Sustainable Environmental Education
by Integrating P4C Education into STEAM Courses

SUSENSTEAM-P4C

PA3 - COMPETENCE FRAMEWORK

Output Leader: Bursa Uludag Universitesi
Output Partners: Ogres Centra pamatskola, Primary School no 90, Wrocław, Osmangazi Ilce Milli
Egitim Mudurlugu, Learning Hub Friesland, DSW University of Lower Silesia

Introduction

"Sustainable Environmental Education by Integrating P4C pedagogy into STEAM Courses": A competence framework for the implementation of P4C and STEAM approaches in classes and social club activities

The competence framework, developed within the "Sustainable Environmental Education: Integration of P4C Pedagogy into STEAM Courses" project, is a tool designed to support teachers and other educators in planning and implementing activities that integrate the Philosophy for Children (P4C) and STEAM approaches. The framework is grounded in the analysis of the curricula and handbooks for subjects related to the STEAM education in primary or lower secondary schools in Türkiye, Poland, Latvia and the Netherlands, aimed at the identification of the content and aims related to climate change and environmental sustainability. It serves as guidance for subject teachers in the STEAM fields who wish to introduce elements of environmental and climate change education, while simultaneously incorporating a philosophical perspective into their teaching. The integration of P4C and STEAM approaches enables students not only to acquire knowledge but also to make sense of it through philosophical discussions and critical thinking processes, as well as to put it into practice.

The framework guides the activities to be implemented in the classroom and social club meetings with the focus on P4C and STEAM integration, with the purpose of helping students in the following areas:
● Acquiring knowledge: Understanding and synthesizing scientific and social scientific knowledge on climate change and sustainability.
● Critical thinking: Analyzing environmental issues and evaluating different perspectives using philosophical questioning techniques.
● Problem solving: Developing creative and innovative solutions to environmental issues using STEAM principles.
● Creative thinking: Designing and implementing projects that increase environmental awareness using artistic and technological tools.
● Social responsibility: Developing a sense of responsibility towards environmental issues and taking an active role in social change.

SCIENCE

No:	Competence Frame Keywords
1	Climate change
2	Drought
3	Recycling
4	Natural events: melting-freezing, floods, erosion
5	Renewable energy

1. Climate Change

Keywords	Climate change
Subject	**Focus**: Explore the environmental impacts of both renewable and non-renewable energy sources, with an emphasis on the role of renewable energy in reducing carbon emissions and mitigating climate change.
Objectifies & Achievements	Students: • Discuss the causes and possible consequences of local climate changes. • Explain the causes and possible consequences of global climate change • Solve problems involving percentages, equations, and data related to environmental topics. • Use statistical data to interpret environmental changes and predict outcomes.
Application in Social Clubs	• Students are shown a video about climate change and asked to reflect on their understanding. • Use data from environmental studies to create graphs and interpret results. • Integrate philosophical questioning and discussions on environmental ethics, sustainability, and the role of technology in shaping the future.

2. Drought

Keywords	**Drought**
Subject	**Water Cycle (Hydrology)**: • **Unit**: Earth Science • **Topic**: Water Cycle, Climate Systems, Drought • **Focus**: You can explore how droughts impact the water cycle and the delicate balance between evaporation, condensation, and precipitation. This leads to discussions about the availability of freshwater resources.

Objectifies & Achievements	Students: • Discuss the causes and possible consequences of local and global drought. • Solve problems involving percentages, equations, and data related to environmental topics. • Use statistical data to interpret environmental changes and predict outcomes.
Application in Social Clubs	• Use data from environmental studies to create graphs and interpret results. • Integrate philosophical questioning and discussions on environmental ethics, sustainability, and the role of technology in shaping the future.

3. Recycling

Keywords	Recycling
Subject	Integration of environmental topics, including recycling, sustainable resource use, and understanding the impact of human activities on the natural world.
Objectifies & Achievements	Students: • Understand the science behind recycling and sustainable practices. • Design projects using recycled materials and evaluate their environmental impact. • Explain the importance of separating solid waste for recycling. • Use research data to evaluate the contribution of recycling to the country's economy.
Application in Social Clubs	• Create artworks inspired by nature and environmental themes. • Develop creative solutions to express environmental messages through the visual arts. • Create a collage using recycled materials to depict the concept of sustainability. • Organize an art exhibition focused on environmental themes.

	• Integrate philosophical questioning and discussions on environmental ethics, sustainability, and the role of technology in shaping the future.

4. Natural Events

Keywords	Natural events
Subject	• Introduction to environmental changes - concepts of melting, freezing, boiling, condensation, and their environmental impacts • Understanding natural disasters and environmental protection methods. • How does overflow or flood occur?
Objictifies & Achievements	• Students explore physical changes and environmental impacts of Earth. • Analyse the causes and effects of natural disasters. • Explain destructive natural events caused by natural processes. • Discuss the ways of protection from destructive natural events. • Discuss destructive natural events caused by erosion
Application in Social Clubs	• Explain the changes that occur due to erosion and their positive and negative aspects. • Engage in experiments that demonstrate the effects of heat on substances. • Use technology to create a presentation on the impact of human activities on the environment. • Integrate philosophical questioning and discussions on environmental ethics, sustainability, and the role of technology in shaping the future. • What kind of scientific developments did the flooding of the Nile River in Ancient Egypt lead to? Explain.

5. Renewable Energy

Keywords	Renewable energy
Subject	- What is energy transformation? **Topic**: Energy, Power, and Renewable vs Non-Renewable Resources **Focus**: Discuss how energy is generated, stored, and used, comparing renewable sources (solar, wind, hydro, etc.) with non-renewable ones (fossil fuels). This can lead to discussions on the efficiency and sustainability of different energy sources.
Objectifies & Achievements	Students generate ideas about the advantages and disadvantages of power plants
Application in Social Clubs	Examples of the economical use of electricity at home.

MATH

No:	Competence Frame Keywords
1	**Percentages and fractions**
2	**Decimal fractions**
3	**Linear and algebraic equations**
4	**Graph analysis**
5	**Stereometry (prisms and pyramids)**

1. Percentages and fractions

Keywords	Percentages and fractions
Subject	What are the terms percentages and fractions?
Objectifies & Achievements	- Solves unusual problems related to partial fractions and percentages. - Solves unusual problems related to determining what percentage of a number is another number. - Solves unusual problems related to the calculation of a percentage of a given number. - Solves unusual problems related to raises and discounts with a given percentage. - Solves unusual problems related to the calculation of a number from a given percentage of it. - Compares data from two diagrams and answers questions about the data found.
Application in Social Clubs	- Solve problems involving percentages, equations, and data related to environmental topics. - Use statistical data to interpret environmental changes and predict outcomes.

2. Decimal fractions

Keywords	Decimal Fractions
Subject	What are the decimal fractions?
Objectifies & Achievements	- Calculates the value of an arithmetic expression that includes operations on natural numbers and decimals. - Solves problems using operations on natural numbers and decimals - Solves unusual problems using operations on natural numbers and decimals. - Solves unusual problems using operations on partial fractions. - Solves unusual problems with operations on partial fractions and decimals. - Solves unusual problems with decimal expansions of partial fractions. - Solves problems related to powers.
Application in Social Clubs	- Show and explain real-world problems using operations on natural numbers and decimals - Use decimal fractions data from environmental studies to create graphs and interpret results.

3. Linear and Algebraic Equation

Keywords	Linear and Algebraic Equation
Subject	- Writing algebraic equations - A number that solves an equation - Solving equations - Unusual problems - Transforming equations
Objectifies & Achievements	- Forms an algebraic equation. - Solves unusual problems using algebraic equations.

	• Solves unusual problems using algebraic transformations. • Solves unusual problems by using and calculating algebraic equations. • Writes a task in the form of an equation • Writes a task in the form of an equation, solves it using adding, subtracting, and multiplying operations on algebraic sums.
Application in Social Clubs	• Interpret climate change data using algebraic equations • Compare climate change data with ten years ago using the algebraic equation • Show global warming by continents in the table using the algebraic equation and then comment.

4. Graph Analysis

Keywords	Graph Analysis
Subject	• What is the map scale? • Gathering data from graphs • Scale on maps • Finding information • Reading statistical data • What is an average?
Objectifies & Achievements	• Uses a calculator to solve a problem. • Answers the questions about the data found on the graph. • Shows data on a graph.
Application in Social Clubs	• Use data from environmental studies to create graphs and interpret results • Draw and interpret graphs using data obtained from global warming studies. • Draw and interpret graphs using data obtained from climate change studies.

5. Stereometry (prisms and pyramids)

Keywords	Stereometry (prisms and pyramids)
Subject	- Cuboids - Cubes - Solid Meshes - Prisms - Pyramids - Surface area of solids - Volume of solids - Volume units - Litres and millilitres
Objectifies & Achievements	- Solves unusual problems related to the volume or a prism. - Solves unusual problems related to pyramids. - Solves unusual problems related to cubes. - Determines the characteristics of the drawn prism. - Calculates surface area of prisms built from cubes. - Converts volume units.
Application in Social Clubs	- Compare the largest and smallest pyramids in Egypt in terms of their areas. - Compare the heights of the largest and smallest pyramids in Egypt. - The volumes of soil lost by erosion are calculated. - The famous Delos problem of ancient Greece is explained and its solution is given.

TECHNOLOGY- DESIGN

No:	Competence Frame Keywords
1	Technological innovation and design
2	Technological materials and their applications
3	Technological knowledge dissemination
4	Recycling of technology devices
5	Technological applications in environmental sustainability

1. Technological innovation and design

Keywords	Technological innovation and design
Subject	• How is a product made of composite materials? • Integrated subject of science, design and technology
Objectifies & Achievements	• Deepen students' understanding of different materials, their properties and possibilities to use. • Create awareness about the need for waste management. • Create your composite material, test the created material by comparing the raw material and the created one. • Make a design product from its composite material
Application in Social Clubs	• Students create their own design object from different materials, according to their properties.

2. Technological materials and their applications

Keywords	Technological materials and their application
Subject	• How to creatively use reusable materials. • Everything around paper • From fibre to clothing • Valuable material wood • Around metals

	• World of plastic • Composites – materials of a new era
Objectifies & Achievements	Students: • Creatively and usefully reuse materials to reduce their negative impact on the environment. • Analyse how the implementation of the created ideas affects the environment and society (community).
Application in Social Clubs	• Explains the relation between paper production and environmental changes. • Explains the application of different kinds of wood. • Knows professions related to forestry and woodwork. • Knows the pros and cons of natural and artificial textile materials. • Can state the drawbacks of plastics. • Can explain the relation between plastic production and environmental pollution.

3. Technological knowledge dissemination

Keywords	**Technological knowledge dissemination**
Subject	• Electronics • Modern world with technology
Objectifies & Achievements	• Lists the names of elements in an electric circuit. • Explains how different installations work.
Application in Social Clubs	• Gives practical ways to decrease the consumption of electricity, gas, and water. • Explains how simple electric devices work. • Reads information about chemical additions in food product labels. • Can explain what conservation and food improvers are

4. Recycling of technology devices

Keywords	Recycling of technology devices
Subject	Integration of environmental topics, including recycling, sustainable resource use, and understanding the impact of human activities on the natural world.
Objectifies & Achievements	• Learn about innovations in sustainable technology and their applications. • Design projects using recycled materials and evaluate their environmental impact.
Application in Social Clubs	• Design a project using sustainable materials and present its environmental benefits. • Use technology to create a presentation on the impact of human activities on the environment.

5. Technological applications in environmental sustainability

Keywords	Technological applications in environmental sustainability
Subject	• House without surprises • Installations and house payments • Everyday devices at home • Modern equipment
Objectifies & Achievements	• Can explain the relation between production and environmental pollution. • List construction elements in a household.
Application in Social Clubs	• Calculates the cost of consumed materials. • Explains the structure and safe operation of basic household appliances • Lists the dangers related to everyday electric devices.

ART

No:	Competence Frame Keywords
1	Environmental rights
2	The right to produce art and culture
3	Creating art from recycled materials
4	Climate change

1. Environmental rights

Keywords	Environmental rights
Subject	Architecture and environment. How to spot connections between the structure and the place where it is located.
Objectifies & Achievements	• Building awareness of the impact of the surrounding environment on the structure to notice the relationship between the structure and the place where it is located. • Students explore public outdoor space in the neighbourhood and discuss architectural work and environmental values. • Combines means of artistic expressions and composition techniques in architecture and, in cooperation with classmates, makes a mock-up appropriate to the surrounding context.
Application in Social Clubs	*If I were the mayor of my city* Students, working in pairs or small groups, create a mock-up made from recycled materials and present their work.

2. The right to produce art and culture

Keywords	The right to produce art and culture
Subject	Ornaments of different nations. How to create a rhythmic composition, using the ornaments of different peoples and giving symbolic meaning.

Objectifies & Achievements	• Students create a rhythmic composition using different folk ornaments and give it a symbolic meaning to think about their own values and identity. • In creative work, both freely combine and transform and purposefully use signs, for expressing the idea of ornaments and rhythms, choosing materials and techniques accordingly to abilities and intended message. • Develop the habit of treating cultural heritage with respect
Application in Social Clubs	• *My guest is the best* • Students create a plate for a foreign friend, using a combination of national symbols and ones that are special in the selected country, and present their work

3. **Creating art from recycled natural materials**

Keywords	Creating art from recycled natural materials
Subject	Art object and nature. How the forms of nature inspire inventions in art Integration of environmental topics, including recycling, sustainable resource use, and understanding the impact of human activities on the natural world.
Objectifies & Achievements	• Students study and use natural forms in the creative work of an art object. • Inspired by nature, base creative ideas on current goals, study natural objects, their lines, shapes, colour, and texture, evaluate and combine them according to the purpose and idea of the creative work. • In creative work, they follow their planned process steps and responsibly evaluate themselves and others according to jointly created criteria. • Develop creative solutions to express environmental messages through the visual arts.

Application in Social Clubs	- Students hike in nature to learn about observing nature as a piece of art. - Students draw abstractly, drawing inspiration from the shapes, lines, and colours of lichens. - Search, sketch, and take photos of shapes and lines of nature. - Create artworks inspired by nature and environmental themes. - Create a collage using recycled materials to depict the concept of sustainability.

4. Climate Change

Keywords	Climate Change
Subject	- Learning and visualizing climate change **Topic**: Greenhouse Gases, Global Warming, and the Greenhouse Effect **Focus**: Explore how the accumulation of greenhouse gases (e.g., CO_2, methane) leads to global warming. Students can learn about the science behind the greenhouse effect, linking it to human activities such as deforestation, fossil fuel consumption, and industrial emissions.
Objectifies & Achievements	- Understanding climate change through different ways of art - Learning about environmental effects from a work of art about drought - Monitoring the state of living things by painting in extreme heat or cold - Understanding the relationship between climate change and life
Application in Social Clubs	- Recreating and interpreting the relationship between climate change and life through a work of art - Creating and discussing artworks that include the consequences of climate change