STEM Competences for the 21st Century* published by UNESCO (2019), several skills are required in carrying out STEM-related tasks, namely: *cognitive skills* (information processing - data interpretation and data analysis, problem solving and engineering thinking, scientific investigation, computational thinking and use of information and communications technology, design Thinking, creativity, and innovation); *manipulative and technological skills*; *collaboration and communication Skills*.

engage in Kim (2016) categorized STEAM teaching competencies in the following way: *cognitive ability in subjects* (understanding and using convergent knowledge); *advanced thinking ability* (creativity, problem-solving ability, critical thinking ability, ability to use information, and decision-making ability); *ability to contribute to the community* (ability to communicate, ability to engage in social relationships, and ability to cooperate); *and individual emotional ability* (self-respect, positive emotion, consideration, and civil awareness) (Perales & Aróstegui, (2021).

Today, contrary to what Descartes believed, that the emotions hindered our thoughts, the emotions are considered as essential guides in the cognitive process (Martins & Pedrosa, 2017). In fact, the cognitive operating system must incorporate the emotional and social domains only this way the brain takes in what has been learned from an experience (Fonseca, 2016).

The “OECD Survey on Social and Emotional Skills Technical Report” characterizes the social and emotional skills to develop in students and assesses the characteristics and contextual factors which foster or hinder the development of these skills in schools and other settings (OECD, 2021).

In this report is presented the ‘Big Five’ domains (Figure 1) – that distinguishes five dimensions of social and emotional skills: task performance, emotional regulation, open-mindedness, collaboration, and engaging with others (OECD, 2021). In this sense, the teaching and learning process must consider the development of emotional and social skills further cognition skills.

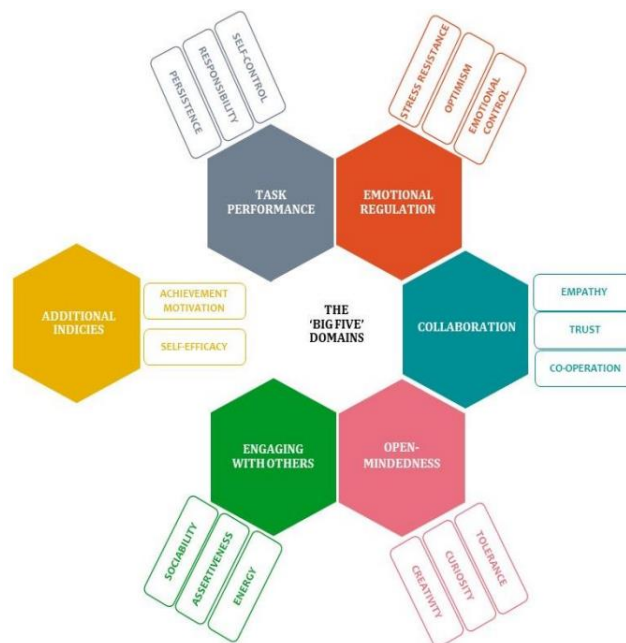


Figure 1. The 'Big Five' Domains

### **3. Art in STEAM pedagogy**

The artistic processes of creating; presenting, performing, and/or producing, increase learner empowerment, interest, engagement, and students' ability to make connections and transfer knowledge. Engagement in the artistic processes naturally ignites learners' focus and dedication, encouraging learner confidence as students work. (Strauss, 2013).

Learning the art, challenges us to find life-fulfilling solutions, which can only be implemented through education and self-edification through the arts. By studying the arts, students study life itself. The patterns of sensory and emotional knowledge of the world are concentrated in art. The experiential and spiritual character of the artistic act, the aesthetic and extra-aesthetic potential of the arts, the integrative factor of the arts in dialogues and cultural traditions, etc. assigns an irreplaceable space to the arts in the educational process.

As man is inseparable from social life, the arts, as a product of human spirituality, come from the laws of life and exist according to the same laws. Thus, education/learning through the arts directly forms translatable culture into conduct and existence.

When the arts are authentically included in STEAM pedagogy, future-forward agenda in education like cultural relevance, social-emotional learning, workforce development, and issues yet unknown can be purposefully addressed. STEAM encourages learners "to be curious, experiment, and take risks—key dispositions artist habits of mind engender" (Bequette and Bequette, 2012). They are also focused and creative, using a variety of methods, as they work to find solutions to the problem (Strauss, 2013).

In the process of training teachers about learning based on STEAM pedagogy, it is useful to consider the answer to the following questions:

- Distinctly defining STEM, STEAM, and integrated learning, including the differences and similarities of each strategy.
- Selection of competence units in Science, Technology, Arts, Mathematics, which are aligned and mutually improve learning through student involvement.
- Building authentic and rigorous STEAM lesson series in terms of individual cognitive and sensorial engagement of students.
- Creating data facilitation resources that engage teachers and students in reflections of a STEAM learning experience and outline next steps in student growth.
- Exploring principles and providing examples of ways in which didactic projects can be successfully implemented for the STEAM lessons.

Learning the Art comes with several challenges related to finding life-fulfilling solutions that can only be implemented through education and self-edification through the arts. At the same time, there are known express references to what can never be taught - artistic creation. This idea is also valid in the case of learning art. The learning process in the disciplines of the Arts curriculum area is a state of openness of each student to the world of the imaginary. Art learning involves freedom and self-discovery and not a system of rules.

#### ***4. Formative assessment: a privileged way to improve teaching and learning activities in STEAM approach.***

Our belief that the STEAM approach aims to develop skills like problem-solving, creativity, innovation, critical thinking, communication, and collaboration makes the formative dimension of evaluation crucial for the evaluation of this process, which is meant to be dynamic, continuous, and significant. These skills are crucial for success in STEAM activities. 2017 (Herro et al).

"All those activities undertaken by teachers – and by their students in assessing themselves – that provide information to be used as feedback to modify teaching and learning activities" is how assessment is described (Black & William, 1998, p. 82 in Rawson, 2019). An assessment is formative if the results are utilized to modify instruction within the instructional unit in which the assessment was conducted to better meet the needs of the students being assessed (Popham, 2006).

According to Scriven (1967), formative assessment is a continuous process that enables instructors and students to keep tabs on students' academic development and modify their teaching methods. It's distinct from summative assessment, which measures learning outcomes at the conclusion of a unit, course, or program. (Scriven,1976).

This method of assessment refers to the tools and assessment procedures used to give students and teachers feedback on their learning progress throughout the learning process. It entails keeping an eye on students' comprehension, spotting misunderstandings, and modifying teaching methods to suit students' needs. Quizzes, polls, observations, self-reflection, peer feedback, and instructor feedback are a few examples of formative assessment techniques (Fernandes, 2018; Barreira, 2019).

These resources can assist students in understanding their educational progress, identifying their areas of strength and weakness, and taking responsibility for their own education. It offers feedback that aids in understanding improvement, misconception correction, and better time and effort allocation decisions. It also aids in the development of metacognitive abilities such as self-reflection, self-regulation, and goal setting, which are crucial for lifelong learning (Allal, 1986, Barreira, 2019).



Concurrently, formative evaluation can assist teachers in keeping track of their students' comprehension, spotting misunderstandings, and modifying their educational tactics to suit the requirements of the class. To guarantee that all students are interested and learning, it gives teachers feedback that enables them to enhance their instruction, adapt learning activities, and adjust tempo. In order to address the various requirements of students, teachers must diversify teaching, give individualized feedback, and customize learning (Fernandes, 2018; Barreira, 2019).

As a result, STEAM educational practices should be guided by a more direct approach (because it comes from relationships with and observations of students), procedural (because it is carried out during the teaching-learning process), interactive (because it necessitates a constant relationship between the teacher and the student), shared (because various educational actors collaborate in the assessment process), and contextual (because it considers the many educational contexts in which educational processes take place) and alternative (since it employs a variety of activities that effectively substitute conventional evaluation instruments) (Fernandes, 2018; Barreira, 2018).

In this context, Allal, (1986) and Fernandes (2018) discuss the significance of implementing formative assessment, also known as assessment for learning, in the development of teaching-learning processes. This assessment truly values student participation in co-evaluation processes and self-evaluation processes, the quality of feedback, and the articulation between the modalities of formative and summative assessment, which require greater care in the selection and appropriate use of differentiating factors.

Formative assessment could significantly increase the STEAM approach's focus on monitoring and assisting student development by integrating STEM subjects (Science, Technology, Engineering, Arts, and Mathematics) (Rawson, 2019). It is a continuous process for gathering data on how students are doing, learning, and developing their STEAM abilities.

As part of the STEAM method, the following are some important elements of formative assessment in the STEAM approach (Rawson, 2019). Continuous feedback in this way, but assuming it to be the decisive factor. In order to assist students understand their strengths, potential areas for growth, and ways to further their STEAM knowledge and abilities, formative evaluation in STEAM entails giving them timely and detailed feedback.

### ***5. Enhanced 7E Instructional Model: as a model to design activities***

The Greek philosopher Socrates defended the inquiry mode of learning by leading students to discover knowledge (Nicol e outros, 2020). According to Socrates, teacher is an observer, a helper which guides the students and pushing the dialogue forward through questioning (Delić & Bećirović, 2016). According to Abraham

(1997), the easiest way to design an inquiry-type lesson, is adopting “a learning cycle, which both represents the way scientists carry out an inquiry and is also patterned after the natural ways we solve problems in an inquiry” (Nicol e outros, 2020, p. 70).

The learning cycle as an instructional model is rooted in the constructivist learning theory, and since Piaget many learning cycles have emerged, namely the *Three-phase Learning Cycle - 3E*, the *Five-phase Learning Cycle - 5E*, and *7E Learning Cycle* (Eisenkraft, 2003) (Nicol et al., 2020). The Figure 2 represents the evolution from the *Three phase Learning Cycle Model* to the *7E Learning Cycle*.

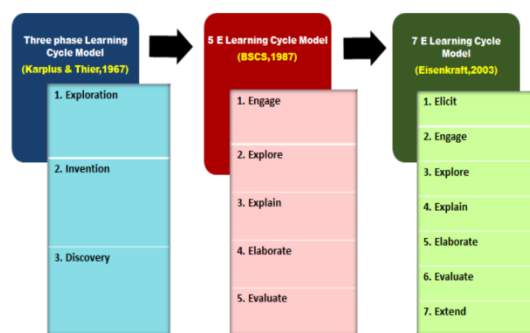


Figure 2. 7E Learning Cycle evolution (Rahman & Chavhan, 2022)

The 7E Learning Cycle involves seven phases described according to Rahman and Chavhan (2022):

1. **Elicit:** To make students able to review their prior experiences and knowledge linked with the learning situations they come across at present.
2. **Engage:** To grasp the interest of students and increase their attention as well as insert their curiosity about the subjects.
3. **Explore:** To provide the students with a common experience, in which the students get involved in the topic directly, explore themselves the concepts which help them build their own understanding and realize the unsatisfactory explanations in their minds.
4. **Explain:** Students discuss and express their conceptual understandings with the teacher and their classmates. Boths teacher and the students actively participate in this phase. The teacher needs to question to examine students' understanding, to induce their thinking and to ensure that the concepts are correctly formed in student's minds.

5. **Elaborate:** To help learners in implementation of knowledge gained in the past when they come across novel situation. This benefits the students in extending their conceptual understanding about the concept thought. Related activities or experiments can be shown to the students to get a deeper understanding of the concept. Students' previous understanding helps them ask more questions and arrive at solutions.
6. **Evaluate:** Both process as well as product of student learning are examined through this phase. The teacher uses rubrics, checklist, observation sheets, self-assessment, peer-assessment, and other formative as well as summative evaluation techniques to guide the students learning.
7. **Extend:** Students apply the concepts learned in real-world situations. Transfer of learning to a new context enhances their conceptual understanding.

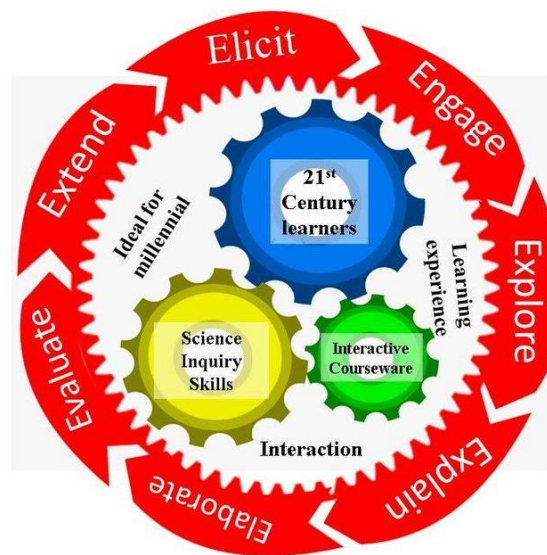


Figure 3. 7E Instructional Model (Lubiano & Magpantay, 2021).

The steps specified in the 7E instructional model can be seen as a roadmap that can increase the quality of education rather than a training prescription. It can be emphasized that the characteristics of the target age group should be considered in the design of the activities that can be done in the steps described here.

Since STEAM education is focused on inquiry-based learning, 7E Learning Cycle was considered to design the lesson plans of this project.

**Authentic Assessments:** Assessments in STEAM are designed to be authentic and connected to real-world STEAM contexts. They may include project-based

assessments, portfolio assessments, performances, presentations, or demonstrations of learning, which allow students to showcase their understanding and application of STEAM concepts.

**Process-Oriented Assessment:** Formative assessment in the STEAM approach focuses not only on the final outcomes but also on the process of inquiry, problem-solving, and design thinking. Teachers assess students' ability to ask questions, think critically, collaborate, experiment, and iterate throughout their STEAM projects.

**Reflection and Self-Assessment:** Students are encouraged to reflect on their own learning and assess their progress in STEAM. They may engage in self-assessment activities, peer assessments, or use rubrics and checklists to evaluate their own work based on predetermined criteria.

**Differentiation and Personalization:** Formative assessment in STEAM recognizes the diverse abilities and interests of students. Teachers use assessment data to differentiate instruction, tailor learning experiences to individual needs, and provide appropriate challenges and support for each student's STEAM learning journey.

**Integration of Multiple Disciplines:** STEAM is an interdisciplinary approach, and formative assessment in this context involves assessing students' understanding and connections across different disciplines. It seeks to identify how students can apply knowledge and skills from science, technology, engineering, arts, and mathematics to solve complex problems and create innovative solutions.

Formative assessment in the STEAM approach fosters a growth mindset, emphasizing that mistakes and failures are opportunities for learning and improvement. Students are encouraged to embrace challenges, solve problems, ask questions, raise hypotheses, persevere through obstacles, and view assessments to further develop their STEAM competencies, without being afraid to fail.

Overall, formative assessment in the STEAM approach plays a crucial role in providing feedback, guiding instruction, promoting self-reflection, and nurturing students' growth as STEAM learners. It supports the integration of interdisciplinary knowledge and skills, enabling students to become creative problem solvers and critical thinkers in the STEAM fields (Rawson, 2019).

## I. 2 APPLICATION PROCESS OF LESSON PLANS

In this study, some themes were determined based on common problems experienced all over the world. In these themes, it was tried to focus on cognitive in order to be gained at the context level, psychomotor in order to develop design and engineering skills, and affective development in order to raise awareness of students' attitudes and emotions.

The following parts should be considered in the implementation of the lesson plans.

1. At the introduction of each lesson plan, the time required for the application and the title that summarizes the lesson plan are included. Teachers can first check whether the relevant plan is suitable for their lessons here.

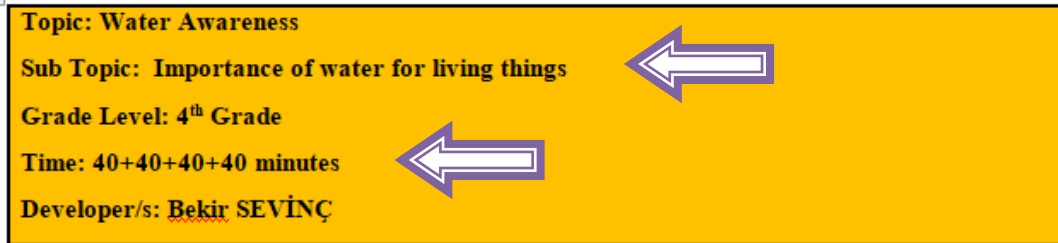


Figure 4. Lesson plan's introduction.

2. In each lesson plan, the targeted student learning outcomes were shared after the introduction. In this section, it is recommended to examine the suitability of the target acquisitions for the level of the student before the application.

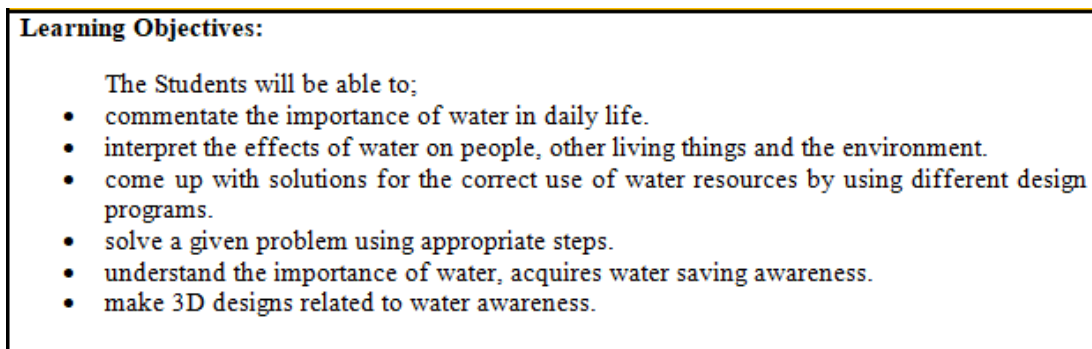
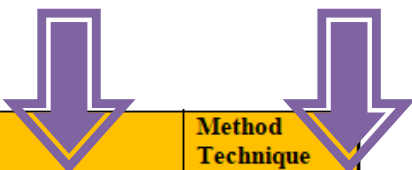


Figure 5. Learning Outcomes of Students targeted in the lesson plan.

3. The materials, the learning methods, techniques to be used are shared at each step in the implementation stages of the lesson plans. It is recommended that practicing teachers pay attention to these sections and prepare the tools in the material section in advance.

In addition, the appendices (course materials, measurement tools and other tools) recommended to be used in the material section should also be obtained from the appendices section in the last part of the plan.



Explore	Materials	Method Technique
<p>In this section, the teacher informs the students about vertical farming practices. He then divides the students into groups. Each group determines its own group name. A piece of paper was distributed to the groups and "What kind of design would you make if it were you?" Should your design be at home only? Can it be applied to other areas as well? "How can you feed more people with your farming?" These questions are asked the Ss to direct them to design. The Ss also give their designs a name and create their designs by discussing among themselves within the group dynamism. Later, pots (vases) and stands are given to the students for the design and they are asked to place them on the stand according to the design they are developing.</p>	<ul style="list-style-type: none"> <li>• <b>Appendix 3.</b> Vertical Agricultural Practices Information Text</li> <li>• Drawing papers</li> <li>• Pencil</li> <li>• Ruler</li> <li>• Vertical Farming Stand</li> <li>• Seedlings</li> <li>• Seed</li> <li>• Soil</li> <li>• Vase (pot)</li> <li>• Irrigation pipes</li> </ul>	<p>Collaborative learning</p>

Figure 6. Lesson plans implementation steps.

4. Each lesson plan has been developed in accordance with the 7E model and the suggested steps are explained in detail in a specific order. Linear application of the lesson plan is recommended.

## II. THEME 1: SAVING WATER

Water, a chemical compound of vital importance to living things with no smell and taste. When you look around you may think that it will never run out and that there is plenty. To some extent, this information is correct. In other words, the total amount of water in the earth's atmosphere and surface is constant. What provides this stability is the water cycle.

But are all existing water resources suitable for the use of every living thing? You may suppose that it can be made convenient. Have you ever thought about the cost of this? Or how the rapid change of water resources and more ocean water, less groundwater and glaciers can affect biodiversity? What kind of sociological changes can occur in a world where water resources are not sufficient? How does climate change affect the availability of water resources? If we start now, what can we do to protect water resources and, more importantly, to ensure conscious consumption?

In order to make it easier for you to find answers to all the questions mentioned above, lesson plans designed for the solution of a real-life problem and in which different disciplines are handled in cooperation, can guide you to reach the answers you need.



Image 2. The effects of drought, by [Pixabay](#) via Pexels.

## II. 1 THE IMPORTANCE OF WATER FOR ALL LIVING THINGS

<p><b>Topic:</b> Water Awareness</p> <p><b>Sub-Topic:</b> The importance of water for all living things</p> <p><b>Grade Level:</b> 4<sup>th</sup> Grade</p> <p><b>Time:</b> 40+40+40+40 minutes</p> <p><b>Developer/s:</b> Bekir Sevinç</p>		
<p><b>Learning Objectives:</b></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Commentate on the importance of water in daily life.</li> <li>• Interpret the effects of water on people, other living things, and the environment.</li> <li>• Come up with solutions for the correct use of water resources by using different design programs.</li> <li>• Solve a given problem using appropriate steps.</li> <li>• Understand the importance of water, acquires water saving awareness.</li> <li>• Make 3d designs related to water awareness.</li> </ul>		
Elicit	Materials	Method/ Technique
<p>Water scarcity in nature is increasing day by day. Saving water has gained importance.</p> <p>What can children in water-scarce areas do to save and decrease/stop water waste?</p> <p>The teacher makes the Ss play the game called 'water collection game' on the online scratch platform. And students are asked the following questions:</p> <ul style="list-style-type: none"> <li>• Why is the scoring system different for droplets dripping from the sky?</li> <li>• What could be the black water droplets dripping onto the ground?</li> </ul> <p>After asking questions, answers are gathered. Attention is drawn to the use and saving of clean water resources.</p>	<p>Game link: <a href="https://scratch.mit.edu/projects/780821270/">https://scratch.mit.edu/projects/780821270/</a></p>	<p>Game Based Learning, Discussion</p>
Engage	Materials	Method/ Technique
<p>Then the teacher asks the students about the words they know about water awareness and asks them to write these words by Wordart, one of web2.0 tools. Since this web2 tool will type the</p>	<p>Web tool link: <a href="https://wordart.com">https://wordart.com</a></p>	<p>Brainstorming</p>



<p>most known words in larger fonts, attention is directly drawn to those words.</p> <p>'Write the words you know about water in the word cloud?' is the direction of the teacher.</p>		
<b>Explore</b>	<b>Materials</b>	<b>Method Technique</b>
<p>In this section, the teacher informs the students about water awareness and saving. The teacher tells that when water scarcity begins all green areas and living things will decrease, and there will be drought.</p> <p>At this stage the Ss are asked to open the Minecraft game and to start with an empty world.</p> <p>Teacher observes the Ss about how they play primarily in survival mode on this Minecraft planet. The teacher wants the Ss to focus on what the basic life materials necessary for survival and the Ss are asked to design accordingly.</p>	<ul style="list-style-type: none"> <li>• Minecraft education</li> <li>• Computer</li> </ul>	<p>Game Based Learning</p>
<b>Explain</b>	<b>Materials</b>	<b>Method Technique</b>
<p>The teacher observes the students' Minecraft designs and asks why they used those materials in the design. The question 'Is water necessary for sustaining life?' asked by the teacher and the teacher examines water resources in design along with the students, asking 'How can we increase the biodiversity around water resources?'. The teacher goes on with the questions below:</p> <ul style="list-style-type: none"> <li>• Is water only necessary for plants?</li> <li>• Can we survive without water?</li> </ul>	<ul style="list-style-type: none"> <li>• Minecraft education</li> <li>• Computer</li> </ul>	<p>Game Based Learning</p>
<b>Elaborate</b>	<b>Materials</b>	<b>Method Technique</b>
<p>In this section questions like the ones below are asked and the students think and answer them:</p> <ul style="list-style-type: none"> <li>• What should we pay attention to when playing the game in survival mode in Minecraft world design?</li> <li>• What 3D materials did you use?</li> <li>• If we designed the world without water, would plants grow?</li> </ul>	<p>Computer</p>	<p>Brainstorming</p>

<ul style="list-style-type: none"> <li>How did we duplicate the materials used in the Blocks in the Minecraft inventory?</li> </ul>		
<b>Evaluate</b>	<b>Materials</b>	<b>Method Technique</b>
Minecraft Water awareness related designs are submitted by students. The question 'Why did you make such a design?' is directed to the students so that they explain their designs. All Ss Express their ideas on the designs presented.	Computer	Collaborative learning
<b>Extend</b>	<b>Materials</b>	<b>Method Technique</b>
The lesson is concluded by applying the self-evaluation form in <b>Appendix 1</b> so that the students can review what they have learned in the lesson and make their self-evaluation.	Appendix 1	Assessment

## REFERENCES

- Gelişen Beyin Net. "Öz Değerlendirme Formu". Date of access: 10.12.2022. [https://www.gelisenbeyin.net/ozdegerlendirme-formu.html#google\\_vignette](https://www.gelisenbeyin.net/ozdegerlendirme-formu.html#google_vignette)
- Minecraft. "Minecraft Education". Date of access: 8.12.2022. <https://education.minecraft.net/tr-tr>
- WordArt. "Create". Date of access: 4.12.2022. <https://wordart.com/create>
- Scratch. "Water Collection Game". Date of access: 4.12.2022. <https://scratch.mit.edu/projects/780821270/>

## APPENDIX 1

### SELF ASSESSMENT FORM

Name Surname:

Date:

1. What did I learn in this activity?

.....

.....

.....

.....

.....

.....

2. What did I do well? Why is that?

.....

.....

.....

.....

.....

.....

3. What was it difficult for me? Why is that?

.....

.....

.....

.....

.....

.....

4. Where did I need help?

.....

.....

.....

.....

.....

.....

5. In which subject should I improve myself more?

.....

.....

.....

.....

.....

.....

6. What will I do differently in future work?

.....

.....

.....

.....

.....

.....

## II. 2 HOW CAN WE MAKE 'URBAN FARMING'?

**Topic:** Use of Water Awareness, Vertical Agriculture Practices

**Subtopic:** How can we make 'Urban Farming'?

**Grade Level:** 4th Grade

**Time:** 40+40+40 minutes

**Developer/s:** Dr. İlknur Efecan Ertaş

### Learning Objectives:

Students will be able to:

- Have interest and curiosity about the events that occur in nature and in the immediate environment and develop a positive attitude.
- Attach credence to the necessity of leaving a liveable environment to future generations by gaining awareness of sustainable development.
- Understand the importance of efficient use of resources and sustainability in solving environmental problems and climate change with a local, national, and global perspective.
- Develop life skills such as analytical thinking, problem solving, decision making, creative thinking, communication, teamwork, social awareness.
- Comprehend scientific working processes such as hypothesis formation, determining variables, experimenting, and drawing conclusions.
- Understands the importance of water, acquires awareness of use.
- Design and implements vertical farming practices.

Elicit	Materials	Method Technique
<p>Problem Statement: There was a global disaster; water problem and famine started in the country due to wars and post-war disasters. Agricultural areas have been damaged and there has been a shortage of drinking water. For this reason, people had to meet their individual needs by themselves. Özlem, 11, realized that they had not been able to eat vegetables and fruits for a long time and thought that she could grow plants on the balcony of her house. With these plants, she wants to meet the needs of both his own family and the entire apartment. How can we help Özlem in this regard?</p> <p>The teacher comes to the classroom with photographs of places destroyed by global disasters. Photos are distributed to students. (Appendix 1) and a short video (the first 5 minutes of the 25 Liter video) are watched (Website 1). Then, if desired, the 'save water save life' video is watched (Website 2).</p>	<ul style="list-style-type: none"> <li>• <b>Appendix 1.</b> End of the World themed photos</li> <li>• Website 1. <a href="https://www.youtube.com/watch?v=nqZ0b6X_6Vs">https://www.youtube.com/watch?v=nqZ0b6X_6Vs</a></li> <li>• Website 2. <a href="https://www.youtube.com/watch?v=CtN-qish49k">https://www.youtube.com/watch?v=CtN-qish49k</a></li> </ul>	<p>Discussion methods</p>

<p>Students are asked the following questions:</p> <ul style="list-style-type: none"> <li>• How did you feel after what you saw in the photos and video?</li> <li>• What do you think global disasters result from?</li> <li>• So, what measures should we take so that our world does not end like this?</li> </ul> <p>After the answers are received, the sample scenario (problem situation) is read, drawing attention to the concept of 'careful use of the resources at our disposal'.</p>		
Engage	Materials	Method Technique
<p>Then, the teacher writes the students' ideas on the board by using the brainstorming method regarding the situation revealed in the problem situation, and the suggestions are discussed. 'Which of these are applicable?' are debated. Particular attention is paid to the following questions:</p> <ul style="list-style-type: none"> <li>• What do we need for the plant to grow?</li> <li>• Is our soil clean? And do we have enough land?</li> <li>• Do we have enough water for irrigation?</li> </ul> <p>Suggestions are evaluated in terms of time, space, amount of water, amount of soil. The teacher receives the students' answers and allows all students to comment. Then, visuals related to vertical farming practices (Appendix 2) are presented and they are asked whether they have seen it before.</p> <p>The efficient use of our resources and the importance of water are emphasized again with the questions:</p> <ul style="list-style-type: none"> <li>• Why do you think there was a need for such agriculture?</li> <li>• What are the advantages it provides?"</li> </ul>	<ul style="list-style-type: none"> <li>• Board and Board marker</li> <li>• <b>Appendix 2.</b> Vertical Farming Application Photos</li> </ul>	Brain storming
Explore	Materials	Method Technique
<p>In this section, the teacher informs the students about vertical farming practices. He then divides the students into groups. Each group determines its own group name.</p>	<ul style="list-style-type: none"> <li>• <b>Appendix 3.</b> Vertical Agricultural Practices Information Text</li> <li>• Drawing papers</li> <li>• Pencil</li> </ul>	Collaborative learning

<p>A piece of paper was distributed to the groups and "What kind of design would you make if it were you?" Should your design be at home only? Can it be applied to other areas as well? "How can you feed more people with your farming?" These questions are asked the Ss to direct them to design. The Ss also give their designs a name and create their designs by discussing among themselves within the group dynamism.</p> <p>Later, pots (vases) and stands are given to the students for the design, and they are asked to place them on the stand according to the design they are developing.</p>	<ul style="list-style-type: none"> <li>• Ruler</li> <li>• Vertical Farming Stand</li> <li>• Seedlings</li> <li>• Seed</li> <li>• Soil</li> <li>• Vase (pot)</li> <li>• Irrigation pipes</li> </ul>	
Explain	Materials	Method Technique
<p>The teacher asks the following questions about the designs of the students and explains the issues that they need to pay attention to. The advantages and disadvantages of vertical farming are written on the board by discussing the following questions:</p> <ul style="list-style-type: none"> <li>• Why did we choose vertical farming?</li> <li>• What should we pay attention to when doing vertical farming?</li> <li>• What are the basic elements necessary for plant growth? (remind the basic elements such as energy, light, nutrients, water and CO2)</li> <li>• How does the plant meet its needs when designing vertical agriculture?</li> <li>• How can we increase efficiency?</li> <li>• Which plants should be preferred?</li> <li>• What are the advantages and disadvantages?</li> </ul>	<ul style="list-style-type: none"> <li>• Board</li> <li>• Board marker</li> </ul>	<p>Brainstorming Explanation Discussion</p>
Elaborate	Materials	Method Technique
<p>In this section, the questions below are asked and the topic is associated with Art.</p> <ul style="list-style-type: none"> <li>• What should we pay attention to when designing?</li> <li>• Which materials should be used?</li> <li>• How can we make our design more aesthetic?</li> </ul> <p>Later, the Ss are asked what the concept of the 'Golden Ratio' is and they are asked to pay</p>	<ul style="list-style-type: none"> <li>• Board,</li> <li>• Board marker,</li> <li>• Drawing Paper,</li> <li>• Crayons</li> <li>• <b>Appendix 4.</b> Examples of the Golden Ratio</li> <li>• <b>Appendix 5.</b> Golden Ratio Drawing Guide</li> </ul>	<p>Demonstration</p>

<p>attention to this in their designs. The teacher also presents some examples of the golden ratio for them to understand better. (If needed, a guide on how to draw the golden ratio is given to each group so that they observe.)</p>		
<b>Evaluate</b>	<b>Materials</b>	<b>Method Technique</b>
<p>The designs are presented by the groups. They explain why they made such a design and make corrections/editing if they deem it necessary by taking the opinions of their friends in the other group. The groups evaluate one another.</p>	<ul style="list-style-type: none"> <li>● Board</li> <li>● Board marker</li> </ul>	<p>Oral presentation of the designs</p>
<b>Extend</b>	<b>Materials</b>	<b>Method Technique</b>
<p>What they have learned from this course and the benefits of vertical farming are evaluated and put into practice. Which of the designed vertical farming applications is more applicable is discussed with the students.</p> <p>For the sample application, field selection is made in the institution. Students are asked to make designs with the materials provided. The stands, which were previously prepared in different sizes, are positioned according to the students' choices. While doing this, they are reminded that they can use the golden ratio.</p> <p>The activity is ended by planting the selected plant seedlings or seeds in the designated places. However, the implementation of the activity and the filling of the observation forms continue for 9 weeks. The observation form to be used is shared in Appendix 6.</p>	<ul style="list-style-type: none"> <li>● Vertical farming stands</li> <li>● Soil</li> <li>● Seedlings</li> <li>● Seed</li> <li>● Vase (Pot)</li> </ul>	<p>Collaborative learning</p>

## RESOURCES

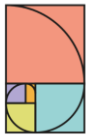
- Aerofarms, Global Headquarters, NJ, USA. (<https://aerofarms.com>, (Date of access: 15.12.2022)
- Al-Chalabi, M. (2015). Vertical farming: Skyscraper sustainability?, Sustainable Cities and Society, Vol. 18, s. 74 – 77
- Busse M., Dierich A., Freisinger U.B., Henckel D., Thomaier S., Siebert R., Specht K., (2015), Zero-Acreage Farming in the City of Berlin: Aggregated Stakeholder Perspective on Potential Benefits and Challenges, Sustainability, 7, 4518–4519 <https://doi.org/10.3390/su7044511>
- Bybee, R. W. (2012). Scientific literacy in environmental and health education. In Science Environment Health (pp. 49–67). Springer, Dordrecht.

- MEB, 2022. Çevre ve İklim Değişikliği Dersi Öğretim Programı, Ankara.
- Scharpe P., 2019. Living Greens Aeroponics allows for lettuce production in Minnesota year round,  
[https://www.agupdate.com/minnesotafarmguide/news/state-and-regional/living-greens-aeroponicsallows-for-lettuce-production-in-minnesota-year/article\\_d11ba720-4f34-11e9-ac13-2b3b6d13e82e.html](https://www.agupdate.com/minnesotafarmguide/news/state-and-regional/living-greens-aeroponicsallows-for-lettuce-production-in-minnesota-year/article_d11ba720-4f34-11e9-ac13-2b3b6d13e82e.html) (Access: 24 September 2019).
- Sahin, G. and Kendirli, B., (2016, 13-14 October), A new agricultural enterprise model: Vertical farms, TÜCAUM International Geography Symposium, Ankara.
- <https://citymonitor.ai/infrastructure/architecture-design/why-we-should-be-farming-skyscrapers-1029>
- <https://news.fordham.edu/inside-fordham/vertical-farming-scholar-brings-vision-to-fordham/#prettyPhoto>
- <https://vertical-farming.net/>
- <https://weburbanist.com/2016/05/22/off-grid-self-sufficient-regen-villages-with-vertical-farms/>
- <https://www.towerfarms.com/us/en/possibilities/greenhouse-farming/scissortail-farms>. Access:16 December 2022)

## APPENDIX 1







**STEAM**  
ing ahead

Fostering critical thinking,  
problem-solving and creativity



Co-funded by  
the European Union





## APPENDIX 2





### APPENDIX 3

## VERTICAL AGRICULTURAL PRACTICES INFORMATION TEXT

Another remarkable practice that has emerged in the last few years, especially in developed countries, is Vertical Farming. Vertical farms can be briefly defined as businesses that are multi-storey established on a field consisting of a single piece and aim to obtain a much more diverse and abundant product from the unit area with other agricultural innovations, especially soilless agriculture. The farms or businesses in question can be 3 – 4 floors or they can be planned as 30 – 40 floors. In vertical farms, which can also be designed as open or closed (Greenhouse) enterprises, not only plant production but also animal production is possible.

It can be designed in the appearance of a classic apartment, but also very marginal examples can be seen. In addition, many problems encountered in classical agricultural enterprises such as land fragmentation and disorganization, shrinkage of enterprises over time and adverse weather conditions do not constitute a problem in these enterprises. At the same time, since these buildings are designed in the city, they also allow the people of the city to access fresh and safe food in a short time (Şahin, G. and Kendirli, B., 2016).

It is emphasized that vertical farms are the most ideal type of enterprise for urban agriculture, as the damage to the environment can be prevented to a large extent by traditional agricultural practices. The system, which was initially developed only for urban agriculture, later became the most remarkable alternative for more efficient use of natural resources and meeting the nutritional needs of the rapidly increasing population in fast and reliable ways.

At the point of water resources, whose importance is increasing year by year and which has become a vital issue for most countries, vertical farms allow agricultural production by using very little water, do not need large agricultural lands and allow production throughout the year without being easily affected by environmental conditions. It is one of the remarkable alternatives for countries that have problems in food supply. (Busse M. et al., 2015)

Energy is just as important in vertical farms as water is in traditional agriculture. Considering that 24% of greenhouse gas emissions worldwide are caused by agricultural activities, it is expected that vertical farms can provide a solution to this issue to a large extent. However, according to a study conducted in the United Kingdom conditions, it was calculated that lettuce grown under vertical farm conditions in the summer period will cause 5 times more carbon emissions compared to outdoor cultivation, and 2 times more carbon emissions in the winter period (Al-Chalabi, 2015).

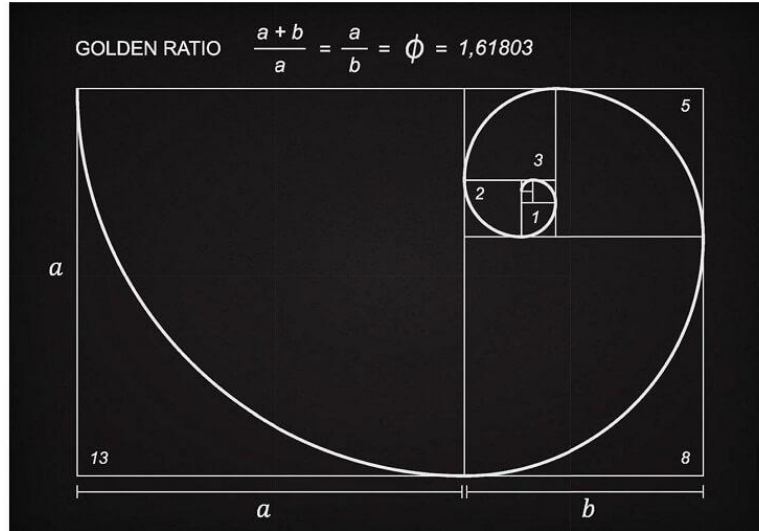
An important disadvantage in terms of production is that there are hardly any varieties suitable for cultivation in such structures today, and it is necessary to develop varieties rapidly. Today, mostly carrots, radishes, potatoes, tomatoes, peppers, peas, cabbage, spinach, lettuce, and strawberries are grown in 3-storey buildings.

However, the fact that products with low market value and little added value are grown in vertical farms with high initial investment costs and high annual energy consumption will not be effective in meeting the operating costs of agricultural structures. Even when the soil environment criterion in organic farming is set aside, the expression "increasing ecological harmony" is not directly related to the principles of vertical farms.

Although there are several advantages from efficient use of resources to obtaining healthy products, the positive effect of vertical farms on the ecosystem may not be direct, but indirect. This is another issue that needs to be overcome in organic farming (Şahin, G. and Kendirli, B., 2016).

## APPENDIX 4

### EXAMPLES OF THE GOLDEN RATIO



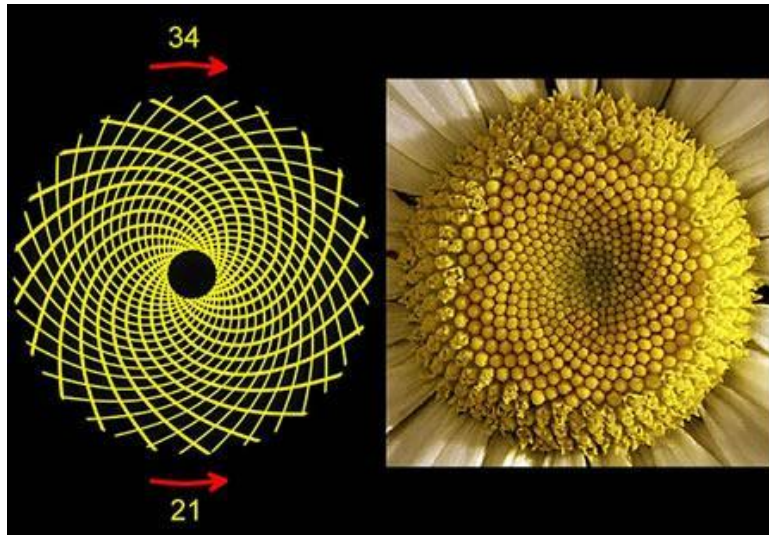
<https://www.tzv.org.tr>



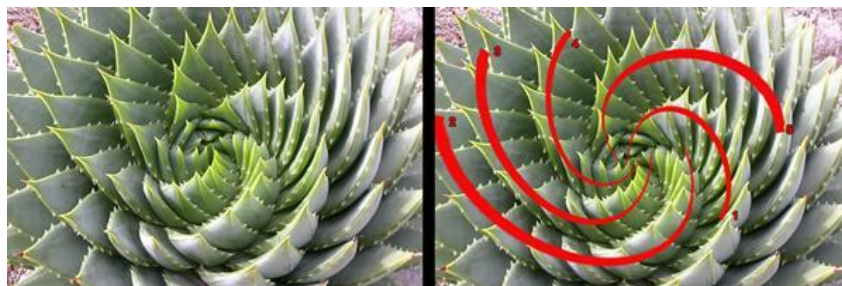
<https://www.yesilist.com/altin-oranin-dogaya-yansidigi-17-ornek/>



<https://www.yesilist.com/altin-oranin-dogaya-yansidigi-17-ornek/>



<http://www.aoder.org.tr/tr/altin-oran/36.aspx>



<http://www.aoder.org.tr/tr/altin-oran/36.aspx>

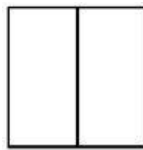
## APPENDIX 5

### GOLDEN RATIO DRAWING GUIDE

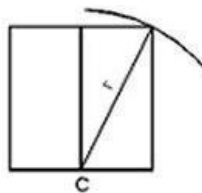
1. Let's start defining the Golden Ratio by drawing a square.



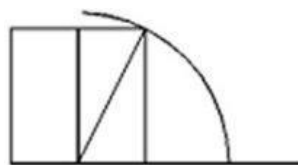
2. Now, let's divide this square in half so that there are two equal rectangles.



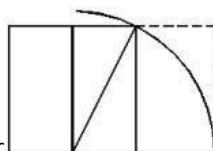
3. Let's put our compass at the point (point C) where the common side of the rectangles intersects the base of the square. Let's open our compass so that the circle we will draw touches the opposite corner of the square, that is, the radius of our circle is the diagonal of a rectangle.



4. Next, let's extend the base of the square until it intersects the circle we've drawn.

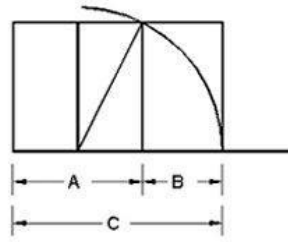


5. When we complete the newly formed shape into a rectangle, we will have a new rectangle next to the square.

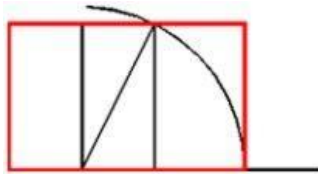


6. The ratio of the base length of the large rectangle to the base length of the square is the Golden Ratio. The ratio of the base length of the square (A) to the base length of the large rectangle (C) is the Golden Ratio.  $A / B = 1.6180339 = \text{Golden Ratio}$   $C / A = 1.6180339 = \text{Golden Ratio}$ .

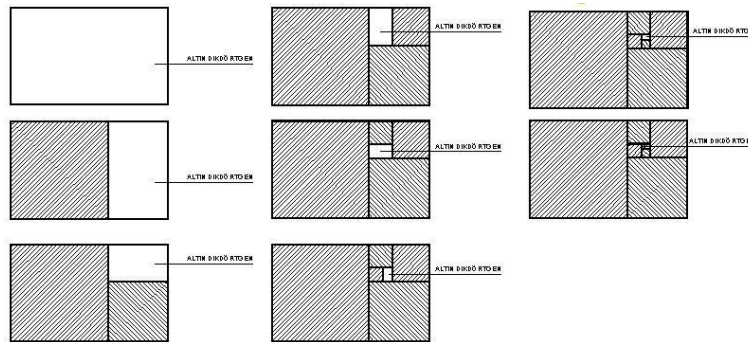




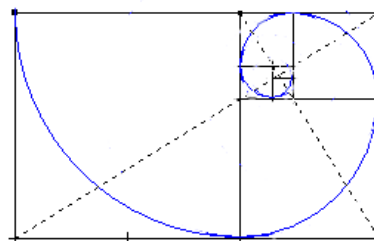
7. This rectangle we have obtained is a Golden rectangle. Because the ratio of the long side to the short side is 1.618, that is, the Golden Ratio.



8. Now, every time we subtract a square from this rectangle, we will always have a "Golden Rectangle".



9. If we draw a circle segment that takes the side lengths of the squares of this Golden Rectangle, from which we have drawn squares many times, into each square, we get a "Golden Spiral". The Golden Spiral forms the form and building blocks of many animate and inanimate beings. As an example, we can show the sunflower plant. The seeds of the sunflower are arranged in a spiral that follows the golden ratio. The golden ratio applies not only to quadrilaterals, but also to triangles, pentagons, and hexagons.



## APPENDIX 6

### OBSERVATION FORM

Group name:

Used materials: (It should be written with the actual weight and length information)					
Detailed drawing of the agricultural model created: (Express actual lengths in cm.)					
Total cost: (Calculate the total cost by writing down the actual cost of each piece of equipment.)					
Seeds used: (How many seeds of cucumber, tomato, pepper, zucchini, bean were planted)	Cucumber	Tomato	Pepper	Zucchini	Bean
<b>WEEK 1 DATA</b>					
Amount of water used (in Liter)					
Information on the general appearance of the plants: (Here, plant height, number of leaves and other detailed observations about the appearance of the plant should be shared.)					
Number/amount of vegetables:					
Additional observations you want to share:					
<b>WEEK 2 DATA</b>					

Amount of water used (in Liter)	
Information on the general appearance of the plants: (Here, plant height, number of leaves and other detailed observations about the appearance of the plant should be shared.)	
Number/amount of vegetables:	
Additional observations you want to share:	

**Note:** The table can be duplicated for the following weeks.

## II. 3 TECHNOLOGIES FOR THE CORRECT USE OF WATER IN AGRICULTURE

<p><b>Topic:</b> Water-Efficient Crops</p> <p><b>Subtopic:</b> Technologies for Correct Use of Water in Agriculture</p> <p><b>Grade Level:</b> 4th Grade</p> <p><b>Time:</b> 40+40+40 min.</p> <p><b>Developer/s:</b> Selim Saraçoğlu</p>		
<p><b>Learning Objective</b></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Raise awareness about different irrigation techniques and their efficiency.</li> <li>• Understand in which situations water conducts electricity and to take advantage of this property of water to develop efficient irrigation methods.</li> <li>• Understand the working principles of sensors, which are becoming more and more widespread today, and develop their own humidity sensors.</li> </ul>		
<b>Elicit</b>	<b>Materials</b>	<b>Method Technique</b>
The lesson starts with the introduction of the concept of irrigation in agriculture. Students are asked whether they know any of the irrigation methods used in agriculture. Pictures are presented in Appendix 1 about irrigation methods used in agriculture are shown.	<b>Appendix 1:</b> Pictures about irrigation methods	Discussion
<b>Engage</b>	<b>Materials</b>	<b>Method Technique</b>
A discussion is launched about which irrigation method is more efficient.  Students are asked to group the methods under the headings of ease of application, cost, and efficient use of water. Appendix 2 is used as a measurement tool at this stage.	<b>Appendix 2:</b> Comparison Table Given in	Assessment
<b>Explore</b>	<b>Materials</b>	<b>Method Technique</b>
Students are asked to divide into groups and do research on the harms of over-irrigation. They are asked to list the damages of excessive irrigation in the table in Appendix 3.  It is emphasized that plants need minerals in the soil besides water, and excessive irrigation causes	<ul style="list-style-type: none"> <li>• <b>Appendix 3:</b> Harms of Excessive Irrigation</li> <li>• <b>Appendix 4:</b> Sensors</li> <li>• <b>Appendix 5:</b> Where do I</li> </ul>	Collaborative learning

<p>these minerals to move away from plant roots and decrease soil quality. It is also explained that excess water is removed from the environment by evaporation and causes waste.</p> <p>The Ss are also asked how they can leverage today's technology to automatically detect when the soil is saturated with water and stop irrigation. They are asked if they have information about the sensors. Examples of sensors are given by making use of the explanations and visuals in Appendix 4. The working principles of sensors are mentioned.</p> <p>Finally, Appendix 5 is used to determine the level of knowledge about where sensors can be used in daily life.</p>	<p>encounter sensors?</p>	
<p><b>Explain</b></p>	<p><b>Materials</b></p>	<p><b>Method Technique</b></p>
<p>The Ss are asked to put the voltmeter in continuity mode and immerse the probes in the dry ground first, with a distance between them. It is observed whether the voltmeter conducts electricity. Then, the same process is repeated for the water in the glass and the wetted soil, and the data is processed into the Observation Chart in Appendix-6.</p> <p>The definition given in the Sensors section is highlighted again. Devices that respond to changing environmental conditions by decreasing or increasing the amount of electricity they transmit are called sensors.</p>	<ul style="list-style-type: none"> <li>● 1 Glass of Water,</li> <li>● Dry Earth (soil),</li> <li>● 1 Voltmeter,</li> <li>● 2 Voltmeter Probes,</li> <li>● <b>Appendix 6:</b> Observation Chart</li> </ul>	<p>Problem-based learning, Experiment</p>
<p><b>Elaborate</b></p>	<p><b>Materials</b></p>	<p><b>Method Technique</b></p>
<p>It is expected from the students who observed that the wet soil conducts electricity as a result of the experiment, to combine the results of their research and experiment. They are asked to design a sensor that will be active when the soil is wet to a certain depth. Students are expected to design a sensor similar to the application pictures in Appendix 7.</p>	<ul style="list-style-type: none"> <li>● Straw,</li> <li>● Wooden Mixing Stick,</li> <li>● 2 stainless steel wire cables,</li> <li>● Hot silicon,</li> <li>● Voltmeter,</li> <li>● Voltmeter Probes,</li> <li>● Students can also use any other materials they desire.</li> <li>● <b>Appendix 7</b></li> </ul>	<p>Problem-based learning, Experiment</p>

Evaluate	Materials	Method Technique
<p>Students place the sensor they designed in the soil and irrigation is started with the irrigation method they will choose. It is expected that the voltmeter will beep only when the water reaches a sufficient depth, that is, when it is ensured that the plant receives enough water. The teacher observes this situation and evaluates the student with the help of the Graded Observation Form in Appendix 8.</p>	<p>Appendix 8: Rubric</p>	<p>Experiment</p>
Extend	Materials	Method Technique
<p>With the help of this sensor we have created, a discussion is held on which areas other than agriculture can prevent water waste. An advertisement brochure is designed showing the determined usage areas and qualities of the sensor. In the brochure prepared, it is expected to pay attention to the design principles and to use the golden ratio. (The sizes and positions of the images and fonts to be used are prepared by observing the golden ratio.)</p>		<p>Collaborative learning, Discussion</p>

## RESOURCES

- Mareels, I., Weyer, E., Ooi, S. K., Cantoni, M., Li, Y., & Nair, G. (2005). Systems engineering for irrigation systems: Successes and challenges. IFAC Proceedings Volumes, 38(1), 1-16.
- Merriam, J. L., Shearer, M. N., & Burt, C. M. (1980). Evaluating irrigation systems and practices. Evaluating irrigation systems and practices., 721-760.
- Robimek. Kendi Flex Sensörünü Yap. Date of access, 10.12.2022. Retrieved from: <https://www.robimek.com/kendi-flex-sensorunu-yap/>
- STEM, H. (2022). Hacking STEM Electroconductivity Meter. Arduino Project Hub. Retrieved from: <https://create.arduino.cc/projecthub/HackingSTEM/hacking-stem-electroconductivity-meter-a82c58>

## APPENDIX 1

### IRRIGATION SYSTEMS

#### a) Wild Irrigation



b) Sprinkler Irrigation



## APPENDIX 2

### COMPARISON TABLES

Compare and order the Wild Irrigation, Sprinkler Irrigation and Drip Irrigation Methods in the table below under the relevant headings.

	Cost Efficiency	Ease of Implementation	Water Efficiency
1)			
2)			
3)			

#### Expected Comparison Order for Assessment

	Cost Efficiency	Ease of Implementation	Water Efficiency
1)	Wild Irrigation	Wild Irrigation	Drip Irrigation
2)	Sprinkler Irrigation	Sprinkler Irrigation	Sprinkler Irrigation
3)	Drip Irrigation	Drip Irrigation	Wild Irrigation

## APPENDIX 3

### HARMS OF EXCESSIVE IRRIGATION

What damage can excessive irrigation do to the soil, plants, and our environment? List the 5 most important harms in the table below.

1)	
2)	
3)	
4)	



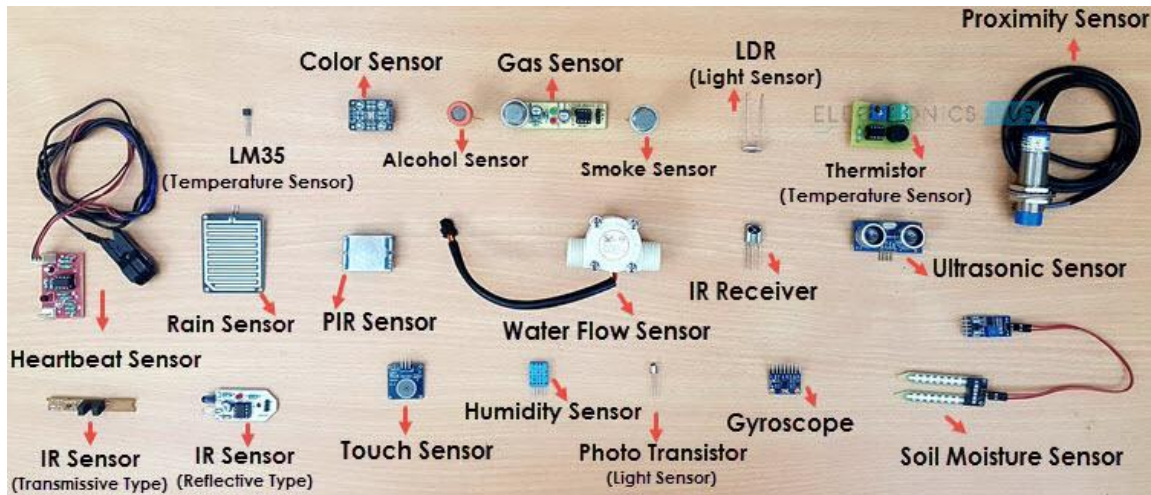
5)

## APPENDIX 4

### SENSORS

We live in the world of sensors! Our air conditioner measures the temperature of our room and works when necessary. Our boiler stops heating the water when the temperature of the water it circulates is high enough. Sensors are everywhere in our lives. So how do the sensors work?

We can find many definitions of sensors. However, in summary, if any substance can respond to changing environmental conditions by increasing or decreasing the amount of electricity it transmits, we can use it as a sensor. For example, with the help of a sensor that increases the amount of electricity it transmits as the temperature rises, small computers in air conditioners measure the temperature of our house or car and decide how long it should work.



## APPENDIX 5

### WHERE DO I ENCOUNTER SENSORS?

Where do you encounter sensors in daily life? In the table below, write the items and tools that you think work with sensors.

1)	Doors that open automatically when approached.
2)	
3)	
4)	
5)	

## APPENDIX 6

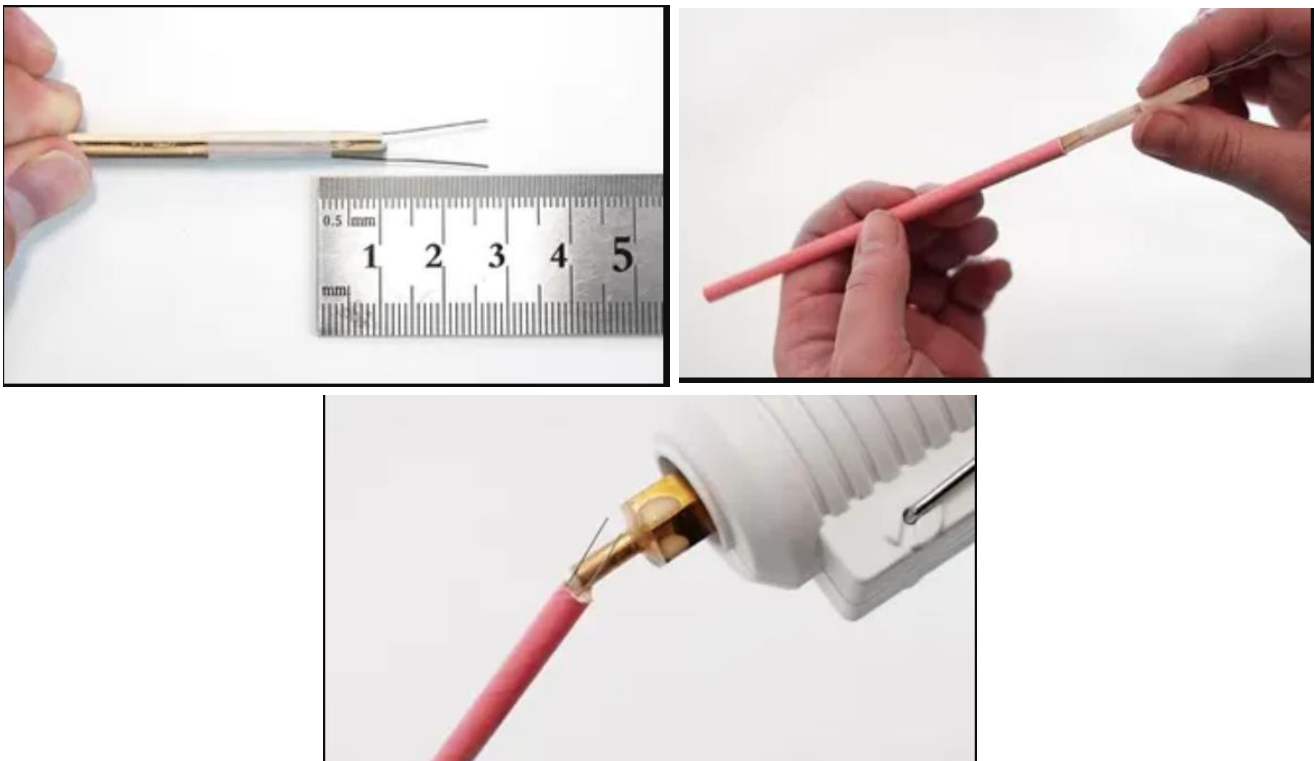
### ELECTRICAL CONDUCTIVITY OBSERVATION CHART

Run the voltmeter in continuity mode. First, immerse the two probes in dry soil with a distance between them. If the voltmeter is beeping, write 'Yes' in the chart opposite Dry Earth/soil, if not, write 'No'. Follow the same procedure in a glass of water. Then pour some of the water in the glass into the dry soil and repeat the same process in the wet soil.

Material	Electrical Conductivity (Yes/No)
Dry soil	
Water	
Wetted soil	

## APPENDIX 7

### MAKING MY OWN SENSOR



## APPENDIX 8

### RUBRIC

Attributes / Qualities	Should be improved (1)	Good (2)	Perfect (3)
<b>Design</b>	The sensor design could not be completed. Or it fails to maintain its integrity when trying to use it.	Sensor design is complete. Although it is difficult, it maintains its integrity in dry and wet soil.	There is design integrity. Suitable for multiple use. Its location and depth can be changed easily.
<b>Functionality</b>	The sensor is not working. It either doesn't beep or it beeps all the time.	The sensor works, but it does not work at ideal water saturation because it is either too deep or too surface.	The sensor is working. Since the pupil adjusts the depth ideally, it whistles when the soil is sufficiently watered.
<b>Presenting the Product and Sharing the Process</b>	S/He does not remember what s/he learned. S/He doesn't know why S/he's doing what s/he's doing.	S/He cannot explain how s/he transferred what s/he learned to the design.	S/He completely understood the subject. S/He transferred what he learned into the design.

## II. 4 WATER-RISING RESISTANT ARCHITECTURE

<p><b>Topic:</b> Climate Change and Water Levels  <b>Subtopic:</b> Water-rising Resistant Architecture  <b>Grade Level:</b> 4th Grade  <b>Time:</b> 40+40+40+40 min.  <b>Developer/s:</b> Bilge Has Erdoğan</p>		
<p><b>Learning Objectives:</b></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Interpret line, column, and circle graphs.</li> <li>• Draw a draft of the external appearance of an architectural structure in accordance with the existing restrictions and guidelines and makes a model of the draft.</li> <li>• Use the golden ratio while designing an architectural work.</li> </ul>		
<b>Elicit</b>	<b>Materials</b>	<b>Method Technique</b>
In order to attract the attention of the students and help their readiness at the beginning of the lesson, the news of BBC in Appendix 1 is reflected on the interactive whiteboard and the Ss watch it.	<b>Appendix 1</b>	Discussion
<b>Engage</b>	<b>Materials</b>	<b>Method Technique</b>
<p>One of the basic skills expected to be acquired in the discipline of mathematics is reading and understanding tables and graphics (Ersoy, 2003). It is considered important that students get experienced in these situations that can be encountered constantly in daily life.</p> <p>In this context, the tables, and graphics in Appendix 2 at the entrance of the lesson are reflected on the interactive board and students are asked to interpret the tables and graphics. (Instead, the tables and graphics can be printed and distributed to the class. However, it should be noted that this choice may be a waste of paper.)</p>	<b>Appendix 2</b>	Discussion
<b>Explore</b>	<b>Materials</b>	<b>Method Technique</b>

<p>The website <a href="https://picturing-our-future.netlify.app/">https://picturing-our-future.netlify.app/</a> is opened, showing sea level changes that may be caused by climate change.</p> <p>A simulation showing how much of the touristic spots on the site from different parts of the world will be submerged in the event of a possible temperature change is examined.</p> <p>The map showing the change of water in the world in Appendix 3 is reflected on the interactive board and students are expected to interpret it.</p>	<ul style="list-style-type: none"> <li>Website: <a href="https://picturing-our-future.netlify.app/">https://picturing-our-future.netlify.app/</a></li> <li>Appendix 3</li> </ul>	
Explain	Materials	Method Technique
<p>The teacher helps the Ss to realize that the architectural structures that the students are accustomed to and see around are insufficient to meet the needs as the climate change is felt more.</p> <p>It is mentioned that the architectural structures in the coastal areas are unprotected despite the rising water levels.</p> <p>Considering that the flood disasters will increase, a discussion is made on the necessity of changing the existing architectural structures.</p> <p>The architectural structures that are being studied to be less affected by the negativities caused by climate change are shared in line with the information in Appendix 4.</p>	Appendix 4	Problem Based Learning, Discussion
Elaborate	Materials	Method Technique
<p>A handout of the problem situations detailed in Appendix 5 is distributed to the groups and reflected on the interactive whiteboard.</p> <p>Each group is asked to choose one of two sample problems.</p> <p>The groups are asked to design their solution proposals for the problem they have chosen in detail (They are asked to draw a sketch of the architectural structure and write down the materials they will need in detail)</p>	<ul style="list-style-type: none"> <li>Appendix 5</li> <li>Paper,</li> <li>Pencil,</li> <li>Ruler,</li> <li>Calculator (or tablet)</li> </ul>	Problem Based Learning, Collaborative Learning
Evaluate	Materials	Method Technique

<p>The groups are asked to make a model of the architectural structures they have designed.</p> <p>The information that the created models will be evaluated by other groups is also shared with the students.</p> <p>(At this stage, students can request materials that are not available in the classroom. At this stage, the teacher or teachers should meet the needs of the students as much as possible.)</p>	<ul style="list-style-type: none"> <li>• Wooden Blocks,</li> <li>• Pipette (Straw),</li> <li>• Glue/Stick,</li> <li>• Balloon,</li> <li>• Water Pool,</li> <li>• Rope,</li> <li>• Macaroni</li> <li>• (Spaghetti),</li> <li>• Marshmallows,</li> <li>• Springs</li> </ul>	<p>Problem Based Learning, Collaborative Learning</p>
<b>Extend</b>	<b>Materials</b>	<b>Method Technique</b>
<p>The peer evaluation form in Appendix 6 is answered by the students.</p> <p>The rubric in Appendix 7 is filled by the teacher for each group.</p> <p>The lesson is concluded by making a brief assessment by the teacher and students on what has been learned.</p>	<ul style="list-style-type: none"> <li>• <b>Appendix 6</b></li> <li>• <b>Appendix 7</b></li> </ul>	<p>Peer Assessment</p>

## RESOURCES

- Geymen, A., & Dirican, A. Y. (2016). İklim değişikliğine bağlı deniz seviyesi değişiminin coğrafi bilgi sistemleri kullanılarak analiz edilmesi. *Harita Teknolojileri Elektronik Dergisi*, 8(1), 65-74.
- Nasa Global Climate Change. Sea Level. Date of access, 11.12.2022. Retrived from: <https://climate.nasa.gov/vital-signs/sea-level/>
- NOAA (National Oceanic and Atmospheric Administration). 2022. Climate at a glance. Accessed March 2022. [www.ncdc.noaa.gov/cag](http://www.ncdc.noaa.gov/cag)
- Arktera. Yükselen Su Seviyesi Tehdidi Altındaki Kentlere Dair Öneri: "Oceanix City". Dte of access, 10.12.2022. Retrived from: <https://www.arkitera.com/haber/yukselen-su-seviyesi-tehdidi-altindaki-kentlere-dair-oneri-oceanix-city>
- Dormakaba. Suyu Uzak Tutmak: Sele Dayanıklı 4 Mimari Örnek . Date of access, 10.12.2022. Retrived from: <https://blog.dormakaba.com/tr/sele-dayanikli-mimarlik>
- Ekoyapı. Yüzen Yapılar Yükselen Deniz Seviyesi Krizlerinden Kurtulmak İçin En İyi Şansımız. Date of access, 10.12.2022. Retrived from: <https://www.ekoyapidergisi.org/yuzen-yapilar-yukselen-deniz-seviyesi-krizlerinden-kurtulmak-icin-en-iyi-sansimiz>

## APPENDIX 1

### 23 MILLION PEOPLE 'WILL BE EXPOSED TO FLOODS AND OVERFLOWS' IN 30 YEARS AS SEA LEVELS RISE

**B B C NEWS TÜRKÇE**

August 2, 2020

**Scientists warned that 23 million people may be affected in the next 30 years due to floods and floods caused by sea level rise.**



According to the news of the Guardian newspaper, which is based on the global research published in the journal 'Scientific Reports', although there may be partial decreases in greenhouse gas emissions, floods and floods may be seen more frequently due to the influence of people, the increase of hurricanes and the swell of the seas.

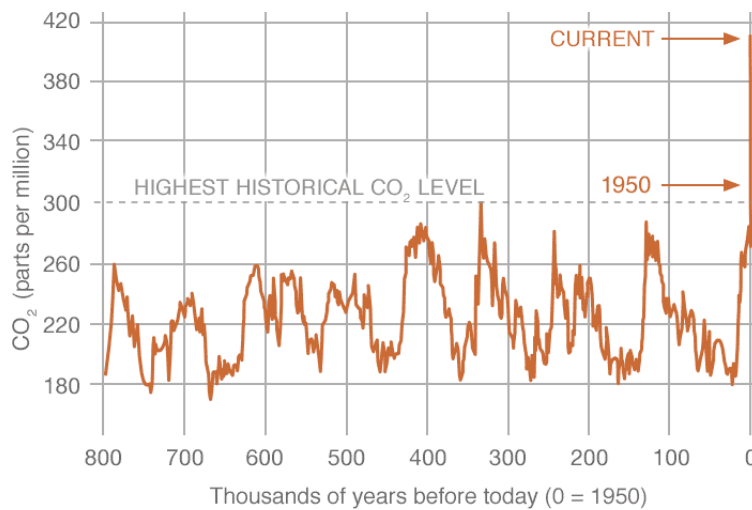
In the worst case, it is stated that 14.2 trillion dollars of assets, which corresponds to about 20% of global gross product, on coasts that have to adapt to increased greenhouse gas emissions and sea level rise, could be in danger of extinction by the end of this century.

The rise of sea level caused by global warming extends into the oceans and causes glaciers to melt.

This means that by the end of this century, floods that normally occur once every 100 years may occur once every 10 years. This means that 4% of the world's population will be affected by floods and floods.

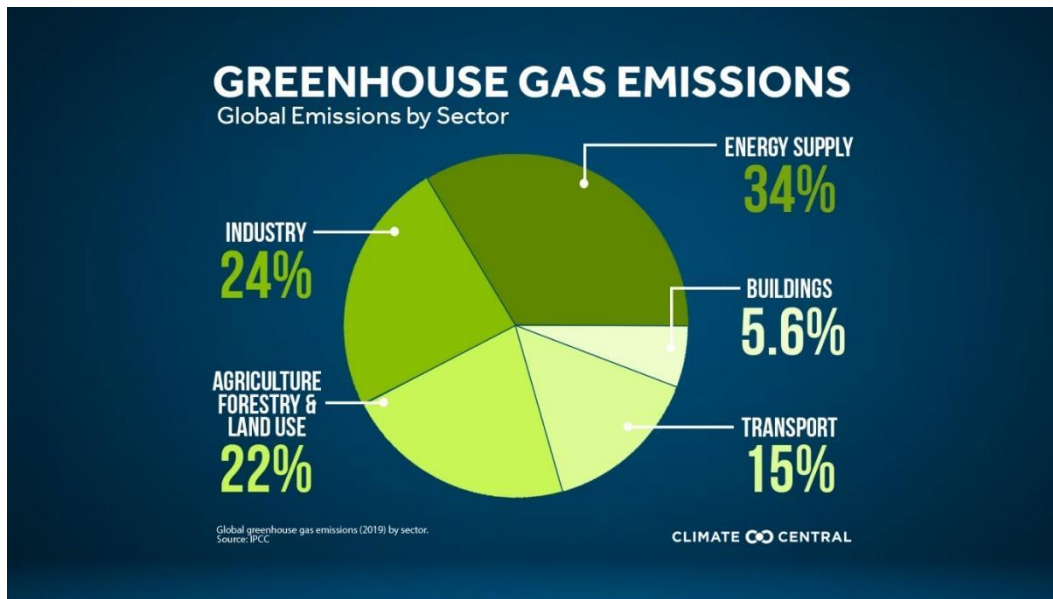
**APPENDIX 2**

**CHANGE IN THE AMOUNT OF CARBON MEASURED IN THE ATMOSPHERE**

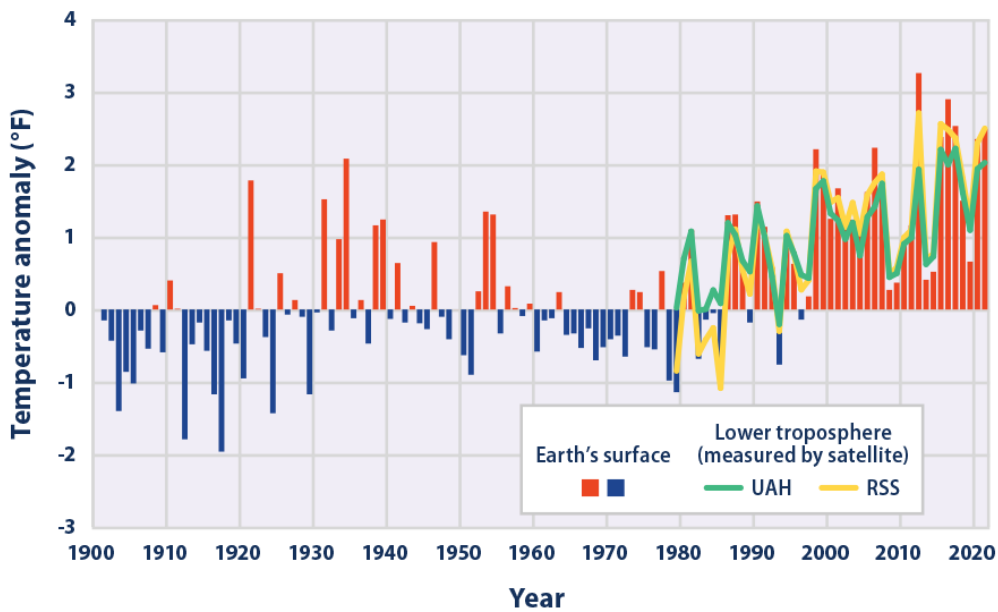


Source: NASA

*Factors that increase greenhouse gas*



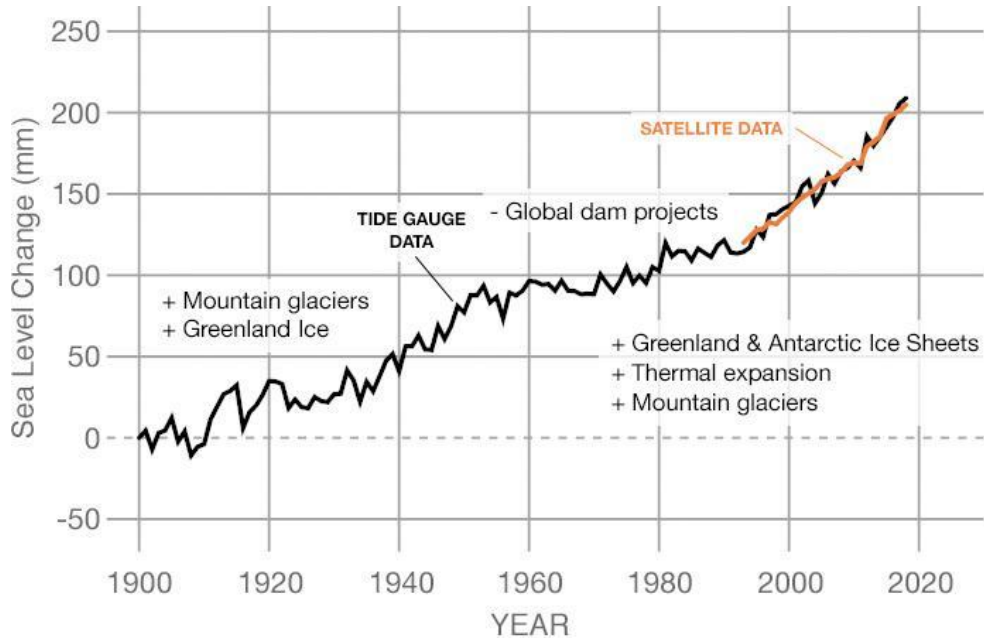
*Change in world temperatures*



Source: National Oceanic and Atmospheric Administration, (2022)



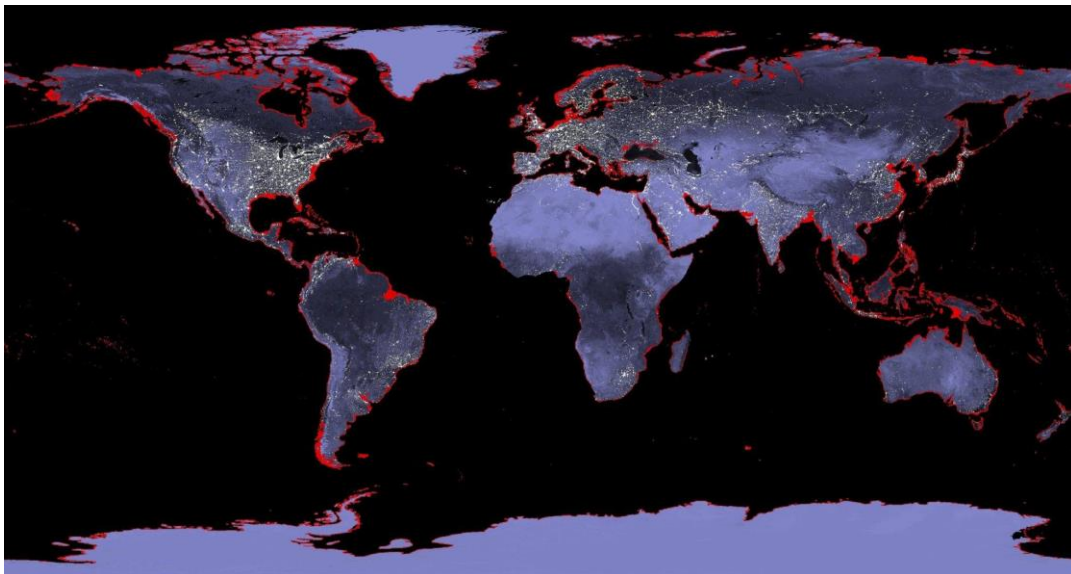
### Change in sea levels



Source: Frederikse et al. (2020)

### APPENDIX 3

#### EXPECTED INCREASES IN SEA LEVELS



City	Results of Monte-Carlo simulation (5.000.000 paths)			Kopp et al. (2014)	
	Median	Mean	P95	Median	P95
Amsterdam	69	70.7	115	69	115
Athens	19	25.0	67	19	67
Barcelona	66	68.6	113	66	113
Copenhagen	57	59.0	99	57	99
Dublin	44	46.2	86	44	86
Glasgow	81	82.6	128	81	128
Hamburg	32	38.5	95	32	95
Helsinki	59	67.9	151	59	151
Istanbul	70	72.7	117	70	117
Izmir	61	64.5	120	61	120
Lisbon	72	74.4	119	72	119
London	67	68.6	116	67	116
Marseille	60	62.3	102	60	102
Naples	62	64.4	104	62	104
Odessa	53	63.1	149	53	149
Porto	66	68.5	112	66	112
Rotterdam	72	73.9	118	72	118
St. Petersburg	47	50.6	101	47	101
Stockholm	17	25.7	80	17	80

*Theoretical and simulated values of sea-level rise in 2100 cm.*

## APPENDIX 4

### "OCEANIX CITY" FLOATING HOMES PROJECT





### *Examples of flood resistant architecture*

A place where floods occur frequently in China, it draws attention with its architecture that has been transformed into a green park. Watch the video in the following link:

<https://www.youtube.com/watch?v=qBHsIQwnGMO&t=23s>.



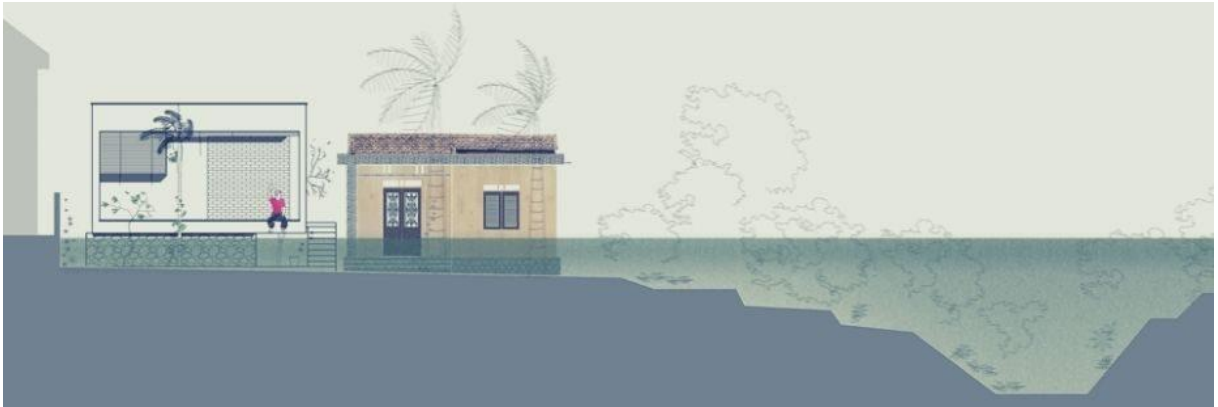
An area to be protected from floods in America is an art gallery  
(<https://crystalbridges.org/architecture/moshe-safdie/>)



Sculpture located in Hamburg in northern Germany [Niederhafen Nehri Kordonu](#)



Floor plan showing flood proofing by lifting the detached house in Vietnam 150cm above the ground.



## APPENDIX 5

### PROBLEM 1



It is known that heavy rains that are effective in the states of Kerala, Karnataka, Maharashtra and Gujarat in the south of India cause floods and landslides. Floods can reach 2m water levels. What kind of architectural structure can minimize loss of life and property in these regions, which are faced with flood disasters every year?

### PROBLEM 2



With climate change, sea levels have started to rise all over the world. The Netherlands, which is mostly at sea level, has started to build large embankments to cope with this situation. In a new project, it has been announced that a house can be built in the sea area within the levees. Can you build a safe house on the sea?

Limitations: The golden ratio must be used in at least two measurements in buildings. Model making should not exceed 60 minutes.

## APPENDIX 6

### PEER ASSESSMENT FORM

Fill in the form given below with the symbol X in line with your observations of your friends in the group work.

1. Name-surname of my friend:

	Very good (5)	Good (4)	Neither good nor bad (3)	Bad (2)	Very bad (1)
Voluntary participation in the study...					
in fulfilling the assigned duty...					
Respecting the opinions of group mates...					
Helping group mates...					
The progress to overcome the problems encountered during the work...					

2. Name-surname of my friend:

	Very good (5)	Good (4)	Neither good nor bad (3)	Bad (2)	Very bad (1)
Voluntary participation in the study...					
in fulfilling the assigned duty...					
Respecting the opinions of group mates...					
Helping group mates...					
The progress to overcome the problems encountered during the work...					

3. Name-surname of my friend:

	Very good (5)	Good (4)	Neither good nor bad (3)	Bad (2)	Very bad (1)
Voluntary participation in the study...					

<b>in fulfilling the assigned duty...</b>					
<b>Respecting the opinions of group mates...</b>					
<b>Helping group mates...</b>					
<b>The progress to overcome the problems encountered during the work...</b>					

## II. 5 WATER AWARENESS WITH PANTOMIME

<p><b>Topic:</b> Water Literacy</p> <p><b>Subtopic:</b> Water Awareness with Pantomime</p> <p><b>Grade Level:</b> 4th Grade</p> <p><b>Time:</b> 40+40+40 min.</p> <p><b>Developer/s:</b> Derya Ceylan</p>		
<p><b>Learning Objectives:</b></p> <p>Students will:</p> <ul style="list-style-type: none"> <li>• Become conscious of the correct use of water resources.</li> <li>• Acquire water literacy awareness.</li> <li>• Understand the importance of water, gain awareness of use.</li> <li>• Understand the importance of efficient use of resources and sustainability for a solution to climate change from a local, national, and global perspective.</li> <li>• Develop creative thinking, teamwork, social awareness, and life skills.</li> </ul>		
Elicit	Materials	Method Technique
<p>The Question 'What are the things we cannot exist without in our lives?' is directed to the students by the teacher. The answers are collected in the form of brainstorming drawn on the board or created with a proper web 2 tools.</p> <p>After the answer 'water' is reached, the reasons why we cannot exist without it is asked by the teacher again. Answers are taken orally. (15 min.)</p>	<ul style="list-style-type: none"> <li>• Board</li> <li>• Board Marker</li> <li>• Recorded Audio</li> </ul>	Discussion
Engage	Materials	Method Technique
<p>The teacher makes the students listen to 3 audio recordings and asks what all 3 sounds remind them in terms of nature?</p> <p>The received answers can also be written on the board as short notes. The Ss are asked to concentrate on the last audio recording and say what comes to mind about the flood.</p> <p>The question 'What connection can floods have with the concepts of Global Warming and Climate change?' is also directed by the teacher so that the Ss discuss in groups. (10 min.)</p>	<ul style="list-style-type: none"> <li>• Audio Record <a href="https://drive.google.com/file/d/1RPJXP2azVQ7qdxTG-5Gm0OMWbG_6DAK/view?usp=sharing">https://drive.google.com/file/d/1RPJXP2azVQ7qdxTG-5Gm0OMWbG_6DAK/view?usp=sharing</a></li> <li>• Board</li> <li>• Board Marker</li> </ul>	Question and Answer Method, Discussion
Explore	Materials	Method Technique



<p>The questions ‘What should be done to reduce the floods as heard in the last sound recording?’ and ‘How and to what extent can the effective use of water contribute to the process?’ are directed to Ss and the Ss work in groups to discuss.</p> <p>The Teachers asks the Ss to find the answers by discussing with the T/F papers handed out by the teacher. Appendix 1 (15 min.)</p>	<p><b>Appendix 1</b></p>	<p>Question and Answer Method, Discussion</p>
<p><b>Explain</b></p>	<p><b>Materials</b></p>	<p><b>Method Technique</b></p>
<p>The teacher gives information about the subject with a short presentation on the use of water and answers the students' questions. Appendix 2 (15 min).</p>	<p><b>Appendix 2</b></p>	<p>Assessment</p>
<p><b>Elaborate</b></p>	<p><b>Materials</b></p>	<p><b>Method Technique</b></p>
<p>Group work continues. With the station technique, each group is asked to write 6 words; 3 of them related to water and 3 of them unrelated to water, on a piece of paper. Each group hands over the paper on which they wrote a total of 6 words to the next group.</p> <p>Each group takes the paper of the previous group and prepares an advertisement text using 6 words written there, as a public spot that will impress the audience to raise awareness of the use of water. The text should not exceed 1 paragraph. (20 min)</p>	<ul style="list-style-type: none"> <li>● Paper</li> <li>● Pencil</li> </ul>	<p>Collaborative Learning, Creative Writing, Station technique</p>
<p><b>Evaluate</b></p>	<p><b>Materials</b></p>	<p><b>Method Technique</b></p>
<p>Each public service announcement is listened and what can be added is discussed and ideas are exchanged between the groups.</p> <p>Peer assessment is done, and the groups give each other points between 1-5. (15 min.)</p>	<ul style="list-style-type: none"> <li>● Paper</li> <li>● Pencil</li> </ul>	<p>Peer Assessment</p>
<p><b>Extend</b></p>	<p><b>Materials</b></p>	<p><b>Method Technique</b></p>
<p>The groups are expected to prepare a pantomime according to the recorded water sounds and present it to the class. The group can use only 1, 2 or all of sound types.</p> <p>They need to use a water sound which they choose. The duration of the performance show should not exceed 1 minute. They should have a message about</p>	<ul style="list-style-type: none"> <li>● Face paints and make-up</li> <li>● Background music recordings</li> <li>● Web site 1</li> <li>● Web site 2</li> <li>● Web site 3</li> </ul>	<p>An Approach to Education Through Art</p>

<p>water, and they should be able to convey it to the audience in the best way with the art of pantomime. It is evaluated with the pantomime evaluation form. Annex 3 (30 min.)</p> <p>Pantomime (mime acting); a dramatic entertainment, originating in Roman mime, in which performers express meaning through gestures accompanied by music.</p> <p>Some example videos:</p> <p>Web site 1 <a href="https://www.youtube.com/watch?v=3WM1EGQktfw">https://www.youtube.com/watch?v=3WM1EGQktfw</a></p> <p>Web site 2 <a href="https://www.youtube.com/watch?v=rZrjvnHijB8">https://www.youtube.com/watch?v=rZrjvnHijB8</a></p> <p>Web site 3 <a href="https://www.youtube.com/watch?v=VVI_Pal4LAU">https://www.youtube.com/watch?v=VVI_Pal4LAU</a></p>		
---	--	--

## RESOURCES

- Hisamidin, D. İ. N. Ç. (2018). Su okuryazarlığı eğitiminin gerekliliği ve etki gücü üzerine bir deneme. *Anadolu Öğretmen Dergisi*, 2(2), 169-176.
- Kyshchun, T., (9.11.2022). Мимы Франция Mim-Art. Youtube: <https://www.youtube.com/watch?v=rZrjvnHijB8>
- McCarroll, M., & Hamann, H. (2020). What we know about water: A water literacy review. *Water*, 12(10), 2803.
- Onan, B. C. (2005). *Sanat eğitimi yöntemleri/yeni yaklaşımlar* (Doctoral dissertation, Bursa Uludag University (Turkey)).
- Sağdıç, M. S., (9.11.2022). Pantomim yer yüzleri. Youtube: [https://www.youtube.com/watch?v=VVI\\_Pal4LAU](https://www.youtube.com/watch?v=VVI_Pal4LAU)
- Su, H. J., Chen, M. J., & Wang, J. T. (2011). Developing a water literacy. *Current Opinion in Environmental Sustainability*, 3(6), 517-519.
- TBNpoRusski, (10.12.2022). Ролик театра Сотворение "Подарок". Youtube: <https://www.youtube.com/watch?v=3WM1EGQktfw>.

## APPENDIX 1

### USE OF WATER AND HOW TO USE IT EFFICIENTLY

1. Don't use hosepipes in the garden. Use a watering can instead.
2. Only fill the kettle as much as you need. This saves electricity too!
3. Make sure you turn the tap off. Dripping taps waste lots of water!
4. Save rainwater to water your garden and house plants.
5. Have a shower instead of a bath- it only uses half the water.
6. Ask your grown-ups to only use the washing machine when there is a full load.

7. Don't let the water run while washing hands or brushing your teeth. Turn it off while you lather or brush and back on to rinse at the end.
8. Reduce indoor water use by choosing water-efficient showers, toilets, taps and appliances.
9. Wash cars and bikes on the lawn to water grass at the same time.
10. Sweep paths and driveways instead of hosing them down.
11. Reuse water where possible to reduce the amount of fresh drinking water used.
12. Choosing plants that are native to your area or need a little watering.
13. Water the garden using a trigger hose or a watering can.

## APPENDIX 2

### LET'S CHECK OUR GENERAL KNOWLEDGE ABOUT WATER (TRUE OR FALSE)

	STATEMENTS	TRUE	FALSE
1	A person can live about a month without food but only about a week without water.		
2	Nearly 70% of the world's water is salty or otherwise undrinkable.		
3	Plants give off water vapor through their leaves which is called transpiration.		
4	Frozen water (ice) is lighter than water.		
5	Half of the Earth's surface is covered with water.		
6	Water is continuously recycled. The water you drink today could be the same water dinosaurs drank millions years ago.		
7	Water is stored in underground caps.		
8	Deserts do not have heavy rains.		

### III. THEME 2: WAR

From past to present, the biggest problem of all humanity is war. Regardless of the reason, wars in which innocent living things are harmed and all human savings are seriously damaged unfortunately continue to be a living problem even in the 21st century.

So, while wars threaten human life, what other damage can they cause? How does it affect society from a sociological perspective? Considering its economic dimension, are its effects regional or global? What can be done to raise awareness about this issue?

In order to make it easier for you to find answers to all the questions mentioned above, lesson plans designed for the solution of real-life problems and in which different disciplines are handled in cooperation can guide you to reach the answers you need.



Image 3. Image of a banner at an anti-war demonstration by [Mathias Reding](#) via Pexels.

### III. 1 PSYCHOLOGICAL, SOCIOLOGICAL AND ECONOMIC EFFECTS OF WAR

<p><b>Topic:</b> Effects of War  <b>Subtopic:</b> Psychological, Sociological and Economic Effects of War  <b>Grade Level:</b> 4th Grade  <b>Time:</b> 40+40+40 min.  <b>Developer/s:</b> Elif Öznur Tokgöz</p>		
<p><b>Learning Objectives:</b></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Question the concept of war.</li> <li>• Comprehend the factors that cause war and their relationship with each other.</li> <li>• Recognize the destructive dimensions of wars.</li> <li>• Create a consciousness against war.</li> <li>• Reflect on its economic, sociological, and psychological consequences.</li> </ul>		
Elicit	Materials	Method/ Technique
<p>First of all, the teacher shows the students Picasso's famous painting Guernica (Appendix 1) and asks the students to examine the painting.</p> <p>Then the teacher ask these questions below to the students to arouse curiosity and interest in students.</p> <ul style="list-style-type: none"> <li>• Have you seen this picture before?</li> <li>• What do you think this picture might be telling us?</li> <li>• Why can only grey and its tones be used in the picture?</li> <li>• Why are only female and child figures used in the painting?</li> <li>• What do the images used in the picture mean?</li> </ul>	<p><b>Annex 1.</b> Picasso's painting 'Guernica'</p>	<p>Socratic Inquiry Method</p>
Engage	Materials	Method/ Technique
<p>Then, the teacher asks the students to produce ideas about the picture using the brainstorming method and writes the ideas on the board.</p> <p>Based on the ideas that the students put forward about the picture, the Ss are made to concentrate and think about the phenomenon of war.</p>	<ul style="list-style-type: none"> <li>• Board</li> <li>• Board Marker</li> </ul>	<p>Brainstorming</p>

Explore	Materials	Method/ Technique
<p>In this part, the teacher gives information to the students about Picasso's Guernica painting by reading Annex 2.</p>	<p><b>Annex 2.</b> Information text on why the Guernica painting was made.</p>	<p>Narration Method</p>
Explain	Materials	Method/ Technique
<p>Then the teacher writes the word 'WAR' on the board and 'If you had to describe the war in three words, which words would you use?'</p> <p>He poses his question to the students. While the students are thinking about the words, the teacher enters the name of the site where they will create Word Cloud on the smart board. Then he asks the students to enter the website written on the smart board with the tablet or mobile phones in front of them.</p> <p>As each student enters the website, the teacher tells the students to write these three words in order in the filter section. As a result of each student's writing, a Word Cloud is formed on the smart board (Appendix 3).</p> <p>Regarding the resulting Word Cloud, a discussion is held with the Ss considering the concepts 'Which words are used more, how the war made people feel in general'</p>	<ul style="list-style-type: none"> <li>● Smart Board,</li> <li>● Tablet or mobile phone</li> <li>● <b>Appendix 3</b></li> </ul>	<p>Discussion</p>
Elaborate	Materials	Method/ Technique
<p>In this section, students were reminded of Picasso's thought that children and women were most affected by the war.</p> <p>The questions 'How were you affected by war as a child, given the devastating effects of wars? Why?' are directed to the students and they are made to think about the psychological effects of war. The answers given by the students are written on the board under the title of "<u>Psychological Effects of War</u>".</p> <p>Afterwards, it was explained to the students that the town of Guernica was destroyed in the 2nd World War, where the painting was made, and that people had to leave the town,</p> <ul style="list-style-type: none"> <li>● 'How does this affect people economically?'</li> <li>● 'Are the economies of the countries that fought the war only affected in the wars?'</li> </ul> <p>With these questions above, students are provided to think by using the Socratic Inquiry Method.</p>	<ul style="list-style-type: none"> <li>● Board</li> <li>● Board Marker</li> </ul>	<p>Socratic Inquiry Method</p>

<p>Students' answers are written on the board under the title of "<u>Economic Effects of War</u>".</p> <p>Later, the students are enlightened with this piece of knowledge 'Picasso did not allow the painting to remain in Spain until freedom and democracy were brought to the country. Fearing the Nazi invasion of France, he lent the painting to the Museum of Modern Art (MoMA) in New York City in 1940.'</p> <p>Just after the info given, these questions below are asked the Ss.</p> <ul style="list-style-type: none"> <li>• 'Why does war damage the concepts of freedom and democracy?'</li> <li>• 'In what other ways can wars have negative effects on societies?'</li> </ul> <p>The answers are written under the title of '<u>Sociological Effects of War</u>' on the board.</p>		
<b>Evaluate</b>	<b>Materials</b>	<b>Method/ Technique</b>
<p>The students are asked whether the concepts related to the three separate parts of the war were written under the correct title by reviewing their answers.</p> <p>In line with the ideas from the students, the concepts of Psychological Effects of War, Economic Effects of War and Sociological Effects of War are rearranged, and a concept map is created by asking related concepts to be combined with arrows.</p>	<ul style="list-style-type: none"> <li>• Board</li> <li>• Board Marker</li> </ul>	Concept Map
<b>Extend</b>	<b>Materials</b>	<b>Method/ Technique</b>
<p>In this section, students are divided into three groups and each group is asked to represent an effect of the war. The Concept Map Poster, which was prepared and printed beforehand, is hung in the classroom (Annex 4).</p> <p>By distributing stickers to the groups, the Ss are asked to write the concepts of the effects they represent on separate sticker papers and paste them on the relevant parts of the poster. The concept map poster is completed by asking for related concepts to be shown with arrows. Finally, the concept map poster is displayed at the school.</p>	<ul style="list-style-type: none"> <li>• <b>Annex 4.</b> Concept Map Poster.</li> <li>• Sticker Paper (colorful Post-it papers).</li> <li>• Colored Pencils.</li> </ul>	Concept Map

## REFERENCES

- Arnheim, R. (2006). *Bir resmin doğuşu: Picasso'nun Guernica'sı*. Kaliforniya Üniversitesi Yayınları.
- Corbin, J. (1999). Savaş görüntüleri: Picasso'nun Guernica'sı. *Görsel Antropoloji*, 13 (1), 1-21.
- [https://acikders.ankara.edu.tr/pluginfile.php/70335/mod\\_resource/content/0/D1\\_SAVA%C5%9E%252C%20%C5%9E%C4%BODDET%20ve%20OG%C3%96%C3%87\\_LER.pdf](https://acikders.ankara.edu.tr/pluginfile.php/70335/mod_resource/content/0/D1_SAVA%C5%9E%252C%20%C5%9E%C4%BODDET%20ve%20OG%C3%96%C3%87_LER.pdf) accessed via.
- <https://birsanatbirkita.com/sanat/sanat-tarihi/picasso-nun-guernica-eseri-hakkinda-bilmeniz-gerekenler/>.

## ANNEX 1.

### PICASSO'S 'GUERNICA' MASTERPIECE





## ANNEX 2.

### INFORMATION TEXT ON WHY THE GUERNICA PAINTING WAS MADE

In April 1937, the vulnerable vasque village of Guernica, located in the north of Spain, was attacked by the German Condor Legion and the Italian Legionary Aviation, which fought in favour of the rebel side against the government of the Second Spanish Republic during the Spanish Civil War.

They planes launched waves of incendiary bombs to the civilian population, and the brutal attack ended with almost 2.000 people dead. This massacre of the war was recorded by the famous painter Picasso with his masterpiece 'Guernica', painted between the months of May and June 1937. The enormous artwork that highlights the pain and horror of war – both literally and figuratively – has become one of the most moving and powerful anti-war paintings in history.

A closer look at Guernica reveals that the main characters in the painting are women. A screaming woman with a dead child in her arms is one of the most powerful images in the painting. Among other women in the work, the woman seen trying to escape, the woman with her arms in the air, and the woman holding a lamp with one hand to symbolize hope. Women represent life and pain, and this may be why Picasso used female figures to convey suffering in Guernica.

Only grey tones are used in the painting, and these colours, according to Picasso, express the despair that followed the bombing.

#### The Dialogue Between Picasso and a Gestapo Officer Marked History

Picasso's sharp wit was almost as famous as his extraordinary artistic talent.

While living in Nazi-occupied Paris during World War II after being exiled from Spain because of the Civil War, a German Gestapo officer (some sources referred to as the German Ambassador) allegedly told him:

**"You did that?"** asked the Gestapo Officer. Pablo Picasso quickly replied, **"No, you did"**.

## ANNEX 3.

### WORD CLOUD APPLICATION STEPS

First, the teacher has to:

- Login to <https://wordart.com/>
- Become a member by clicking the 'Sing Up' section on the site.
- Click on 'Create new Wordart' that appears on the screen.
- Allows students to enter the same page by sharing the address of the opened page with the students.
- Ask students to write their separate words in the 'Filter' section on the page that appears on the screen.
- Create the word cloud by clicking the 'Visualize' section after the word writing process is finished,

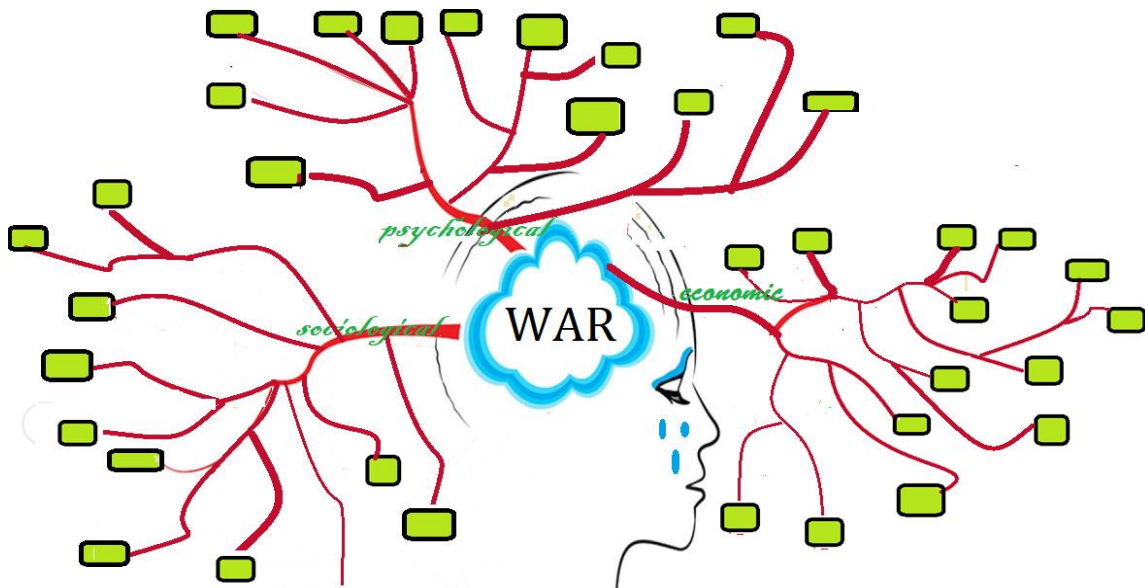
- An example word cloud is given below.



In the word cloud, the most repeated words by the students are shown in bold. The colored printout of the word cloud created at the end of the lesson will be displayed at the school together with the concept map poster.

#### ANNEX 4.

#### CONCEPT MAP POSTER



Before the lesson, the above concept map is printed as a poster by the teacher. Students are asked to tack their sticker papers (colorful post-it papers) on which they wrote about their psychological, sociological, and economic dimensions onto the green boxes in the relevant sections, related concepts will be combined with arrows and the poster will be completed.

## ANNEX 5.

### LIST OF ANSWERS EXPECTED FROM STUDENTS

<i>Psychological Effects of War</i>	<i>Sociological Effects of War</i>	<i>Economic Effects of War</i>
Depression Stress Disorder Insecurity Chronic Diseases Fear Suicide Hate Despair Absurdity Anger Loneliness Grief Conflict Loss of Identity Loss of Prestige unresponsiveness Self-Alienation	Democracy Human rights Law Violence Environmental pollution Genocide Torture Colonialism Weapon Othering Artificial intelligence Injustice Education Health Chaos Propaganda Technology	Money Need Famine Poverty Hunger Inflation Energy Technology War reparations Digitalization

### III. 2 THE IMPORTANCE OF SHELTERS IN WARS

<p><b>Theme:</b> Effects of War</p> <p><b>Subtopic:</b> The Importance of Shelters in the War</p> <p><b>Grade Level:</b> 4th Grade</p> <p><b>Time:</b> 40+40+40+40 min.</p> <p><b>Developer/s:</b> Bekir SEVİNÇ, Bilge Has Erdoğan</p>		
<p><b>Learning Objectives:</b></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the structure of shelters.</li> <li>• Tell the features that the shelters should have.</li> <li>• Design a shelter in the Makeblok program.</li> <li>• Calculate the average cost of a shelter design.</li> </ul>		
Elicit	Materials	Method/ Technique
<p>The teacher shows pictures of refuges (shelters) via the interactive whiteboard and asks these questions to attract attention.</p> <p>"What do you see in this picture? What does it do?"</p>	<ul style="list-style-type: none"> <li>• Smart Board</li> <li>• <b>Annex 1</b> Examples of Refuges</li> </ul>	<p>Discussion</p>
Engage	Materials	Method/ Technique
<p>The teacher poses the following questions to the students to determine the students' prior knowledge about the refuges/shelter and to deepen the subject:</p> <ul style="list-style-type: none"> <li>• What is a refuge?</li> <li>• What does a shelter/bunker/refuge do?</li> <li>• When are bunkers used?</li> <li>• Are bunkers only for humans?</li> <li>• How does the Sanctuary protect us in battles?</li> </ul> <p>After the questions were discussed, the students are asked; "What tools are important to have in bunkers?" The answers given by asking the question are written on the board and the students are asked to evaluate the written answers.</p>	<ul style="list-style-type: none"> <li>• Board</li> <li>• Board Marker</li> <li>• <b>Annex 2.</b> Info about Refuges/shelters/Bunkers</li> <li>• Web Page 1: <a href="https://www.castellax.com/how-to-repurpose-your-current-basement-into-a-nuclear-survival-shelter/">https://www.castellax.com/how-to-repurpose-your-current-basement-into-a-nuclear-survival-shelter/</a></li> <li>• Web Page 2: <a href="https://yalova.csb.gov.tr/hangi-binalarda-siginak-yapilmaz-haber-232445">https://yalova.csb.gov.tr/hangi-binalarda-siginak-yapilmaz-haber-232445</a></li> </ul>	<p>Discussion Brainstorming Narration</p>

<p>After the students' evaluations are completed, the shelter information in Annex 2 is shared with the students.</p> <p>The shelter model on web pages 1 and 2 can also be examined together with the students to set an example for more detailed information and design.</p>		
Explore	Materials	Method/ Technique
<p>Programs that allow students to test their theoretical knowledge based on technology are used. Among them, brief information about the Makeblok program is given and the program is downloaded from the link on web page 3 together with the students.</p> <p>The teacher tells the children the codes in Appendix 3 and the steps in the instruction through the program.</p> <ul style="list-style-type: none"> <li>• First, they are told to add airplane objects to the screen. Airplane object in the sky is moved with the motion effect.</li> <li>• They are then asked to add or draw the shelter objects on the screen. Each student adds or draws their own designated shelter objects.</li> <li>• They are asked to draw children figures on the stage or a child object is drawn from the ready-made template. In order for the child figures to be added to the screen to escape to the shelter with the siren sounds heard when the plane starts to move, the same code blocks are used for the child to move to the shelter,</li> </ul>	<ul style="list-style-type: none"> <li>• Computer</li> <li>• Makeblok: <a href="https://mblock.makeblock.com/en-us/download/">https://mblock.makeblock.com/en-us/download/</a> (PC version)</li> <li>• <b>Annex 3.</b> Code blocks that can be used.</li> </ul>	<p>Narration Demonstration and doing</p>
Explain	Materials	Method/ Technique
<p>Students are asked to form groups, or the teacher creates the groups. (Make sure that there are at least 4 students in each group)</p> <p>The problem situation in Appendix 4 is reflected on the board. The problem is read to the students.</p> <p>Each group is asked to make a design that will produce a solution to the problem. The</p>	<ul style="list-style-type: none"> <li>• Paper,</li> <li>• Pencil,</li> <li>• <b>Annex 4</b> problem</li> </ul>	

information that the design will first be made on paper is shared with the students.		
<b>Elaborate</b>	<b>Materials</b>	<b>Method/ Technique</b>
Groups are asked to transfer their designs on paper to a program of their choice, such as Makeblok or Minecraft.	<ul style="list-style-type: none"> <li>• Computer</li> <li>• Makeblok, Minecraft or any other program that the Ss wish.</li> </ul>	Computer Based Learning
<b>Evaluate</b>	<b>Materials</b>	<b>Method/ Technique</b>
<p>The groups present their completed designs to the class. During the presentation, they answer the questions of their peers, if any.</p> <p>Each group is asked to evaluate the design of the presenting group with the evaluation form shared in Annex 5.</p>	<ul style="list-style-type: none"> <li>• Smart Board</li> <li>• Computer</li> <li>• <b>Annex 5</b> Evaluation Form</li> </ul>	Narration (Presentation) Peer Assessment
<b>Extend</b>	<b>Materials</b>	<b>Method/ Technique</b>
<p>The peer review forms in Annex 6 are distributed to the group members so that the group members can evaluate each other. The Ss are asked to evaluate their group mates.</p> <p>At the end of the lesson, what has been learned is summarized with student participation and the lesson is concluded.</p>	<ul style="list-style-type: none"> <li>• <b>Annex 6</b> Peer Assessment Form</li> <li>• Pencil</li> </ul>	Peer Assessment

## REFERENCES

- <https://www.afad.gov.tr>
- <https://education.minecraft.net/>
- <https://scratch.mit.edu/>
- <https://wordart.com>

ANNEX 1.

EXAMPLES OF SHELTERS



## ANNEX 2.

### SHELTERS

A shelter is a place of protection built to protect the living and non-living values necessary for the survival of people, people and the continuation of the war power of the country with the effects of nuclear, classical and modern weapons, biological and chemical warfare materials.

#### TYPES OF SHELTER

Shelters are gathered in two groups as Shelters according to the users and purpose of use:

#### Shelters by User

- Private shelters: They are built in houses, public and private workplaces, basements or gardens of factories and establishments. It is used to protect those who live and serve here.
- General shelters: They are built jointly by the government, municipality, and private administration in places where there is a lot of public community or in places with heavy traffic (such as bazaar, market, garage, port, station) for the protection of those outside at that time.

#### Shelters by Purpose of Use

- Pressure bunkers: These are the bunkers built to protect against the sudden (light, heat, pressure, and initial radiation) and residual (radioactive fallout) effects of nuclear weapons, the effects of classical and modern weapons, and chemical and biological warfare agents.
- Fallout shelters: These are shelters built to protect against the radioactive fallout effects of nuclear weapons. These shelters also provide protection against chemical and biological warfare agents, weakened pressure and heat effects of nuclear weapons, and fragmentation effects of classical and modern weapons.

#### MATERIALS TO BE INCLUDED IN THE SHELTER

- Personal clothing, cleaning, and toilet materials according to the season.
- Bedding material.
- Food items that will last for a few days, water for drinking and use, hand bucket, plate, glass, spoon, fork, etc.
- Lighting material; sailor's lantern, flashlight, and spare batteries etc.
- Gas stove for cooking.
- Heating device.
- A closed garbage bin to put the garbage.
- Sanitary equipment, first aid kit and necessary medicines.
- Simple tools and repair kit.
- Battery powered radio and spare batteries, clock.
- Book vs. some entertainment materials.



- Simple radiation measuring instrument if possible. (<https://www.afad.gov.tr>).

### ANNEX 3.

Installation: Windows or Mac versions are downloaded and installed.  
<https://mblock.makeblock.com/en-us/download/>



mBlock PC version

Version: V5.4.0  
Released: 2021.11.30

[Released log >>](#) [Previous version >>](#)

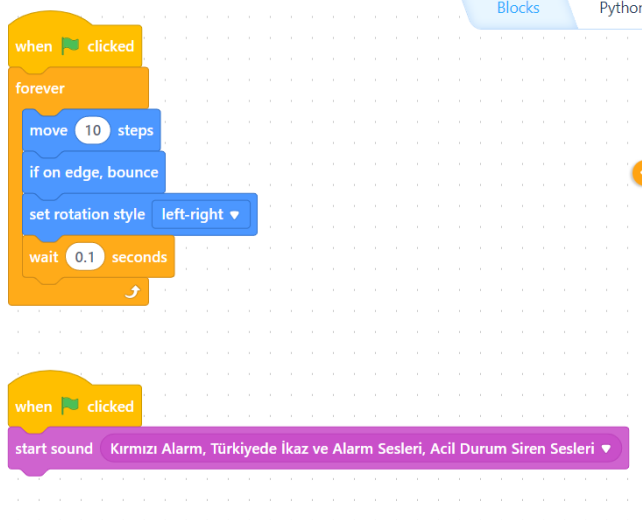
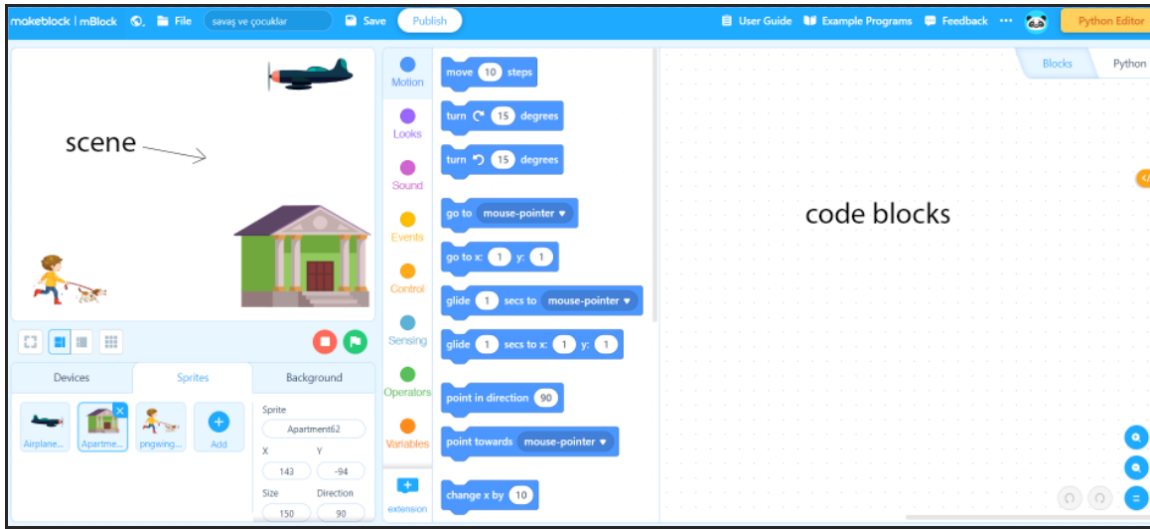
Download for Windows

Win7 or Win10 (64-bit recommended)

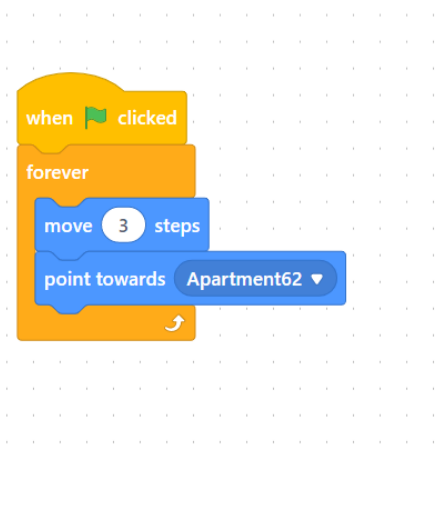
Download for Mac

macOS 10.12+

Home Page:



Airplane code blocks.



Object block codes to move.

<https://www.youtube.com/watch?v=Q2wiHgalSYw&t=112s> (resource for siren sounds)

## ANNEX 4.

### PROBLEM



10-year-old Maria has four dogs. The little girl, who loves her dogs very much, is worried about how to protect them in case of war. Can you help Maria with the precautions she can take for her dogs?

1. Can dogs stay in shelters that include Maria? What conditions might this depend on?
2. Can a separate shelter for dogs or an addition be made to the shelter Maria is considering? Can you compare the estimated costs of these two cases?
3. What should be included in the shelter? What technologies might be needed?
4. Can you calculate the cost of a shelter for dogs and how long it can be used?
5. At what points can the golden ratio be used in a shelter design? In what way might this be beneficial?

Based on the questions above, can you design a shelter for Maria's four dogs?

## ANNEX 5.

### GROUP EVALUATION FORM

This form was created in order to evaluate the design made by each group by other groups.

Evaluated Group Name:	Very successful	Successful	To be improved	Unsuccessful
1. In terms of clarity (understandability) of the group's presentation.				
2. In terms of transferring the design into practice.				
3. In terms of design cost.				
4. In terms of design aesthetics.				
5. The design is in accordance with the golden ratio.				

## ANNEX 6.

### PEER ASSESSMENT FORM

Fill in the form given below with the symbol X in line with your observations of your friends in the group work. The following table can be replicated as needed.

1. Name-surname of my friend:

	Very good (5)	Good (4)	Neither good nor bad (3)	Bad (2)	Very bad (1)
Voluntary participation in the study.					
in fulfilling the assigned duty.					
Respecting the opinions of group mates.					
Helping group mates.					
The progress to overcome the problems encountered during the work.					



### III. 3 ECONOMIC EFFECTS OF WAR

<p><b>Topic:</b> Effects of War</p> <p><b>Subtopic:</b> Economic Effects of War</p> <p><b>Grade Level:</b> 4th Grade</p> <p><b>Time:</b> 40+40+40 min.</p> <p><b>Developer/s:</b> Bilge Has Erdoğan</p>		
<p><b>Learning Objectives:</b></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Comprehend the effects of war on the economy.</li> <li>• Show the skill to find a location on the map.</li> <li>• Make a mathematical calculation of the ratios used on the map.</li> <li>• Calculate and compare costs in different economic activities.</li> </ul>		
Elicit	Materials	Method/ Technique
<p>To attract the attention of the students at the entrance of the lesson. Students are asked these questions below one by one:</p> <ol style="list-style-type: none"> <li>1. Have you heard of a country called Ukraine?</li> <li>2. Do you know which continent it is located in?</li> </ol> <p>A discussion environment is created by asking questions. Its location is shown on the world map.</p> <p>In the continuation of the course, the graphs related to the economy shared in Annex 1 are presented to the whole class with an interactive whiteboard. Students are asked to interpret the graphs. While examining the graphics, the teacher poses questions to deepen the subject.</p>	<ul style="list-style-type: none"> <li>• Smart Board</li> <li>• <b>Annex 1.</b> Economic Data</li> </ul>	<p>Socratic Inquiry Method</p>
Engage	Materials	Method/ Technique
<p>To improve the map reading skills of the students, examinations are made on Google Earth.</p> <p>Students are divided into groups of four. The groups try to find three countries and three cities the teachers ask them to find on the map by competing with each other.</p>	<ul style="list-style-type: none"> <li>• Smart Board</li> <li>• Google Earth program</li> <li>• <a href="https://earth.google.com/web/">https://earth.google.com/web/</a></li> </ul>	<p>Game Based Learning</p>
Explore	Materials	Method/ Technique

<p>The groups are asked to observe Ukraine via Google Earth program in terms of:</p> <ul style="list-style-type: none"> <li>• Location.</li> <li>• Its size.</li> <li>• Which countries it neighbours.</li> </ul> <p>Attention is drawn to the relationship between the distance seen on the map and the map drawing ratios.</p>	<ul style="list-style-type: none"> <li>• Smart Board</li> <li>• Google Earth program <a href="https://earth.google.com/web/">https://earth.google.com/web/</a></li> </ul>	<p>Question-Answer Method</p>
<b>Explain</b>	<b>Materials</b>	<b>Method/Technique</b>
<p>The problem shared in Annex 2 is reflected on the interactive whiteboard so that the life-based problem can be solved through the learned information. The problem is read by the teacher.</p> <p>Groups are expected to come up with a solution to the problem. In this process, the teacher is expected to guide the students.</p>	<ul style="list-style-type: none"> <li>• Smart Board</li> <li>• <b>Annex 2.</b> Transportation Cost</li> </ul>	<p>Problem Based Learning</p>
<b>Elaborate</b>	<b>Materials</b>	<b>Method/Technique</b>
<p>The groups are asked to present the reports prepared by them regarding the problem in Annex 2 to the class. During the presentation, groups should be encouraged to ask each other questions and a discussion environment should be created.</p>	<ul style="list-style-type: none"> <li>• Smart Board</li> </ul>	<p>Presentation Discussion</p>
<b>Evaluate</b>	<b>Materials</b>	<b>Method/Technique</b>
<p>The Padlet program is used to determine what students have learned and inferences during the course. Students are asked a question, "In what ways does the war affect the economy?" They are directed to the Padlet program to answer the questions.</p>	<ul style="list-style-type: none"> <li>• Padlet Program <a href="https://padlet.com/">https://padlet.com/</a></li> </ul>	<p>Evaluation</p>
<b>Extend</b>	<b>Materials</b>	<b>Method/Technique</b>
<p>The student comments written on the Padlet are read one by one and what is learnt is summarized and evaluated. The lesson ends when it is seen that there is no problem with the concepts.</p>	<ul style="list-style-type: none"> <li>• <b>Annex 3</b></li> </ul>	<p>Evaluation</p>

## REFERENCES

- OECD (2022), *OECD Economic Outlook, Interim Report September 2022: Paying the Price of War*, OECD Publishing, Paris, <https://doi.org/10.1787/ae8c39ec-en>.

- World Bank (2022), “World Bank Commodities Price Data (The Pink Sheet)”, <http://www.worldbank.org/commodities> (accessed on 18 October 2022).

## ANNEX 1.

### ECONOMIC DATA OF UKRAINE

Change of the Ukrainian currency Hryvnia against the Euro in Time

**EUR to UAH Chart** +22.91% (1Y)

• 1 EUR = 39.2268 UAH Feb 12, 2023, 19:56 UTC

Euro to Ukrainian Hryvnia

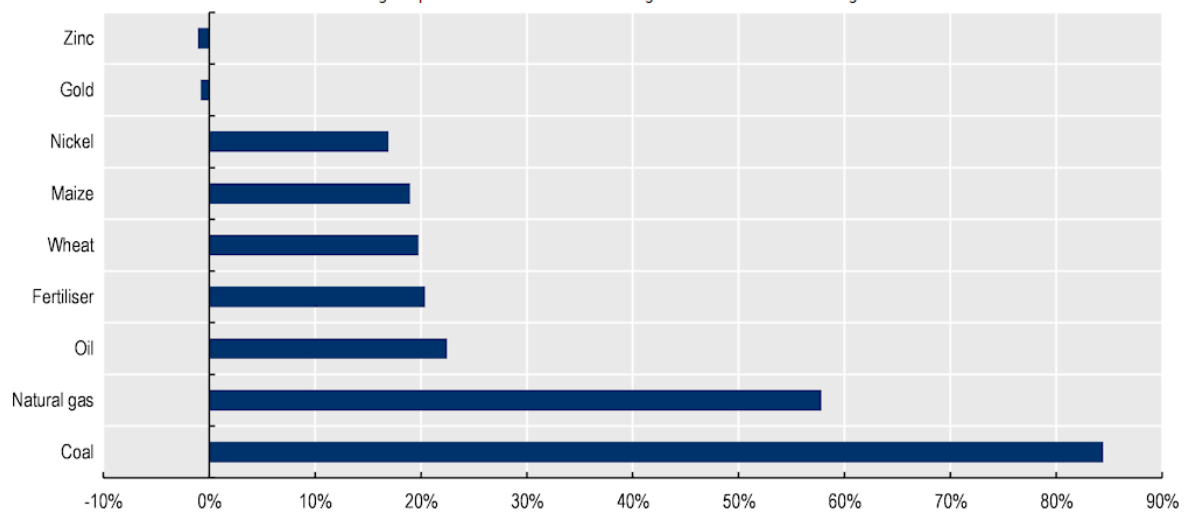


<https://www.xe.com/currencycharts/?from=EUR&to=UAH>

Changing prices as a result of Russia's war on Ukraine

Figure 2.3. **Commodity price increases**

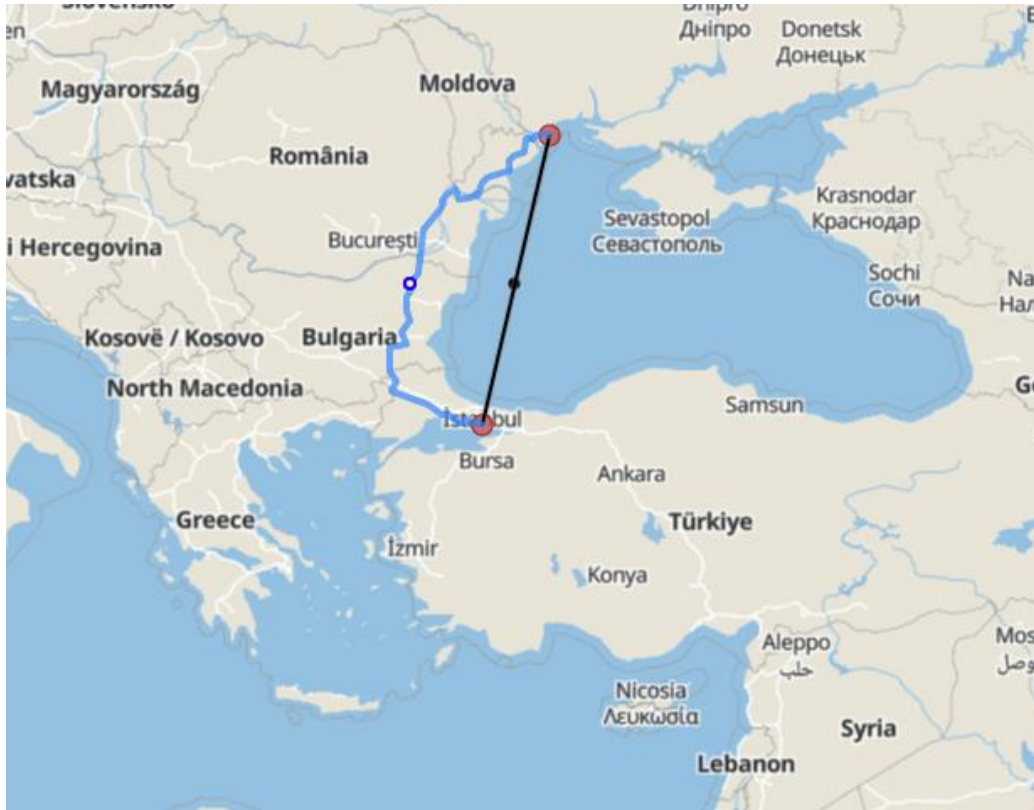
% change in price between Jan 2022 average and Mar-Oct 2022 average



(OECD, 2022[42]); (World Bank, 2022[43])

## ANNEX 2.

### SHOULD WE CARRY OUR LOAD BY SHIP OR TRAILER?



Ukraine meets 7% of the world's grain need. It transports the grain products it produces mainly from Odessa Port to Istanbul, then to various cities in Asia and Europe over the Black Sea. After the military attack of Russia on February 24, 2022, transportation over the Black Sea was not possible for a long time. In this process, the transportation costs of grains delivered to Istanbul by land have changed significantly. Write a short report interpreting the situation by calculating the changing cost in line with the information given below:

- Seaway distance: 623 km
- Transportation by land: 1,101 km
- A ship can hold an average of 12,000 containers.
- A container can hold 76 cubic meters of cargo, while a truck can hold 100 cubic meters of cargo.
- While a ship consumes about 660 liters of diesel per 100 km, a truck consumes about 300 liters of diesel per 100 km.



### ANNEX 3.

Student Name:	Date:			
<i>Observed Behaviors</i>	<i>Always</i>	<i>Often</i>	<i>Occasionally</i>	<i>Never</i>
Working with group.				
work on solution options.				
Doing mathematical calculations correctly.				
Sharing the result in an explanatory way.				
Answering questions about your calculations.				

### III. 4 PUBLIC ANNOUNCEMENT SERVICE

<p><b>Theme:</b> The Effects of War  <b>Subtopic:</b> Creating a Public Announcement Advertisement About War  <b>Grade Level:</b> 4th Grade  <b>Time:</b> 40+40+40 min  <b>Developer/s:</b> Elif Öznur Tokgöz</p>		
<p><b>Learning Objectives:</b></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Question the concept of war.</li> <li>• Reflect on the psychology of children who experience war.</li> <li>• Express the concept of war from the eyes of children.</li> <li>• Express the effectiveness of the public service advertisement in raising awareness with their own words.</li> <li>• Understand how to create a public announcement.</li> <li>• Know the concept of golden ratio.</li> </ul> <p><b>Preparations:</b></p> <ul style="list-style-type: none"> <li>• The teacher will prepare the t-shirts containing the words about the war as much as the number of students before the application (Appendix 3).</li> <li>• The picture in Annex 5 will be printed as a poster.</li> </ul>		
Elicit	Materials	Method/ Technique
<p>The teacher writes a title on the board as follows:  <i>'The children are crying because.....'</i></p> <p>Then the Teacher goes on telling as follows:          "Dear Children, there is an incomplete sentence on the board, I ask you to complete this incomplete sentence in line with your own views. I'll give you a few minutes for this".</p> <p>When the time is over, the teacher writes the answer of each student on the board and points out the situations that upset the children in the eyes of the students one by one.</p>	<ul style="list-style-type: none"> <li>• Board</li> <li>• Board Marker</li> </ul>	<p>Socratic Inquiry Method</p>
Engage	Materials	Method/ Technique
<p>Then the teacher shows the students a picture on the smart board and asks the students to observe the picture. (Annex 1).</p>	<ul style="list-style-type: none"> <li>• Annex 1</li> <li>• Smart Board</li> </ul>	<p>Discussion Socratic Inquiry Method</p>

<p>The Teacher asks the S such questions one by one to make the Ss' attention being consolidated in phenomenon of war:</p> <ul style="list-style-type: none"> <li>• What are the children in the picture doing?</li> <li>• Why do children do these activities on a tank?</li> <li>• What do you think this picture might be telling us?</li> </ul>		
<b>Explore</b>	<b>Materials</b>	<b>Method/ Technique</b>
<p>Then the teacher opens a video on the smart board and has the students watch it. (Annex 2).</p> <p>The Teacher asks the Ss such questions as follows:</p> <ul style="list-style-type: none"> <li>• How did you feel while watching the video?</li> <li>• Who do you think is most affected by the war?</li> </ul> <p>The teacher gets the answers of the Ss, in this phase the teacher tries to make all Ss join in the lesson actively.</p>	<ul style="list-style-type: none"> <li>• Annex 2,</li> <li>• Smart Board</li> </ul>	
<b>Explain</b>	<b>Materials</b>	<b>Method/ Technique</b>
<p>In order to handle the phenomenon of war in detail with the Ss, the Teacher asks the question:</p> <p><i>'Why do people fight?'</i></p> <p>The teacher writes the answers on the board. Later each answer is handled with the factors of wars (one by one) to be discussed with the Ss.</p>	<ul style="list-style-type: none"> <li>• Board</li> <li>• Board Marker</li> </ul>	
<b>Elaborate</b>	<b>Materials</b>	<b>Method/ Technique</b>
<p>Later the teachers ask the Ss this question:</p> <p><i>'What do you think children show their reaction to the war by doing?'</i></p> <p>(NOTE: The answers expected from the students here are crying, painting, writing poetry, preparing posters... etc. If the answers from the students are not in this direction, the teacher directs the students to provide these answers).</p>	<ul style="list-style-type: none"> <li>• Board</li> <li>• Board Marker</li> </ul>	
<b>Evaluate</b>	<b>Materials</b>	<b>Method/ Technique</b>
<p>In this section, the teacher divides the students into 3 groups and puts cardboard, pencil, crayons, etc. in</p>	<ul style="list-style-type: none"> <li>• Cardboards,</li> <li>• Pencils</li> <li>• Any needed stationary</li> </ul>	

<p>front of each group (puts whatever materials needed). The teacher gives directions to the Ss: <i>“Dear Children, you have cardboards in front of you on which:</i></p> <ul style="list-style-type: none"> <li>• <i>The 1<sup>st</sup> group will draw a picture depicting the war.</i></li> <li>• <i>The 2<sup>nd</sup> group will create a 4-line poem about war.</i></li> <li>• <i>The 3<sup>rd</sup> group will find a slogan against war”.</i></li> </ul> <p>You have 10 minutes for this. At the end of this period, your cardboards will remain on your desks, but you will change places, so the 1st group students will move to the 2nd group's table, the 2nd group students will move to the 3rd group's table, and the 3rd group students will move to the 1st group's table.</p> <p>Whatever activity is on the cardboards on each group table, they will continue the activities from where they left off (for example, the new group will write a 4-line poem as a continuation of the poem, which is a 4-line poem, the new students will enlarge the picture and draw new pictures, the slogan Students who come to the cardboard with the following card will write a new slogan). Your time is still 10 minutes.'</p> <p>At the end of the time, the teacher changes the groups again and makes the same practices repeated within 10 minutes.</p> <p>NOTE: In this activity, the teacher will use the 'Station Method' to allow all students to take part in each stage, and to take things one step further by contributing to what the previous group did.</p>	<p>supplies like colored pencils, eraser</p>	
Extend	Materials	Method/ Technique
<p>The teacher asks the Ss this question to get their answers: <i>“Yes, dear children, we have 3 different cartons now. You all showed your feelings and thoughts towards the war on these cardboards, but how can we let other people know about these cardboards and your reactions to the war?”.</i></p> <p>NOTE: If the public service announcement is not among the answers given by the students here, the teacher directs the students so that the students focus on the public service announcement.</p>	<ul style="list-style-type: none"> <li>• T-shirts (<b>Annex 3</b>)</li> <li>• Poster (<b>Annex 5</b>)</li> <li>• Camera</li> </ul>	<p>Public Announcement Service</p>

<p>Later the Teachers tells the ss as follows to enlighten the Ss about public announcement service they will be preparing:</p> <p><i>“Children, public service announcements can increase our awareness of a subject, change our thinking or behavior, and encourage a behavior that we want to gain”.</i></p> <p>Afterwards, the teacher distributes t-shirts with the theme of war to the students and asks all students to wear the t-shirts. (Annex 3).</p> <p>Before the video shoot, the teacher gives a brief information to the students about the concept of the golden ratio and states that they will also use the concept of the golden ratio in the public spot they will shoot. (Annex 4).</p> <p>Preparations before shooting: 3 different themed cardboards and war posters (Appendix 5) prepared by the students are placed in 4 different parts of the school.</p> <p>Video shooting stages:</p> <ol style="list-style-type: none"> <li>1. Stage 1: The poem quatrains written by the students are read in groups in front of the area where the poem cardboard is located (approximately 20 seconds).</li> <li>2. Stage 2: The slogans written by the students are read separately in groups in the section where the slogan cardboard is (approximately 10 seconds).</li> <li>3. Step 3: The image of the picture prepared on cardboard by the Ss describing the war fought is taken (approximately 4 seconds).</li> <li>4. Stage 4: All students stand around the war poster (Appendix 5) and say the words 'Peace has no color, Children's dreams are colorful' in unison (approximately 5 seconds). With this step, video shooting is completed.</li> </ol> <p>NOTE: In the video shooting, the teacher will shoot considering the golden ratio. The Teacher will take care that the video duration is no longer than 40 seconds. A background music can be added to the video by the teacher.</p>		
--	--	--

## REFERENCES

- Bütün, M., Selçuk, M., Akadal, E., & Gülseçen, S. (2018). Kamu spotlarının etkililiği üzerine bir araştırma. *Selçuk İletişim*, 11(2), 273-291.

- <https://masivaturk.com/evrenin-matematigi-altin-oran>
- [https://www.youtube.com/watch?v=ns6UDrYD3\\_c](https://www.youtube.com/watch?v=ns6UDrYD3_c)  
[https://c6.staticflickr.com/6/5350/17293178669\\_217f6d464e\\_n.jpg](https://c6.staticflickr.com/6/5350/17293178669_217f6d464e_n.jpg).

### ANNEX 1.



### ANNEX 2.



[https://www.youtube.com/watch?v=ns6UDrYD3\\_c](https://www.youtube.com/watch?v=ns6UDrYD3_c)

### ANNEX 3.

Sample T-shirts photos with images printed on.



## ANNEX 4.

### INFORMATION AND EXAMPLES ABOUT THE CONCEPT OF THE GOLDEN RATIO

The golden ratio is the golden ratio if, in mathematics, the ratio of the larger of two quantities to the smaller is the same as the ratio of the sum of the quantities to the larger of the quantities.

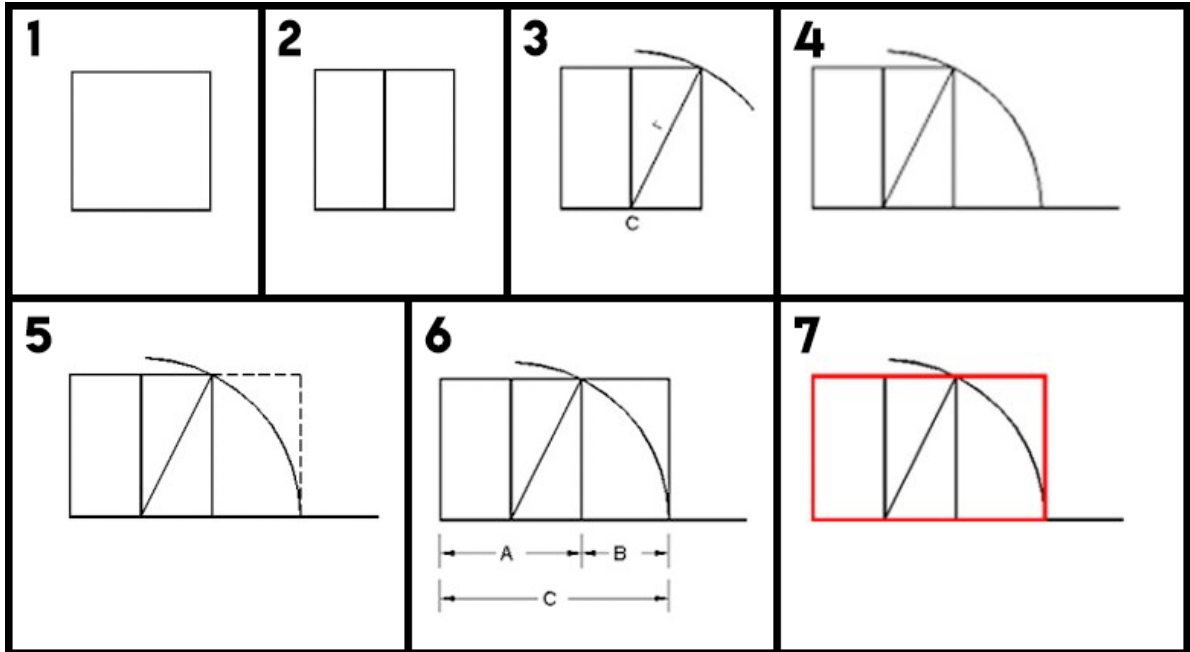
Golden Ratio Calculation Steps:

If you follow the steps in the image below; After the first square (picture 1) is divided into two in the middle and becomes two equal rectangles (picture 2), a circle is tried to be drawn with a compass from the lower point of the common side of the two rectangles up, touching the opposite corner of the square (picture 3). The rectangles are then extended until the baseline intersects the drawn circle (picture 4).

When the newly formed shape is completed into a rectangle, a new rectangle will appear next to the original square (picture 5). The ratio of the base of this newly formed rectangle to the base length of the original square is the Golden Ratio (picture 6).

In addition, the ratio of the base length of the square (A) to the base length of the large rectangle (C) is the Golden Ratio. (Picture 6):  $A / B = 1.6180339 = \text{Golden Ratio}$ ,  $C / A = 1.6180339 = \text{Golden Ratio}$ .

The rectangle obtained in the 7th picture, which is the last picture, is also a Golden Rectangle. Because the ratio of the long side to the short side is 1.6180339, that is, the Golden Ratio.



Now every time we subtract a square from this rectangle, we're left with a Golden Rectangle.

## ANNEX 5.

### THE PICTURE TO BE PRINTED AS A POSTER



The poster will be printed in a size of 2m in width and length.