European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available online at: www.oapub.org/edu

DOI: 10.46827/ejes.v10i5.4802 Volume 10 | Issue 5 | 2023

DESIGN AND IMPLEMENTATION OF A TEACHING SCENARIO FOR PRIMARY SCHOOL STUDENTS ON CREATING A SCHOOL GARDEN USING INQUIRY METHOD

Filippos Evangelou[i]
Hellenic Open University,
Greece, Ioannina

Abstract:
This paper analyses the design and implementation of a teaching scenario for the creation of a school garden using the inquiry method. It was implemented by students aged 6 to 12 years old at the 9th Primary School of Intercultural Education in Ioannina (Greece) during the teaching period: from September 2018 to June 2019. The main purpose of the implementation of the teaching scenario is the creation of the school garden - through a field of practical daily teaching and learning activities and through the inquiry approach - to form a culture among the students about sustainability and sustainable development. All students in the school - native, foreign, Roma, students with special educational needs - in the context of inclusive education are involved in the learning process with specific strategies such as group work, research work projects (project method), learning by experiment, learning with digital and collaborative learning tools, field research. Finally, through the use of Information and Communication Technologies (ICT) and in combination with playful activities, cooperation on the topic under study is sought between groups, classes, schools, and institutions within and outside the Region of Epirus (Greece).

Keywords: teaching scenario, school garden, inquiry method, Greek students, primary school

1. Introduction

Creating school gardens in school yards is a widespread practice worldwide, involving not only teachers and students but entire communities (Deniz et al., 2022; Korfiatis & Petrou, 2015; Papadopoulou, 2020; Papadopoulou et al., 2020; Pollin & Retzlaff - Fürst, 2021; Taylor et al., 2021). At the same time, many governments aiming to reduce the impacts of anarchic urbanisation 'use' school gardening and the creation of school gardens in schools to improve student health and development, interaction with parents

[i] Correspondence: email filipevang@gmail.com

and the community, experiential learning, environmental awareness, social well-being and education for sustainable/sustainable development (Dyment, 2005; Garitsis, 2016; Ozer, 2006; Taylor et al., 2021). In these ways, the teaching space is taken outside the classroom and learning is approached in an exploratory, experiential and inquiry-based way (Austin, 2022; Papadopoulou, 2020).

At the same time, the design and creation of a school garden improves students' academic performance and through the active participation of students, positive attitudes towards school and their interest in learning are developed (Austin, 2022; Blair, 2009; Broda, 2007; Deniz et al., 2022; Korfiatis & Petrou, 2015; Pollin & Retzlaff - Fürst, 2021). More specifically, research can be identified at the international level that deals with the measurement of students' learning performance during their experiential engagement in the school garden (Garitsis, 2016; Lohr et al., 2022). In particular, an extensive study (Graham & Zidenger - Cherr, 2005, cited in Garitsis, 2016:107) investigated teachers' perceptions regarding the impact of school gardens on student teaching and learning in all schools in the state of California in the context of a project implementation entitled: "A garden in every school". From the processing and analysis of 592 questionnaires, it was found that through student engagement in the school garden, academic instruction is enhanced. Specifically, teachers reported that using the garden enhances written language (42%), nutrition science (65%), environmental studies (43%), and mathematics (40%). Reports were also recorded on the development of students' social skills such as teamwork and communication skills, physical activity, and healthy eating habits (Garits, 2016:107).

Other studies show that cooperation in the context of students' work groups during their engagement with the school garden has benefits in other areas of school life, such as communication and problem-solving skills, attitudes towards school, social and emotional learning, acceptance of diversity (Garitsis, 2016; Lohr et al., 2021; Lohr et al., 2022; Strom & Strom, 1996; Waliczek et al., 2001). Typically, regarding the acceptance of diversity, the school garden provides an opportunity to engage immigrant parents or parents who have agricultural rather than academic knowledge (Greer et al, 2019; Lohr et al., 2022; Ozer, 2006; Sotiropoulou, 2014). In this context, research shows that the participation of students from different nationalities involved in gardening projects resulted in the development of intercultural interactive communication, as students were given the opportunity to pass on the traditions of their cultural heritage and to understand the complexity of the relationships of both people with each other and with the natural environment (Cutter - Mackenzie, 2009; Garitsis, 2016; Greer et al., 2019; Lohr et al., 2021; Lohr et al., 2022).

At the same time, the variety of subjects that can be taught in a school garden promotes interdisciplinary learning (Boyle, 2013; Desmond et al., 2004), while engagement with it increases pupils' environmental awareness (Boyle, 2013) and creates conditions for pupils to develop into adults with environmental values and sensitivities (Blair, 2009; Sotiropoulou, 2014). In this context, it is worth noting that by involving students in the design and creation of a school garden, a sense of belonging,

responsibility, accountability, patience and perseverance are developed (Wake, 2007). In addition, collaborative and organisational skills are cultivated and the school's openness to society is promoted (Ozer, 2006; Korfiatis & Petrou, 2015).

Research examining students' participation in garden activities has found the development of their nutritional awareness, as well as the improvement of their nutritional behaviour and the adoption of healthy eating habits (Canaris, 1995; Garitsis, 2016; Korfiatis & Petrou, 2015; Morris et al., 2001; Papadopoulou, 2020; Qi et al., 2021; Selly, 2012).

Taking into account the above data, this paper attempts to design and implement a teaching scenario for Primary School students on the creation of a school garden using the inquiry method.

It is worth noting that the teaching scenario in general, and in this paper in particular, refers to a complete teaching intervention since it involves the description of a learning context with a focused cognitive or cognitive object, with pedagogical principles and actions that utilize specific teaching tools, as well as with specific and clearly formulated teaching objectives (Bauer & Baumgartner, 2010; Baumgartner, 2011; Mikropoulos & Bellou, 2010). In other words, teaching scenarios may include one or more testable topics of one or several subjects, setting educational goals and objectives, utilizing pedagogical principles and theories, teaching techniques and methods, teaching modes and specific teaching pathways (Lygda et al., 2021; Panagiotakopoulos et al., 2016; Pedro et al., 2019).

In this paper, the teaching scenario aims through the construction of a school garden to implement practical daily teaching and learning activities, so that through the inquiry approach to form a culture among students for sustainability and sustainable development (Korfiatis & Petrou, 2015; Pedagogical Institute, 2011; Tzika & Kaldi, 2021; Tsantou, 2014).

The ultimate aim of all the proposed educational practices of the teaching scenario is the transformation of the school into a dynamic system that has as its starting point the student and his/her immediate local environment, emphasizing not only knowledge but also action and experiential participation (Tzika & Kaldi, 2021). This scenario aims not only to change individual behaviour but also to promote socio-ecological systems (Katsikis, 2007).

The teaching scenario was implemented by students aged 6 to 12 years old at the 9th Primary School of Intercultural Education in Ioannina (Greece) during the teaching period from September 2018 to June 2019.

In summary, the teaching scenario - which is analysed in detail below - has the following structure: i) Basic aim of the teaching scenario, ii) Content of the teaching scenario, iii) Linking the school garden with the Curriculum and the subjects of the Primary School, iv) Preferred age groups, v) Prerequisite knowledge, vi) Duration of implementation, vii) Educational Objectives: Cognitive, emotional and psychomotor objectives, viii) Five (5) implementation phases coded as follows: (a) First phase: orientation and questions, (b) Second phase: Hypotheses building or preliminary

explanations, (c) Third Phase: Planning and Inquiry, (d) Fourth phase: Analysis and Interpretation, (e) Fifth phase: assessment/reflection

2. Methodology for the implementation of the teaching scenario

2.1 The methodological framework for the implementation of the teaching scenario

The methods applied for the implementation of the scenario are the following:

I) Inquiry method: the purpose of the inquiry method, which was introduced by Dewey and structured as a combination of the principles of constructivism and discovery learning (Bruner, 1960), is to integrate the learner into the scientific world of inquiry by creating questions or hypotheses and testing them in order to arrive at secure conclusions by mastering knowledge and developing skills through the activities he/she will do to verify or disprove his/her hypotheses about the topic of concern (Kalovrektis et al., 2020). The teacher in the context of the Inquiry method will combine different types of learning skills, such as problem-solving and cognitive strategies, integrating processes of metacognition and a sense of self-efficacy when engaging students in multiple projects and in different learning environments, such as hands-on/minds-on activities (Dimitriadou, 2016; Kaldi & Konsolas, 2016; Nielsen et al., 2009; Stavrianoudaki et al., 2019).

Inquiry-based learning has attracted the interest of those involved in education, as it is considered a practice that bridges the dichotomy between student-centred and teacher-centred approaches. There is a sharing of teaching responsibility to both the classroom teacher and the whole student (Bacon & Matthews, 2014; Stavrianoudaki et al., 2018; Stavrianoudaki, 2021). Inquiry-based learning as a type of learning based on investigation, influenced by the constructivist and discovery learning perspective, emphasizes the active role of the student and the solution of real problems of an investigative nature that create motivation for the student (Kaldi & Stavrianoudaki, 2017; Lederman, 2007; Stavrianoudaki et al., 2018; Stavrianoudaki, 2021; Wheeler, 2000).

In conclusion, the inquiry method can be interpreted as a 'boundary' that can be 'stretched and folded' to fit the diversity of perceptions of many different people and thus of students (Stavrianoudaki, 2021:31; Wheeler, 2000). In this case, where the teaching scenario will be applied to students of the 9th Primary School of Intercultural Education of Ioannina, the composition of the student population consists of foreign students with different ethnic and cultural backgrounds, students with different learning needs, students with specific learning difficulties, and students with high learning abilities.

II) Collaborative work project (project method): students are invited to work in collaborative groups of 3 - 4 people. In the formation of each group, mixed groups of boys and girls will be formed. At the same time, it is worth noting that in the formation of the groups, emphasis is also placed on the inclusion of foreign students, students from sensitive social groups and students with special educational needs and skills (Filippatou& Kaldi, 2010; Kaldi et al., 2011; Kaldi, 2014; Kaldi et al., 2017; Kougiourouki, 2019; Tziovara et al., 2019). More specifically, based on the student population of the 9th

Primary School of Intercultural Education of Ioannina, at ages 6 - 8 students from sensitive social groups and students (e.g. Roma) participate equally in the groups, at ages 8-10 students with special needs and skills (Asperger's syndrome, Attention Deficit Hyperactivity Disorder (ADHD)) participate equally in the groups, and at ages 10-12 foreign students participate equally in the groups. The composition of the teams is not rigid and unchanging, but this does not mean a constant movement from one team to another.

To build new knowledge, students use the exchange of opinions and experiences and the invocation of their prior knowledge through their answers to the questions posed by the teacher. Initially, the teacher, using the participatory-active teaching technique of "brainstorming", poses questions to students of the type: "have you grown a plant in a pot or garden?", "is anyone in the family professionally involved in agriculture?". The teacher then asks the students to create a concept map with the concept mapping software “Cmap Tools”. Thus, through participatory-active teaching techniques, students' individual, collective and critical thinking are fostered. Furthermore, their self-esteem increases due to the perceived satisfaction from the sense of personal expression and the cultivation of their communication skills, a trait that has a positive effect on the formation of their personality.

The role of the teacher is advisory, coordinating and guiding, in order to facilitate the functioning of the groups. In carrying out their activity, the pupils should make decisions at the group level, communicate them to the class and in the field - in this case the school garden - and answer their peers' questions in plenary. This will enable them to become aware of the new knowledge they have acquired and to reflect on the process by which they have acquired the new knowledge (metacognitive skills).

III) Problem-Solving Method: this method involves students in the process of solving an environmental problem and is oriented towards the local community and action.

IV) Field study: initially, the field study starts before the school garden is created. It involves an introductory activity of mapping the yard and the area where the garden will be created. Then all activities will be carried out in the yard and specifically in the school garden area.

2.2 Pedagogical framework for the implementation of the teaching scenario

The teaching scenario aims through the construction of a school garden to implement practical everyday teaching and learning activities and through the inquiry approach to teaching and learning to shape a culture among students for sustainability and sustainable development.

At the same time, in addition to inquiry-based learning, students are exposed to constructivist theory. For example, this happens through the implementation of the 1st orientation activity where at the beginning of the lesson the concept mapping software “Cmap Tools” will be used in order for the teacher to highlight the students' pre-existing

knowledge of the concept "garden" by guiding them to create in the “Cmap Tools” software a concept map with a central concept, the concept: "garden".

At the same time, there are also interactive learning theories that promote interaction between individuals, the wider society and the natural environment. One such learning theory is Activity Theory, which focuses on the transformations of individuals and their social and physical environment and which is applied to the creation of the school garden (Engeström, 1999, 2009). Activity Theory argues that learning emerges through the interactions between six elements of an activity system: the subjects (participants), the objects (e.g. school garden), the community (the participants and the wider society affected by their actions), the tools (e.g. soil, shovels, etc.), rules (e.g. plants need watering, sun to grow) and division of labour, such as the roles of participants and other community members (Engeström, 1999, 2009; Korfiatis & Petrou, 2015).

At the same time, it is worth noting that the pedagogical framework emphasizes the inclusion of foreign students, students from sensitive social groups (e.g. Roma) and students with special needs and skills (student with Asperger's syndrome, student with ADHD). In the 6-8 age groups, pupils from sensitive social groups and students (e.g. Roma) participate equally in the groups; in the 8-10 age groups, pupils with special needs and skills (student with Asperger's syndrome, student with ADHD) participate equally in the groups and in the 10-12 age groups, foreign students participate equally in the groups. For example, foreign students bring knowledge from their home countries, or even plants and seeds from their home country, while learning from their classmates about the flora of their host country.

3. Detailed structure of the teaching scenario

i) Basic aim of the teaching scenario: the basic aim is for the members of the school community to create a garden of joy and work, oriented towards sustainability and sustainable development. Through the creation of the school garden, the aim is to raise children's awareness of modern plant species cultivation both through the exploration and understanding of conceptual contents and through activities with practical-experiential impact, in a school garden environment where they themselves will have the pleasure of creating and shaping it (Tsagliotis et al., 2007).

ii) Content of the teaching scenario: The content of the teaching scenario is fully compatible with the principles and objectives of the Primary School Curriculum and through its implementation, it aspires to contribute to the development and especially to the transformation of the school into a living-learning organisation, oriented towards sustainability and sustainable development. It is a flexible teaching scenario, which can be adapted to the needs, interests and learning profiles of students, as well as to the use of multiple sources.

The teaching scenario is distinguished by the following features:

- **Innovation - Originality:** it is based on the principles of inquiry learning and through the inquiry approach to teaching and learning it seeks to shape a culture in students about sustainability and sustainable development
- **Emphasis on inclusion:** the emphasis is placed on the inclusion of foreign students, pupils from sensitive social groups and pupils (e.g. Roma) with special needs and skills (student with Asperger's syndrome, student with ADHD). At the ages of 6-8 years, students from sensitive social groups and students (e.g., Roma), at ages 8 - 10 years participate equally in the groups students with special needs and skills (student with Asperger's syndrome, student with ADHD) and at ages 10 - 12 years participate equally in the groups foreign students.
- **Sustainability:** managing in most actions the ideas of environmental protection and sustainable development, aiming to help students develop attitudes, skills and knowledge towards the constant changes in both the social and natural environment, in order to contribute to the improvement of the quality of life and the development of human civilization
- **Digital:** uses the computer and specific software as cognitive tools. More specifically, through targeted activities, it uses the conceptual mapping software "Cmap Tools", which is based on visual learning theory and constructivism and helps active learning. At the same time, it engages students and teachers throughout the implementation of the scenario, with the almost daily use of the online (e-learning) and asynchronous teaching platform (moodle) available at the 9th Primary School of Intercultural Education of Ioannina.

At the same time, through the content of the scenario, multiple dimensions are achieved such as:

- **The environmental dimension:** students will be able to identify problems related to modern farming methods, they will become familiar with environmentally friendly farming methods. They will also understand the balance of the ecosystem, the rational use of water and the management of residues.
- **The social dimension:** students are linked to other social groups and institutions
- **The local dimension:** students understand the place of the garden in today's reality and its relation to the past and the future
- **The historical dimension:** students will study and understand the impact of the school garden over the years in terms of its existence, form, function, care, necessity and usefulness
- **The cultural dimension:** references are made to arts, cultures and other peoples
- **The economic dimension:** students will explore the relationship between self-sufficiency and survival, the relationship between the economy and globalization

iii) Linking the school garden with the Curriculum and the subjects of the Primary School: First of all, it should be noted that the typical teaching scenario approach for the school garden is linked in many ways to the curriculum of various subjects, such as science (e.g. plants, photosynthesis, energy ecosystem, living and non-living, etc.), mathematics (e.g. problem-solving, statistics, etc.), language (textual genres, argument

development, reading and interpreting texts, etc.). At the same time, the non-formal approach of the scenario is also linked to the development of work projects by students, teamwork, the development of social and communication skills, etc., elements that are now part of the spirit of the Curriculum.

The subjects involved are the following:

a. Language lessons, including activities with the following expected learning outcomes:

- Production of written discourse on the theme of the garden as a social space.
- Development of relevant vocabulary.
- Searching for relevant themes in literature (prose or poems about or relating to gardens).
- Encourage the creation of poems with similar themes.
- Keeping a diary of events in the garden as a linguistic exercise.
- Getting to know the names of garden plants, such as trees, shrubs, climbing and other plants
- Reading and listening to fairy tales with plant characters (e.g. 'Jack and the Beanstalk') or small garden animals.
- Writing fairy tales and illustrating them (individually and in groups).
- Study, and collect information about plants from relevant books and encyclopaedias.
- Drafting a letter to various stakeholders such as the municipality, environmental education centres, local or private organisations.
- Writing texts describing a plant. Using specific vocabulary about colours, leaf shape, height, etc.
- Writing articles on relevant topics in local newspapers, magazines or school newspapers or relevant online communities.

b. History - Geography, including activities with the following expected learning outcomes:

- Inventory the garden's alien plants and find information about their places of origin and the history of their transportation to other places. For example, the cultivation of corn, beans and squash, native plants of the Americas, provides an opportunity to study these peoples. The cultivation of potatoes takes us back to the peoples of Peru and Bolivia, while rice introduces us to the peoples of South-East Asia.
- Finding information about the ways of cultivating different plants and how they were cultivated in the past, in specific historical periods.
- Recording the historical and geographical details of the areas that were routes for the spread of the plants.
- Study of the local history of the school area. Linking garden form-architecture to climate.
- Study of the local geography of the school area.

- Study of the natural resources (energy, water, soil, air, water, air, aggregates) used or used in the garden.
- Use of "Google Earth" software (http://www.google.com/earth/). Students will identify and define the location of the geographical area (Epirus) and the prefecture of Ioannina. They will study its main geomorphological features and specialize in the surface and climate of the region and the school garden.

c. Environmental Studies - Physics (Sciences), which include activities with the following expected learning outcomes:

- Observations on seed germination, plant growth, flowering and reproduction.
- Experiments with garden plants to study metabolic processes (photosynthesis, respiration).
- Creation of a nursery for better observation.
- Observation of the diversity of organisms to understand biodiversity.
- Observation and recording of the fauna of the yard and garden.
- Observation of birds (migration, feeding, breeding, etc.).
- Identifying and classifying organisms present in the garden, flower beds.
- Recording the habitat of each organism.
- Inventory of the small ecosystem(s) of the yard, flower beds, nurseries, finding the food relationships.
- Observation of decomposition (burying decomposing and non-decomposing materials). Creating compost and using it in the school garden.
- Construction and operation of a small greenhouse for better observation of plants.
- Construction of a small pond or tank and observation of aquatic organisms.
- Establishment of a botanical garden and sale of its products.

d. Mathematics, including activities with the following expected learning outcomes:

- Drawing of courtyard and garden plans to scale, reduce or enlarge individual elements.
- Calculations of total and partial areas.
- Calculation of the volume of soil or other materials required.
- Measurements of plants (stem or shoot height, stem diameter, cover area, growth rate, etc.).
- Monitoring and graphical representation of plant growth.
- Nursery design (number of plants required based on area and spacing, volume of soil required, amount of water required, estimate of construction and operating costs, etc.).
- Study for various structures such as pergolas (quantity of materials, cost).

e. Arts, including activities with the following expected learning outcomes:

- Painting on the walls.
- Arrangements of dried leaves or flowers, pot-pourri, or dried flowers on paper. Making outdoor sculptures - constructions for the yard and garden.
- Creation of large chess boards or other table and floor games (e.g. tic-tac-toe, lame).

- Design of gardens, small fountains, aquariums, etc.
- Construction of elegant signs, wind indicators, etc.
- Construction of stylish litter baskets.
- Study of the colouring properties of plants - plant dyes.

Music, which includes activities with the following expected learning outcomes:

- Search for traditional or contemporary songs related to plants or animals of the region. Listening to musical pieces and dramatising them on themes related to the life of plants and animals in a garden. For example, what music is appropriate for the movement of the caterpillar and what music is appropriate for the movement of the bird?
- Listening to songs about the seasons.

f. Information and Communication Technologies (ICT), including activities with the following expected learning outcomes:

- Search for information about school gardens on the Internet.
- Computer visualisation of the school garden and design of the proposed interventions.
- Writing short texts.
- Painting plants and animals.
- Illustrating leaflets.
- Use of the concept mapping software "Cmap Tools"
- Use of "Google Earth" software
- Use of the online (e-learning) and asynchronous learning platforms (moodle)

g. Physical Education, which includes activities with the following expected learning outcomes:

- Study of the physical activity involved in garden work.
- Kinetic games for physical expression. For example, "plant that grows taller", "tree that is blown by the wind", "plant that is thirsty", etc.
- Traditional group games, such as 'The bee passes by', 'A thin onion', for entertainment and study (analysis of rules, commenting on words, the environment, etc.).

iv) Suggested ages: 6 - 8 years old (1st and 2nd grade of primary school), 8-10 years old (3rd and 4th grade of primary school), 10 - 12 years old (5th and 6th grade of primary school)

v) Prerequisites knowledge: students should have implemented the collaborative group teaching method, have minimum familiarity with the concept mapping software “Cmap Tools”, and minimum familiarity with the e-learning and asynchronous teaching platform (moodle)

vi) Duration of implementation: From September 2018 to June 2019

vii) Educational Objectives:

a. Cognitive objectives: students should be able to:

- acquire a basic knowledge of the structure and layout of a school garden

- identify basic plant species and classify them into categories such as vegetables, herbs, fruit trees, ornamental shrubs, flowers, etc.
- grow their own plants in appropriately designed areas
- be able to describe how garden plants are grown and how they are cared for according to the seasons of the year
- discover the stages of growth and the biological cycle of plants through experience
- acquire knowledge of the aesthetic, environmental and educational value of a school garden
- understand the ecological, cultural, nutritional and aesthetic value of plants and greenery in general and their relationship with the quality of life
- formulate hypotheses in an attempt to interpret the phenomena around them
- be actively involved in the learning process, emphasising observation and experience as sources of evidence
- participate actively in the learning process by responding to every opportunity for exploratory learning or by taking similar initiatives for investigation and action
- understand, through experimental activities, natural phenomena such as plant transpiration, photosynthesis
- study the fauna of the garden
- analyse the pH of the soil
- estimate the cost of creating a school garden
- write texts about their experiences and impressions of the school garden
- use new technologies such as the conceptual mapping software "Cmap Tools", "Google Earth" software and the Moodle platform

b. Emotional objectives: students should be able to:

- feel the value of creation and aesthetic intervention in the spaces that surround them
- love nature and develop an environmental ethic
- have a positive attitude towards the environment
- develop respect for the school environment and responsibility for its design and maintenance
- feel joy and satisfaction from the results of their work
- be entertained by frequent contact with nature throughout the garden
- realise that they are tomorrow's successors to the seed heritage
- become aware of the cultivation of plant species both through the exploration and understanding of conceptual contents and through activities with a practical and experiential impact, in a school garden environment where they themselves will have the pleasure of creating and shaping it
- become aware of the flora species of Greece, which are adapted to the Greek climatic conditions and do not require large amounts of water
- raise young people's awareness of the environmental, nutritional and economic value of growing local produce
- acquire the ability to take on environmental problems

- become aware of the dangers of modern lifestyles - such as the excessive use of medicines, chemicals, etc. - and become aware of the use of environmentally friendly substitutes

c. Emotional Objectives: students should be able to:

- feel the value of creation and aesthetic intervention in the spaces that surround them
- love nature and develop an environmental ethic
- have a positive attitude towards the environment
- develop respect for the school environment and responsibility for its design and maintenance
- feel joy and satisfaction from the results of their work
- be entertained by frequent contact with nature through the garden
- realise that they are tomorrow's successors to the seed heritage
- become aware of the cultivation of plant species both through the exploration and understanding of conceptual contents and through activities with a practical and experiential impact, in a school garden environment where they themselves will have the pleasure of creating and shaping it
- become aware of the flora species of Greece, which are adapted to the Greek climatic conditions and do not require large amounts of water
- raise young people's awareness of the environmental, nutritional and economic value of growing local produce
- acquire the ability to take on environmental problems
- become aware of the dangers of modern lifestyles - such as the excessive use of medicines, chemicals, etc. - and become aware of the use of environmentally friendly substitutes

d. Psychomotor objectives: students should be able to:

- work together in the context of a team
- develop a spirit of cooperation, responsibility and sociability through teamwork and task sharing
- learn to work on an equal footing with foreign pupils, Roma pupils and pupils with special educational needs
- interact in a social context
- construct arguments and communicate with others
- develop autonomy and self-regulation through experience
- operate nurturing tools
- acquire skills in handling tools
- construct layouts and models of the yard and garden
- practise problem-solving
- practise collecting, analysing, processing and cross-referencing information
- discovering and presenting their inclinations and interests
- organise and develop initiatives and responsible attitudes

- encourage their social environment to adopt good and responsible environmental habits
- participate in playful activities such as puppet shows, fairy tales, musical performances, etc.
- express and communicate through a variety of forms of representation (e.g. verbal, visual, physical)

viii) The five (5) phases of the Teaching Scenario

A. First phase of the Teaching Scenario: orientation and questions

In the first phase, four orientation activities will be carried out, followed by questions to the students. More specifically, these four activities are as follows:

a. First orientation activity: creating a concept map with the concept mapping software "Cmap Tools". In the first activity, at the beginning of the lesson, the "Cmap Tools" concept mapping software (freely downloadable from http://cmap.ihmc.us/download) will be used to enable the teacher to highlight the students' pre-existing knowledge of the concept "garden" by guiding them to create a concept map in the "Cmap Tools" software with "garden" as the central concept.

Furthermore, the "Cmap Tools" software will be used at the end of the lesson in order for the students to create a new conceptual map, which will be compared with the original one and will reflect how much they have realised the new knowledge they have acquired from the preceding activities.

The conceptual mapping software "Cmap Tools" belongs to the qualitative modelling environments that represent knowledge that cannot be expressed in a measurable way. "Cmap Tools" conceptual mapping software is based on visual learning theory and constructivism and helps in active learning (Jonassen, 2000). Conceptual mapping is a way of representing and communicating knowledge with a key feature being the representation of the relationships between the concepts that structure a particular topic (Barta et al., 2022; de Ries et al., 2022; Evangelou, 2023; Jonassen, 2000).

The construction of conceptual maps is (Barta et al., 2022; de Ries et al., 2022; Jonassen, 2000):

- a means for the teacher to organise teaching
- a visual means of presenting material to students
- an assessment tool for organizing the teaching of students

b. Second orientation activity: viewing of videos with examples of other schools where pedagogical intervention has been made to improve and pedagogically exploit the school space. The aim is to stimulate the interest of students and teachers to participate in the redesign of the outdoor school space and the creation of a school garden.

The web addressesof the videos are: URL: http://efepereth.wikidot.com/garden-intro (9th Primary School of Rethymnon/Greece) and URL:http://northathensgardens.blogspot.gr/ (Primary Education Directorate of Athens/Greece).

c. Third orientation activity: Reading and studying the book entitled: "A garden in our classroom". The web address of the book is: http://paidiki-logotexnia.blogspot.gr/2013/04/blog-post.html

d. Fourth orientation activity: identifying and recording plants in the schoolyard. In order to orient students to the topic under investigation and to establish students' existing knowledge about plants, a fourth activity is implemented in the school yard to identify and record plants.

The procedure is as follows:

- Division into groups
- The teacher invites the students to identify the different species of trees, shrubs and plants growing in the schoolyard with the help of teachers and other experts, such as the municipal agronomist, gardening parents, etc.
- Each group takes on an area of the schoolyard that has greenery. For example, a schoolyard flower bed
- They are then asked to give the area and their group the name of the most characteristic plant that grows there and to complete a table with the species of trees, shrubs, etc.

Finally, the questions asked to students and based on existing knowledge are:

- What do you like best about the courtyard area and why? Describe in words, pictures, phrases
- What do you dislike about the yard and why? Describe in words, pictures, phrases what do you like about the yard and what do you dislike most about the yard?
- What parts of the yard do you prefer to be in and why?
- What kind of feelings do you have about the state of school yard? Answer with words, phrases and sentences.
- What do you know about gardens?
- What do you know about aromatic plants? Name a few.
- In what ways do you think a garden can change a school?

B. Second phase of the Teaching Scenario: Hypotheses building or preliminary explanations

Before the teacher makes the hypotheses, preliminary explanations are given to the students, with the following two informative actions:

a. First information action: visits and information about the gardens and the environment at the following institutions:

- Environmental Education Centre of Filippiada (Prefecture of Preveza/Greece)
- Environmental Education Centre of Pramanton (Prefecture of Ioannina/Greece)
- Environmental Education Centre of Konitsa (Prefecture of Ioannina/Greece)
- University of Ioannina, School of Agricultural, Food and Nutrition Technology, Department of Agricultural Technologists

b. Second information action: information via Teleconference from primary schools that have created school gardens in their courtyard, such as the 9th Primary School of Rethymnon (Crete, Greece). The website of the Science Laboratory of the 9th Primary School of Rethymnon is URL: http://efepereth.wikidot.com/

The four (A, B, C, D) hypotheses are then generated, which are coded as follows:

- **Hypothesis A: Action 1:** Design and preparation for the creation of the school garden:

The planning and preparation for the creation of the school garden include the following sub-actions:

- mapping the yard (a spatial mathematics exercise)
- application of a method of the decision-making process for the location of the school garden in the school yard
- application of a method for deciding on the type of plants to be grown
- making a model of the schoolyard with the school garden

- **Hypothesis B: Action 2:** The creation of the school garden

The creation of the school garden includes the following sub-actions:

- creation of the school garden (budget for the school garden, visit to a nursery, supply and transport of plants, soil preparation, planting)
- composting and organic fertilisation process

- **Hypothesis C: Action 3:** Use of digital tools, such as "Google Earth" software:

Digital tools will be used, more specifically "Google Earth" software, so that students can locate the location of the school garden they are going to build in their school, as well as school gardens both in Greece and in other countries worldwide.

- **Hypothesis D: Action 4:** Use of an e-learning platform (moodle) in combination with the creation of a separate course on the subject of the school garden:

Given the fact that the school has foreign students, students from sensitive social groups (e.g. Roma students and students with special needs and skills (Asperger's Syndrome, ADHD), it is necessary to creatively manage the linguistic/cultural diversity and heterogeneity of the students by providing differentiated and individualized instruction in the various subjects of the curriculum. This can be achieved through the use of ICT and more specifically through the use of an e-learning and asynchronous teaching platform (moodle) combined with the creation of a separate course for the school garden.

By using the e-learning platform teaching (moodle), the aim is: for teachers to enrich their daily lessons, to make them more interesting for their students and for students to improve their learning both at school and at home, autonomously and at a pace that suits each of them.

c. Third Phase of the Teaching Scenario: Planning and Inquiry

It should be noted that the design of the scenario is based on both a specific pedagogical and methodological framework, which are discussed in detail in Section 2: "Methodology for the implementation of the teaching scenario" of this paper.

Initially, a work diary will be kept for the implementation of the actions related to the four hypotheses of the second phase of the scenario.

In the third phase, the design of the school garden includes four activities:

First activity: planning and preparation for the creation of the school garden

Second activity: planning and designing the school garden

Third activity: use of digital tools - "Google Earth" software

Fourth activity: use of an e-learning platform (Moodle) in combination with the creation of a separate lesson available on the subject of the school garden.

In more detail, for the *first activity* entitled: "*Planning and preparation for the creation of the school garden*", the priorities and sub-actions planned to be implemented are as follows:

I) Mapping the yard (a spatial mathematics exercise):

- Students prepare for mapping the outdoor school space.
- They are divided into groups and each group will be assigned to map a section of the yard. They note the location of buildings, trees, bushes, seating areas, sports fields, fountains, trash cans, and anything else in the yard.
- The teacher gathers all the groups' maps and we make as many photocopies as the groups. Each group presents the map they made to the other groups. There is a class discussion and comment on the map. Each group will try to put together the puzzle of the map of the whole yard and then present it to the class.
- The teacher invites an expert (agronomist or architect) to the school or the students with the teacher can visit a nursery to identify the plants they photographed.
- Students gather information about their habits, soil and climate requirements, growth rate, shape, resistance to environmental pollution.

II) Application of a method of decision-making process for the location of the school garden in the schoolyard: based on the above activity and after discussion with the municipal agronomist, we make a final decision on the location of the school garden in the schoolyard.

III) Application of a method of decision-making process for the type of plants to be grown: the choice of plants is one of the most important elements in the creation of a school garden. The functional purpose of the garden combined with local conditions and available space determines the choice of plant species. For example, if the purpose is to improve the aesthetics of the site, then plants are selected based on specific characteristics such as scent, foliage colour and flower colour or if the purpose is to produce food, then plants suitable for human nutrition are planted.

In order to decide on the type of plants to be grown, the following individual actions are carried out:

- Students study the world phytosociological map and observe that Greece is covered by Mediterranean-type vegetation.
- Students research (internet, other sources) and collect information about the flora of Greece and in particular the city of Ioannina (Greece). They create a list of different plants (e.g. aromatic plants) that they could plant and decide to plant the aromatic plants (e.g. rosemary, lavender, mint)

IV) Construction of a model of the schoolyard including the school garden:
with the above elements, a model of the schoolyard and the garden to be created can be constructed. In this activity, parents who are architects or civil engineers and the school's art teacher are invited to collaborate in this activity to contribute to the implementation.

V) Playful activities to familiarize students with the school garden:

- Puppet theatre: acting out ecological stories.
- Songs: the pupils will sing about plants, gardens, flowers, birds, animals
- Fairy tales: reading fairy tales and ecological stories. Then a fairy tale/story will be produced and illustrated by the pupils themselves.
- Construction: pupils will express themselves creatively by drawing and making constructions with different materials from the school garden and aromatic plants

VI) Cooperation with the Municipality of Ioannina, the Association of Agriculturalists of Ioannina Prefecture, the Forestry Department of Ioannina and the Parents' Association of the 9th Primary School of Intercultural Education of Ioannina: For example, the Municipality of Ioannina will contribute to the landscaping of the area, the agronomists will give advice and guidance on the creation of the school garden, the Forestry Department will supply the plants and parents can participate in the landscaping and creation of the garden.

For the second activity entitled: "*Creation of a school garden*", the priorities and sub-actions planned to be implemented are as follows:

I) Creation of a school garden. The procedure to be followed is as follows:

- Initially, after investigating the suitability of the soil and the microclimate for various types of plants, such as aromatic plants, with the help of agronomists and parents, the location of the school garden in the schoolyard was decided by applying the decision-making process method.
- Then the help of the green service of the Municipality of Ioannina or other parent and teacher volunteers was requested for the preparation of the soil and planting
- The students were then divided into groups according to the types of plants they wished to plant
- Measuring the dimensions of the space allocated for planting in each group
- It was decided to allocate responsibilities and time to groups of students to grow the plants with proper watering and protection from damage
- Students monitor and record in the diary the stages of plant growth

II) Budgeting for the school garden: first, students continue to be in groups. Then, the teacher invites them, according to the information collected in the above activity, to follow the following steps to create the school garden:

- attempt to budget for the cost of the crop they have undertaken, such as including the cost of plants, tools, watering water, etc. For example, one group will budget the cost of plants, another group the cost of tools and another group the cost of watering water.
- discuss in each group which body will bear the cost of cultivation (municipality, school committee, parents' association) and explore if there is a way to reduce these costs.
- drafting a letter to be addressed to potential sponsors for the school garden.

III) What plants are needed for the school garden: visit to the Forestry Department of Ioannina and to a nursery in the city of Ioannina to collect plants needed by the students

IV) Composting and organic fertilization process: with this process, students are pushed into a logic of managing their daily organic waste and observe the process of turning it into organic, biological fertilizer for their plants in their garden.

For the third activity entitled: "*Use of digital tools – "Google Earth" software*", the priorities and sub-actions planned to be implemented are the following: digital tools will be used and more specifically the "Google Earth" software (http://www.google.com/earth/). First, students will identify and define the location of the geographical region (Epirus) and the Prefecture of Ioannina. They will study its main geomorphological features and specialize in the surface and climate of the region and the school garden. "Google Earth" is a visualization and simulation software. It allows the computer to become a tool to navigate the world. The application with the help of high-resolution satellite photographs allows the user to see in detail different locations of the world. Also, "Google Earth" is a software that leads to learning through discovery, exploration and construction, so that the learner is guided in building knowledge. In the process of knowledge building, pre-existing knowledge coexists and also emerges, on which new knowledge is built (constructivist).

For the fourth activity entitled: "*use of an e-learning and asynchronous teaching platform (moodle) in combination with the creation of a separate course on the subject of the school garden*", the priorities and the sub-actions that are planned to be implemented are the following: it should be noted that the school already has an e-learning and asynchronous teaching platform (moodle) which is in a trial phase and an effort is being made to use it.Initially, the teachers in cooperation with the students will create a separate lesson on the platform about the school garden. In all four cases with their respective four actions, students will be involved to participate in activities in the use of the tele-education and asynchronous teaching platform (moodle). These activities will be: online exercises, assignments, assessment tests with automatic or manual correction and saving of the result and worksheets.

At this point in the third phase of the teaching scenario (Planning and Inquiry), the inquiry is carried out. More specifically, based on the activity planning calendar, the project activities will start in October 2018 with an initial planting of the garden with aromatic plants. In the following months, the students will start their care and study of them. At the end of spring and until June 2019, the students will taste the fruits of their labours and approach environmental issues, as well as conservation-conservation through the drying of the garden.

The implementation of the inquiry is based on the methods - mentioned above in detail - such as the collaborative work plan (project method), the Problem-Solving Method and Field Study.

Other activities related to the implementation of the inquiry are:

I) Observing the growth of plants:

- Students place laminated labels on the plants with their names (common and Latin).

- Students observe which parts of the plant grow the most (top, sides, base) and where do new branches appear.
- Students observe which month do deciduous plants begin to shed their leaves. What month do the new leaves appear?
- Do students observe how much the plants grow each month (measurement).
- Students observe what traditional uses do the plants they planted have.

II) The layers of soil: the students dig a small hole with a small hoe, trying not to mix the layers. They notice that the soil is not uniform, but has a series of layers. The first layer consists of leaves, twigs, fruits and animal remains that have not undergone much decomposition. The deeper you go, the more the remains decompose and you can't distinguish them.

III) The action of the earthworm: the following experiment is carried out: students are given 2 identical glass containers. They put sand up to the middle and fill it with fertile soil. In one container they put 2 earthworms. They keep both containers moist and add organic matter. They observe the action of the earthworm and how it stirs the soil and enriches it.

IV) The phenomenon of transpiration: the teacher in collaboration with the students creates an experimental application on transpiration in plants. At this stage, students' participation is sought in terms of the initial processes of the experimental method: observation and hypothesis. Students are motivated to observe the phenomenon and to hypothesize about the possible origin of the droplets inside the bag tied around the branch of a plant.

V) The phenomenon of photosynthesis: students discover that a plant can grow before it starts to photosynthesise, from the stored starch in the seed, when it is found in the right conditions. With an enriched introduction of images from the literature and simulations of photosynthesis (from digital material), students understand the function and interdependence of the factors of photosynthesis. To assess their understanding of photosynthesis, each group of students is given a set of plastic lids of different colours (sun, oxygen, carbon dioxide, water) and the students place in different coloured bags, representing different spaces (soil, plant, air), as many of these as they think are necessary for a plant to start photosynthesising. The students then place the products of photosynthesis in the corresponding spaces - sachets and in plenary explain the pathways of transport of the substances from one space to another.

D. Fourth phase of the Teaching Scenario: Analysis and Interpretation

According to the Primary School Curriculum for the subject area "Environment and Education for Sustainable Development", the teaching scenario that contains the term: "school garden" will be explored at four (4) levels:

- Level 1: Fundamental knowledge
- Level 2: Issue/problem identification
- Level 3: Inquire into the issue/problem
- Level 4: Actions

The objectives of the teaching scenario for "*Level 1 - Fundamental knowledge*" are for students to:

- recognise the morphological and functional elements of different school gardens
- learn about the aesthetic, environmental and educational value of a school garden
- name different species of trees, shrubs and plants
- argue the advantages of creating a school garden
- understand the process of plant production
- learn about the main types and categories of aromatic plants and their uses
- understand the importance of the school garden in landscape architecture
- learn about the basic techniques used in the construction of the school garden, the materials and resources required

The objectives of the teaching scenario for "*Level 2 - Issue/Problem identification*" are for students to:

- compare their schoolyard with other schoolyards
- identify the morphological and functional elements of vegetation in their schoolyard
- reflect on the design of the school garden
- list the materials and resources needed for its construction
- identify the advantages of using aromatic plants, initially in horticulture and later in business

The objectives of the teaching scenario for "*Level 3 - Inquire into the issue/problem*" are for students to:

- investigate the climatic, soil and economic conditions for the creation of a school garden
- investigate the perceptions of students, teachers, and parents about the creation of a school garden
- draw up a budget and investigate possibilities of financing the construction of the school garden by the school committee, the green department of their municipality or other institutions.
- seek information on whether an investment in herbs in their area would be financially viable

The objectives of the teaching scenario for "*Level 4 - Actions*" are for students to:

- inform and activate the whole school community about the possibility of creating a school garden
- design the school garden they want
- cooperate with each other and with appropriate bodies (e.g. local authorities, parents' association, teachers, volunteers, scientists, agronomists, universities, environmental education centres) to create a school garden
- take responsibility for the planting, cultivation and care of the school garden
- plan the construction of the school garden and carry it out
- undertake and organise the maintenance of the school garden on an annual basis
- present their work to the school community and the wider society

E. Fifth phase of the Teaching Scenario: assessment/reflection

The degree of achievement of the objectives of the teaching scenario is assessed using the following assessment tools:

- Observation during the implementation of the scenario
- Discussion
- Interviews
- By asking students questions - which are related to reflection - and coded as follows:"- What did you like about this scenario?, - What did you find difficult?, - What would you still like to do (e.g. visits, activities, events)?, - What do you consider to be the key points from what you have studied?, - How did you study them (planning, programming, working methodology)?, - Where do you think what you have studied will be useful?,- How did we work in our group?, - What resources did you use and how did they help you?".

In addition, the initial questions that were asked to the students before the implementation of the teaching scenario will also be asked, so that the teacher can compare what the students learned after the implementation of the teaching scenario.

The initial questions are:

- What do you like most about the yard and why? Describe in words, pictures and phrases what do you like most about the yard and what do you like about it?
- What do you dislike about the yard area and why? Describe with words, pictures, phrases.
- What parts of the yard do you prefer to be in and why?
- What kind of feelings does the condition of the schoolyard area evoke in you?
- What do you know about the gardens?
- What do you know about aromatic plants? Name a few.
- In what ways do you think a garden can change the school?

Another assessment tool is the conceptual mapping software “Cmap Tools”. It was used in the initial orientation activities. However, it will also be used at the end of the instruction in order for students to create a new conceptual map, which it will be compared with the original one and to reflect on how much they have taken ownership and how much they have realized the new knowledge acquired from the preceding activities.

Finally, the students themselves will be assessed for their participation, their cooperation, their interest and their degree of satisfaction with the course of the work.

4. Conclusions

With the implementation of the specific teaching scenario of this paper, the school garden - with the proposed structure and educational function - can highlight at the micro level an approach to sustainable development with ecological sensitivity and holistic management of products and energy resources. Every corner of the garden can be a small laboratory for studying and becoming aware of the delicate environmental balances and

their effects on the life of modern people (Tsagliotis et al., 2007). The school garden is a great way to use the schoolyard as a classroom, to reconnect students with the natural world and with various subjects such as maths, science, art, etc. In addition, it is possible to teach more general pedagogical objectives such as individual and social responsibility. At the same time, participation in growing a school garden increases the student's interest in learning since he or she is actually involved in the learning process through research, exploration, discovery and creation. In addition, the student's academic performance improves, cooperative and organisational skills, a sense of responsibility, patience and perseverance are cultivated, as well as positive attitudes towards the natural environment. A sense of belonging is created since the garden is not made for the students but by the students. Furthermore, the cooperation between the school and the community in the context of the creation and maintenance of the school garden allows pupils to develop closer relationships with their family members and the wider community, thus contributing to the development of skills of social participation and democratic citizenship.

The school garden emerges as a multifaceted learning environment that satisfies the basic principles of interactive learning theories, responds to contemporary trends in Education for Sustainable Development and promotes key objectives of contemporary education, such as conceptual understanding, experiences from the Natural World, scientific method skills, reasoning strategies, school-community connection and collective action.

It is worth noting that student participants in a school garden teaching scenario plant aromatic plants themselves, which in turn attract other soil organisms and other school students to observe the garden or cut plants. Thus, the interactions of the participants with the garden and the interactions of the visiting students with the garden and with the student participants form a new dynamic network. These interactions help students to understand themselves as part of the environment and the wider social system. This realisation may in adulthood motivate them to contribute in practical ways to the promotion of social and environmental well-being.

At the same time, they are shaping critical-thinking citizens who will reflect, participate in solving their community's environmental problems, act locally but also reflect on global environmental issues. In this way, they will develop competences and skills that will allow them to participate fully in the events of a democratic society, ensuring a sustainable future (Korfiatis&Petrou, 2015).

In conclusion, the school garden can be a framework for developing activities that - by changing the overall culture of the school - will contribute to the overall change that is necessary for the school to incorporate and assimilate the characteristics and principles of sustainable development that will transform it into a sustainable school, thus promoting changes in society towards a sustainable way of life (Sterling, 2001; Garitsis, 2016:116).

Conflict of Interest Statement

The author declares no conflicts of interest.

About the Author

Filippos Evangelou holds a PhD in Science Education and the use of Information and Communication Technologies (ICT) from the University of Ioannina, Department of Primary Education, Greece (2012). From 2020 until today he teaches as a Tutor – Counselor at the Hellenic Open University. His research interests and publications are in the areas of teaching, teaching methodology, pedagogy and the use of computer-based simulations and exploratory experimentation as cognitive tools in science teaching and learning. His research interests and publications are also in the areas of adult education and open and distance learning.

References

Austin, S. (2022). The school garden in the primary school: meeting the challenges and reaping the benefits, Education. *3-13*, 50 (6), 707-721, Doi: 10.1080/03004279.2021.1905017

Bacon, K. & Mathews, P. (2014). Inquiry-based learning with young learners: a Peirce-based model employed to critique a unit of inquiry on maps and mapping. *Irish Educational Studies*, 33 (4), 351-365. https://doi.org/10.1080/03323315.2014.983303

Barta, A., Fodor, L. A., Tamas, B. & Szamoskozi, I. (2022). The development of students critical thinking abilities and dispositions through the concept mapping learning method – A meta-analysis. *Educational Research Review*. 1 - 17. Doi: https://doi.org/10.1016/j.edurev.2022.100481

Bauer, R. & Baumgartner, P. (2010). The potential of Christopher Alexander's theory and practice of wholeness: clues for developing an educational taxonomy. *EuroPLoP 2010 Proceedings of the 15th European Conference on Pattern Languages of Programs*. Doi: 10.1145/2328909.2328924

Baumgartner, P. (2011). Educational scenarios with e-portfolios - A taxonomy of application patterns. In P. Sojka & M. Kvizda (Eds.), *Proceedings of Sharable Content Objects, SCO 2011* (pp. 3–12). Czech Republic: Masaryk University.

Blair, D. (2009). The Child in the Garden: An Evaluative Review of the Benefits of School Gardening. *The Journal of Environmental Education*, 40 (2), 15-38. https://doi.org/10.3200/JOEE.40.2.15-38

Boyle, A. (2013). *School Gardens: Reconnecting Children with Nature and Food*. Thesis, Claremont Colleges.

Broda, W. H. (2007). *Schoolyard Learning - Using the Outdoors as an Instructional Tool, K-8*. United States of America: Stenhouse Publishers.

Bruner, J. (1960). *The process of Education*. Cambridge: Harvard University Press.

Canaris, I. (1995). Growing Foods for Growing Minds: Integrating Gardening and Nutrition Education into the Total Curriculum. *Children's Environments*, 12 (2), 264-270.

Cutter - Mackenzie, A. (2009). Multicultural School Gardens: Creating Engaging Garden Spaces in Learning about Language, Culture, and Environment. *Context, Experience, and the Sociological: Inquiries into Practice*, 14, 122-135.

Deniz, U. H. & Kalburan. N. C. (2022) Preschool Educators' Opinions and Practices on School Gardening. *Urban Education*, 70, 004208592211257.

deRies, K. E., Schaap, H., vanLoon, A. M.M.J.A.P., Kral, M.M. H. &Meijer, M.M. H. (2022). A literature review of open-ended concept maps as a research instrument to study knowledge and learning. *Quality & Quantity*, 56, 73–107. Doi: https://doi.org/10.1007/s11135-021-01113-x

Desmond, D., Grishop, J. & Subramaniam, A. (2004). *Revisiting garden-based learning in basic education.* Retrieved on 15 June 2021, from URL: http://www.fao.org/sd/erp/revisiting.pdf

Dimitriadou, K. (2016). *New orientations of teaching. Adapting teaching to the educational challenges of the 21st century*. Athens: Gutenberg Publications.

Dyment, J. (2005). *Gaining Ground: The Power and Potential of School Ground Greening in the Toronto District School*. Retrieved on 7 June 2021, from URL: http://www.evergreen.ca/downloads/pdfs/Gaining-Ground.pdf

Engeström, Y. (1999). Activity theory and individual and social transformation. In Y. Engeström, R. Miettinen, & R.- L. Punamääki (Eds.). *Perspectives on activity theory* (pp.19-38). New York: Cambridge University Press.

Engeström, Y. (2009). The Future of Activity Theory: A Rough Draft. In A. Sannino, H. Daniels & K. Gutierrez (Eds). *Learning and Expanding with Activity Theory* (pp.303-328). Cambridge: Cambridge University Press.

Evangelou, F. (2023). Teaching techniques for developing the learner-centred approach in the classroom. *European Journal of Education Studies*. 10 (2), 166 – 192. Doi: http://dx.doi.org/10.46827/ejes.v10i2.4667

Filippatou, D. & Kaldi, S. (2010). The effectiveness of project-based learning on pupils with learning difficulties regarding academic performance, group work and motivation. *International Journal of Special Education*, 25 (1), 17-26.

Garitsis, I. (2016). *The school garden as a field for entering changes aiming at the evolution of the school in the direction of sustainability*. PhD thesis, Department of Primary Education. Thessaloniki, Greece: Aristotle University.

Graham, H., & Zidenger-Cherr, S. (2005). California teachers perceive school gardens as an effective nutritional tool to promote healthful eating habits. *Journal of the American Dietetic Association*, 105, 1797–1800.

Greer, A. E., Rainville, K., Knausenberger, A. & Sandolo, C. (2019) Opportunities for School Garden-Based Health Education in a Lower-Income. Diverse, Urban School District. *American Journal of Health Education*, 50 (4), 257-266, DOI: 10.1080/19325037.2019.1616010

Jonassen, D. (2000). *Computers as mindtools for schools: Engaging critical thinking*. Columbus, Prentice-Hall.

Kaldi, S., Filippatou, D. & Govaris, C. (2011). Project-based learning in primary schools: effects on pupils' learning and attitudes. *Education 3-13: International Journal of Primary, Elementary and Early Years Education*, 39 (1), 35-47. https://doi.org/10.1080/03004270903179538

Kaldi, S. (2014). Project-based learning meets differentiated instruction in the primary school curriculum. Anadolu Bil Professional School of Higher Education Journal, Special Issue: *Implementations of Basic Education Systems*, 57-90.

Kaldi, E. S. &Konsolas, N. M. (2016). *Project teaching method and interdisciplinarity: Theory, research and practice*. Athens: Grigoris Publications.

Kaldi, S., Govaris, C. & Filippatou, D. (2017). Teachers' views about pupil diversity in the primary school classroom. *Compare: A Journal of Comparative and International Education*, 48(1), 2-20. doi.org/10.1080/03057925.2017.1281101

Kaldi, S. & Stavrianoudaki, A. (2017). The development of higher cognitive skills through collaborative group exploration. In *2nd Panhellenic Conference of School Psychology "School Psychology, Education and Society: collaborations and challenges*", Greece, Volos, 19-22 October 2017.

Kalovrektis, K. Kontou, P., Psicharis, S. & Paraskevopoulou - Kolia, E - A. (2020). *ICT in Education Sciences: Designing teaching scenarios*. Thessaloniki, Greece: Tziola Publications.

Katsikis, A. (2007). Environment and Education. Interconnections based on the principles of sustainability, *Proceedings of the Panhellenic Conference "Primary Education and the Challenges of our Time*" (pp. 261 - 267). School of Education, Department of Primary Education, University of Ioannina.

Korfiatis, K. & Petrou, St. (2015). School Gardens as Innovative Learning Environments: Think-Collaborate-Do", *Journal for Environmental Education - Panhellenic Association of Teachers for Environmental Education*, vol. 8 (53). Retrieved on 25 June 2021, from URL: http://www.peekpemagazine.gr

Kougiourouki, M. (2019). The Project Method and its Contribution in Establishing Good Interpersonal Relationships Among Student Teachers – Research. *Education Sciences*, *2019*(2), 37–53. https://doi.org/10.26248/.v2019i2.591

Lederman, N. G. (2007). Nature of science: Past, present, and future. In S. K. Abell, & N.G. Lederman, (Editors), *Handbook of research in science education* (pp 831-879). Mahwah, New Jersey: Lawrence Erlbaum Publishers

Lohr, A. M, Krause, K. C., McClelland, D. J., Gorden, N. V., Gerald, L. B.,Del Casino Jr, V.,Wilkinson-Lee, A. & Carvajal, S. C. (2021) The impact of school gardens on youth social and emotional learning: a scoping review. *Journal of Adventure Education and Outdoor Learning*, 21 (4), 371-384, Doi: 10.1080/14729679.2020.1838935

Lohr, A. M., Bell, M. L., Coulter, K., Marston, S., Thompson, M., Carvajal, S. C., Wilkinson-Lee, A. M., Gerald, L. B., Korchmaros, J. (2022). The Association

Between Duration of School Garden Exposure and Self-Reported Learning and School Connectedness. *Health Education & Behavior*, 21, Doi: 10.1177/10901981221084266

Lygda, A., Karatrantou, A. &Panagiotakopoulos, Ch. (2021). Concepts, objectives and techniques of teaching scenarios of computer science in digital repositories. In Th. Bratitsis (Ed.), *Proceedings of the 12th Panhellenic and International Conference "ICT in Education*" (pp. 66-73). University of Western Macedonia, Greece - Florina.Doi: https://doi.org/10.12681/cetpe.3733

Mikropoulos, T. A. & Bellou, I. (2010). *Computer-based teaching scenarios*. Athens: Klidarithmos Publications.

Morris, L., Neustadter, A. &Zidenberg-Cherr, S. (2001). First-grade gardeners more likely to taste vegetables. *California Agriculture*, 55 (1) 43 – 6. https://doi.org/10.3733/ca.v055n01p43

Nielsen, W. S., Nashon, S. & Anderson, D. (2009). Metacognitive engagement during field-trip experiences: A case study of students in an amusement park physics program. *Journal of Research in Science Teaching*, 46 (3), 265-288. https://doi.org/10.1002/tea.20266

Ozer, J. E. (2006). The effects of school gardens on students and schools: Conceptualization and Considerations for maximizing healthy development. *Health Education & Behavior*, 34, 846-86. https://doi.org/10.1177/1090198106289002

Panagiotakopoulos, Ch., Armakolas, S., Karatrantou, A., & Sarris, M. (2016). The DSR Teaching Scenarios Repository: description, key points and evaluation of its operation. *Issues in Science and Technology in Education*, 9 (2), 45 - 61.

Papadopoulou, A. (2020). *Educational policy and innovative actions in education. A proposal for the implementation of an environmental program with emphasis on the creation of a biological school garden*. PhD thesis. Dissertation. Greece, Thessaloniki: Aristotle University.

Papadopoulou, A., Kazana, A. & Armakolas, S. (2020). Education for sustainability development via school garden. *European Journal of Education Studies*. 7 (9), 194 – 206. Doi: http://dx.doi.org/10.46827/ejes.v7i9.3247

Pedagogical Institute (2011). *Pilot Curricula: Environmental Studies Curriculum for the "New School". The "New School for Environmental Education" pilot project*. Greece, Athens: Ministry of Education, Pedagogical Institute.

Pedro, A., Piedade, J., Matos, J. F. & Pedro, N. (2019). Redesigning initial teacher's education practices with learning scenarios. *International Journal of Information and Learning Technology*, 36 (3),266 – 283. Doi: https://doi.org/10.1108/ijilt-11-2018-0131

Pollin, S. & Retzlaff – Fürst, C. (2021). The School Garden: A Social and Emotional Place. *Frontiers in Psy*chology. 12, 567720. Doi: 10.3389/fpsyg.2021.567720

Qi, Y., Hamzah, S. H, Gu, E., Wang, H., Xi, Y., Sun, M., Rong, S. & Lin, Q. (2021). Is School Gardening Combined with Physical Activity Intervention Effective for Improving Childhood Obesity? A Systematic Review and Meta-Analysis. *Nutrients*. 13(8), 2605.Doi: 10.3390/nu13082605.

Selly, B.P. (2012). *Early Childhood Activities for a Greener Earth*. United States of America: Redleaf Press.

Sotiropoulou, D. (2014). *The contribution of the school garden to sustainable schools. in the collective publication School - Urban Gardens: Why and how*. Publications: Centre for Environmental Education of Drapetsona and Troizina – Methana, Greece (pp. 21 - 29), Retrieved on 7 June 2021, from URL: http://sxolikoskipos.weebly.com/uploads/4/3/1/5/43150059/entypo_2014_sxolikoi-astikoi_kipoi.pdf

Stavrianoudaki, A., Smyrnaios, M. & Kaldi, S. (2018). Tracing teachers' views on the inquiry model of learning in history teaching. A multiple case study. *Paper presented at the History Educators International Research Network (HEIRNET) - 15th International Research Network Conference*, Corfu, Greece.

Stavrianoudaki, A., Smyrnaios, A. & Kaldi, S. (2019). Teachers' views about Inquiry-Based Learning in teaching History: a qualitative research approach. *Proceedings of the 19th biennial conference of international study association on teachers and teaching (ISATT) 12 "Education beyond the crisis: new skills, children's rights and teaching contexts*", (pp.116- 119). Sibiu: Lucian Blaga Publishing House.

Stavrianoudaki, A. (2021). *The application of the inquiry model of learning in the classroom as a factor in the development of higher cognitive skills through the history lesson*. PhD thesis. Department of Primary Education.Volos, Greece: University of Thessaly.

Sterling, S. (2001). *Sustainable Education: Re-visioning Learning and Change.* Bristol: Green Books.

Strom, R. & Strom, P. (1996). Student evaluation of social skills. *J. of Instructional Psychology*, 23, 111-116.

Taylor, N., Wright, J. & G O'Flynn, G. (2021). Cultivating 'health' in the school garden. *Sport, Education and Society*, 26 (4), 403-416, Doi: 10.1080/13573322.2020.1843425

Tzika, V. & Kaldi, S. (2021). Philosophizing with children and play: Design and implementation of a teaching scenario for cultivating students' interdisciplinary/transversal lifelong learning skills. In E. Kantartzi & C. Kandartzi. Papadimitriou (Eds.), *Proceedings of the 1st Panhellenic Conference "Educational play in formal and non-formal learning"* (Vol. B', pp. 480-488). Athens: Museum of School Life and Education of the National Centre for Research and Rescue of School Material. Retrieved on 5 June 2022, from URL: https://ekedisy.gr/praktika-1oy-panellinioy-synedrioy-to-ekpaideytiko-paichnidi-stin-typiki-kai-mi-typiki-mathisi/

Tsagliotis, N., Kourculos, E., Lachnidakis, I., Savvanou, E., Pantazi, M., Kourupaki, Al., Chokkas, M., Bogeas, D., Mavragani, M. & Merissoglou, M. (2007). *Our school garden ... another garden, Environmental Education & Health Education School Activities Programmes/ Actions 2006 - 07*, Environmental Actions, Life Actions - Education for Sustainability. Greece, Rethymno: Primary Education Directorate of Rethymnon Prefecture and 9th Primary School of Rethymnon.

Tsantou, Ol. (2014). Scientific knowledge..... from the garden! An original Natural Sciences Laboratory in Crete - What the teacher Nektarios Tsagliotis says in "Epikaira", *Epikaira*, 248, 88-90.

Tziovara, Ch., Kaldi, S. & Golfinopoulou, V. (2019). Differentiatedinstructionandanti-racist education in EFL lesson planning and teaching. The case study of Alice Walker's "in searchofourmothers'gardens" inanEFLclassroom. *Proceedings of the 11th annual International Conference on Education and New Learning Technologies (EDULEARN) (pp. 1117-1125).* Palma, Spain: IATED.ISBN:978-84-09-12031-4/ ISSN:2340-1117. doi: 10.21125/edulearn.2019

Wake, S. J. (2007). Children's gardens: answering 'the call of the child? *Built Environm*ent, 33 (4), 441 - 453. https://doi.org/10.2148/benv.33.4.441

Waliczek, T., Bradley, J. &. Zajicek, J. (2001). The effect of school gardens on children's interpersonal relationships and attitudes towards school. *Hort Technology*, 11 (3), 466 -468. https://doi.org/10.21273/HORTTECH.11.3.466

Wheeler, G. (2000). The three faces of inquiry. In Minstrell, J. & van Zee E. (Eds.), *Inquiring into inquiry learning and teaching in science* (pp. 14-19). Washington DC: American Association for the Advancement of Science (AAAS).