# Curriculum

## Integration of Algorithmic Thinking Skills into Preschool Education

ALGORUTHMIC THINKING SKILLS THROUGH PLAY-BASED LEARNING FOR FUTURE'S CODE LITERATES

With the support of the Erasmus+ Programme of the European Union

## Project Information

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## INTRODUCTION

ALGOLITTLE is an EU funded Erasmus+ KA203 project seeking the ways of integrating algorithmic thinking skills into preschool education to cultivate future's code literates starting from the earliest years. When we consider the COVID-19 outbreak process, while a transformation has been being experienced in every field, education has also been digitalized in a tremendous way. These developments promise the systems digitalized in a more global scale. Therefore, it becomes important to raise individuals with the skills allowing them to keep up with the expectations of the 21st century business world.

ALGOLITTLE project consortium consists of 6 partners: İzmir Democracy University (Turkey), Scuola di Robotica (Italy), University of Maribor (Slovenia), University of Rijeka (Croatia), Instituto Politecnico de Viseu (Portugal) and Educloud Ed-Tech (Turkey). The consortium has been developing a curriculum and teaching materials to equip early childhood education undergraduates with the new skills which modern world demands and support them to become competent to meet the requirements of their future professions.

Algorithmic thinking skills are defined as thinking about the steps to achieve a determined objective in a clear and detailed way (Brown, 2015). This term was suggested for the first time by Wing (2006) and is based on the studies of Seymour Papert (Papert, 1980, 1991). Wing (2006) claims that algorithmic thinking requires "solving problems, designing systems and understanding human behaviour by benefiting from the basic concepts of computer science". And this becomes an opportunity in teacher education to ensure undergraduate students gain contemporary and innovative skills.

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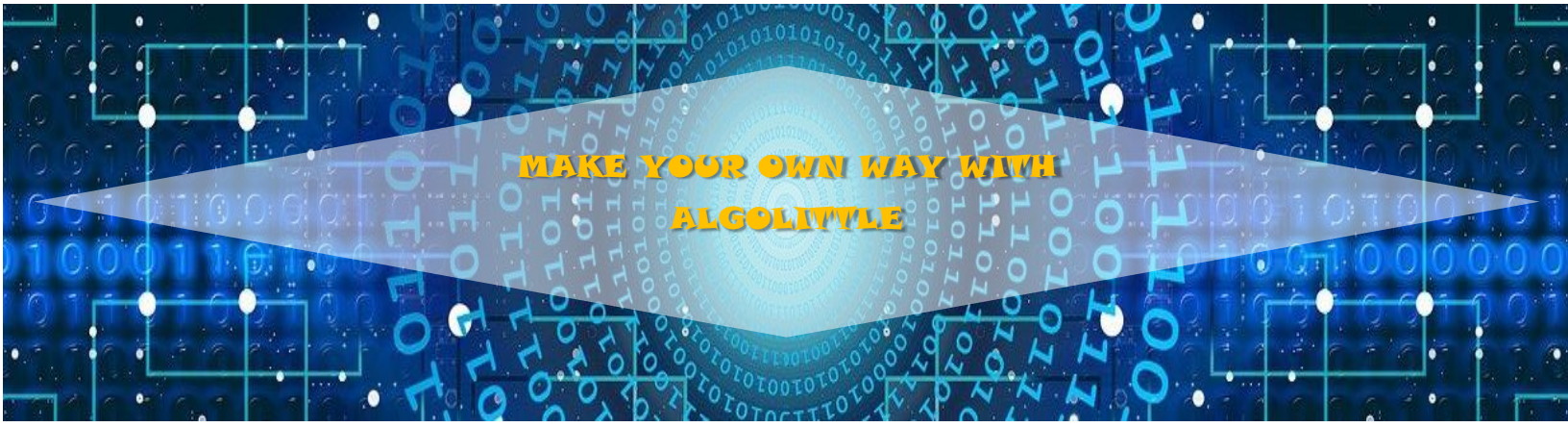
ALGOLITTLE project consortium prepared the state-of-the-art also including the national situation analyses in a document regarding algorithmic thinking in early childhood education. Later, a needs analysis was carried out with a descriptive approach. The descriptive analysis refers to both the damage which the absence of a situation causes and the benefit which its presence brings. In this direction, the project consortium held meetings at the national and international levels and workshops were organized with the participation of preschool and kindergarten teachers in the partner countries. The findings helped clarify the philosophy of the curriculum, learning outcomes in line with the module titles, teaching methods & techniques together with assessment methods.

This curriculum aims to develop algorithmic thinking skills of future's code literates through play-based learning in line with the descriptive analysis results and it is based on pragmatist and progressive philosophy. Besides, the curriculum was designed in accordance with the learner-centered instruction and a modular approach was adopted to develop its content. In this direction, the curriculum was designed based on the flipped teaching model that focuses on students' learning on their own and reflecting what they have learned in the classroom by using informative presentations, videos, short films or animations, etc. before the lesson. Therefore, the teaching and learning processes of the curriculum include learner-centered active teaching techniques. Contemporary and alternative assessment techniques were used in this curriculum "Integration of Algorithmic Thinking Skills into Preschool Education through Play-based Learning for Future's Code Literates" in the light of all these specified objectives, content and teaching and learning processes.

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## GENERAL OBJECTIVES

ALGOLITTLE aims to foster undergraduate students' competencies regarding designing and implementing learning/teaching activities to develop algorithmic thinking skills of children in all learning areas which early childhood education focuses on such as language development, music, art, mathematics, drama, nature, social and emotional learning, social sciences, daily life skills and behavior development.

**Other objectives**

- Closing skills gaps in ICT oriented teaching/learning activities for immediate impact on contemporary teaching skills of preschool teaching undergraduates

- Increasing the acquisition of knowledge and skills of preschool teaching undergraduates related to employing algorithmic thinking skills through play-based learning as an innovative teaching approach

- Upskilling the lecturers of the partner universities related to the integration of algorithmic thinking skills into all subject areas focused, in preschool education

Developing algorithmic thinking skills in early childhood period occupies an essential place in developing skills such as discovering, reaching a solution systematically, planning, organizing, collaborating, discussing, synthesizing, and critical thinking and an efficient education in this respect can help develop problem-solving skills of children such as critical thinking, planning, organizing, revising, and evaluating.

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## CURRICULUM MODULES

The curriculum modules were determined as a result of the literature reviews, focus group interviews and discussions of the partners as follows.

1. Algorithmic Thinking (The importance of Algorithmic Thinking, Types of Algorithmic Thinking, Examples from Real Life Experiences, The Importance of Algorithmic Thinking in Early Childhood Education, Methods and Techniques to Develop Algorithmic Thinking Skills)
2. Developing Algorithmic Thinking Skills in Different Development Areas
   Research and Cognitive Development
   a. Mathematics
   b. Logic,
   c. Natural Sciences
3. Developing Algorithmic Thinking Skills in Different Development Areas
   Language and Communication Development
   a. Native Language Development
   b. First Foreign Language Development
4. Developing Algorithmic Thinking Skills in Different Development Areas
   Social & Emotional Development
   a. Social & Emotional Learning
   b. Social Life Skills
5. Developing Algorithmic Thinking Skills in Different Development Areas
   Motor Development
   a. Sports & Play
   b. Art & Handcrafts
   c. Music, Dance & Drama
6. Developing Algorithmic Thinking Skills in Different Development Areas
   Self-Help Skills Development
   a. Health
   b. Daily Life Skills
   c. Social Sciences
7. Developing Algorithmic Thinking Skills in Different Development Areas
   Creative Skills Development

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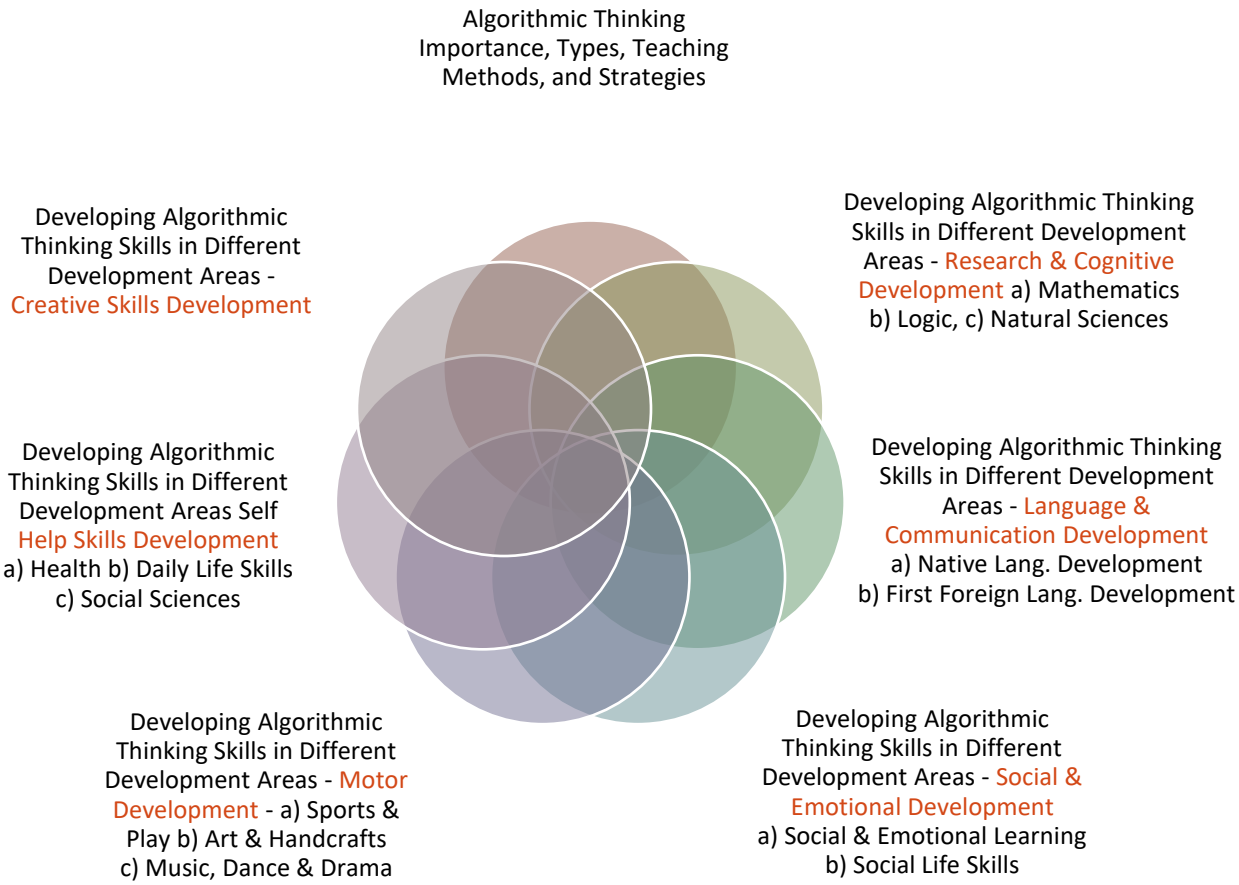


**Figure 1.** *Algolittle Curriculum Modules*

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# MODULE 1

## Algorithmic Thinking

### OBJECTIVES/LEARNING OUTCOMES

#### *COGNITIVE DOMAIN*

Undergraduate Students

- Define algorithmic thinking,
- Explain the features of algorithmic thinking,
- Give examples of real-life experiences including algorithmic thinking,
- Explain the types of algorithmic thinking,
- Compare "linear algorithm", "branch algorithm" and "cyclic algorithm" and explain their similarities and differences,
- Integrate algorithmic thinking into appropriate life situations and implement it in these situations,
- Assess the benefits and limitations of algorithmic thinking in early childhood education,
- Develop appropriate methods and strategies to teach algorithmic thinking skills,
- Design algorithmic games for early childhood education.

#### *AFFECTIVE DOMAIN*

- Comprehend the importance of algorithmic thinking in early childhood education,
- Assess the importance of algorithmic thinking in early childhood education,
- Recognize that algorithmic thinking enriches early childhood education,
- Become disposed to do algorithmic thinking skills activities in early childhood education,
- Become disposed to do research on algorithmic thinking in early childhood education
- Volunteer to participate in in-class activities.

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### *PSYCHOMOTOR DOMAIN*

- Do the psychomotor activities including types of algorithmic thinking skills

## CONTENT

- The Importance of Algorithmic Thinking,
- The Types of Algorithmic Thinking,
- Examples of Real-Life Experiences
- The Importance of Algorithmic Thinking in Early Childhood Education
- The Methods & Techniques to Teach Algorithmic Thinking Skills

## TEACHING & LEARNING PROCESSES

- Algorithmic thinking digital materials in early childhood education
- Play-based teaching techniques
- Active teaching techniques (Collaborative teaching techniques: station, cornering, Discussion techniques: think, pair, share)
- Workshops (In groups of 3, 4, or 5)
- Worksheet / Drawings / Puzzles / Charts / Compositions

## ASSESSMENT

- Self-Assessment
- Peer Assessment
- Designing an algorithmic thinking skills game for early childhood education
- Participation in the activities organised within the scope of the lesson

## EXAMPLE SESSION

### Objectives

- Define algorithmic thinking
- Explain the features of algorithmic thinking
- Explain types of algorithmic thinking

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## Teaching & Learning Process

### Out of Classroom:

- The necessary explanations about algorithmic thinking and PPT presentation
- Watching a video about algorithmic thinking,
- Itemizing/summarizing the features/types of algorithmic thinking through Think/pair/share technique,

### Classroom Time:

- Implementing Station Technique with a theme "The Types of Algorithmic Thinking and the Importance of Algorithmic Thinking in Early Childhood Education" e.g.

  Station 1: Poster/Visual

  Station 2: Slogan

  Station 3: Music

  Station 4: Writing a story

## Assessment

Filling out a Last Words Worksheet

| | |
|---|---|
| What I have learned best in this course are: | What I enjoyed most in this course are: |
| What I find most difficult in this course are: | The areas where I will improve myself with what I have learnt in this course are: |

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# MODULE 2

## Developing Algorithmic Thinking Skills in Different Development Areas: Research & Cognitive Development

### OBJECTIVES & LEARNING OUTCOMES

#### *COGNITIVE DOMAIN*

Undergraduate Students

- Classify the types of algorithm that can be used in mathematics, logic and natural sciences domains in early childhood education,
- Design algorithm examples/creates algorithms that can be used in mathematics, logic, and natural sciences domains in early childhood education,
- Comprehend the features of coding tools (cubetto, scratch, python, game lab, code.org, codable etc.) produced for developing algorithmic thinking skills in early childhood education,
- Design activities where they can use coding tools (cubetto, scratch, python, game lab, code.org, codable etc.) produced for developing algorithmic thinking skills in early childhood education.

#### *AFFECTIVE DOMAIN*

- Recognise the importance of algorithmic thinking in mathematics, logic, and natural sciences education in early childhood,
- Become disposed to implement the activities to develop algorithmic thinking skills in mathematics, logic, and natural sciences domains in early childhood education
- Become disposed to do research on algorithmic thinking regarding mathematics, logic, and natural sciences in early childhood education,
- Volunteer to participate in in-class activities.

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### *PSYCHOMOTOR DOMAIN*

- Do the psychomotor learning activities in mathematics, logic, and natural sciences including algorithmic thinking.

### CONTENT

- Algorithmic thinking in early childhood mathematics education
- Algorithmic thinking in early childhood logic education
- Algorithmic thinking in early childhood natural sciences education

### TEACHING/LEARNING PROCESSES

- A group discussion about how to benefit from the algorithm types to teach mathematics, logic, and natural sciences in early childhood education,
- Designing a play-based algorithm to teach mathematics, logic, and natural sciences in early childhood education
- Using coding tools (cubetto, scratch, python, game lab, code.org, codable vb.) to improve cognitive development produced for developing algorithmic thinking skills in early childhood education
- Digital materials for algorithmic thinking in early childhood education
- Researching and reporting mathematics, logic, and natural sciences activities (to develop algorithmic thinking skills) in research and cognitive development domain in early childhood
- Active teaching techniques
- Play-based teaching techniques

### ASSESSMENT

- Self- Assessment
- Peer Assessment

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- Designing a learning activity where they use coding tools (cubetto, scratch, python, game lab, code.org, codable vb.) produced for developing algorithmic thinking skills in early childhood education
- Doing research (Group Work)
- Participation in the activities implemented within the scope of the course

## EXAMPLE SESSION

### Objectives

- Design algorithm examples/creates algorithms that can be used in mathematics, logic, and natural sciences domains in early childhood education,
- Design activities where they can use coding tools (cubetto, scratch, python, game lab, code.org, codable etc.) produced for developing algorithmic thinking skills in early childhood education.

### Teaching & Learning Process

Out of Classroom:

- The necessary explanations about how to develop algorithmic thinking skills while teaching mathematics, logic, and natural sciences in early childhood and PPT presentation
- Watching videos including good practices about how to develop algorithmic thinking skills while teaching mathematics, logic, and natural sciences in early childhood
- Introduction of coding tools (cubetto, scratch, python, game lab, code.org, codable, etc.) and explaining how to develop algorithmic thinking skills while teaching mathematics, logic, and natural sciences in early childhood by using these tools

Classroom Time:

- Designing a learning activity by using these coding tools to develop algorithms and benefit from them while teaching mathematics, logic, and natural sciences in early childhood education

### Assessment

Filling out a KWL Worksheet (K: What I **K**now, W: What I **W**onder, What I **L**earned)

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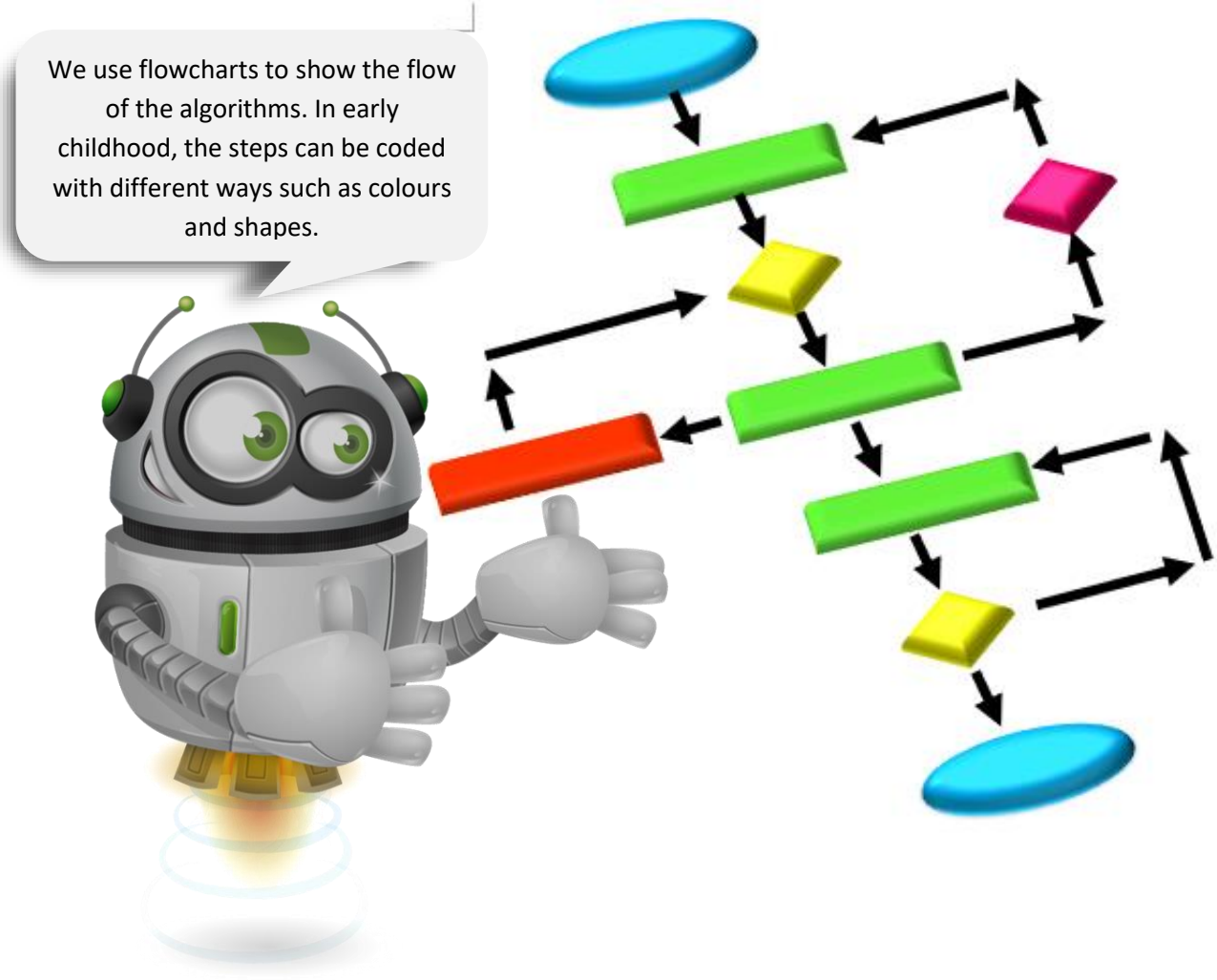
About integrating algorithmic thinking skills in early childhood mathematics, logic, and natural sciences instruction.

| K-WHAT I KNOW | W-WHAT I WONDER | L- WHAT I LEARNED |
|---|---|---|
| | | |

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# MODULE 3

## Development of Algorithmic Thinking Skills in Different Development Areas: Language and Communication Development

### OBJECTIVES/LEARNING OUTCOMES

#### *COGNITIVE DOMAIN*

Undergraduate Students

- Comprehend the features of algorithmic thinking in native language/first foreign language education in early childhood.
- Give examples to how to use algorithmic thinking in native language/first foreign language education in early childhood.
- Discuss the algorithms that can be used native language/first foreign language education in early childhood.
- Develop algorithms that can be used in native language/first foreign language education in early childhood.
- Prepare a lesson plan including algorithmic thinking in native language/first foreign language education in early childhood.

#### *AFFECTIVE DOMAIN*

- Realise the importance of algorithmic thinking in native language/first foreign language in early childhood.
- Become disposed to develop activities including algorithmic thinking in native language/first foreign language in early childhood.
- Volunteer to participate in in-class activities.

#### *PSYCHOMOTOR DOMAIN*

- Implement the psychomotor activities for native language/first foreign language development including algorithmic thinking.

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## CONTENT

- Algorithmic thinking in native language education in early childhood
- Algorithmic Thinking in first foreign language education in early childhood

## TEACHING/LEARNING PROCESSES

- Sharing key concepts in native language/first foreign language development domains in early childhood by using information paper bag technique
- Evaluation of how to benefit from algorithmic thinking in native language/foreign language development education in early childhood by using student response cards technique
- In small groups, preparation of a lesson plan including algorithmic thinking in native language/first foreign language in early childhood
- Using algorithmic thinking digital materials in early childhood

## ASSESSMENT

- Assessment of the lesson plan including algorithmic thinking in native language/first foreign language development education in early childhood by using rubric
- Self-assessment
- Peer Assessment
- Participation in in-class activities

## EXAMPLE SESSION

### Objectives

- Give examples to how to use algorithmic thinking in native language/first foreign language education in early childhood.
- Discuss the algorithms that can be used native language/first foreign language education in early childhood.
- Prepare a lesson plan including algorithmic thinking in native language/first foreign language education in early childhood.

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## Teaching and Learning Process

### Out of Classroom:

- Explaining how to develop algorithmic thinking skills in native language/first foreign language education in early childhood and PowerPoint presentation exchange

### Classroom Time:

- Sharing key concepts in native language/first foreign language development education in early childhood by using information paper bag technique.
- For example: Primarily, key concepts and information about algorithmic thinking in native language/ first foreign language development in early childhood are listed on the board.
- Then, a paper bag/envelope is given to each student. Students are asked to write what they know about these concepts on these paper bags/envelopes.
- Then students get into groups and group members share what they wrote on the paper bags.
- After that, index cards are distributed to the students. On the index cards, they write the new concepts which they have learnt after the group work and put the cards in their paper bags.
- Finally, groups exchange their paper bags and read what the other groups have written. Hereby, students associate the information they have learnt after the group work with the information before the group work.
- Preparing a lesson plan including algorithmic thinking in native language/first foreign language development areas in early childhood

## Assessment

Designing the lesson plan that aims to develop algorithmic thinking in native language/first foreign language development areas in early childhood

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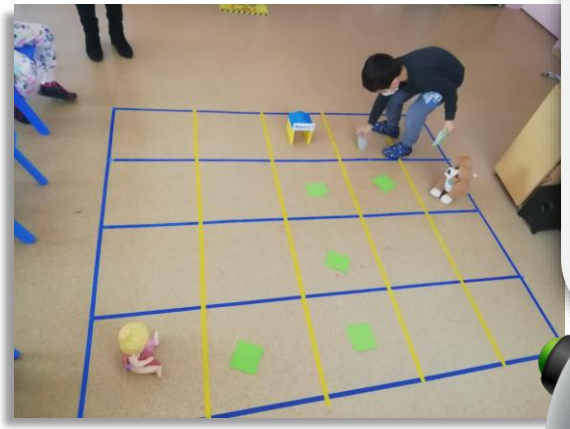
| LESSON PLAN | |
|---|---|
| Objectives | |
| Development Area | |
| Duration | |
| Teaching Learning Process | |
| Teaching Materials | |
| Assessment | |



Storytelling is a good way of integrating linear algorithms into language development education in early childhood. By asking yes/no questions we can turn these linear algorithms into branch algorithms and let children make their own ways according to their answers and let them see the result of their choices.

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# MODULE 4

## Development of Algorithmic Thinking Skills in Different Development Areas: Social & Emotional Development

### *RATIONALE*

*"Educating the mind without the heart is not educating". Aristotle*

Emotional and social competencies are basic skills for life, essential for the integral development of children's personality. They are an indispensable complement of cognitive development. Social-emotional learning (SEL) optimizes human development in its integrity: physical, intellectual, moral, social, emotional

Social and emotional learning comprises fostering in children the skills of *persistence*, *empathy, mindfulness,* relationship skills. From the learning side, it implies to develop a mindset promoting *curiosity, decision-making, self-regulation,* and *self-assessment.*

Algorithmic Thinking can favour other soft skills such as:

- Accepting and welcoming ambiguity and complexity with confidence.
- Persevering through iteration and experimentation.
- Reappraising challenges as opportunities.

Algorithmic thinking can support the SEL development in children fostering some domains:

Self-Awareness

Self-Management

Social-Awareness

Relationship Skills

Responsible Decision Making

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## OBJECTIVES & LEARNING OUTCOMES

### *1. META-ANALYSIS*

#### *a. SEL AND LEARNING PROCESSES*

How innovation in education is combined with emotional skills.

How emotional and social skills take part in the learning process of understanding, complying and intervening in the community of origin.

How the emotional and social development makes possible children's coexistence in democratic community for the construction of personal and social well-being.

How SEL is associated with learning language and communications means, literacy outcomes, such as letter and images recognition, sequencing, and sounds; listening and comprehension; vocabulary; and understanding concepts and structures of stories.

#### *b. ALGORITHMIC -THINKING AND ICT SUPPORTING SEL DEVELOPMENT*

Assess if and how Algo-thinking and ICT can support children's development of skills of reasoning, predicting and problem-solving;

Assess if and how ICT games, tools with touch screen and remote controls can support children's abilities (attention, concentration, fine handling, fine motor skills, ect).

Assess if and how children, using ICT technologies, work and play together, relating to one another, share materials, cooperate in achieving given tasks and accept others.

### *2.DOMAINS OF RESEARCH*

#### *COGNITIVE DOMAIN*

Undergraduate Students

- Classify the types of algorithm and ICT tools that can be used in early childhood education to support SEL and SE skills.

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- Design algorithm examples that can be used to support social emotional and social life skills in early childhood education.
- Analyse some coding tools (Cubetto, Bee Bot, mTiny, ScratchJR, etc.) from the viewpoint of supporting the development of SEL.
- Design activities to use coding tools (Cubetto, Bee Bot, mTiny, ScratchJR, etc.) for supporting the development of SEL (understanding the social community, story-telling capacities, team working, ect).
- Design activities with the same purpose with unplugged/ algo-thinking cases.
- Explore activities where Algo-Thinking can become a playground encouraging open-ended exploration, creativity, imagination, and social interactions.

### *AFFECTIVE DOMAIN*

- Recognise and express the role of your emotional social experience in using ICT tools alone, with mates, in playing activities, in learning activities, in solving problems.
- Recognise and assess the role of the teachers' skill in using ICT and Algo-Thinking tools and his/her emotional commitment and participation.
- Define if and how educators must be knowledgeable and prepared to make informed decisions about how and when to appropriately select, use, integrate, and evaluate technology and media to meet the social and emotional needs of young children.

### *PSYCHOMOTOR DOMAIN*

- Recognise and assess the role of algorithmic thinking in psychomotor activities: sense of space, symmetry, laterality, precision of movement, fine motor skills, gymnastics, sports activities, collective games, dance.

### CONTENT

- Algorithmic thinking in early childhood emotional learning
- Algorithmic thinking in early childhood social learning
- Algorithmic thinking in early childhood psychomotor domain

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## TEACHING/LEARNING PROCESSES

- Defining and profiling the target groups
- Design how incorporate SE Learning into children daily schedule and routines using Algorithmic thinking.
- Students' teams prepare short theses on the topics of cognitive, affective, and psychomotor domains as indicated above by testing the thesis (or falsifying it when possible), designing the assessment tools.
- Designing play-based algorithms and activities to support the development of SEL skills in early childhood education (The designs will cover emotional and social skills using only unplugged games and tools.)
- Using coding tools (Cubetto, Bee Bot, mTiny, ScratchJR, etc.) to improve SEL development
- Researching and reporting SEL activities
- Play-based teaching techniques

## ASSESSMENT

- Literature review
- Self-assessment
- Peer review
- Designing playground activities using coding tools (Cubetto, Bee Bot, mTiny, ScratchJR, etc.) to develop SEL skills in early childhood education.
- Ethical and Social evaluation of the processes. Designing an Evaluation & Assessment tool to detect and evaluate the ethical and social implications of using ICT tools in early education.

## EXAMPLE SESSION

### Objectives

- Design algorithm examples/creates algorithms that can be used in early childhood education SEL development.

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- Design activities where they can use coding tools (Cubetto, Bee Bot, mTiny, ScratchJR, etc.) to develop SEL skills in early childhood education.
- Assess the ethical and social values of the designed activities.

## Teaching & Learning Process

### Out of Classroom:

- *Social and Emotional Skills:* Design playground activities of Algorithmic Thinking promoting Self-Awareness, Self-Management, Social-Awareness, Relationship Skills, Responsible Decision Making.
- *Storytelling:* Design activities using unplugged and plugged ICT tools to evaluate children progresses to play co-operatively: develop a story-narrative for their play, sharing ideas and negotiating over the agreed changes.
- *Feelings:* how to use an Emotional Chart to create narrative and use unplugged and plugged ICT tools to support children in story-telling activities.
- *Playing Areas:* Design play areas with Algorithmic Thinking unplugged and plugged tools suitable to promote SEL: Children playing together; children have enough room to play alone, etc.

### Classroom Time:

- *Sharing Practices:* Design how to use algorithmic thinking unplugged and plugged tools to develop practice sharing and turn-taking during daily life.
- *Social Interactions*: Design how to use Algorithmic Thinking unplugged and plugged tools to promote social interactions.
- *Sharing interests*: How include children's home interests in ICT/AT activities.
- *Talking about one's emotions:* how to use Algorithmic Thinking unplugged and plugged tools to promote children expressing their emotions.
- *To the Garden*! How to use algorithmic thinking activities and processes to promote outdoor activities.
- *Useful Educational tools*: How to design and prepare Educational Material, Posters, Booklets, Music, up-cycling material.

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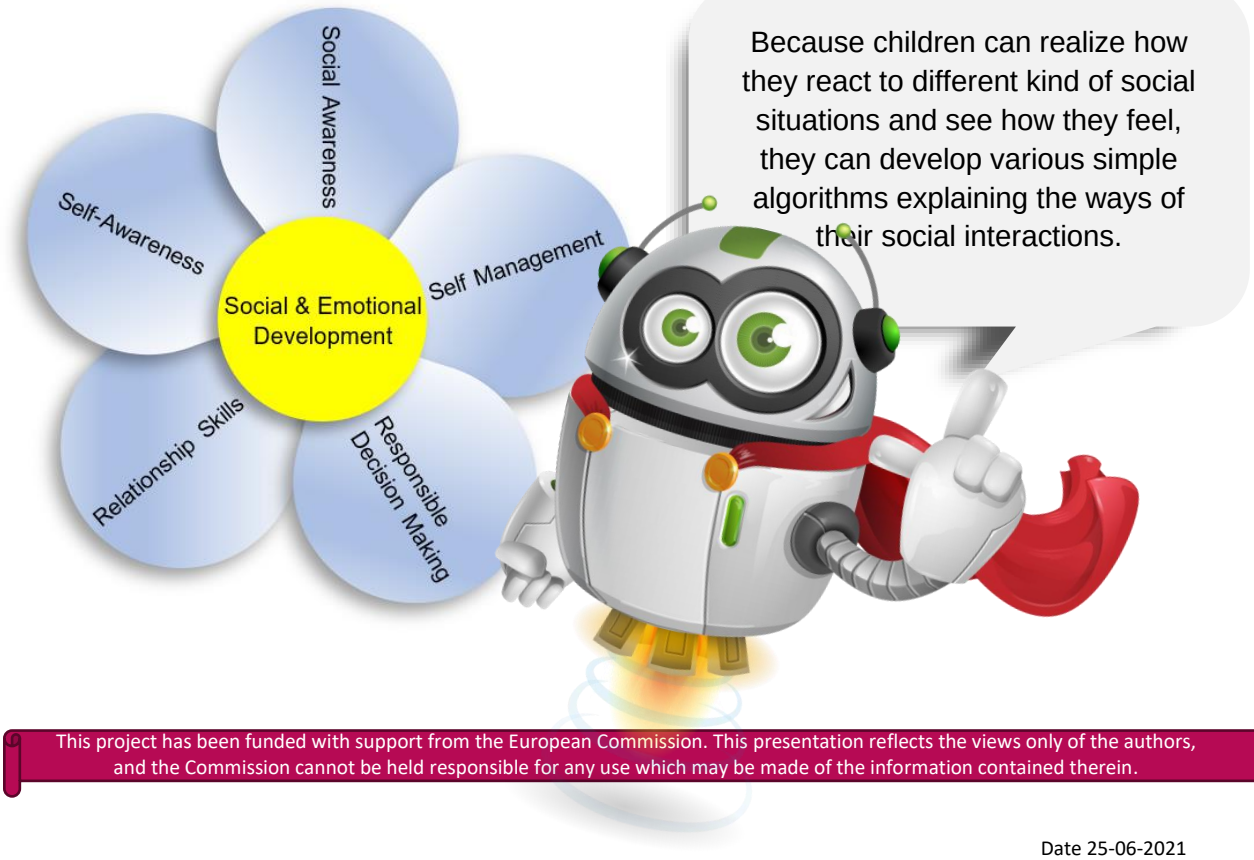
## Assessment

Filling out Colour-Symbol-Image assessment page.

| Colour | Symbol | Image |
|---|---|---|
| What colour best represents this? | What symbol best represents this? | What image best represents this? |
| Why did you choose this color? | Why did you choose this symbol? | Why did you choose this image? |

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# MODULE 5

## Development of Algorithmic Thinking Skills in Different Development Areas: Motor Development

### MODULE OBJECTIVES:

- Students will be introduced to different methods of performing activities in preschool as well as learning strategies through games to encourage the development of algorithmic thinking skills, creativity and problem-solving skills in children in the field of motor development, sports and play, art and handcraft, music and dance, drama
- Students will design and implement preparations for practical work based on incentives for the purpose of conducting activities to encourage algorithmic thinking

### OBJECTIVES/LEARNING OUTCOMES

#### *COGNITIVE DOMAIN*

Undergraduate Students

- Describe the basic concepts and skills of algorithmic thinking in the field of motor development, sports and play, art and handcraft, music and dance, drama
- Describe the principles of play-based learning
- Apply targeted games in various activities
- Develop an activity plan for performing game-based unplugged activities through various forms of teaching
- Describe the principles of problem-based learning (PBL)
- Design and prepare activities using innovative ideas that will include encouraging the development of algorithmic thinking and problem-solving skills
- Be able to independently research and develop algorithmic thinking skills for motor development, sports and play, art and handcraft music and dance, drama

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### *AFFECTIVE DOMAIN*

- Realise the importance of algorithmic thinking in motor development in early childhood.
- Become disposed to develop activities including algorithmic thinking in motor development in early childhood.
- Volunteer to participate in in-class activities.

### *PSYCHOMOTOR DOMAIN*

- Implement the psychomotor activities for motor development including algorithmic thinking.

## CONTENT

- Algorithmic thinking skills in early and preschool motor development
- Algorithmic thinking skills in early and preschool sports and play
- Algorithmic thinking skills in early and preschool art and handcraft
- Algorithmic thinking skills in early and preschool music and dance
- Drama through storytelling

## TEACHING/LEARNING PROCESSES

- During classes, individual and group activities and discussions are encouraged
- Conversation method – group discussion how can motor development in sports and play, art and handcraft or music and dance be developed by using algorithmic thinking skills, discussion about storytelling
- Research method – researching and analyzing various examples of good practice to explain play-based learning, project-based learning and researching strategies in young children

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- Method of practical work – designing activity plan for developing algorithmic thinking skills in unplugged activities for motor development, sports and play, art and handcraft, music and dance or drama.
- Problem solving method – placing design activities in activity centers or outdoor spaces, decisions about groups, time, and daily practices.

## ASSESSMENT

- Self-assessment in reflecting on activity plan
- Peer-assessment in discussing implemented activity
- Teacher assessment in evaluating activity plan
- Module assessment - students will highlight the most important insights gained in the module and make recommendations for improving the understanding of the content

## EXAMPLE SESSION

### Objectives

- Describe the basic concepts and skills of algorithmic thinking in the field of motor development, sports and play, art and handcraft, music and dance, drama
- Describe the principles of play-based learning
- Apply targeted games in various activities

### Teaching and Learning Process

Out of Classroom:

- The necessary explanations about how to develop algorithmic thinking skills while teaching motor skills development in early childhood and PPT presentation.

Classroom Time:

- Rhythmic Performance According to The Defined Algorithm: Children design an algorithm of motor movements for a nursery rhyme or a song. Symbols are drawn on the paper: the drawing of hands means that the child should clap; the drawing of feet means that the child kicks the floor with one foot than with the

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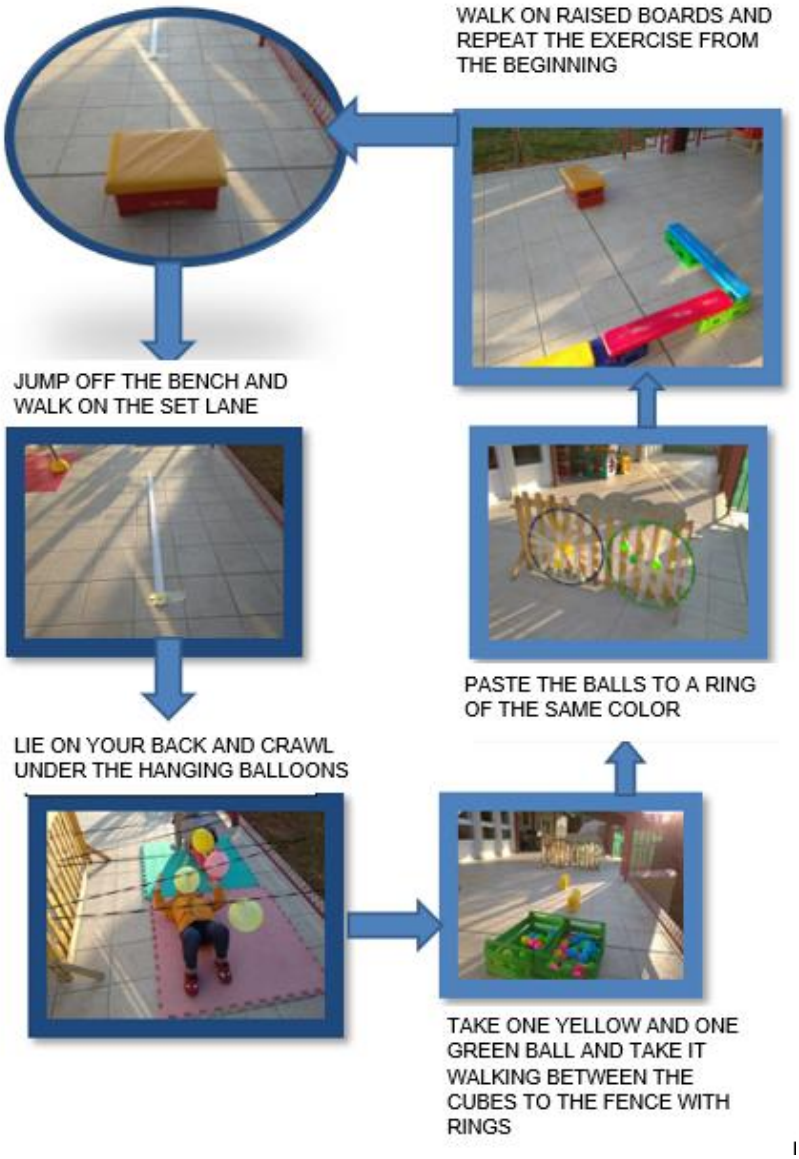
other. Following the markings, the rhythm is performed together with the nursery rhyme or song.

- Learning Corners: Students are divided into 4 groups. In each learning corner, a different activity is held that deals with algorithmic thinking skills in motor development. (1. Sports and Play, 2. Art and Handcraft, 3. Music and Dance, 4. Drama)

Sports and Play

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Art and Handcraft

Creation of a Leperello picture book according to the defined algorithm:
Prepare several A4 hard papers, prepare duct tape, prepare scissors, prepare wooden crayons, fold the paper in half, draw the first action of the story on the front with crayons, draw the next action of the story on the page after, when filling all four pages take new paper and fold it on half, take duct tape, bond two papers together.

Music and Dance

Determine the order of performing dance structures using the appropriate images
Conduct the dance according to images

Drama

Storytelling: express the known story with drawn pictures: use the "what if" option by replacing the pictures and retelling the story in another way.

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## Assessment

The self-evaluation page about the activity will be filled out.

| Self-Assessment | |
|---|---|
| **The activity was (hard/easy) to complete because...** | |
| **The part of the activity I did best was...** | |
| **I could have done a better job if...** | |
| **After completing the activity, I felt because...** | |
| **I would rate my work on the activity as excellent/good/fair/poor) because...** | |
| **Previously, I used to think...** | |
| **Now I think...** | |

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# MODULE 6

## Development of Algorithmic Thinking Skills in Different Development Areas: Self-Help Skill Development

### OBJECTIVES & LEARNING OUTCOMES

#### *COGNITIVE DOMAIN*

Undergraduate Students

- Understand the content and learning goals in early childhood education for self-help skill development, health education, daily life skills and social studies.
- Classify the types of algorithm and ICT tools that can be used to support self-help skill development, health education, daily life skills and social studies in early childhood education.
- Design algorithm examples/creates algorithms that can be used in self-help skill development, health, daily life skills and social studies in early childhood education.
- Analyze and understand the features of coding tools (e. g. cubetto) produced for developing algorithmic thinking skills in early childhood education from the view point of supporting self-help skill development, health education, daily life skills and social studies.
- Design activities where they can use coding tools produced for developing algorithmic thinking skills in self-help skill development, health, daily life skills and social studies in early childhood education,
- Design unplugged activities with algorithmic thinking that can be used in self-help skill development, health, daily life skills and social studies in early childhood education.

#### *AFFECTIVE DOMAIN*

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- Recognize the importance of algorithmic thinking in self-help skill development, health education, daily life skills and social studies in early childhood.
- Become disposed to implement the activities to develop algorithmic thinking skills in self-help skill development, health education, daily life skills and social studies.
- Become disposed to do research on algorithmic thinking regarding self-help skill development, health education, daily life skills and social studies in early childhood education,
- Volunteer to participate in in-class activities.

### *PSYCHOMOTOR DOMAIN*

- Do the psychomotor learning activities in self-help skill development, health education, daily life skills and social studies including algorithmic thinking.

### CONTENT

- Algorithmic thinking in early childhood self-help skills education
- Algorithmic thinking in early childhood health education
- Algorithmic thinking in early childhood daily life skills education
- Algorithmic thinking in early childhood social studies education

### TEACHING/LEARNING PROCESSES

- A group discussion about how to benefit from the algorithm types to teach self-help skill development, health education, daily life skills and social studies in early childhood education.
- Designing a play-based algorithm to teach self-help skill development, health education, daily life skills and social studies in early childhood education.
- Using coding tools to improve cognitive development produced for developing algorithmic thinking skills in early childhood education.

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- Researching and reporting self-help skill development, health education, daily life skills and social studies activities (to develop algorithmic thinking skills) in cognitive development domain in early childhood.
- Active teaching techniques.
- Play-based teaching techniques.
- Research based didactical strategies.
- Project based learning.

## ASSESSMENT

- Self- Assessment
- Peer Assessment
- Designing a learning activity where they use coding tools produced for developing algorithmic thinking skills in early childhood education
- Designing unplugged learning activities with use of algorithmic thinking skills for children
- Doing research (Group Work)
- Participation in the activities implemented within the scope of the course

## EXAMPLE SESSION

### Objectives

- Design algorithm examples/creates algorithms that can be used in self-help skill development, health education, daily life skills and social studies in early childhood education.
- Design examples for unplugged learning activities that can be used in self-help skill development, health education, daily life skills and social studies in early childhood education.
- Design activities where they can use coding tools produced for developing algorithmic thinking skills in early childhood education.

### Teaching & Learning Process

Out of Classroom:

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- The necessary explanations about how to develop algorithmic thinking skills while teaching self-help skill development, health education, daily life skills and social studies in early childhood education in early childhood and PPT presentation.
- Watching videos including good practices about how to develop algorithmic thinking skills for self-help skill development, health education, daily life skills and social studies in early childhood education.
- Introduction of coding tools and explaining how to develop algorithmic thinking skills while teaching self-help skill development, health education, daily life skills and social studies in early childhood education by using these tools.

## Classroom Time:

- Designing a learning activity by using these coding tools to develop algorithms and benefit from them and designing unplugged learning activities with use of algorithmic thinking.


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**Assessment:**

Filling out a worksheet about integrating algorithmic thinking skills that can be used in self-help skill development, health education, daily life skills and social studies in early childhood education.

Students will fill out the evaluation form below at the end of the module.


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# MODULE 7

## Development of Algorithmic Thinking Skills in Different Development Areas:

## Creative Skills

### OBJECTIVES & LEARNING OUTCOMES

#### *COGNITIVE DOMAIN*

Undergraduate Students

- Understand the content and learning goals in early childhood education for creative skills development.
- Establish connections between creative skills development and algorithmmic thinking skills in early childhood education.
- Classify the types of algorithms and problem-solving processes that can be used to support creative skills development in early childhood education.
- Analyze and understand the features of coding tools (e.g. ScratchJR, mTiny, Bee Bot) produced for developing algorithmic thinking skills in early childhood education from the viewpoint of supporting creative skills development.
- Design activities with algorithmic thinking that can be used in creative skills development in early childhood education.

#### *AFFECTIVE DOMAIN*

- Recognize the importance of algorithmic thinking in creative skills development in early childhood.
- Become disposed to implement the activities to develop algorithmic thinking skills in creative skills development.
- Become disposed to do research on algorithmic thinking regarding creative skills development in early childhood education,
- Volunteer to participate in in-class activities.

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### *PSYCHOMOTOR DOMAIN*

- Act in the learning activities regarding creative skills development including algorithmic thinking.

## CONTENT

- Creative skills development in early childhood education.
- Algorithmic thinking in early childhood creative skills development education

## TEACHING/LEARNING PROCESSES

- A brainstorm activity about creative skills in the national early childhood education curriculum. Organize a visual aid of the main concepts, skills and attitudes involved.
- A small group discussion about connections between algorithm types and algorithmic thinking and creative skills development in early childhood education. Share the results in a plenary discussion.
- In pairs, research, and report about creative skills development activities useful to develop algorithmic thinking skills in early childhood.
- A small group discussion about criteria to select activities that articulate creative skills development and algorithmic thinking in early childhood education. Share the results in a plenary discussion.
- In small groups or pairs, plan/design activities for integrating algorithmic thinking in creative skills development through: outdoor experiences, a project approach, enrichment of the play centers with materials related to algorithmic thinking, opportunities in the daily routine for children's problem solving, whole group activities, small group/pairs activities, coding tools (e.g. ScratchJR, mTiny, Bee Bot) and unplugged coding activities. Build a digital poster for presenting your ideas to the group.

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## ASSESSMENT

- Self-Assessment
- Peer-Assessment
- Products created during the sessions: poster, report of the research, set of criteria, planning of activities, poster.
- Criteria: active participation in the activities, quality and depth of the research work, didactical and innovative relevance of the learning activities planned/designed, effective communication of ideas through several media.

## EXAMPLE SESSION

### Objectives

- Understand the content and learning goals in early childhood education for creative skills development.
- Establish connections between creative skills development and algorithmic thinking skills in early childhood education.

### Teaching & Learning Process

#### Out of Classroom:

- The necessary explanations about how to develop algorithmic thinking skills while teaching creative skills development in early childhood and PPT presentation
-

#### Classroom Time:

- In the plenary, remind participants of the main concepts about algorithmic thinking and some of the connections with other learning areas that have been established in the previous sessions.
- Start a discussion with the participants about creative skills in the national early childhood education curriculum: How are they organized in it? How important are they? What learning aims and contents are included?

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- Ask volunteers to write down ideas in a white board or flipchart and deepen the discussion about what is learned in creative skills development and how is it taught: activities, materials, situations, spaces.
- In small groups, suggest that participants create a visual aid of the main concepts, skills and attitudes involved. Visual aids can be shared between participants.
- Start small group discussions about connections between algorithm types and algorithmic thinking and creative skills development in early childhood education. Highlight how connections can be about content, methods, opportunities, materials, etc.
- Invite participants to share the results of the discussions back to the plenary. Register agreements and questions that arise.

**Assessment:**

1.Filling out a Connect-Extend-Challenge sheet about the activity.

| Connect | Extend | Challenge |
|---|---|---|
| How are the ideas and information presented connected to what you already knew? | What new ideas did you get extended or broadened your thinking in new directions? | What challenges or puzzles have come up in your mind from the ideas and information presented? |
| | | |

2. Evaluation of the products from the activity: poster and participation in the discussions in terms of: active participation in the activities, effective communication of ideas through several media.

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## AFTERWORD

This curriculum has been designed for preschool teaching departments of the European and Turkish universities that are interested in teaching how to integrate algorithmic thinking skills into development areas in preschool teaching.

The modules of this curriculum can be integrated into an existing study program or can be used as a whole. It has been designed in compliance with the European Credit Transfer and Accumulation System (ECTS) including 28 Hours lessons that is equal to 1 ECTS. The implementation hours can be stretched based on the requirements of the university departments. Accordingly, the curriculum designed with flipped learning model can be adapted to only face-to-face or only distance education environments.

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