Codeinnova curriculum

General knowledge level aims to provide tools and skills to identify programming as part of a societal impact, to develop multiliteracy skills and to provide resistance to forms of computing as an integral part of lifelong learning.

Knowledge

Computational thinking and programming skills

Programming level offers basic skills for programming (related to core concepts, practises and views of programming) but it also offers computational thinking and abstracting skills in a general level.

Skills

Content creation

The level of digital content creation provides topics for programming and introduces the most essential ways of digital content and technologies that are most relevant in the coming decades.

Practise

Other content:
This section summarizes other topics for content creation.

To support teaching

Objectives are provided to support the planning of activities, in particular to support thinking and learning, communication and group work and the teaching of multiliteracy skills.

All goals also provide tips on age-appropriate teaching methods.

Teachers have a lot of autonomy to use this curriculum, they can vary order of content and modify difficulty level.

This section provides definitions of relevant words.

Multiliteracy skills Set of thinking and communication skills, which are needed to interpret and produce messages in different situations and environments. Most essential element is an ability to acquire, modify, produce, present, assess and appraise information.

Erasmus+ -project CodeInnova
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1st grade

Pupils understand the meaning of programming related words such as “programming” and “an application”.

Computational thinking and programming skills

Pupils learn step-by-step troubleshooting and the basics of programming in a graphic programming environment by programming people and tangible objects.

Content creation

Pupils become familiar with tangible objects and non-digital programming.

To support teaching

Pupils are offered various opportunities for individual and group work.

From the everyday experience of the pupils, issues related to the topic are emphasized and spoked in appropriate situations.

The development of multi-literacy is supported by a multi-sensory, holistic and phenomenal approach.

Graphic programming environment Programming is based on visual symbols in graphic programming environment, for example giving moving instructions with arrows.

Holistic Comprehensive approach

Non-digital programming Programming via games, symbols, instructions and other non-digital things

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2nd grade

Pupils learn to recognize different codes around them and understand the purpose of programming. Furthermore, they understand that each code has its creator and purpose.

Computational thinking and programming skills

Pupils explore, design, and create step-by-step and creative instructions to solve a specific challenge or problem.

Content creation

Pupils introduce programming games and animations in a graphical programming environment. At the same time, they understand the potential of programming as a means of creative expression.

Other content: tangible objects, non-digital programming

To support teaching

Pupils gain experience from different programming-related working habits using digital communication tools that support learning, communication and teamwork.

Pupils are encouraged to ask questions, to listen, to make detailed observations, to find information developing ideas that already exist and to come up with new ideas and to present ideas.

Pupils are guided to develop their multiliteracy skills by enabling them to interpret, produce and develop various age-appropriate codes.

Graphic programming environment
Programming in these environments takes place in different blocks instead of words, for example Scratch junior or Scratch

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3rd grade

Pupils learn how human decisions affect the performance of technology.

Computational thinking and programming skills

Pupils solve problems, organize information and learn about concepts of algorithms.

Pupils learn how to visualize problems with different charts and generalizations.

Pupils design, code and develop programs using sequential commands, selections and repetitions.

Content creation

Pupils become familiar with advanced mobile devices and build and program physical or virtual robots.

Other content: tangible objects, non-digital programming, simple games and animations

To support teaching

Pupils gain experience working in a secure group and creating things together.

Pupils are guided to identify the most appropriate ways of learning and to develop their learning and innovation techniques.

Multiliteracy skills are promoted by analyzing different codes from the perspective of the author and the user, taking into account context and situation.

Algorithm A set of systematically executable instructions for performing a particular task

Command Command to control the device

Repetition Repeating the same thing several times

Selection Taking one or more of the options

Virtual robot Simulator that lets you program robots without a physical device.

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4th grade

Pupils understand the potential of programming for automatic and simultaneous operations.

Computational thinking and programming skills

Pupils design and program in a graphical programming environment using input values.

Pupils introduce simple variables that include numerical values and texts with different kinds of materials.

Pupils can solve more complex logical problems with and without technology.

Step-by-step and conditional instructions and events are utilized in problem solving.

Pupils learn to use iterative working habits.

Content creation

Pupils learn about the concept of artificial intelligence and different kinds of practical use of it.

Pupils create games for different platforms.

Other content: tangible objects, non-digital programming, simple games and animations, physical and virtual robots

To support teaching

Pupils are guided to evaluate and develop their own communication and teamwork skills.

Interactive learning, especially peer learning, is used in many ways, thus reinforcing the pupils' teamwork skills.

Thinking skills are practiced using problem solving and reasoned tasks and working methods that utilize and support curiosity, imagination, inventiveness, and learning.

Critical programming literacy is developed in a cultural context relevant to pupils and near their everyday experiences.

Artificial intelligence A program capable of doing what is considered intelligent

Input For example, a number entered in a program or pressing a button can also be an auxiliary device connected to the device, for example sensor or button

Iterative Displaying frequently occurring items only once, for example avoiding unnecessary repetition of code

Variable Storage location for programming

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5th grade

Pupils begin to understand how code is always a mathematical problem-solving exercise and how it can possibly lead to ethical issues.

Computational thinking and programming skills

Pupils design and program software that prints values which includes numbers or texts.

Pupils check the correctness of the code, and detect and correct errors.

Pupils create simple variables.

Pupils get introduced to outcomes prediction, testing and explaining existing programs..

Content creation

Pupils design and create simple internet of things and wearable technology devices and at the same time learn to express themselves through design and creation.

Other content: tangible objects, non-digital programming, simple games and animations, physical and virtual robots, artificial intelligence

To support teaching

Pupils are encouraged to look for ways of expression that are suitable for collaboration.

Pupils are encouraged to use their imagination to find creative solutions.

Pupils learn to analyze different features of games, programs, and applications to distinguish between them.

Internet of things Various devices connected to the Internet, for example measuring sensors or household appliances

Output Value provided by a program or by functioning accessory connected to a device

Printed output Value that program gives, for example after mathematical operations.

Wearable technology For example smartwatch or intelligent clothing

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6th grade

Pupils are directed to discuss the role of programming as affection. Pupils learn to identify the author values that the code reflects.

Computational thinking and programming skills

Pupils plan, anticipate, monitor, create and adjust programs, which are suitable for age-level.

The pupil will be able to code a workable program and solve more complex problems by dividing them into smaller subproblems.

Pupils learn more about using different kinds of variables and they create them.

Content creation

Pupils design and create a working game or program for a specific purpose.

Other content: tangible objects, non-digital programming, simple games and animations, physical and virtual robots, artificial intelligence, internet of things (IoT) and wearable design

To support teaching

Pupils gather experiences to make their own skills available to the group in the best possible way.

Making observations and using a variety of information sources and tools strengthens the pupil's skills in asking questions and finding answers, both independently and with others.

Pupils are directed to compare and evaluate the appropriateness of the code used for a particular purpose.

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7th grade

Pupils deepen their understanding of the use of various software and policies.

Computational thinking and programming skills

The pupil will be able to design and create programs that utilize subroutines, appropriate structures and data types, expressions, variables and iterative and conditional commands.

General programming languages are used to create programs which are suitable for age-level..

The pupil understands the different ways to use simulations and step-by-step organization algorithms to solve problems.

Content creation

Pupils create a more complex game, application, or mobile application that solves a particular problem from specific subject or topic.

Pupils learn how to outline the operation of a more complex program into various patterns and generalizations.

Other content: games and animations, physical and virtual robots, artificial intelligence, internet of things (IoT) and wearable design

To support teaching

Pupils understand different ways to collaborate and different group roles. In addition, they gain experience working in these different group roles.

Pupils are guided to identify and continuously develop their own programming strategies for programming.

Pupils develop their programming-related analytical, critical, and cultural literacy.

Data type A concept used to define variables that defines a variable to contain, for example a string or integer

General programming language Programming is done by a programming language (for example python or javascript)

Iterative Displaying only one repetition of things, ie avoiding unnecessary repetition in the code

Sorting algorithm An algorithm that arranges the list in a specific order for ease of processing

Subroutine An independent part of a program that performs a specific function

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8th grade

Pupils deepen their understanding of the meaning, potential and risks of programming at a society level. Pupils learn to use artificial intelligence.

Computational thinking and programming skills

Pupils are able to design, create, document, and present programs and robots that solve a particular real-life problem.

Created programs include search algorithms, tables and automatic functions.

Several simultaneous events happen in these programs.

Content creation

Pupils create more complex games, applications or mobile applications that simulate subject matters.

Pupils learn about the potential and features of more advanced microcontrollers.

Other content: games and animations, physical and virtual robots, artificial intelligence, internet of things (IoT) and wearable design

To support teaching

Pupils know and use different methods for physical and virtual communication, collaboration and collaboration in programming projects.

Pupils are encouraged to express their own experiences and their importance in their own way of thinking and encourage them to listen to themselves and others and see things from the perspective of others.

Pupils are encouraged to use their multi-literacy skills while participating in different situations.

Microcontroller A system that combines analog electronics components (for example leds) with user-programmed code

Search algorithm An algorithm that organizes a list into a specific order for ease of processing.

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9th grade

Pupils have a broad understanding of programming, programs and their role in the modern society. In addition, they understand the importance of programming in influencing and expressing themselves.

Computational thinking and programming skills

Pupils design and implement various automation solutions as well as analyze automation solutions for various hardware and software applications.

Pupils will explore opportunities to develop mobile operating systems via practical examples.

Content creation

Pupils become familiar with blockchain technology and its applications, they understand the working principles of solutions that simulate block chains and they get acquainted with simple cryptographic principles.

Pupils get familiar with mobile devices and their operating systems working principles.

Other content: games and animations, physical and virtual robots, artificial intelligence, internet of things (IoT) and wearable design, microcontrollers

To support teaching

Pupils will have a good command of the use of various programming aids (for example programming environment) and different working methods.

Pupils can express their own way of thinking and see things smoothly from the perspective of other people.

Pupils have the skills to utilize their own multi-literacy skills and actively develop them independently.

Blockchain technology Technology that allows unknown entities to maintain distributed databases, for example used in connection with virtual money

Programming environment A program or a set of programs used to code, the environment can translate the code into a program and automatically correct errors in the code (for example keystrokes)

Virtual money Digital virtual money based on an encryption system, all transfers and ownership of which are stored in the money block chain.

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Basic concepts of computational thinking

Abstraction Programming languages, programs and data are abstractions of the real world phenomenon.

Algorithms Number of systematic executable instructions or commands to perform some task.

Automation Performing the tasks to automatic programmed instructions using.

Collaboration Working together and sharing responsibility.

Creativity Creating a project is always a form of creative expression, programming requires finding and using different options.

Data A plurality of different data consisting of sources members and using of it.

Figures and generalization of figures Repetition of the general form solutions that solve similar problems.

Iteration The original idea is improved through design, testing and error correction until the ideal situation is achieved.

Logic Logic programs include a variety of logic elements such as conditional statements, Boolean logic and arithmetic operations.

Modeling and Design Programming includes design and algorithmic design models that can be later programmed. Programming involves taking care of the structure, layout and functionality of the system.

Partitioning problems Problems can be divided into smaller and simpler parts that can be solved separately.

Performance Algorithms do not include unnecessary or extra steps.

Reconciliation and similarity Programs can perform multiple operations at the same time, timing requires control.

Testing and debugging Programmers follow code, design and execute test plans and cases, and isolate and fix problems.

Additional information: *Fagerlund, J., Häkkinen, P., Vesisenaho, M. & Viiri, J.* (2020). Computational thinking in programming with Scratch in Primary schools: systematic review. Computer Applications in Engineering Education, In press. DOI: 10.1002/cae.22255

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