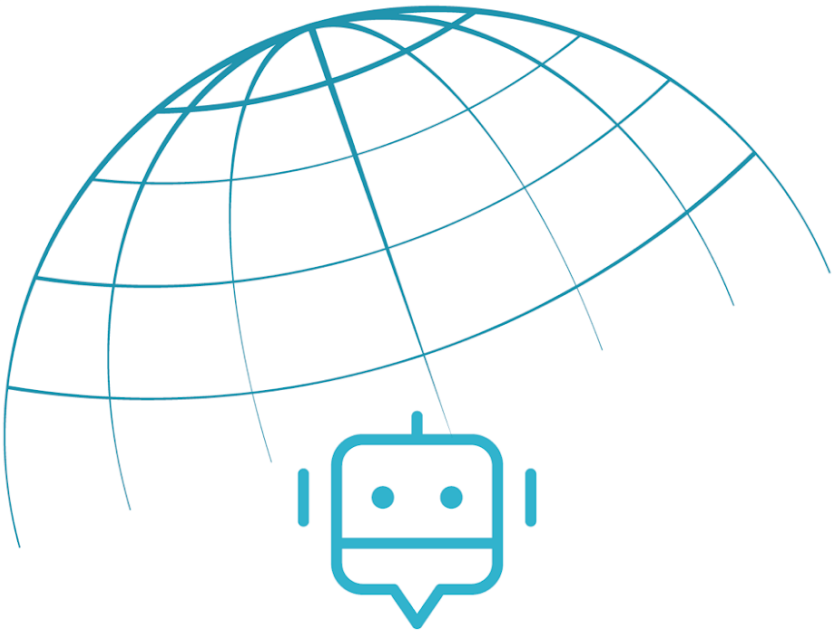

EARLY

DISTANCE LEARNING MODEL
REINFORCED WITH ROBOTICS FOR
3-7 YEARS OLD CHILDREN

HIGHER EDUCATION COURSE CURRICULUM

Funded by the European Union

Higher Education Course Curriculum for a Distance Learning Model Reinforced with Robotics for 3 to 7 Years Old Children

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About the project

Erasmus+ EARLY aims to address the challenges of online education for children aged 3-7 years by providing a methodology and resources for preservice teachers, current teachers, parents, and young children. As the COVID-19 pandemic led to the closure of kindergartens and preschools, the need for effective online education became crucial. However, young children require special attention and support in the online learning environment. This project focuses on developing a curriculum, a manual and a MOOC to support preservice and current preschool teachers and parents to enhance digital and online learning experiences for early childhood education.

The Objectives of the EARLY Project:

- Supporting European teachers, parents, and young children in utilising digital and online technologies effectively.
- Addressing the specific needs of online early education, including adult supervision, age-appropriate activities, and online safety.
- Enhancing the professional development of kindergarten and preschool teachers through innovative teaching practices.
- Promoting the holistic development of children aged 3-7 years by fostering their skills and diverse backgrounds.
- Gathering reliable data on the needs of preservice teachers for effective teaching activities.

Project Activities:

- Higher education modular course curriculum: A curriculum focused on early childhood education, utilising open-source online teaching and learning tools which will be developed for teacher training.
- Development of a manual for early education online labs: The manual will provide dynamic content and guidance on distance learning. It will serve as a practical resource for teachers and parents.
- Massive Open Online Course (MOOC): The project will create a MOOC that incorporates the project's findings and content, making it accessible to a wide audience.

- Collaboration with partner organisations: The project involves collaboration with universities, robotics experts, preschools, and educational technology specialists to ensure diverse perspectives and expertise.

EARLY recognizes the importance of early childhood education and the potential of digital technologies in enhancing learning experiences. By providing teachers, parents, and children with effective strategies and resources, it aims to improve the quality of online education for young children. Through a transnational approach, the project seeks to address common challenges and promote collaboration among stakeholders in Europe.

DISTANCE EDUCATION IN EARLY CHILDHOOD EDUCATION

The idea of distance education, which emerged in the 19th century, has become more essential as a result of the COVID-19 pandemic. According to UNESCO, 1.6 billion students, including preschool children, have been affected by distance education worldwide. Preschool is a critical period in which all developmental areas such as psychosocial, cognitive, language and motor skills progress at a faster rate and need to be supported. Today, technology education introduced during the preschool period, should be done in line with the developmental characteristics of preschool children. This method, which differs from the traditional understanding of education, directs students to use screens consciously, to communicate correctly through technology, to prepare and share digital content, to provide student support and assessment should be planned taking into account the developmental characteristics of preschool children. Moreover, preschool education environments are important places where children socialise with their peers, improving their communication skills and their ability to adapt and develop problem solving and social interaction skills. The restrictions imposed by the COVID-19 pandemic which resulted in the social isolation of children who spent all day at home during the pandemic period need also to be revised.

Considering the above, the importance of preschool teachers' competence and confidence in delivering distance education cannot be ignored. Teachers need professional development opportunities in this area, to update their skills in cooperating and communicating with the family online, and families also need training in supporting their child at home and providing an appropriate learning environment to support distance education at home.

INTRODUCING CHILDREN TO PROGRAMMING AND ROBOTICS

For some years now, in Europe and in other Nations, coding and educational robotics (ER) have been introduced in preschool education with children aged 3 and up as playful activities and easy technoscientific labs for the development of various skills. In some European Nations, coding and ER have already been integrated in the preschool curriculum. There are several reasons and many benefits for children. The first reason is that ER is fun. The whole process of programming, building and controlling a robot sets complex mentation abilities in motion, engages children in team and cooperative working, trains their space-time relationship, and refines skills of proprioception of one's own body and education in their movement control. Learning to program robots includes design, manufacture, control of the robots, and an important sense of knowledge and attention towards the external environment (the maps) in which the robots move.

By coding and programming a robot, children can simulate animal behaviour, invent algorithmic games, and imagine intelligent machines for different purposes, fantastic or real: for storytelling (using software to create animations) and for imagining solutions for the problems on the planet. Coding and ER at an early age can contribute to the development of inclusive education, i.e., tailored to the needs of each child. If children learn about their potential at an early age it leads to great levels of satisfaction and motivation. Designing and developing a robot is a great way to boost self-confidence and self-esteem.

EARLY Training Curriculum

TARGET GROUPS

To ensure that all preschool children have access to a continuous learning process in different circumstances (e.g., pandemics, prolonged illness or other situations), teachers and parents benefit from being prepared for these different circumstances. The materials developed and offered in the Higher Education Course Curriculum for Distance Learning Model Reinforced with Robotics for 3-7 Years Old Children are, therefore, relevant. Besides the Curriculum itself, which can be used for structuring training or for self-learning, EARLY offers some examples of activities and lesson plans for online activities with educational value.

The main target group of this curriculum is pre-service preschool educators (under-graduates in most countries), but the material is also suitable and recommended for experienced preschool educators who want to expand their competences and those who are in close contact with an early childhood learner. In a distance learning scenario, where the child is studying at home or at any other place outside the educational institution, parents, family, or carers also play a big role, as their participation in the distance learning process is fundamental to the success of the child's growth and development. Therefore, this curriculum is offered to those who care about and are involved in the education of preschool children – undergraduates, educators, families, parents, carers, and others.

MODULAR STRUCTURE

The curriculum is organized in five different modules, with different focus. The first module is about Basic Concepts of Computational Thinking, presenting the foundations for the rest of the learning. The second module, on Computational Thinking with Block-Based and Text-Based Coding Environments, and the third module, on the Fundamentals of Physical Programming and CT with Robotic Activities, further expand the learning about computational thinking by providing information on the potential of preschool children for computational thinking and how this can be developed through different environments and tools. The fourth module changes the focus to planning and evaluating activities with children by presenting information on Designing Activities and Learning through Distance Education. This is the module that deals with the challenges and potential of distance education in Early Childhood Education, connecting practice with reflection and further learning for educators through self-evaluation and reflection. Finally, the fifth module, on Building Partnerships for Learning, looks at the development of digital skills for early age as

a societal endeavour, supporting practitioners in identifying partners and initiatives as well as building communities that can leverage the educational offer.

The whole curriculum was planned to provide knowledge and competences that support the development of a distance learning model reinforced with robotics for 3-7 years old children. But each module is a stand-alone learning opportunity based on the lesson plans, slides presentation and materials available. Interested users are also welcome to combine different modules into unique training experiences.

PEDAGOGICAL APPROACH

The higher education course curriculum is primarily addressed to pre-service teachers, usually undergraduates of Early Childhood Education, but also in-service teachers, to equip them with knowledge and skills to be able to design distance education activities relevant for learning about computational thinking and/with robotics. It is acknowledged that this is also of interest for other educational actors like stakeholders, parents, carers, families, to provide them with skills to support young children in distance learning activities. For all target groups, the curriculum was devised with an active learning approach that is based on group discussions, hands-on activities, examples from practice, and a strong theoretical framework that is infused in the activities and general approach. Although it can be beneficial to experience the curriculum as a group, for allowing collaboration and exchange of ideas, it is also possible to go through the material as self-learning.

The curriculum and the materials have also been planned for both in-person sessions and distance education sessions. This, again, supports the possibility of self-learning by exploring the materials and, again, highlights the relevance of having companions for the journey.

Whatever is the case for you, dear reader, we wish you a enjoyable learning experience and hope to hear from you through our communication channels.

MODULE 1

Basic Concepts of Computational Thinking

Module Description

We have developed technologies throughout history, and this journey of exploration has endless destinations that will never satisfy the curiosity that exists in our nature. Since Ada Lovelace wrote an algorithm for the "analytical engine" in 1843 and took that tender step for the programming language, computer technologies have reached an incredible dimension for nearly two centuries and coding has become a must that everyone wants to learn. Therefore, we can comfortably say that the language of today and the future is the language of programming. As the first step to orient children to coding, we need to foster computational thinking skills that have been systematically defined, thanks to the efforts to develop various programming languages so far.

This module will introduce preservice teachers to computational thinking and will focus on how to teach computational thinking skills in early childhood education. How can children become computational thinkers? How can they acquire skills that will lead them to think more systematically to solve problems or to reach their goals? The applied components of the module will teach the basics of computational thinking and focus on its concepts and dimensions through play-based activities planned for the children.

Module Structure

LEARNING OBJECTIVES

Basics of Computational Thinking

1. The participants can define what it means to think computationally.
2. The participants can recognise the basic concepts of computational thinking.
3. The participants can classify the dimensions of computational thinking.
4. The participants can relate the dimensions of computational thinking to real-life situations.
5. The participants can develop class activities for children by integrating computational thinking-oriented activities with play-based activities.
6. The participants can analyse each other's class activities to assess if they are suitable for fostering computational thinking.

Decision making & Loops

1. The participants can generate an algorithmic solution for a problem situation.
2. The participants can use a loop for a problem scenario.
3. The participants can combine decision making and looping for a problem situation.
4. The participants can perform basic debugging.
5. The participants can engage in logical reasoning.

Mixed Algorithms and Evaluation

1. The participants can generate a mixed algorithmic solution for a complex problem situation.
2. The participants can debug and evaluate algorithms according to different criteria.
3. The participants can think critically and creatively to solve a problem.

TEACHING METHODS AND TECHNIQUES

The theoretical concepts of computational thinking, loops, and mixed algorithms and evaluation are taught through a combination of activity-based teaching, peer collaboration, discussion techniques (think, pair, share), workshops (In groups of 3 to 5), group and individual discussion.

In-class and out-of-class activities will contribute to the transformation of theoretical knowledge into practice. End-of-course self-assessment forms provide a self-assessment for the learning of the subject content. Group work intends that pre-service teachers gain different perspectives. In-class activities are varied with in-class worksheets to be completed, and the worksheet at the end of the module aims to help pre-service teachers reflect on what they have learned.

Module Content: Theoretical Information

BASIC CONCEPTS OF COMPUTATIONAL THINKING

Brennan and Resnick (2012) point to the concepts of computational thinking for preschool and primary school students as follows.

Sequence (Algorithm)

Let's say we want to cook scrambled eggs for breakfast. In this case, we follow a series of actions for cooking. First, we take the eggs out of the fridge. We crack them into a bowl one by one and throw their shells out. Then, we whisk until the yolk and whites are thoroughly combined. Next, we preheat the pan and melt butter inside it. We pour in the egg mixture and let it cook for a few seconds. We continue cooking over medium-low heat, folding, and stirring the eggs every few seconds. Finally, we remove the pan from the heat and season it to taste with salt and pepper.

Just as in our example, process steps are executed one after another in programming. The sequence is the order in which these steps are followed. Following the critical steps in a sequence is extremely important if we want to accomplish our task successfully. For example, if we preheat the pan before we start to whisk eggs our butter may burn in it, and no one wants to cook scrambled eggs in burnt butter. So, there are critical steps in a sequence that we shouldn't change.

Also, each step should be clearly articulated so that it means the same to everyone. And finally, children should be supported to see that there may be different ways to reach an objective. For example, in our case, salt and pepper can be added when whisking the eggs. Therefore, we can support children to create their own steps to reach their goals, encourage them to try these steps out, and let them see what happens.

Loop (Control Structure)

When the same step is iterated over a sequence, we call this sequence a "loop" or an "iteration". For example, if we hop continuously when we dance or if we hammer repeatedly to drive a nail into the wall, it means these actions continue in a loop. In computer science, a loop is a sequence of instructions that are repeated continually until a specific condition is met. In the programming language, the number of iterations is displayed together with the action repeated. In this way, we do not have to write the same code over and over again.

Let's consider that children will colour a printed mandala in different colours. We can say that they will colour all the circle shapes red and all the square shapes blue. In this way, we won't need to give the same instruction separately for each shape.

In general, we can classify the loops as "for loops" and "while loops". In "for loops", we use the number of iterations over a sequence if we know how many times we will repeat the action. We use "while loops" if we don't know how many iterations are needed to complete a task.

Conditionals (Control Structure)

We all need to make decisions when we encounter some conditions and we have to choose one of them. Let's suggest that your mother asks you to run errands at home and she says that if you do this, you will be able to invite your friends to a party at home. However she also says that if you don't run the errands, then you won't be able to invite your friends to the party.

Computers also make decisions based on the pre-stated conditions and depending on whether they are true or false. They run only when certain criteria are met meaning whether they are true or false. A conditional statement includes "if", "else", or "else if" statements. "If..." instructs the programme to execute a certain action when the condition is true. When the statement is false, the programme does not run a process (just as in our example: either inviting friends or not) and this is called the "Else" statement. However, the "Else if" statement can instruct the programme to execute a different action when the condition is false.

To illustrate the else-if statement: your mother calls you and asks you to drop by the market and buy a carton of almond milk and 6 eggs, if the market sells almond milk. She says that if you can't find almond milk (because the market doesn't sell it), then you should buy 10 eggs and a carton of cow's milk. In this example, the true statement leads you to do a certain action, while the false statement instructs you to do another one.

In early education, children can follow simple conditions such as taking an umbrella if it is raining, feeding the cat if it is hungry, etc.

Data

Let's say we are inviting a group of people to a meeting. To organise everything perfectly, we must collect some information from them. For example, we may need to learn how many of them will come by car and need a parking space. We may also need to inquire about their food preferences. We may also need to distribute tasks to the meeting participants that they will work on before they attend the meeting.

These pieces of information form "data" that may include facts, concepts, or tasks in order, so we can interpret or process them easily.

Depending on what we inquire about, the data we collect varies or changes. For example, we can classify our meeting participants according to their interest areas to give them different gifts at the end of the meeting. Then the interest area will be our variable during the data collection process since it differs from person to person.

In early education, numerous data collection activities can be organised. For example, children can go to the school garden and observe leaves or stones lying around. They can collect those materials, and in the classroom, they can order them based on their size, shape or colour. Another data collection activity could be measuring the length of a bean that they plant. Every day, they mark its length and create a simple graph.

As we see, all computational thinking skills are the creation of human cognition, and we use them in our daily lives unwittingly. Use of these cognitive skills will facilitate daily life activities by noticing and learning from our mistakes and seeing smarter ways of doing things. The awareness of computational thinking skills will also facilitate the process of programming education at future education levels.

Modularity

Modularity is breaking down tasks or procedures into smaller units that are simpler and more manageable. It is breaking down a project or a task into smaller meaningful pieces and creating a solution instruction for each piece.

The modules of an application should follow the same philosophy. This means that they should only perform their specific tasks, regardless of which part of the application they are (Morrison, 2021).

Let's say after art time in a preschool classroom, all crayons are left in the same basket. However, children need to put the crayons in their own boxes. With the teachers' assistance, children can modularize the task by sorting the crayons by their colours, taking one from each colour, and putting it into their own boxes.

In modularity, we need to focus on the functionality of each unit of a whole on its own. For example, each module in a modular coursebook handles a different theme that can be removed from the book and used separately. Because it has its own objectives, lesson plans, teaching methods and techniques, theoretical/applied information, and assessment techniques. For example, a car has a modular construction, and its pieces can be removable.

Hardware and Software

The hardware refers to a computational system's physical parts that need software or instructions to run. We, humans, have physical integrity thanks to our bodies (Hardware). The language we use for communication makes us human beings (Software). We use different means of communication such as verbal, non-verbal, written, or visual (Programmes/Applications).

The important thing here is to realise that computers and other smart devices do not work by magic. All computers, tablets and telephones are the products of human engineering and the main goal in early education should be enabling children to understand them.

Debugging

Debugging is to define problems and eliminate errors to achieve a goal. With its simplest definition, debugging is the evaluation of the accuracy and appropriateness of the solution steps of a problem. For example, an author debugs his writing after finishing it by revising it according to grammar rules, punctuation, or appropriateness for the target readers, and then making the necessary corrections.

When debugging is understood, the evaluation skill (one of the dimensions of computational thinking) can be developed. It is necessary to analyse the steps, test them, and evaluate them systematically. Programmers often use debugging processes.

Design Process

The design process refers to handling and planning a design thoroughly. It is a series of steps engineers and designers use to develop solutions to problems. For example, authors use a series of process steps that they use to express themselves through written communication (books, thesis, etc.). It is crucial to realise the creative processes including imagination, planning, creation, revision, and sharing. These processes are cyclic and iterated having no exact starting or ending points.

SKILL DIMENSIONS OF COMPUTATIONAL THINKING

Ordering the dimensions in learning activities from easy to difficult in line with Bloom's Taxonomy facilitates to concretize computational thinking in learning settings (Selby, 2014). The skills definitions given below can be accepted as the indicators enabling us to observe those skills. The skills below are ordered starting from the skill dimension whose acquisition is easier to the skill dimension whose acquisition is more difficult.

The other modules will provide practical information about these dimensions which are not considered among the concepts of computational thinking. This module will only give descriptions as a preliminary for the next modules.

Algorithmic Thinking

An algorithm is a series of steps to solve a problem or reach an objective. In an algorithm, each step should be defined as an exact instruction, so everyone can understand and follow.

Building on that, algorithmic thinking is a pool of abilities that are connected to creating algorithms (Futschek, 2006). These abilities include:

- to realise what the problem is (or what the goal is)
- to analyse the problem or situation
- to see the problem from different aspects
- to be aware of different steps that can help solve the problem (or reach the goal)
- to create the necessary steps to solve the problem (or reach the goal)
- to improve the algorithm according to different variables

Everyone uses algorithmic thinking to some extent in daily and working life. It is the way of reaching a solution by defining the construction steps clearly. The more algorithms we can create to solve a problem or reach a goal, the more we can develop our algorithmic thinking skills. This algorithm-creation process includes the stages of developing the steps, trying, and improving the steps (Developing, Experimenting, and Iterating).

Evaluation

We evaluate an algorithm if it offers a good solution and is created for the purpose. The evaluation skill is the capability to evaluate whether various features of algorithms are correct or not (e.g., clearly instructed, properly ordered, etc.), and whether they are fast and economical enough. The evaluation enables us to ensure the algorithm works and that we can find the errors and solve them (Testing and Debugging).

Generalisation

Generalisation is a way of solving new problems quickly by benefiting from previous problem-solving experiences. An algorithm created to solve a problem can be applied in the solution processes of similar problems. For example, the algorithm used to make daisy tea can be used to make melissa tea or other kinds of herbal tea. This enables us to reuse an existing algorithm instead of creating a new one. Or we can build upon an existing algorithm to create a new one. And we can also mix algorithms to create more complex ones through generalisation. In this way, our work is simplified (Reusing and Remixing).

Abstraction

Abstraction is another way of thinking about problems and systems. It hides (or overlooks) details and eliminates unnecessary complexity. Abstraction skills enable us to select the right details that must be hidden in order to reveal the real problem to focus on. It is a way

of creating complex algorithms. Different representations of a problem facilitate us to perform different tasks. It is necessary to select the representation to define the purpose of the problem. This skill dimension refers to the ability to explore the connections between the whole and the pieces (Abstracting and Modularising).

Abstraction is the most challenging skill dimension to understand. In terms of early education, understanding the data is an abstraction on its own. In terms of functionality, one of the best examples of abstraction is maps. In a road map, determining the route between two locations is an example of abstraction. When a child can show the buildings and roads on a map that s/he needs to pass to go to school, this shows s/he can make an abstraction.

Decomposition

This is the ability to break down a complex problem or structure into smaller pieces. It is the way of thinking about problems, algorithms, processes, products, and systems in terms of their own pieces. The pieces broken down can be understood, developed, and evaluated separately after the decomposition process. In early education, a task which is complex for children can be determined. Then children will be assisted to break down the task into meaningful smaller tasks. Then children can work on each task separately, reach solutions easier, and integrate the solution.

Teaching Materials

Texts, Videos, Games, Worksheets, Crayons, Modelling Clay, Mobile Applications.

In “Lesson Plans from the Higher Education Course Curriculum for a Distance Learning Model Reinforced with Robotics for 3 to 7 Years Old Children”, you will find lesson plans, worksheets, and handouts. In www.earlyeu.org, you can also find slide presentations.

Assessment

In each lesson, there is an activity that the pre-service teachers carry out together with the instructor. These activities are supported by worksheets to be completed with in-class group work. At the end of each lesson, homework is given either to prepare for the next lesson or to practise the learning gained. There is a self-assessment form at the end of each lesson.

Self-assessment

Connect	Extend	Challenge
How can I connect what I already know with what I learnt in this lesson?	What new ideas can I build around what I learned today and broaden my perspective?	What challenges or puzzles have come up in my mind from what I learned?

References

Brennan, K., & Resnick, M. (2012, April). New frameworks for studying and assessing the development of computational thinking. In *Proceedings of the 2012 annual meeting of the American educational research association, Vancouver, Canada* (Vol. 1, p. 25).

Futschek, G. (2006, November). Algorithmic thinking: the key for understanding computer science. In *International conference on informatics in secondary schools-evolution and perspectives* (pp. 159-168). Springer, Berlin, Heidelberg.

Morrison, R. (2021). Modüler programlama: özellikler, örnekler, avantajlar, uygulamalar. https://tr.warbletoncouncil.org/programacion-modular-11773

Selby, C. C. (2014). *How can the teaching of programming be used to enhance computational thinking skills?* (Publication No. 366256) [Doctoral dissertation, University of Southampton]. http://eprints.soton.ac.uk/id/eprint/366256

MODULE 2

Computational Thinking with Block-Based and Text-Based Coding Environments

Module Description

The module presents design teaching of Computational Thinking tools (block and text-based programming environments) that can be used in various activity designs suitable for the preschool age group. In this module, activities are directed towards the prospective teachers' algorithmic design, evaluation, generalisation, abstraction, and decomposition skills.

Module Structure

LEARNING OBJECTIVES

Participants will be able to:

1. Identify elements and differences of block-based coding and text coding.
2. Determine the most appropriate exercises for development of computational thinking with the help of apps or robots.
3. Develop teaching materials and lesson plans.

TEACHING METHODS AND TECHNIQUES

- Group and individual work, peer collaboration
- Frontal work
- Practical activities
- Exploratory activities
- Discussion

Module Content: Theoretical Information

THE DEVELOPMENT OF PRESCHOOL CHILDREN AND THE POTENTIAL FOR DEVELOPING COMPUTATIONAL THINKING

When starting to plan activities with an educational robot or an app that promotes coding skills, it is important to be aware of the competences that coding can develop in children at

preschool age. Alongside, this should be followed by specific objectives and outcomes that will be achieved by promoting computational thinking.

Jeannette Marie Wing, a professor of computer science, defines the concept of computational thinking as the thought processes involved in seeing and formulating problems and their solutions, followed by a solution by a human, a machine or a combination of a human and a machine (Wing, 2011). In the context of the preschool educational level, the term computational thinking can be seen as the skills of logical thinking, observation of patterns and parallels, as well as problem spotting, dissection and solving, where actions are logically, sequentially, successively planned to reach the solution of the task.

When including educational robots and programming, the age, developmental level and previous experiences of the children should be taken into account. According to the Swiss psychologist Jean Piaget's (1964) theory of cognitive development, the preschool stage of education is known as the preoperational stage (2-7 years). At the age of five, the child's brain has reached about 80% of the weight of an adult brain, has significantly improved eye focusing abilities, and control over his/her small and large motor skills, which is evidence of brain maturation (Baumgarten, 2003). Alongside physical development, cognitive processes are also developing: language skills, concentration, memory, a rapidly expanding vocabulary, the ability to see and understand symbols and to use the imagination have all been developed (Baumgarten, 2003). At this age, children are able to imitate an action, imagine a situation, fantasise – as evidenced by role-play in everyday activities. These parts of the development of the thinking process suggest that children at this age are able to work with technology in appropriate contexts and environments, but the specificity of cognitive processes at this age should also be taken into account, which implies that a large proportion of 5 year old have: "difficulty in seeing more than one aspect of an object, which is called centrism; difficulty in understanding another's perspective: egocentrism; attribution of personality to inanimate objects: animism; the belief that fantasy is the same as reality" (Baumgarten, 2003).

Despite the development of imagination and the understanding of symbols, children at this age are not yet able to think abstractly and equate everything in their minds with reality. However, at the age of 6-7, children move into the stage of concrete operations (Piaget, 1964), where logical thinking, understanding of mathematical concepts, the ability to see causal relationships, and the ability to understand peers, to put oneself in their shoes (egocentrism) begin to emerge (Baumgarten, 2003).

The educational robots give preschool children the opportunity to develop and improve their skills in seeing, formulating and breaking down a problem (into steps, stages), as well as their skills in making connections between similar problems and previous experiences.

DIFFERENCE BETWEEN BLOCK BASED CODING AND TEXT CODING

What is the difference between block-based coding and text coding? Given how widespread technology is, teaching coding is becoming more and more necessary. Knowing how to code – or at least the basics of coding – is now an important skill for students moving into higher education and when they begin looking for a job (Darvell, 2021).

What is block-based coding?
What is a block-based coding environment?
Why block-based Coding?
Most popular block based environments

Block-Based Coding

What is block-based coding?	Visual Syntax-free Block-based Block-based coding has emerged as a tool to offer students an introduction into the world of coding that allows them to explore code in a friendly environment. The block-based approach of visual programming is by no means a new idea but initial implementations lacked technical means to make its usage in a correct way. It has just become popular in recent years due to the appearance of new generation tools like Scratch, Blockly, and Snap. The idea is to create a code in a way that is both visual (simple) and similar to traditional text-based coding (powerful). All the developer has to do is to connect visual "building blocks" in a logical way. This approach became predominant in introducing children to programming and is used all over the world now. However, the idea of visual programming is very compelling and experiments continued. The block-based family of visual languages became the first to become widely popular, at least with children (Codejig, 2021). Block-based and visual code editors use a drag-and-drop approach that makes it easier than ever for students and teachers to enter the world of programming. Unlike traditional, text-only programming,

	block-based programming requires little prior knowledge, training, or setup, making it accessible to students and teachers at the beginner level and beyond (Codio, 2023).
What is a block-based coding environment?	Block-based coding involves dragging "blocks" of instructions to manipulate the code. Block-based programming provides visual clues through predefined groups of code (blocks), such as events, controls, commands, loops, conditions, and more, that can be selected, modified, and sequenced to create and run games, apps, and other programs (Codio, 2023). While the code written in visual blocks is almost "syntax free", it has strong expressive power and can be mixed with text-based code written in mainstream programming languages such as Java or JavaScript. It cuts development time and allows the production of solutions that are easier to maintain than traditional software projects. Usage of block-based coding by professional software developers cuts development costs and benefits both development team and customers (Codejig, 2021). As opposed to text-based programming, block-based programming refers to programming language and IDE that separates executable actions into modular portions called blocks. These blocks are generally represented with icons that can be clicked and dragged to reorder them. Editable fields, like drop-down menus, allow users to provide further input. This graphical representation of the code can demonstrate the process to new users who may be unfamiliar with programming (Computer Hope, 2019).
Why block-based coding?	The main goal of visual programming is to make programming more accessible at 3 different levels: Syntax – the use of block/icons, diagrams, and forms to eliminate syntactic errors. Semantics – usage of meta-information to document and explain the program. Simulation – visual programming languages may include visual mechanism to bring the program in a particular state and check its behaviour (Codejig, 2021).

	Block-based programming can be easier to learn than traditional text-based programming languages, like Python or Java. However, block coding is far more limited than text languages, which require more specific instructions from the programmer to complete actions. Block-based programming is often used to help children learn how to create basic programs and begin to understand programming (Computer Hope, 2019). More recently, researchers have demonstrated that block-based and visual coding platforms are very helpful for adult novice learners, as they help teach the causal relationships between code and behaviours. While visual and block-based programming has definite limitations, there are very good ways for children to begin their coding journeys (Codio, 2023).
Most popular block-based environments	1. Scratch 2. Scratch Jr. 3. Code.org 4. Snap! 5. Blockly
	· https://www.computerscience.org/resources/best-programming-languages-for-kids/ · https://code.org/curriculum/course1 · https://blocklycodelabs.dev/codelabs/getting-started/index.html#4 · https://bsd.education/programming-languages-explained-python-vs-javascript-css-html/

Text-Based Coding

Text-based Coding is introduced when teachers and students want to move beyond the blocks and are ready to take their digital skills to the next level with text-based programming like HTML, CSS, and JavaScript etc.

What is text-based coding?	Text-based coding involves writing lines of code and can be introduced to children after they get used to block-based coding. Text-based coding is essentially typing instructions in a

	programming language following a syntax. Syntax is the grammar and spelling rules of a programming language (Priyanka, 2021). Programming languages provide the rules for building websites, apps, and other computer-based technologies (McGee, 2022). A programming language that does not involve graphical elements (blocks) as a main part of its programming language, but instead is mostly oriented around text (Giannakoulas, 2020).
Is there a bridge between block and text programming?	SWITCH in a coding environment from Block-based to Text-Based Coding – making the connection, and allow your students to translate their block code into either Python or JavaScript text-based code (or vice versa)! Students can: · Start off by writing a block coding program that is easy for them to understand. · Translate their block code into text-based code. · Gain an understanding of Python and/or JavaScript syntax by drawing comparisons between their intuitive block code and their new text-based code (Roark, 2022).
What is a text-based coding environment?	These are just a few examples of the many code editor software options available. The choice of code editor will depend on the individual needs and preferences of the programmer.
Why NOT text-based coding at preschool?	What is the biggest barrier to learning a programming language? Syntax. The word “syntax” refers to the symbols, words, and rules that define the structure of a programming language, functioning much like the words and grammar behind a spoken language like English. Parenthesis, brackets, colons, semicolons, and keywords like “if,” “for,” “while,” and “print” are all examples of syntax commonly used in programming languages. Developing an intuition for when and how to properly use coding syntax can often prove to be just as challenging as learning a new spoken language like Spanish or Chinese (Roark, 2022). So, text-based coding may not be suitable for preschool children in most cases. The teacher must take into account the child’s prior

	knowledge of reading, writing, and English, without which it is impossible to implement this type of coding.
Most popular text-based languages	1. JavaScript 2. HTML/CSS 3. Python 4. SQL 5. Java 6. Node.js 7. TypeScript 8. C# 9. Bash/Shell 10. C++

Block-based coding and text-based coding are two different approaches to writing computer programs. Here are the key elements and differences between the two:

Block-based coding

- Visual interface: Block-based coding uses a visual interface where users can drag and drop code blocks to create a program. The blocks represent different programming concepts, such as loops, conditions, and variables.
- Simplified syntax: Block-based coding simplifies the syntax of a programming language, making it easier for beginners to understand and use.
- Limited flexibility: Block-based coding limits the flexibility of programming, as users are constrained to the blocks provided by the programming environment.
- Easy to learn: Block-based coding is generally considered easier to learn than text-based coding, making it a popular choice for beginners.

Text-based coding

- Text interface: Text-based coding uses a text-based interface where users write code using a programming language's syntax and structure.
- Complex syntax: Text-based coding requires knowledge of a programming language's syntax, which can be complex and difficult to understand for beginners.

- Increased flexibility: Text-based coding provides users with increased flexibility, allowing them to write any code they want and giving them access to more advanced programming concepts.
- Steeper learning curve: Text-based coding has a steeper learning curve than block-based coding, as users must learn the syntax and structure of a programming language.

In summary, block-based coding simplifies the syntax of a programming language and uses a visual interface to make it easier for beginners to learn, while text-based coding uses a text-based interface and provides increased flexibility but has a steeper learning curve.

Some general topic insights

- Computer science can be introduced to children at a young age, but the concepts must be simple to understand, reports the Computer Science Teachers Association. Charlie King of CLEARLINK suggests that children should start coding and delving into computer science as soon as they show an interest. Their specific age is not as important.
- Coding is a subset of programming. Coding uses programming languages to translate directions into something a computer can understand. Programming creates the instructions that tell a computer how to follow the directions (Simmson, 2022).
- Given how widespread technology is, teaching coding is becoming more and more necessary. Knowing how to code – or at least the basics of coding – is now an important skill for students moving into higher education and when they begin looking for a job (Darvell, 2021).

THE DEVELOPMENT OF COMPUTATIONAL THINKING WITH THE HELP OF EDUCATIONAL ROBOTS

Studies have shown that children under the age of 3 develop the beginnings of computational thinking through adult-guided play activities and toys (Critten et al., 2022). Play activities presented in a positive and friendly atmosphere help children learn their first skills in cooperation, communication, problem solving, etc. Later on, for older children (5-6 years old), developing the skills to program the educational robot is facilitated by these earlier play activities, which inadvertently pave the way for an easier technology learning process. Skills such as understanding directions and sequences, etc. are also promoted from a very young age. All these basic skills can be acquired initially through play and games, which later already serve as a basis for the first steps in robot programming (Critten et al., 2022).

A Danish study published in 2022 suggests that educational robotics in preschool is not primarily aimed at teaching children to code or learn to solve technical problems, but rather as a kind of playground that provides additional opportunities to express, participate, communicate and learn about technology, where problem-solving skills play an increasingly important but secondary role (Odgaard, 2022). The idea is thus put forward that technology is one form of communication or an assistant in this process of learning to communicate and collaborate.

Diverse approaches to learning mean pursuing the same goals through different pathways, i.e. using a variety of approaches. For example, games have already provided basic knowledge about directions, sequencing, etc. Also, the skills learnt in robotics lessons can be practised in advance with other technological solutions such as apps. In order to give children a full experience of the world of programming and to give them a broader view and more versatile skills, it is possible to combine the programming of the educational robot with different programming apps. For children from 5 years of age, the programming apps could be offered as a first or initial stage of programming, followed by programming activities with the educational robot, while for younger children the initial stage of programming could be demonstrated in a more visual, physical way (map, drawn path, arrows, etc.). The results of a study on the impact of coding apps on the development of young children's computational thinking show that at least four coding apps – Kodable, Lightbot, Daisy the Dinosaur and ScratchJr – have been tested and found safe for teaching (Papadakis, 2021). These four apps were analysed and evaluated according to several criteria, which led to the conclusion that these apps promote children's algorithmic thinking and mathematical skills, programming skills and create positive attitudes towards programming in a fun and playful way.

The visualisation of actions plays an important role in the inclusion of educational robots in preschool education, where children have the opportunity to first draw or place their planned programming actions, for example, using the robot's action cards. Such visualisation helps both to structure and review their planned programming path and to look for a bug in the solution later on, if one occurs. Research also highlights the importance of individual support from the teacher (Kyriakoula & Charoula, 2019). In addition to individual support, task succession should be observed, where a task goes from easier to more complex. For example, in a session with an educational robot, children may be invited to initially draw the path on paper, subsequently plan it with the help of direction cards, and in the last phase program the robot to perform the actions without aids. By using a variety of approaches and methods, there is an optimal chance that knowledge and skills will be acquired by learners of all perceptual types.

THE DEVELOPMENT OF COMPUTATIONAL THINKING WITH THE HELP OF APPS

Computational thinking is the process of breaking down complex problems into smaller, more manageable parts, identifying patterns and relationships, and developing algorithms and solutions that can be executed using computers.

Computational thinking can be introduced to preschool children through various apps that use playful, interactive approaches to help develop their problem-solving, pattern recognition, and logical thinking skills. Here are some examples of apps that can be used to introduce **preschool** children to computational thinking:

- ScratchJr: ScratchJr is a simplified version of Scratch designed for children aged 5-7 years. The app allows children to create simple animations and interactive stories by snapping together graphical programming blocks. ScratchJr is designed to be easy to use, with a drag-and-drop interface that allows children to create their own programs by selecting and arranging commands.
- Kodable: Kodable is an app designed to teach young children the basics of coding through a series of games and activities. Children learn to recognize patterns, develop problem-solving skills, and think logically as they navigate through the app's challenges.
- Daisy the Dinosaur: Daisy the Dinosaur is an app that teaches children the basics of programming through a series of interactive challenges. The app features a simple drag-and-drop interface that allows children to create their own programs by snapping together commands and actions.
- Tynker Junior: Tynker Junior is an app designed to introduce young children to the basics of coding through a series of fun, interactive challenges. Children learn to develop their problem-solving skills, think logically, and recognize patterns as they work their way through the app's activities.
- Hopscotch: Hopscotch is an app that allows children to create their own interactive games and animations by snapping together code blocks. The app features a drag-and-drop interface that makes it easy for children to create their own programs, while also helping them develop their logical thinking and problem-solving skills.

These apps can help preschool children develop their computational thinking skills by introducing them to the concepts of problem-solving, pattern recognition, and logical thinking in a playful and interactive way. By engaging children in hands-on activities and challenges, these apps can help lay the foundation for future learning in computer science and other technology-related fields.

Computational thinking is an important skill for anyone interested in computer science, software development, or other technology-related fields.

There are many apps available that can help users develop their computational thinking skills also **after preschool age.** Some examples include:

- Scratch: a programming language and online community that allows users to create interactive stories, games, and animations using drag-and-drop code blocks.
- Code.org: an online platform that offers free coding courses and resources for students of all ages, including introductory lessons on computational thinking.
- Tynker: an app that offers coding lessons and activities for children, including games, puzzles, and programming challenges.
- Codeacademy: a platform that offers interactive coding lessons and exercises in a variety of programming languages, including Python, HTML/CSS, and JavaScript.
- Khan Academy: an online learning platform that offers courses in a variety of subjects, including computer programming and computer science.

These apps can help users develop their computational thinking skills by providing hands-on experience with coding and problem-solving. By working through coding exercises and challenges, users can learn to break down complex problems into smaller, more manageable parts, and develop algorithms and solutions that can be executed using computers.

SCHOOL TEACHING MATERIALS. LESSON PLAN AND ASSESSMENT PRE AND POST TOOL DEVELOPMENT

When starting technology-enhanced activities in preschool, especially for educational robots, it is essential to first create in the learners the awareness that humans communicate with computers in a “language” of symbols, where each instruction has to be specific, precise, sequential in order to achieve the desired result (Saxena et al., 2020). Specifically, to create the awareness that an educational robot will not do anything that we have not “told” it to do.

The basic principles of a technology-enhanced lesson are the same as for any purposefully planned lesson, for example, using Gagné’s nine learning events model for effective lessons. At the same time, it is important to remember a few basic conditions for designing lessons and activities – a Taiwanese-UK study published in 2012 on improving preschool children’s computational skills through smart toys has outlined the most important preconditions to consider when designing activities with smart toys, including educational robots:

- the activity is in the form of a game/play,

- activities should be fun/entertaining,
- clear objectives for the teacher to incorporate the technology and clear tasks for the children,
- easy-to-use, understandable technology chosen for interaction,
- regularity and structure in the task conditions,
- tasks are adjusted to the level of difficulty,
- a sense of achievement that motivates children,
- tasks include a challenging, problem-solving aspect,
- social interaction with peers,
- a common theme/story as the background for the whole activity (Lin et al., 2020).

A purposefully designed curriculum will be followed by a real lesson, where it is important to keep in mind the indispensable role of the teacher – to be there for the learners, to help, motivate and encourage. Research highlights the importance of the presence of the educator, meaning not only support but also a concept in which the child acts independently, but within the limited field of action of the educator, i.e. the educator plays a driving role, where he or she creates the environment, creates the problem and then helps to see the problem and potential solutions (Odgaard, 2022).

Teaching Materials

In “Lesson Plans from the Higher Education Course Curriculum for a Distance Learning Model Reinforced with Robotics for 3 to 7 Years Old Children”, you will find lesson plans, worksheets, and handouts. In www.earlyeu.org, you can also find slide presentations.

Assessment

In “Lesson Plans from the Higher Education Course Curriculum for a Distance Learning Model Reinforced with Robotics for 3 to 7 Years Old Children”, you will find a test.

Have these learning outcomes been achieved?

- Identify elements and differences of block-based coding and text coding.
- Determine the most appropriate exercises for development of computational thinking with the help of apps or robots.
- Develop teaching materials and lesson plans.

References

Blockly. (2023). https://developers.google.com/blockly

Critten, V., Hagon, H. & Messer, D. (2022). Can Pre-school Children Learn Programming and Coding Through Guided Play Activities? A Case Study in Computational Thinking. Early Childhood Educ J 50, 969–981. DOI: 10.1007/s10643-021-01236-8

Code.org. (2023) https://code.org

Computer Hope (2019). Block-based programming. Retrieved January 17, 2023, from https://www.computerhope.com/jargon/b/block-based-programming.htm

Codejig (2021-2023). Block coding. Retrieved January 17, 2023, from https://www.codejig.com/en/block-based-coding

Codio (2023). What is Block-Based Coding? Retrieved January 17, 2023, from https://www.codio.com/solutions/block-based-programming

Daisy the Dinosaur. (n.d.). Daisy the Dinosaur. https://www.daisythedinosaur.com

Darvell, B. (2021). Block-Based Coding Vs. Text-Based Coding. BSD Education. Retrieved January 17, 2023, from https://bsd.education/block-based-coding-vs-text-based-coding

Hopscotch: Make Games. (n.d.). Hopscotch: Make Games. https://www.gethopscotch.com

Kalogiannakis, M. & Papadakis, S. (Eds.). (2020). Handbook of Research on Tools for Teaching Computational Thinking in P-12 Education. IGI Global. DOI: 10.4018/978-1-7998-4576-8

Kodable. (n.d.). Kodable – Programming Curriculum for Elementary Schools. https://www.kodable.com

Kyriakoula, G. & Charoula, A. (2019). Developing preschool children's computational thinking with educational robotics: The role of cognitive differences and scaffolding. Paper presented at the 16th International Conference on Cognition and Exploratory Learning in Digital Age, CELDA 2019, 101-108. DOI: 10.33965/celda2019_201911l013

Lin, S. -., Chien, S. -., Hsiao, C. -., Hsia, C. -., & Chao, K. -. (2020). Enhancing computational thinking capability of preschool children by game-based smart toys. Electronic Commerce Research and Applications, 44 DOI: 10.1016/j.elerap.2020.101011

Make code. (2023). https://www.microsoft.com/en-us/makecode

McGee, V. (2022). What Is Coding and What Is It Used For? Retrieved January 19, 2023, from https://www.computerscience.org/resources/what-is-coding-used-for

Odgaard, A. B. (2022). What is the problem? A situated account of computational thinking as problem-solving in two danish preschools. KI – Kunstliche Intelligenz, 36(1), 47-57. DOI: 10.1007/s13218-021-00752-4

Papadakis, S. (2021). The Impact of Coding Apps to Support Young Children in Computational Thinking and Computational Fluency. A Literature Review. Front. Educ. 6:657895. DOI: 10.3389/feduc.2021.657895

Priyanka, R (2021). A Beginner's Guide to Block-based and Text-based Coding. Retrieved January 19, 2023, from https://www.codingal.com/coding-for-kids/blog/block-based-and-text-based-coding/#Block-based

Roark, J. (2022). Bridging The Gap Between Block Coding And Text-Based Coding With Micro:Bit. Stem Education Works. Retrieved January 19, 2023, from https://stemeducationworks.com/blog/bridging-the-gap-between-block-coding-and-text-based-coding-with-microbit

Saxena, A. et al. (2020). Designing Unplugged and Plugged Activities to Cultivate Computational Thinking: An Exploratory Study in Early Childhood Education. Asia-Pacific Edu Res 29, 55–66. DOI: 10.1007/s40299-019-00478-w

Scratch. (2023). https://scratch.mit.edu

Scratch Jr. (2023). https://www.scratchjr.org

Simmson, L. (2022). Best Programming Languages for Kids. ComputerScience.org. Retrieved January 19, 2023, from https://www.computerscience.org/resources/best-programming-languages-for-kids

Snap!. (2023) https://snap.berkeley.edu

Tynker Junior: Coding Games for Kids. (n.d.). Tynker Junior: Coding Games for Kids. https://www.tynker.com/junior

Wing, J., M. (2011). Research notebook: Computational thinking—What and why. The link magazine, 6, 20-23.

MODULE 3

Fundamentals of Physical Programming and CT with Robotic Activities

Module Description

In the module “Fundamentals of Physical Programming and Computational Thinking with Robotic Activities” basic sensor knowledge is being addressed. The participating pre-service teachers are engaged with robotic tools and applications which can be used for the design of computational thinking activities. The activities include the basic competences of computational thinking: algorithmic design, evaluation, generalisation, abstraction and decomposition.

Module Structure

LEARNING OBJECTIVES

Human Senses and Electronic Sensors

1. The participants can explain the connection between human sensing and electronic sensors.
2. The participants can describe different forms of electronic sensors and the specific measurements these sensors take as input.

Computational Thinking with Robotic Activities

1. The participants can sketch basic algorithms that combine sensor input with robotic actions.
2. The participants can analyse which sensor is being used in everyday objects.
3. The participants investigate the synergy between different sensors used in everyday objects by decomposing real life applications.

TEACHING METHODS AND TECHNIQUES

The theoretical concepts of Robotics and Computational Thinking are taught through a combination of video lectures, explanatory videos, text documents (e.g., empirical studies, tool descriptions, manuals) and podcasts. Online quizzes are used to foster theoretical competencies.

Practical exercises, which can be done at home, at the school or at the workplace, will allow students to explore their surroundings, making connections between theoretical models and real-life applications.

The students design their own teaching concepts and share their ideas with colleagues over the MOOC platform. They discuss their results over the forums with other stakeholders to improve their designs. In addition, they evaluate their designs by running tests in their specific fields and consequently redesign their teaching concepts.

Module Content: Theoretical Information

COMPUTATIONAL THINKING

The term computational thinking was reintroduced by Jeanette Wing in 2006. It describes different fundamental concepts of computer science which are being used to solve problems, design systems and understand human behaviour (Wing, 2006). Computational thinking competencies are required to understand how computers work and how they can be used to solve everyday problems. Consequently, computational thinking includes the principles of human thinking which form the basis of algorithmic design. A set of characteristics that can enhance the understanding of CT, especially in a K–12 environment, was compiled in the computational thinking teachers' resources (Barr & Stephenson, 2011; Delcker & Ifenthaler, 2017):

1. CT is a way to formulate problems so they can be solved using a computer.

2. It is also the logical organisation and analysis of data.

3. Models and simulations are introduced to represent data through abstraction.

4. By thinking in algorithms, students can create automated solutions.

5. One of the goals is to achieve the most efficient and effective combination of steps and resources by identifying, analysing, and implementing a variety of possible solutions.

6. The whole process of solving one particular problem can be generalised and transferred to a variety of problems.

Teachers who understand these CT concepts can design interactive learning activities which help students to develop basic computing skills. These activities can include physical programming with the use of simple robotic functionalities. An important aspect of robotic functionality is the interplay of sensor functions, measurement and algorithm design. Electronic sensors can be seen as the artificial counterparts of human senses. A

light sensor is the equivalent of the human eye. A heat sensor measures temperature like the human skin. Accordingly, robots are programmed to react to measurement data and interact with their environment based on external inputs. Robots are controlled by internal, programmed processes. Algorithms combine the input of sensors with programmed processes so the robot is able to react accordingly to the input. A combination of the described basic sensor knowledge, applied robotic skills and computational thinking competences is required to design holistic learning experience for different target groups.

HUMAN SENSES & ROBOT SENSORS

Humans experience the world around them by using their senses. Sight, hearing, touch, taste and smell are used to gather information about the environment. Touching an object can tell you whether it is cold or hot, a sound can be perceived as loud or silent, the shape of an object can be seen, as well as its distance from the observer. The things that humans are able to sense allow them to react to the environment and to make decisions about their daily life. Can I take a sip of my tea or is it too hot? How far do I have to go until I reach a destination? Will I be able to fit an object into my backpack or will it not fit because of its size?

Much like human senses, robots are relying on their sensors to gather data about their environment and to act according to it. In general, robots are thought of as machines which are programmed to do certain tasks. Some of these tasks have traditionally been done by humans, but they are either too simple (e.g., repetitive tasks in an assembly line) or too hard (e.g., a robot exploring the bottom of the ocean) for humans to do. The code inside a robot tells the machine what to do. To be able to fulfil their purpose, robots need to be aware of their environment, they need to know where they are, where different objects are, what the condition of these objects is etc. Robots rely on data to perceive their surroundings and this data is gathered through sensors. A temperature sensor gives data about the temperature of an object, a proximity sensor tells the robot how far or close an object is, a tilt sensor tells the machine about their positioning etc.

Many of these sensors are built into objects and machines around us. To understand how robots work and how they can be programmed, students need to know about the different sensors and how the data from these sensors can be used.

Teaching Materials

In “Lesson Plans from the Higher Education Course Curriculum for a Distance Learning Model Reinforced with Robotics for 3 to 7 Years Old Children”, you will find lesson plans and worksheets. In www.earlyeu.org , you can also find slide presentations.

Assessment

- Peer2Peer feedback for instructional designs
- Self-evaluation of instructional designs

References

Barr, V., & Stephenson, C. (2011). Bringing computational thinking to K-12: What is Involved and what is the role of the computer science education community? *ACM Inroads*, *2*(1), 48–54. DOI: 10.1145/1929887.1929905

Delcker, J., & Ifenthaler, D. (2017). Computational thinking as an interdisciplinary approach to computer science school curricula: A German perspective. In P. J. Rich & C. Hodges (Eds.), *Emerging research, practice, and policy on computational thinking* (pp. 49–62). Springer.

Wing, J.M. (2006). Computational Thinking. *Communications of the ACM, 49*, 33-35. DOI: 10.1145/1118178.1118215

MODULE 4

Designing Activities and Learning through Distance Education

Module Description

The module presents concepts and suggestions regarding distance education with children. Distance education has a long tradition but its use for promoting learning in Early Childhood Education is still contested and requires careful planning. Based on recent experiences, the module puts forward some guidelines for designing activities, but also for considering their quality. This allows for a clear connection between the experience of distance education and of face-to-face education.

Module Structure

LEARNING OBJECTIVES

Participants will be able to:

1. Discuss the main characteristics of distance education activities and how these differ from face-to-face teaching in Early Childhood Education.
2. Summarise the elements of distance teaching that need a different skillset to face-to-face teaching.
3. Design and evaluate activities and strategies for distance education in Early Childhood Education.
4. Develop procedures that will help in the process of self-evaluation leading to quality provision and improved outcomes for children in distance education.

TEACHING METHODS AND TECHNIQUES

- Group discussions
- Group work: design and evaluate activities
- World Café discussion

Module Content: Theoretical Information

DISTANCE EDUCATION IN EARLY CHILDHOOD EDUCATION

In recent years, due to the COVID-19 pandemic from 2020-22, several children and young people have engaged in remote learning at home through materials provided by their preschool setting or school. These could be paper-based or online learning materials or a combination of both. Usually, families were involved in these endeavours. There was a large-scale deployment of distance education in many countries. Smaller initiatives of distance education for young children exist in some parts of the world, catering to children who cannot access other early childhood education services on a regular basis.

We will learn about distance education and its challenges in Early Childhood Education, as well as some practical guidance for implementing activities with children and families.

Distance education

Distance learning or education is a type of education in which students or learners and their teachers are in different physical locations or timeframes, therefore requiring technologies to communicate with each other so that teaching and learning can happen. It has a long history and different technologies have been used: postal services, radio, TV, and the Internet. Distance education is planned to be implemented as such from the outset. The design process and the careful consideration of different design decisions have an impact on the quality of the instruction. Because it has been useful in many situations, distance education has been researched and improved (Saykılı 2018). Effective learning results from careful instructional design and planning, using a systematic model for design and development.

During the COVID-19 pandemic, the term “emergency remote teaching” (Hodges, Moore, Lockee, Trust, & Bond, 2020) began to emerge to describe what was occurring in education at all levels. It was used to differentiate existing distance education (including online learning) from the efforts to provide temporary access to instruction and instructional support. This access was set up quickly and was relevant during the emergency, but does not fulfil the requirements now to be considered distance education. That is why the new term was introduced, to highlight that the careful design process was absent in the emergency shift that occurred.

Synchronous and asynchronous

Distance education can be classified into two categories: synchronous and asynchronous. The terms synchronous and asynchronous are used for describing online learning although they similarly exist in in-person learning environments.

Synchronous learning refers to instructors and students gathering at the same time and (virtual or physical) place and interacting in real time. These interactions can be listening to live radio programs, participating in live online sessions, or debating in a live chat.

Asynchronous learning is based on the interactions between the teacher and the learner at different times, such as listening to recorded lectures, watching pre-recorded video tutorials, or replying to messages in a forum. It refers to students accessing materials at their own pace and interacting with each other usually over longer periods.

Students will benefit from courses that incorporate both asynchronous and synchronous activities since both have pros and cons. For example, synchronous teaching is well-suited to create social engagement and faster exchanges of information, allowing for asking questions and clarifying concepts. It's important to build a sense of community since everyone is together and interacts. However, it is prone to technical and accessibility limitations, and it also requires scheduling shared times for all students and teachers. Asynchronous instruction is temporally more flexible: in terms of scheduling as well as allowing students to work through the course at their own pace with more time to explore and engage with the material.

It is helpful to view learning experiences as falling along a spectrum of synchronous-to-asynchronous experiences. Hybrid activities can create continuity across these spheres, e.g., assigning a defined task to do offline during a scheduled synchronous session before coming back online and sharing their reflections with the group.

Challenges of distance education in Early Childhood Education

Implementing distance education for young children has several challenges (Atiles, Almodóvar, Vargas, Dias, & León, 2021). Most preschool curricula are holistic/play based and expect children to learn best from **human interaction, hands-on exploration, and all kinds of sensory and physical activities**. Arranging for similar experiences in distance education requires careful planning and a focus on discovery, playing together, and imagination. Early Childhood Education relies on a purposefully organized **educational environment** that cannot be replaced in distance education solutions. This environment includes the physical space and materials accessible to children, as well as the social interactions with other children and staff and a time schedule that caters to children's needs. These are important parts of the support for learning that Early Childhood Education promotes. The experience

during the COVID-19 pandemic also showed that **involving families and/or caregivers** is essential as children learn best with company and might require support for dealing with technology and problem-shooting.

A challenge for the teachers is, therefore, the awareness that it is impossible to replicate the world of the real preschool, the vital social interactions taking place as children learn to be part of a wider world, and the careful planning of activities designed for children's individual needs. When in-person, hands-on learning isn't possible, however, distance learning can keep children engaged with appropriate activities and opportunities for interaction. For example, children's social and emotional development can benefit from ongoing relationships with other children (colleagues) and their teachers/adults, even when they can't be together physically. It is also important for families and caregivers to have that connection with an education provider and other families.

For parents or caregivers, being part of distance education is challenging in terms of dealing with multiple online resources, managing their children's involvement and responses, trying to give feedback to teachers, and managing the time needed for all those activities.

Overall, the opportunities for benefiting from distance education depend on access to devices and an Internet connection, support in using technology for the youngest children, and also existing learning materials online.

Good practices in Early Childhood Education

Quality distance preschool education should be **flexible, child-centred, and fun**. A balance is needed between **teacher-led group experiences** and **at-home activities** for families/caregivers to set up in their own time. The first will usually be held over a video call synchronously. The teacher-led experiences can also be video-recorded and made accessible to children and families/caregivers. This way, it's possible to respect that families have different schedules that don't allow for synchronous learning as a group. The activities to be developed with the children will usually be planned for asynchronous learning led by families/caregivers. This is based on explicit support about the activity organized in a brief information sheet to be sent out by the teacher.

All activities will require technological support (video calls, exchange of files, etc) and will benefit from being **resourced** with materials that support children's learning such as books, equipment, puzzles, and games. The main focus is on engaging in activities and play experiences with the children.

The connection between the activities is established through **regular communication** between teachers and families/caregivers and children through a platform, or at least by

email/social media. This allows exchanges before and after the activities, as well as sharing the result of the activities and feedback on that. A good platform will also allow **children to interact with each other**.

The **feedback** provided by the families/caregivers to the teachers is essential to improve the quality of the experience (activities aligned with children's interests, for example) but also to allow the **evaluation** of the children's learning for educational purposes.

Teacher-led distance sessions

Video calls can be effective with younger children if they are **brief and playful**, much like in-person large-group activities (Fenmachi, & Edah, 2022). The video calls can include sing-alongs, dance parties, or exercise activities for the whole group but video conferencing can also be used to connect small groups of children and teachers for show-and-tell or story time.

From the experiences gathered in the last few years, some dimensions have been highlighted as crucial in preparing quality experiences.

On **communication**: arranging with families/caregivers ahead of time how video calls will work and what tools will be used. This can guarantee that the needed software will be installed (support for it before the call might be needed). If possible, it will be helpful to have a short visual guide for the most used functionalities of the video call platform (emojis, hand-up, micro on/off, etc). After the sessions, asking for feedback and reflecting on the experience can support its improvement.

With good communication and planning, video calls can be prepared for large groups or smaller groups. Knowing how many participants and who will join can help teachers tailor their activities to the individual children ahead of time.

On **technology**: children will learn the basic functionality of whatever video platform is chosen, but it will take some time and practice. Similar to the beginning of the school year when the focus is on the basic classroom routines, the virtual classroom will require an introduction period. Prepare the families/caregivers for this adaptation so it will be smoother.

On **materials/resources**: it's good to have shared experiences between everyone but it will be difficult to guarantee everyone has the same items at home. Suggest generic resources (spoons, sheets of paper, pens, pans, books) with simple substitutes so each child can have a hands-on experience. Children don't need to have the exact same items to be able to draw, build, create patterns, and make music. The challenge presented can be to get creative with what families/caretakers and children have available at home (something to make noise with, something you like, ...).

On **dynamic**: the activities will be more successful if children are involved by having active (and playful) participation. In large groups, this has to work as a collective participation as it will be difficult to manage individual contributions from the children (answering questions, for example). It is best to avoid planning video lessons that require children to stay quiet or sit still for too long or that are focused on instruction or require children to wait for their turn to talk. Instead, preference should be given to activities where children are allowed to make noise and move around.

On **mediation**: the teacher will need to have an active role in mediating the conversation and managing participation in a virtual call – even more so than in a physical setting where children can interact with each other more easily. Managing the focus of the video and microphones during the call can be a good way to help the mediation. One video on the screen is easier for children to follow. If children are to feel heard, the mics have to be on and the unstructured participation has to be welcomed and managed. Finally, giving feedback positively will be important to keep children engaged.

On **time**: Time management is also key: the synchronous moments need to be brief and have periods without requests made to the children (while only the adult or a child speaks).

On **videorecording**: if you record the session for families/caregivers to watch asynchronously, remember to still engage children actively and leave time for their participation. Also, remember to give feedback (generically) after each request for participation.

Remember general tips, tricks, and troubleshooting for synchronous distance education:

- arrange a neutral background that will not shift attention from you,
- the light source should be in front of you and be diffuse,
- the angle of the computer should be at your eye level,
- if you use visual aids (like ppt or video), turn it off every so often and talk on screen,
- make sure technology works for you and the families/caregivers and for the purposes needed,
- remember to purposefully plan your appearance and to use your body as a tool for engagement and focusing or directing attention.

At-home activities

Children that are participating in distance education will have adults at-home (or in the same context) that are in a better position to develop activities with them. This will be a

hands-on element that is needed to support learning. These activities are mostly prepared as asynchronous education by teachers.

When preparing at-home activities, teachers need to: rethink **lesson plans**, to make them family friendly, provide access to **resources** (online and offline), and have good **communication** with families/caregivers and children to be able to receive feedback about the activity after it has been experienced. This means families/caregivers communication is a top priority. The better informed they are about the expectations and purposes of the activities, the better they will be able to support the children (Dong, Cao, & Li, 2020).

The activities that are suggested need to take into consideration the context in which they will be developed (children's homes, hospitals, care facilities, etc.). This usually requires **flexibility** in terms of set-up and materials that are suggested. Clear guidance in terms of what is essential and what can be adapted makes it easier for families/caregivers to implement the suggested activity.

As discussed for the video calls, **playfulness** is important (O'Keeffe & McNally, 2021). Both for children and for families/caregivers, having joyful, creative, and bonding experiences will be essential. The ideas for play and learning activities that are provided will be part of what families/caregivers do with their young children so they need to contribute to **positive interactions**. On the other hand, these activities will imply that families/ caregivers think and act like a teacher, therefore an important feature of any home learning idea is the clarification of the why/**purpose** behind the idea – what is a child learning in this activity?

Lesson-plans will be the support for all this information. Different structures can be used but the following items should be taken into account (Soares, 2021):

1. General **purpose** of the activity is to make sure it is perceived as valuable for learning. This might entail links to the curriculum if families/caregivers are interested/knowledge-able of the curricular guidance for preschool.
2. Basic information about **concepts** being focused on in the activity. This should be easy to skip if parents already feel confident in their knowledge of the concepts. But clarifying the concepts can be important for parents to know what to highlight in the activity.
3. Required **materials** for the activity and suggested set-up (space, materials arrangement, time, etc.). It's important to remember that families/caregivers do not always have access to the same toys and items at home so it is best to avoid planning activities that require supplies that would have to be purchased. Options like basic household items ensure equity and make it easier for families/caregivers to start developing the activities. This might also involve online resources – in which case clear guidance to use those resources is needed. Again, avoid resources that require a subscription.

4. Guidance for preparation and **implementation**. Families/caregivers will most likely have a short time for the activities so knowing what is required as preparation and having an overview of the whole process is essential. A step-by-step explanation, well prepared and focused on being explicit will be key. Also, guidance on what to avoid and what to guarantee is important for less-experienced families/caregivers. It's good to always consider the families/caregivers' knowledge of the child/ren as a basis for necessary adaptations. This way, the flow of the activity will be better adapted to the specific child/ren.

5. **Tips** for success. When planning the activity, it is important to identify the essential components of the activity in terms of children's engagement with the concepts and the dynamic being created. Sharing those key points will better support families/caregivers to develop the activity.

6. Clear expectations about what, where, and how to be returned as a **result/product** of the activity to the teacher. Some activities will result in products that can be shared (drawings, videos, collages, etc) others will be immaterial. From the start, it is useful that families/caregivers know what is expected to be produced from the activity. This might be a short paragraph about the experience, a video of the child/ren reporting on their satisfaction/learning, or artefacts that were created.

7. **Follow-up activities**. If the experience is positive, families/caregivers might wish to extend or deepen the activity. Some suggestions for follow-up activities can support this. These might entail changing the materials, inverting the order of the steps, harder challenges, involving other people, etc.

Technology and resources for distance education

Many learning apps and tools can facilitate learning exchanges and student engagement. Mentimeter, Padlet, Canva, Miro are just some of the endless tools that can provide children with new ways of working together and creatively online.

When using technology with children, some considerations are needed. Overall, teachers and families/caregivers have a responsibility to protect and empower children by helping them learn to ask questions and think critically about the technologies and media that are used. For a more detailed position, the National Association for the Education of Young Children and the Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College (2012) issued a joint statement whose key messages are:

1. When used intentionally and appropriately, technology and interactive media are effective tools to support learning and development.

2. Intentional use requires early childhood teachers and administrators to have information and resources regarding the nature of these tools and the implications of their use with children.
3. Limitations on the use of technology and media are important.
4. Special consideration must be given to the use of technology with infants and toddlers.
5. Attention to digital citizenship and equitable access is essential.
6. Ongoing research and professional development are needed.

The Developmentally Appropriate Technology in Early Childhood (DATEC) project identified seven general principles for determining the effectiveness of ICT applications – or uses of ICT – in the early years, to help practitioners provide the best possible experiences (Siraj-Blatchford, & Siraj-Blatchford, 2000). This is still relevant today and can be used as a useful tool to evaluate software programs or other ICT applications and to consider while preparing distance education for children:

1. Ensure an educational purpose.
2. Encourage collaboration.
3. Integrate with other aspects of the curriculum.
4. Ensure the child is in control.
5. Choose applications that are transparent (ie their functions should be clearly defined and intuitive so the application can complete each task in a single operation).
6. Avoid applications containing violence or stereotyping.
7. Be aware of health and safety issues.

Teachers can decide which materials are most likely to help children achieve the learning goals outlined. Interactive materials make learning more interesting, practical, concrete, and appealing. Besides choosing resources for the activities suggested by teachers, it has proven useful to indicate apps and resources that are of good quality for parents/caregivers to explore on their own. Teachers can evaluate if some guidance for each suggestion will be helpful.

SELF-EVALUATION AND REFLECTION

Gaining feedback and **reflecting on practice** is important for both teachers and learners, and this is another area where distance education offers its own opportunities and challenges.

Good pedagogy and the role of the adult

Research on teaching has shown that some key practices are impactful in terms of learning. Some **principles of good-quality teaching** have been summarized by Coe, Aloisi, Higgins, and Major (2014).

Content knowledge

This is when teachers have a deep knowledge of the subject that they teach and can communicate content effectively to their students. As well as a strong understanding of the material being taught, teachers must also understand the ways students think about the content, be able to evaluate the thinking behind students' own methods and identify students' common misconceptions.

Quality of instruction

There is also strong evidence of the impact the quality of instruction can have on learning. This includes teachers being skilled in effective questioning and the use of assessment. Good teachers also deploy techniques such as reviewing previous learning, and giving adequate time for children to practise, meaning skills are embedded securely. When done well, teachers scaffold students' learning by progressively introducing new skills and knowledge.

Teaching climate

The quality of the teaching and learning relationships between teachers and students is also very important. Good teaching creates a climate that constantly demands more, and pushes students to succeed. A good teaching climate challenges students, develops a sense of competence, attributes success to effort rather than ability, and values resilience to failure.

Classroom management

There is moderate evidence of the impact on students' learning of: efficient use of lesson time; co-ordinating classroom resources and space; and managing students' behaviour

with clear rules that are consistently enforced. These factors are perhaps the necessary conditions for good learning but are not sufficient on their own. A well-ordered classroom with an ineffective lesson will not have a large impact.

Teacher's beliefs

There is some evidence to show the reasons why teachers adopt particular practices and the purposes or goals that they have for their students are also important. For example, research indicates that primary school teachers' beliefs about the nature of mathematics and their theories about how children learn – and their role in that learning – are more important to student outcomes than the level of mathematics qualification the teacher holds.

Professional behaviours

Developing professional skills and practice, participating in professional development, supporting colleagues and the broader role of liaising and communicating with parents also have a part to play in effective teaching.

The **role of the teacher** is, therefore, a crucial one. Whether in-person or in distance education, the teacher's role is to facilitate continued learning and interaction opportunities. The adult's intervention in Early Childhood Education is normally considered in terms of stimulation, sensitivity, and promotion of autonomy (Laevers, 2005). A good way to think about these dimensions of the adult style is to answer the following questions about oneself:

Do you, as the teacher, intervene in a "stimulating" way?

Which means: you sense what a child is interested in and you give experiences that make children more involved in their activities.

Do you relate to children in a sensitive way?

Which means: you are very much aware of children's feelings and you respond adequately to their basic needs (the need for attention and affection, for clarity and affirmation, for understanding of their emotions).

Do you offer children autonomy?

Which means: you give children the space to follow their own interests, to experiment, to determine when something is "finished", to participate in the making of agreements and solving conflicts.

In distance education, these questions are to be addressed in an amplified way: during the interactions, focused on the activity proposals that are shared with families/caregivers, and as pointers for the other adults that interact with the children to use for understanding their own intervention.

These three dimensions come across or underlay important aspects of the teacher's actions in Early Childhood Education, such as: sustaining shared thinking; observing, waiting, listening (OWL); introducing new vocabulary; scaffolding children's learning; observing, then building on the child's ideas; praising and encouraging to build confidence; promoting independence and problem-solving; and using all opportunities for learning in a natural way.

While focusing on the role of the adult, it's important to consider the educational environment as part of the intervention. Adults' interaction with children is only part of what pedagogy is about in Early Childhood Education (Figueiredo, Gomes, & Rodrigues, 2018). A combined approach to evaluate how the educational offer is impacting the children is useful. Laevers (2005) self-evaluation instrument for providers answers the question "How are children doing?" by giving practitioners immediate feedback on the impact of their approach.

The Leuven Scales are a form of assessment developed by Ferre Laevers and his team at Leuven University in Belgium. There are two five-point scales that allow childcare practitioners to measure children's "emotional well-being" and "involvement" – two vital components of learning, development, and progress in children.

Ferre Laevers believes that when children have high levels of **well-being** they will display the following; Children in a state of well-being feel like "fish in water". The prevailing mood in their lives is pleasure: they have fun, enjoy each other's company and feel good in their environments.

Similarly, high levels of **"involvement"** – characterised by curiosity, fascination, deep satisfaction, and a genuine interest in what they are doing – is an indicator of "deeper-level", meaningful learning. These signs of a child's "involvement" are also directly linked to the characteristics of effective teaching.

But its major contribution lies in the discovery and conceptualization of well-being and involvement as key indicators of **process quality**. This is the most conclusive way to assess the quality of any educational or care setting. Even how limited it may be, any increase in the levels of well-being and involvement means children are getting emotionally stronger and are developing at a deeper level within the areas of development that are addressed

while they are engaged. With these two measures, teachers get the tools to maximize their impact for the benefit of children today and the adults they become.

Self-evaluation and reflection

Self-evaluation is an important attitude and process for all teachers. It involves celebrating what is working well to build confidence while at the same time exploring new ways of working. It's a way of keeping the discussion about what constitutes quality alive and, through that, highlighting areas for improvement in provision and practice. It also entails reflecting on the teachers' roles – individually and collectively. Being reflective means to learn, extend and refine by: a) clarifying what you are aiming to achieve, b) reflecting on current practice, c) identifying and celebrating areas where the provision is good and therefore needs to be maintained, d) identifying and prioritising areas which need to be improved, e) planning for development, f) engaging in professional development, and g) raising the standards of the provision.

Evaluation informs practice by applying critical thought or analysis to a situation. Together with reflection, it can be part of transforming practice. To bring about the required changes, different levels and people need to be involved and take responsibility for it so that it is not just left to one person. Through observations, but also through team meetings or the use of process-oriented or formal assessment documents (e.g., "Highscope Program Quality Assessment" (HighScope Foundation, 2023), "Together Towards Improvement/Evaluating Preschool Education" (Education and Training Inspectorate Northern Ireland, 2017)), professionals can use reflection as part of self-evaluation and improvement. The process of reflection potentially leads to more than just a gain in your knowledge; it should also challenge the concepts and theories by which you make sense of that knowledge.

Reflection can be thought of as:

- Self awareness: thinking of yourself, your experiences and your view of the world,
- Self improvement: learning from experiences and wanting to improve some area of your life,
- Empowerment: putting you in control of making changes and behaving in a different way.

There are many different **models of reflection**. Using models, or at least being aware of their similarities and differences, can help you to deconstruct experiences, ensure you are accessing the deeper level of reflective questions and issues, and ultimately provide a way to structure your learning from situations.

Schön's model

Schön's (1983) theory is that there are several types of reflection. Two important ones are: during and after an activity or event. An aspect of Schon's theory looks at learning from experiences using the tool of reflection which can be applied both during the experience and after it happens. This is known as Reflection In Action and Reflection on Action.

This model has the strength of considering reflection in action (during an event/experience) with those that happen in hindsight (after the event).

Driscoll's the 3 Whats

This model (Driscoll, 2007) centres on three questions: What?, So what? & Now what? (or What next?):

What – description of the event that happened in your professional practice – Trigger questions: What…

… is the purpose of returning to this situation?

… happened?

… did other people do who were involved in this?

… did I see/do?

… was my reaction to it?

So What – analysis by reflecting on specific important aspects – Trigger questions: So what…

… did I feel at the time of the event?

… are my feelings now, after the event, any different from what I experienced at the time?

… were the effects of what I did (or did not do)?

… positive aspects now emerge for me from the event that happened in practice?

… have I noticed about my behaviour in practice by taking a more measured look at it?

… observations does any one helping me to reflect on my practice make of the way I acted at the time?

… is the purpose of returning to this situation?

Were those feelings I had any different from those of other people?

Who was also involved at the time?

Did I feel troubled, and if so, in what way?

Now What? – proposed actions following the event – Trigger questions: Now what…

…are the implications for me and others in practice based on what I have described and analysed?

…difference does it make if I choose to do nothing?

…is the main learning that I take from reflecting on my practice in this way?

…help do I need to help me "action" the results of my reflections?

…aspect should be tackled first?

Where can I get more information to face a similar situation again?

How can I modify my practice if a similar situation arises again?

How will I notice that I am any different in practice?

Gibbs' Reflective Cycle

It was developed by Graham Gibbs (1988) to give structure to learning from experiences. It offers a framework for examining experiences, and given its cyclic nature lends itself particularly well to repeated experiences, allowing you to learn and plan from things that either went well or didn't go well. It covers 6 stages: *a)* Description of the experience, *b)* Feelings and thoughts about the experience, *c)* Evaluation of the experience, both good and bad, *d)* Analysis to make sense of the situation, *e)* Conclusion about what you learned and what you could have done differently, and *f)* Action plan for how you would deal with similar situations in the future, or general changes you might find appropriate.

Gibb's model acknowledges that your personal feelings influence the situation and how you have begun to reflect on it. It builds on Boud's model by breaking down reflection into the evaluation of the events and analysis and there is a clear link between the learning that has happened from the experience and future practice.

However, despite the further breakdown, it can be argued that this model could still result in fairly superficial reflection as it doesn't refer to critical thinking/analysis or reflection. It doesn't take into consideration assumptions that you may hold about the experience, the need to look objectively at different perspectives, and there doesn't seem to be an explicit suggestion that the learning will result in a change of assumptions, perspectives, or practice. You could legitimately respond to the question "What would you do next time?" by answering that you would do the same, but does that constitute deep-level reflection?

As the Laevers (2005) approach as shown, taking into consideration **children's perspectives** is an important part of self-evaluation. Article 12 of the Convention on the Rights of the Child (UNCRC, 1989) recognises that a child has the right to express an opinion and have

that opinion taken into account in any matter affecting their lives. The article respects the views of all who are significant in the child's life and places an obligation on adults to ensure that children are enabled and encouraged to contribute their views on all relevant matters – if they want to. This does not mean that whatever children say must be complied with – simply that their views are given proper consideration based on their level of knowledge of the issues. Childhood is the perfect time to develop foundational digital literacy skills, such as critical thinking, problem-solving, and online communication. Technology also allows for different ways of expressing their ideas. In challenging contexts like distance education, listening to children and families/caregivers will be essential for improving practice and developing oneself as an educator.

Some general topic insights

1. Distance education doesn't have a long tradition in Early Childhood Education but different experiences throughout the world and, particularly, the COVID-19 pandemic have allowed for challenges and good practices to be identified. This has been the result of research and reflective practice through which it is possible to build professional knowledge that supports others in providing quality education for children.
2. Distance education in Early Childhood Education works best as a combination of synchronous video calls, best suited for interaction, and asynchronous activities that are suggested by the teacher and implemented by families/caregivers. The basis for this articulation is good, frequent, and open communication between the teacher and the families/caregivers. Good resources and educational intentionality are also key aspects.
3. Reflecting on one's own practice is strong support for growing as a professional. Based on evidence collected during the sessions and a constant drive for self-evaluation, practice can be questioned and improved. Through this attitude and process, it is possible to enhance the opportunities and experiences of and for children.

Teaching Materials

In "Lesson Plans from the Higher Education Course Curriculum for a Distance Learning Model Reinforced with Robotics for 3 to 7 Years Old Children", you will find lesson plans, worksheets, and handouts. In www.earlyeu.org , you can also find slide presentations.

Assessment

Have these learning outcomes been achieved?

- Identify elements and challenges of distance education in Early Childhood Education.
- Develop lesson plans for relevant distance education experiences for Early Childhood Education.
- Explain strategies for self-evaluating practice in Early Childhood Education

How are they reflected in the Lesson Plan (lesson 1 and 2) and in the Audit (lesson 2)?

References

Atiles, J., Almodóvar, M., Vargas, A. C., Dias, M., & León, I. (2021) International responses to COVID-19: challenges faced by early childhood professionals, *European Early Childhood Education Research Journal, 29*(1), 66-78, DOI: 10.1080/1350293X.2021.1872674

Coe, R., Aloisi, C., Higgins, S., & Major, L. E. (2014). *What makes great teaching? Review of the underpinning research*. The Sutton Trust. https://www.suttontrust.com/our-research/great-teaching/

Dong, C., Cao, S., & Li, H. (2020). Young children's online learning during COVID-19 pandemic: Chinese parents' beliefs and attitudes. *Children and Youth Services Review, 118*, DOI: 10.1016/j.childyouth.2020.105440

Driscoll, J. J. (2007) Supported reflective learning: the essence of clinical supervision? In J. J. Driscoll (ED.), *Practising Clinical Supervision: A Reflective Approach for Healthcare Professionals* (2nd ed., pp. 27-50). Bailliere Tindall.

Early Years – the organisation for young children (2014). *Are you Making a Difference? Improving Outcomes for All Children – a Step by Step Guide to Self-Evaluation*.

Education and Training Inspectorate Northern Ireland (2017). Together Towards Improvement/Evaluating Preschool Education. https://www.etini.gov.uk/publications/inspection-and-self-evaluation-framework-isef-effective-practice-and-self-evaluation

Fenmachi, E.A., & Edah, R.O. (2022). Distance Learning in Cameroon: Case Study of Private Nursery School Children's Experiences and Challenges Amidst COVID-19 Lockdown. *NZ Journal of Educational Studies, 57*, 589–606. DOI: 10.1007/s40841-022-00255-2

Figueiredo, M. P., Gomes, H., & Rodrigues, C. (2018). Mathematical pedagogical content knowledge in Early Childhood Education: Tales from the 'great unknown' in teacher education in Portugal. *European Early Childhood Education Research Journal, 26*(4), 535–546. DOI: 10.1080/1350293X.2018.1487164

Gibbs, G. (1988). *Learning by Doing: A guide to teaching and learning methods*. Further Education Unit. Oxford Polytechnic.

Hao, W. (2020). Remote Learning in Early Childhood. Policy update, 27(6), 1-2.

HighScope Foundation (2023). Highscope Program Quality Assessment. https://highscope.org/our-practice/pqa

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The Difference Between Emergency Remote Teaching and Online Learning. *Educause Review*, Available at: https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning

Laevers, F. (Ed.). (2005). *Sics/Zicko. Well-being and Involvement in Care Settings. A Process-oriented Self-evaluation Instrument*. Kind & Gezin e Research Centre for Experiential Education.

National Association for the Education of Young Children and the Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College (2012). *Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth through Age 8*. Joint position statement. Available at: https://www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/resources/position-statements/ps_technology.pdf

O'Keeffe C., & McNally, S. (2021). 'Uncharted territory': teachers' perspectives on play in early childhood classrooms in Ireland during the pandemic. European Early Childhood Education Research Journal, 29(1), 79-95, DOI: 10.1080/1350293X.2021.1872668

Saykılı, A. (2018). Distance education: Definitions, generations, key concepts and future directions. International Journal of Contemporary Educational Research, 5(1), 2-17.

Schön, D. A. (1983). *The reflective practitioner*. Jossey Bass.

Siraj-Blatchford, I. & Siraj-Blatchford, J. (2000) More than Computers: Information and Communications Technology in the Early Years, London, Early Education. The British Association for Early Childhood Education.

Soares, A. R. (2021). Percurso formativo em Educação Pré-Escolar e 1.º Ciclo do Ensino Básico: descobrir e aprender em família [Learning journey in early childhood and primary education: searching and learning with families]. Final report of the Masters' Degree in Early Childhood and Primary Education. School of Education, Polytechnic of Viseu, Portugal. https://repositorio.ipv.pt/handle/10400.19/7238

The United Nations Convention on the Rights of the Child (UNCRC, 1989) https://www.unicef.org.uk

MODULE 5

Building Partnerships for Learning

Module Description

In Europe, the early childhood education and care (ECEC) system includes publicly and privately funded, pre-school and pre-primary provision, centre-provided and "family day care". This educational community managed according to different legislation and regulations. Throughout Europe, however, the first educating community is the family, and, where possible, the 0-year nursery school. In many European nations, pre-education in kindergarten has become mandatory from the age of three. In some countries, such as Italy, coding and the use of age-appropriate digital technologies has become a compulsory part of the curriculum in state and municipal kindergartens.

The rules in Europe, as defined by the EC European Education Area, norm that "Every child in the European Union (EU) has the right to affordable and high-quality early childhood education and care, as outlined in the European Pillar of Social Rights. Educational attainment should be decoupled from social, economic and cultural status (..) Early childhood education and care has been identified as a priority area for cooperation under the European Education Area initiative for the period 2021-2030". [1]

The educational community of children from 0 to 6 and 7 years is the complex social structure that includes parents and families, public and private kindergarten, religious centres, schools in hospitals, play centres, sports and religious centres, up to the media by which children can be influenced, and educated. All these figures can – and should – work together to develop all the children's abilities and potential.

The children can live with the family, or go to kindergarten and then return home, or, if the parents work or the children like it, they can continue their day in play centres, other private facilities or with relatives.

In relation to the possibilities of remote digital education for children, it is certain that the educational community, at local and national level, can support the families, especially when they do not have digital devices or the skills to use digital educational platforms and tools.

Computational Thinking (CT) and Educational Robotics are crucial fields that offer a strong foundation for students in a rapidly changing world. These skills are increasingly in demand in the modern workforce, and schools are now taking note. However, teaching CT and Robotics within the school's curriculum alone is inadequate for students to achieve their full potential. To expand students' worldview and build social and communication skills that

[1] https://education.ec.europa.eu/education-levels/early-childhood-education-and-care/about-early-childhood-education-and-care

contribute to their future success, it is essential to develop activities and projects that also involve partners outside the school.

This module focuses on developing activities and projects related to CT and Educational Robotics that involve partners in the European educational system and the whole educational community. The goal is to teach future teachers how to work with the local, national, and European educational community to establish partnerships that contribute to learning computational thinking skills from an early age.

By contextualising the learning, students can see how CT and Educational Robotics are applied in real-world settings, and they can better understand how these skills can be valuable in their future careers.

Working with the educational community outside the school provides an excellent opportunity for students to build their social and communication skills. This module provides prospective teachers with the tools they need to facilitate group discussions, provide constructive feedback, and encourage collaboration and teamwork. These skills are critical not only for success in CT and Educational Robotics applications to education also for success in any career.

Summarising, the module focuses on developing activities and projects related to CT and Educational Robotics that involve families and the whole educational community and it is an essential step in supporting pre-service teachers to develop some ideas about how to involve all the partners that compose the educational community. By working with partners in and outside the school systems, they can contextualise learning, design engaging activities and projects, and build valuable social and communication skills. This approach to learning is essential in a rapidly changing world, where digital skills are increasingly in demand.

Module Structure

LEARNING OBJECTIVES

Participants will be able to:

1. Understand the role of the educational community at local, national and European level. They will be able to contextualise their educational activities in the community.

2. Understand how strong Partnerships for Learning can support ECE learning, and how they can activate and cooperate with it.

3. Understand how educational centres outside the school can support ECE learning, and how they can be involved in the process.

4. Understand the role of parties and non-competitive challenges to support learning.

5. Be part of the European educational community and design projects to be submitted in the European Educational Area Call (Erasmus plus, etc.).

TEACHING METHODS AND TECHNIQUES

- Face to face frontal learning
- Activity-based teaching method
- Peer collaboration
- Discussion techniques: (think, pair, share)
- Individual, small and large group activities.
- Simulation and design activities for the creation of extended partnership alliances.

Module Content: Theoretical Information

Several social structures are involved in early childhood education outside of schools: parents, families, carers, early childhood playground, schools in hospitals, religious centres, etc. All these educational figures can support children's learning in different ways, according to their skills and expertise, and also to the kind of relationships they have with families and children. Involving parents and other members of a family in developing computational thinking skills to children in early childhood can be a valuable and effective approach. Families play a critical role in their child's learning and development and

involving them in the learning process can have numerous benefits for the child. Here are some ways in which parents can be involved. Students are invited to identify and develop some means and ways to enter in contact with children's families and develop a fruitful collaboration with them.

Students should also identify the needs of families where they do not have the facilities to work on educational platforms nor the skills to do so. In these cases, even more, alliances with partners outside the families become crucial.

It may be that public and private school facilities, kindergartens and play centres do not have the digital communication equipment and skills required either. Here, too, it will be necessary to find partners who support online communication.

- Workshops: Organising workshops for families on computational thinking can be an excellent way to involve them in their child's learning. The workshop can cover basic concepts of computational thinking and provide parents with ideas for activities they can do with their child at home.
- Home activities: Providing families with activities they can do with their child at home can reinforce computational thinking skills. These activities can be simple, such as playing pattern games or sorting objects based on different attributes, or more complex, such as building simple robots or coding with block-based programming languages.
- Parents/families-teacher meetings: Meetings with parents can be an excellent opportunity to discuss the child's progress in computational thinking and provide feedback on how parents can support their child's learning at home.
- Parents/Families/educational centres, volunteer programs: Creating a parent volunteer program can be a great way to involve parents in the classroom and support their child's learning. Parents can come into the classroom and help with activities, share their skills and knowledge, and provide support to the teacher.
- Family events: Organizing family events, such as science fairs or maker fairs, can be a great way to involve parents in their child's learning and showcase the child's computational thinking skills. These events can also provide an opportunity for parents to interact with other parents and share ideas for supporting their child's learning.

The following paragraphs identify steps to form alliances and partnerships for the implementation of online education for children. In addition, students will find guidance on how to be inspired by European experiences and how to link up with European initiatives to organise events and small competitions in coding and educational robotics for children.

Europe (EC Commission, European Parliament) encourages the creation of extended Partners for pre-school education and has recently invested in EU Code Week at all levels,

including pre-primary, precisely to promote educational communities on the development of digital competences.

MAPPING AND IDENTIFYING NATIONAL AND LOCAL INITIATIVES FOR THE DEVELOPMENT OF DIGITAL SKILLS FOR EARLY AGE

Students should identify which educational figures in the national and local community they can call upon to structure a proactive collaboration. These can be both public and private schools and educational centres such as playgrounds, museums, libraries, parents' associations, sports centres, etc. Students should be able to apply digital skills activities for early years in the communities they surveyed and apply their experience to modulate games, events and other educational activities to the chosen context.

For example, if the partner were a sports association, students could design algorithmic games inspired by sport and play.

Another example is children's playgrounds. In this case, it would be possible to design interactive games using the park's own digital technology material. In this way, children would continue to develop their digital skills remotely.

PROFILING THE IDENTIFIED PARTNERS OF THE EDUCATIONAL COMMUNITY

Once the map of potential educational community partners has been identified, the students should prepare a dedicated survey to analyse each partner's characteristics, capabilities and possibilities for collaboration. This can be carried out either at national or local level.

On a national level, this map can represent the National Alliance dedicated to the students' project goals. This alliance can draw up an educational programme that can be presented at various levels, not least the respective Ministries of Education.

At the local level, students can decide with their potential partners which common activities to carry out.

BUILDING LOCAL AND NATIONAL EDUCATIONAL COMMUNITIES

2023 has been designated by the European Commission as the Year of Skills and several initiatives have been launched to build National Alliances for digital education and skills. The initiatives will not be limited to 2023, but from this year they will extend to 2027.

National coalitions are multi-stakeholder partnerships that bring together a range of partners with the aim of developing concrete measures to deliver digital skills to every level of society in their countries. Involving educational centres outside schools (such as NGOs, business, museums, libraries, community centres and other organisations), in teaching computational thinking skills to children in early childhood can be a valuable approach. These entities bring different perspectives, resources, and expertise to the educational activities, which can enhance children's learning experience.

WORKING WITH THE NATIONAL AND LOCAL EDUCATIONAL COMMUNITIES

Involving educational centres outside schools in teaching computational thinking skills to children in early childhood can be a valuable approach. These entities bring different perspectives, resources, and expertise to the educational activities, which can enhance children's learning experience. Here are some ways in which they can be involved in teaching computational thinking skills to children:

1. Guest speakers: Inviting experts to give talks or conduct workshops can be an effective way to expose children to different perspectives and ideas. They can provide children with real-world examples of how computational thinking can be applied to solve social and environmental problems.
2. Collaborative projects: Collaborating with external entities on projects can be an excellent way to integrate computational thinking skills into real-world contexts. For example, children can work with them to develop an application to raise awareness about a social issue (such as sustainability awareness).
3. Mentoring programs: Establishing mentoring programs between external organisations and children can be an effective way to provide individualised support and guidance to children. Mentors can help children develop their computational thinking skills and provide them with feedback and guidance on their projects.
4. Resource sharing: external bodies can provide resources such as software, hardware, and learning materials to enhance children's learning experience. Moreover, they can provide professional development opportunities for teachers to improve their knowledge and skills in teaching computational thinking.

EVENTS AND NON-COMPETITIVE CHALLENGES

Parties, other events, and non-competitive challenges can be used in early childhood education to foster computational thinking and encourage engagement with parents, caregivers, and other external entities. These types of events must be designed to be fun

and engaging while also teaching children fundamental computational thinking concepts. One example is the Lego Challenge for Kids and the EU Code Week, two events we will talk about.

Here are some ways in which parties and non-competitive challenges can be used:

1. Coding parties: Hosting coding parties is a great way to make coding fun and engaging for children. Coding parties can involve various coding activities, including coding games, building simple robots, physically based games to learn algorithmic thinking. By involving parents and caregivers, these parties can also help to foster collaborative learning and promote parent-child interactions.
2. Design challenges: Design challenges, such as creating a bridge or building a tower, can be an excellent way to teach children about the design process and computational thinking concepts such as problem-solving and algorithm development. These challenges can be done in groups, with children working with their parents and caregivers or other external entities, to promote teamwork and collaboration.
3. Hackathons: Hackathons are events where participants collaborate on solving problems using technology. These events can be tailored to children, and they can be an excellent way to encourage children to use computational thinking to solve real-world problems. Parents and caregivers can also participate in these events, providing support and guidance to the children.
4. Puzzle challenges: Puzzle challenges can involve different types of puzzles. These challenges can help children develop logical thinking and problem-solving skills, which are important components of computational thinking.
5. Robot challenges: Robot challenges involve building and programming robots to complete a specific task. These challenges can be done in groups, and children can work with their parents and caregivers to design and program the robots. These challenges can promote creativity, problem-solving, and teamwork while also teaching children about the basics of programming and robotics.

NATIONAL AND EUROPEAN EVENTS ABOUT CODING AND PROGRAMMING

There are national and European events dedicated to coding and educational robotics where even 4-5 year old can participate. Among these, we mention the Junior section of the First Lego League and the Eu Code Week. EU Code Week aims to mainstream coding, computational thinking, and digital literacy in educational settings and boost new ideas by bringing motivated people together.

We can also mention the Meet and Code contest.

By participating in these events, children can submit their creations, drawings, flowcharts, videos, and participate in online Finals with great enthusiasm.

THE EU CODE WEEK BOOTCAMP FOR PRE-PRIMARY

The EU Code Week Online Bootcamp is a new EU Code Week MOOC that will provide pre-primary, primary and secondary school teachers with practical ideas, tools and resources to help them bring coding and computational thinking into the classroom. Teachers will raise awareness of diversity and inclusion in coding and explore the potentials of artificial intelligence in education.

In this three-module course, they will experiment with new learning materials and challenges, and they will create their own activities. Teachers will be introduced to the EU Code Week initiative and the opportunities it offers. They will connect with like-minded peers and become part of a community that fosters collaboration, teamwork and exchange of good practice and stimulates discussion and reflection. This MOOC will be organised around the concept of blended learning with onsite study-groups working alongside the online course.

https://twitter.com/hashtag/OnlineBootcampMOOC

https://www.europeanschoolnetacademy.eu/courses/course-v1:CodeWeek+OnlineBootcamp+2021/about

CONCLUSION

Involving the whole educational community in promoting computational thinking skills to children in early childhood face-to-face and online can be a valuable and effective approach. Parents, families, and the whole educational community in which children live play a critical role in promoting children's digital skills and involving them in the learning process can have numerous benefits.

Developing partnerships, whether institutional or voluntary, will be crucial, especially to support those families, or school facilities, that lack digital equipment and the skills to use it. These partnerships, by providing workshops, home activities, parent-teacher meetings, parent volunteer programs, and family events, can become a unique development system for the whole community and be the centre of new aggregations (e.g., inclusion activities, adult education, support for the elderly).

Teaching Materials

In “Lesson Plans from the Higher Education Course Curriculum for a Distance Learning Model Reinforced with Robotics for 3 to 7 Years Old Children”, you will find lesson plans, worksheets, and handouts. In www.earlyeu.org , you can also find slide presentations.

Assessment and Worksheets

At the end of each lesson, there is an Assessment sheet.

Students, working in groups, are invited to prepare projects that can be implemented in class to support computational thinking skills, through the cooperation of an educational community.

References

Bers, M. (2020). *Coding as a Playground*. Routledge

Bers, M. (2012). *Designing Digital Experiences for Positive Youth Development: From Playpen to Playground*. Oxford.

Bers, M., New, R., & Boudreau, L. (2004). Teaching and Learning when no one is Expert: Children and Parents Explore Technology. *Early Childhood Research and Practice, Vol. 6/2*. Retrieved June 2023, from https://files.eric.ed.gov/fulltext/EJ1084881.pdf

Bower, M., & K. Falkner (2015). Computational thinking, the notional machine, pre-service teachers, and research opportunities. In D. D’Souza & K. Falkner (eds.), *Proceedings of the 17th Australasian Computing Education Conference (ACE 2015)*, Australian Computer Society. Retrieved June 2023, from http://crpit.com/confpapers/CRPITV160Bower.pdf

Dredge, S. (2014). *Coding at school: a parent’s guide to England’s new computing curriculum*, The Guardian. Retrieved June 2023, from https://www.theguardian.com/technology/2014/sep/04/coding-school-computing-children-programming

Eurydice background report (2022). Structural indicators for monitoring education and training systems in Europe. *Early childhood education and care*, pp. 5-13. Retrieved June

2023, from https://www.anefore.lu/wp-content/uploads/2022/11/Structural_indicators_2022.pdf

Govind, M. (2019). *Families that code together learn together: Exploring family-oriented programming in early childhood with ScratchJr and KIBO Robotics*. Unpublished master's thesis, Tufts University. Retrieved June 2023, from https://www.proquest.com/openview/b6e09d5cd97111e917a467963738358d/1?pq-origsite=gscholar&cbl=18750&diss=y

Govind, M., & Bers, M. (2020). Family Coding Days: Engaging Children and Parents in Creative Coding and Robotics. In J. Kalir & D. Filipiak (eds.), *Proceedings of the 2020 Connected Learning Summit*, Carnegie Mellon University: – ETC Press, Pittsburgh, PA. Retrieved June 2023, fromhttps://2020.connectedlearningsummit.org/proceedings/

Karpiński, Z., G. Di Pietro, & F. Biagi (2021). *Computational thinking, socioeconomic gaps, and policy implications,* IEA Compass: Briefs in Education No. 12. Retrieved June 2023, from https://www.iea.nl/publications/seriesjournals/iea-compass-briefs-education-series/january-2021-computational

Schola Europaea – Office of the Secretary-General (2022, September). Early Education Curriculum – Nursery and Primary Cycles of the European Schools. Retrieved June 2023, from https://www.eursc.eu/Syllabuses/2022-01-D-42-en-2.pdf

Redmond, P. et al. (2021). Primary teachers' self-assessment of their confidence in implementing digital technologies curriculum. *Educational Technology Research and Development, Vol. 69/5*, pp. 2895- 2915. DOI: 10.1007/s11423-021-10043-2

Relkin, E. et al. (2020). How Parents Support Children's Informal Learning Experiences with Robots. *Journal of Research in STEM Education*, Vol. 6/1, pp. 39-51. DOI: 10.51355/jstem.2020.87

Rideout, V. (2014). *Learning at Home: Families Educational Media Use in America*, The Joan Ganz Cooney Center at Sesame Workshop, https://joanganzcooneycenter.org/publication/learning-at-home

Sinno, S., & Killen, M. (2009). "Moms at Work and Dads at Home: Children's Evaluations of Parental Roles". *Applied Developmental Science, Vol. 13/1*, pp. 16-29. DOI: 10.1080/10888690802606735

ANNEXES

Video Tutorials

A – Video Tutorial Scripts

Children's Involvement in Distance Education

Preparation of the Learning Environments

Selection of Platforms for Children's Well-being

Distance Education Tools

Communication and Relationship in the Distance Education Process

Parents/Carers Role Supporting their Child during the Online Training Process

Ethical Issues and Involvement

B – Video Tutorials

https://www.earlyeu.org

Children's Involvement in Distance Education

Script 3:15

Distance education requires children to concentrate without the environment of the early childhood centre to support their concentration. When doing activities with family members or when participating in online sessions with teachers, children need to be engaged or involved so that there is learning and development taking place.

Young children have short attention spans. Research on child development indicates that a child's ability to pay attention is related to their age. The general rule of thumb is that a child should have an attention span for 2–3 minutes per year of the child's age.

By 25–36 months, children learn to participate in activities like playing and can stay attentive for 5–8 minutes. When they reach 3–4 years of age, they learn how to shift their attention between a parent talking to them and the activity they are doing. Their attention span is generally in the range of 8–10 minutes.

Remember that many things impact children's concentration: being hungry, having distractions in the room, and not being interested in the activity will lead to less focus.

Concentration is one important part of being engaged with the activity. Another important indicator that the child is engaged is persistence. When concentrating, the children direct their full attention and energy towards one point and are 'captured' by the activity. They are not easily distracted by others or stopped by obstacles. It is when they are engaged that children can surprise us with the duration of their concentration.

Ferre Laevers has highlighted other signals to notice that the activity is relevant for the child. One is the energy that is put into what is being done. This could be loud, like a lively pace of actions, or very quiet, as displaying zeal in what is done. Complexity and creativity are also important indicators. Children engage with activities that are somewhat challenging, that they can add an individual touch to, bringing in their own elements.

Engagement is easily perceived in the children's facial expressions and posture. Non-verbal signs are a great help when identifying involvement. It is, for instance, possible to distinguish between eyes staring dreamily into space and an intense look. For example, during storytelling feelings and moods can be observed straight from the child's face. The overall posture can reveal high concentration or boredom.

There are other indicators – satisfaction, precision, reaction time, language… but they all point to the same: involvement can be recognised by concentration and persistence. It involves motivation, interest, and fascination and is accompanied by deep satisfaction and a strong flow of energy.

High levels of involvement show 'deep-level' meaningful learning – which is very important for the children and for the adults caring for them!

By using the indicators as lenses when looking at children, we can start to identify when a change is going to be needed – because the involvement is lowering.

Changes can be made to the surroundings, like lessening the distractions, for example.

A small break before continuing is also a good idea. Managing emotions during the activity – especially frustration – is very helpful.

It can also be the case that the presence or closeness of the adult is needed. A joyful partner in the activity, or in listening to a story, helps the child to stay involved. In general, making things fun and interesting by modelling enthusiasm and curiosity is a great way to promote engagement.

Preparation of the Learning Environments

Script 03:37

As we all know, the preschool period is a critical period in which rapid progress is made in all areas of development and affects a child's whole life. In these preschool years, which are so important in terms of cognitive development, personality and social development, the role of the teacher and the learning environment is critical.

In the preschool period, it is important that learning environments are suitable for the developmental characteristics of children and are of a quality that will meet their educational needs. In order to obtain maximum efficiency, the learning environment should provide creative opportunities for children, be suitable for exploration and for active learning opportunities. An educational environment that offers suitable learning opportunities for developmental characteristics increases quality in early childhood.

With the COVID-19 pandemic, which affected the whole world, there has also been a change in educational environments. Necessary arrangements should be made for children to adapt in education which has moved from the classroom environment to the home.

First of all, teachers must be competent in distance education.

- The preschool teacher must have a strong Internet connection and sufficient technological equipment.
- Before the education process begins, the process should be planned in detail to meet the needs of preschool children.
- This planned educational process and crucial materials should be shared with families and besides families should be given information about the process.
- It should be ensured that families and children have adequate equipment and Internet access.
- Integration of distance education and teaching strategies should be effectively managed.
- Considering the developmental characteristics of preschool children, the educational process should be supported with visual and concrete materials.
- In order not to distract children, short breaks should be given and an active-passive balance should be ensured in activities.
- Teachers should use Web 2.0 tools to involve children in the process for synchronous education.
- Equipment used should be suitable for the physical development of children.

- Collaboration and support should be sought from families during distance education.
- Online education platforms such as Zoom, Google Classrooms and Teams can be used.
- During the distance education process, Web 2.0 tools should be used to communicate and collaborate with families.

Taking these suggestions into consideration will ensure that a quality learning environment will be established to meet the individual needs of children.

Selection of Platforms for Children's Well-being

PART 1. Important information before using platforms with children

Script 2:46

Children and young people are inevitably online. Sooner or later, they will come into contact with the possibilities offered by the Internet. Also, the COVID-19 pandemic, or other individual circumstances, has forced learners at all educational levels to move their traditional educational environment to a remote format. For this reason, it is essential to develop healthy habits for using technologies, Internet platforms and various applications from the preschool age group. We have prepared some suggestions and ideas on how and to choose platforms to ensure children's well-being.

Before choosing and exploring the platform itself, it is important to be aware of what needs to be considered for a safe online experience for children.

Here are a few important recommendations for Internet use for young children:

- Check it out!
  Check the content yourself first, then offer it to your children. Explore its management, safety and suitability.
- Limit time!
  No more than 15 minutes at a time and 30 minutes per day.
- Content – age-appropriate!
  Research age restrictions, content relevance, perception and purpose of the platform for consuming the content.
- Use control tools!
  Enable content filters that are appropriate for children. Exclude locations (GPS).
- Talk about the risks!
  Teach children that they should not *post photos of themselves, communicate with strangers, "click" on unknown links, images, etc.*
- Do not post private information!
  When registering on a platform, remember and also remind your children not to post private information that could potentially endanger safety: *birth data, place of residence, photo, etc.*
- Be present!
  Don't just be physically present when using the Internet, but create a dialogue about what you see, hear and do.

- Talking about what is happening online:
  - allow children to reflect on the activity,
  - ensure safety on the Internet and appropriate content for children,
  - develop healthy Internet habits for the future, where children share their experience with an adult.

PART 2. Platforms

Script 04:28

What exactly is a platform?

A platform is widely available software used for learning, collaborating, collecting, sharing, storing and working together on common tasks.

In other words, the platform is a great, widely accessible, virtual place for collaboration and learning.

It is important to remember that children around the age of 5 are able to engage with technology in an appropriate context and environment, BUT the specific nature of cognitive processes at this age should also be taken into account, which means that a large proportion of 5-year-olds have the belief that fantasy is the same as reality.

It is therefore important to offer platforms that help to create well-being, awareness of emotions and at the same time are easy to use, work well and are simply structured!

Platforms that can be used for children, with the help of the family, to support distance learning

1. **Bee-Bot Online**. An educational Bee-Bot robot simulation site where children can practise developing problem solving and understanding robot control. https://beebot.terrapinlogo.com
2. **Code.org**. This platform gives children the opportunity to learn coding both at home and at preschool. The platform offers different levels, different themes, tutorials, videos and the possibility to choose the most suitable language of communication, as most of the world's languages are available. https://code.org
3. **Free online jigsaw puzzles**. Choose from a variety of interactive puzzles or draw a picture and make your own personalised puzzle. Imagine how fun it is to assemble your favourite picture from puzzle pieces. https://www.jigsawplanet.com
4. **LearningApps**. A platform that offers a wide variety of interactive tasks. You can offer them to your child or create them together! The only limit is your own imagination. https://learningapps.org/createApp.php

Some applications or platforms dedicated to the peace, harmony and well-being of the child

· **Headspace** aims to keep children "calm and focused" through short meditation exercises. It uses common meditation techniques like becoming aware of environmental

sounds, breath awareness, breath counting, and more. Kids can learn the basics of meditation and mindfulness. https://www.headspace.com/

- **Smart Tales** is an educational app full of interactive and animated stories that teach STEM subjects through narratives. Each Smart Tale contains many animated and interactive storybook pages. The child can interact with the animations with a single touch and discover a world filled with magic and fun.
  https://www.educationalappstore.com/app/smart-tales-stem-learning
- **Breathe, Think, Do with Sesame** is a free app that helps kids learn to deal with frustrating situations using the "breathe, think, do" method. They'll learn to take long, deep belly breaths to calm down, think of a few strategies to handle the problem, and then do those things. They'll develop resilience as they overcome frustrations and challenges on their own.
  https://play.google.com/store/apps/details?id=air.com.sesameworkshop.ResilienceThinkBreathDo
- **Family Lives**. Sometimes long-term distance learning can be challenging for everyone. This platform offers resources for families, with a wide range of information - videos, songs, articles and other supportive materials to choose from, depending on the age group and the topic of the issue/crisis. https://www.familylives.org.uk

In summary, the Internet offers endless opportunities for learning, gaining knowledge and experience, collaborating and communicating. It is therefore important to identify which platforms are valuable, meaningful, and healthy to offer at the preschool age.

Distance Education Tools

Script 05:45

Concerning online education at home, it may be that the family does not have a computer and uses a smartphone to offer online lessons to the child. Children, even young ones, are very interested in smartphones and have learnt how to connect to various sites simply by watching their parents or by using it for fun. More and more pre-school children have their own tablets or borrow their parents' devices to play games, use apps and watch their favourite TV programmes.

Parents and carers should intervene with simple examples to make sure they are safe online.

Parental control over communication devices is important, even more so is discussion with children on how to use smartphones, the Internet and social media sites responsibly. It is often we adults who demonstrate bad habits to children. For example, we should not use our smartphones at the dinner table, we have to adopt privacy-restricting rules on social media, etc.

Limitation of network filters

Some platforms for online activities and conferences/lessons can be encrypted, which means they're coded in a way that prevents the controls from knowing what the content actually is, so filters will not necessarily apply. Parents/carers will need to consider setting your device controls and for platforms too.

Children should not use digital media alone. Often adults do not realise how observant children are and can, for example, remember their parents' passwords. Reported events related to WhatsApp and TikTok are known to have involved young children.

Platforms for online lessons

G Suite / Google Workspace is the most widely used by schools because it is simple and free. It allows pupils to share a webcam and microphone. It offers other free apps like Google Classrooms with accessories like:

- Forms
- Calendar
- Docs
- Sheets
- Slides
- Drive
- Google Chat
- Google Meet

From the safety side, all the messages are encrypted moving into Google, but Google can track all the user's activities. https://workspace.google.com

Google Kids Space. Google also has a space designed for children. Families have to open a Google Account and use a compatible device. Parental Control requires the Family Link app on a supported Android, Chromebook or IOS device. Feature availability may vary by region. Google Kids Space is available on selected Android tablets.
Google also provides a Safe Search Kids, a custom search engine enhanced by Google to allow everyone to search the Internet more safely. Google's SafeSearch features additional filtering and promises to block potentially harmful material at home and in schools. This search filtering is available on computers, laptops, tablets and phones.
https://families.google/intl/ALL_it/kidsspace

Zoom. This company allows users to have live streamed virtual meetings, using the built-in video camera and microphone on virtually any PC, laptop, or mobile device.
Zoom's basic version is free to use, and can accommodate a meeting of up to 100, but it does come with time restrictions. A variety of paid versions offer more features, greater flexibility and better support. Fast and agile, it nevertheless seems less secure from a privacy point of view. Concerns about Zoom security have been raised by experts because the messages and information are not encrypted. Attendee tracking, for example, allows hosts to see whether participants are still viewing the meeting window. https://zoom.us

GoTo Meeting uses robust encryption mechanisms and protocols designed to ensure the confidentiality, integrity, and authenticity for data that is transmitted between GoTo and users and stored within GoTo. https://www.goto.com/meeting

Free coding and Educational Robotics apps for children

ScratchJr is a free, introductory computer programming language that runs on iPads, Android tablets, Amazon tablets, and Chromebooks. Inspired by Scratch, the wildly popular programming language used by millions of children worldwide, ScratchJr helps even younger children create their own playful animations, interactive stories, and dynamic games. Tablet needed. https://www.scratchjr.org

Blue-Bot, an evolution of the Bee-Bot, is a cute bee-shaped robot designed to teach the basics of educational robotics to kindergarten and primary school children in a fun way and can be controlled via tablet. Kits needed.
https://www.tts-international.com/blue-bot-bluetooth-programmable-floor-robot/1015269.html

Code.org is a pre-school course to learn computer science by practising with the following lessons at your own pace! Learn how to create computer programmes, develop problem-

solving skills and tackle fun challenges! Create creative games and projects to share with friends, family and teachers. https://code.org

Padlet is like paper one can use on the screen. Start with an empty page and then put whatever you like on it. Upload a video, record an interview, snap a selfie, write your own text posts or upload some documents, and watch your padlet come to life. Once others add to it, the page will update in real time. https://padlet.com

The **Blockly** area offers numerous coding activities of graded difficulty that can be used online. There is an area that collects many of the materials. https://blockly.games

Communication and Relationship in the Distance Education Process

Script 03:51

The early childhood education period is a crucial stage for children's growth and development. Therefore, ensuring effective communication and building a strong relationship between teachers, parents, and young children is vital, even in distance education settings.

As the COVID-19 pandemic has forced schools to shift to distance education, preschool teachers are faced with the challenge of helping ECE children understand that the nature of the learning process through distance education is different from face-to-face education. Although the pandemic is under control now, there may be other situations that require both teachers and children to be prepared for distance education. Thus, children need to learn how they will interact during the distance education process before being involved.

To ensure this, we have some suggestions for you.

- First, you can start with a discussion by using age-appropriate language and examples to help children understand the key differences between face-to-face and distance education. You can explain that distance education requires active engagement, just like face-to-face learning.
- It is important to encourage children to ask questions and participate in discussions during online sessions. You can set clear expectations for behaviour during online sessions, explaining that children should, for short periods of time, sit still, listen carefully, and participate actively.
- Another important point is to consider their attention span. You should plan your learning activity sessions in short periods and apply some transition activities to keep their attention alive.
- To support ECE children during the transition to distance education, you should provide resources to help them adjust to the online learning environment. You should provide access to educational materials, tech support, and online resources. Interactive activities, games, and songs make the distance education experience fun and engaging for children.
- Finally, positive reinforcement, such as praise and encouragement (rewards), will encourage children to engage actively in distance education. You can make good progress by being patient and flexible as children adjust to the new learning environment, and providing ongoing support as needed.

In distance education settings, the role of teachers and parents becomes even more critical. As children are learning from home, they may feel isolated and disconnected from their peers and teachers. Effective communication and building strong relationships can help to bridge this gap, ensuring that children feel supported, engaged, and motivated to learn. For this purpose, we have some suggestions.

- First, to establish effective communication, you should use various communication channels, such as video conferencing, email, messaging apps, and social media platforms. You should communicate with parents regularly, provide feedback about the child's progress, and ask for parents' feedback and opinions. Using simple language and clear instructions is crucial when communicating with young children to ensure they understand the content.
- Second, you should create a positive and engaging learning environment for young children in distance education. You can use interactive teaching tools such as videos, games, and online quizzes to keep children engaged and motivated. Using a friendly and approachable tone to communicate with children will make them feel comfortable and safe.
- Third, you should involve parents and guardians in the learning process and encourage parents to participate in activities with their children, such as reading books, playing educational games, and doing exercises together. Parents can also provide feedback about their child's progress and let you know about their achievements, which can help you adjust your teaching methods and strategies.
- Fourth, you should ensure that you have adequate training and resources to deliver effective distance education. You should have access to appropriate technology and software and training on how to use them, and be familiar with best practices in distance education, including effective communication strategies, and child development and learning theories.

In summary, we can say that although it requires quite a bit of effort, maintaining effective communication and strong relationships between teachers, parents, and young children, using various communication channels, creating a positive and engaging learning environment, involving parents in the learning process, and having access to appropriate training and resources can bring success in distance education. By doing so, you can ensure that young children receive a quality education, even in distance education settings.

For more information, you can reach us through https://www.earlyeu.org

Stay tuned for more updates and have a great day!

Parents/Carers Role Supporting their Child during the Online Training Process

Script 04:42

We all know that distance learning is a specific challenge for families with young children. Thankfully, your early years teacher can provide that familiar and safe connection for you on the online platform. Remember you are the parent and not a teacher! And you are your child's first and most important educator.

For children, distance learning is when their learning environment shifts from being present in the preschool to learning from their teacher at home via the Internet. Perhaps you are already familiar with some of these platforms such as Google Classrooms, TEAMS, Zoom etc. There is no right or wrong way to learn remotely.

All learning for preschool children is based in play … so think about how you can adapt your home environment to enable this.

- **Space**: indoors or outdoors, small and cosy - a nook, under a table covered with a blanket can become a place of imaginings.
- **Resources**: items found around the home or commercially produced can be used in an open-ended way.
- **Time**: extended and uninterrupted time to play allows children to become deeply involved. No need for a 'school length' day or adding pressure to ourselves or children.
- **Mess is ok**: early learning is messy and unpredictable in all respects.
- **Joining in**: respect children's rules and decisions; supporting and enhancing the play rather than leading it.

Allow your child time and space to figure things out on their own first.

- Don't give the answer right away, even if you know it.
- It's OK to not have all the answers! Feel open to making mistakes in front of your child so that they see it is part of the learning process.
- Ask your child questions that direct their attention toward the issue to investigate.
- If you get completely stuck, rather than allow your child to get too discouraged, try a different activity. And return to the previous activity later.

So what happens when things don't go according to plan?

Children of different ages face different challenges in remote classrooms.

Communicating positively and taking care of mental health is so important.

Being a good listener, building safe spaces for conversations and providing emotional support will go a long way in stress management.

Take a break! Use the activities that you know your child enjoys – get up and move around – practise some **'chill skills' activities** like these to help you and your child feel relaxed and energised.

Fizzy Lemonade

Jump up and down and shake your body as fast as you can.
Now stop and feel your body fizzing like lemonade.

Pencil

Stand up tall with your legs together
Raise your arms above your head
And clasp your thumbs together
With your fingers pointing upwards
And squeezing your arms against your ears
Stand very tall and stretch your whole body
Squeezing your legs together
Squeeze your whole body as tight as you can
Hold for about 10 seconds
Then let your arms go and relax.

You are there to support your child's understanding of the content that they are learning. **You are not expected to teach them**. So, remember to keep in touch with your preschool and teachers. Don't feel as though you must do this on your own. If you feel as though your child is having difficulty or problems, the preschool is always there to help and will provide you with resources, such as specific websites, ideas to adapt at home or extra help.

Good luck!

Ethical Issues and Involvement

Script 4:01

The interaction between children and robots requires a range of ethical considerations. The following video is going to summarize some of the main ethical considerations of child-robot interactions in early childhood education settings. We follow the argument made by Tolksdorf and his colleagues. Their research work can be found in the literature section of the learning platform.

While the relationship between humans and technology has been a re- occurring discussion point for every new intervention which has found its way into everyday life, the dilemma of children and their interaction with technology takes a special place in those discussions. The reason for this is the vulnerability of children and the fact that their perceptions, communication needs and competencies, emotional wellbeing as well as physical capabilities are so much different from adults. In the context of technology, children are often seen as naïve users, who rely on the protection and guidance of caregivers, to shield them from potential harm. This is especially true for the interaction with robots, because they are very different from other tools and technology.

Two main perspectives can be differentiated: the personal-level and the overarching institutional level. From an institutional perspective, the introduction of robots into early childhood education has to be embedded into an institution's educational agenda. This includes the pairing of technology with a pedagogical concept with the goal of being beneficial for the children. To maintain parents' trust in educational institutions, these pedagogical concepts have to be clearly communicated when working with robots. These concepts have to make sure that the children will not be hurt or scared when interacting with the robot. Educators have to make sure that the technology they are using is working in accordance with the applicable privacy laws and prevent unintended recording or storing of personal data. While most robots are currently not able to work autonomously, the liability of their actions and how institutions deal with them from a legal perspective might be an important consideration in the future.

When creating educational concepts, early childhood institutions have to constantly reflect whether these concepts fit into the general agenda of the institutions, most importantly into existing diversity, equality and inclusion strategies.

On a personal level, children have to be able to participate in child-robot interaction. In many cases the robots are programmed for interactions with adults and will not be able to understand or interact with children. This has to be considered when choosing the specific tools for an early childhood education setting. While frustration and learning about frustration is part of the growing up progress, it should not be the focus of the introduction

of robots and the interactions with them. This includes the autonomous decision of children to not interact with robots or not to take part in activities that include interaction with robots. Caregivers have to help children to decide about the way and the extent a child wants to interact with the new tools, shaping an informed relationship with the technology.

Caregivers can support children as mediators between the robots and the children, encouraging playful experiments, testing limits or functionalities. Furthermore, they act as gatekeepers for the wellbeing of the children and intervene if the actions might be harmful for the child.

For more information, you can reach us through https://www.earlyeu.org

Stay tuned for more updates!

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