COMPUSEL

TEACHERS' GUIDE

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Computational Thinking in Enhancing Primary Students' Social-Emotional Learning Skills

TEACHER'S GUIDE

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ACKNOWLEDGEMENT

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INTRODUCTORY OVERVIEW

Welcome to COMPUSEL, an Erasmus+ KA220-SCH project dedicated to reshaping education by integrating computational thinking and social-emotional learning (SEL) within primary school curricula. This guide serves as a comprehensive tool for educators to foster a transformative learning environment that cultivates essential cognitive and affective skills in students.

Project Scope and Application

COMPUSEL is a collaborative initiative involving six institutions across Europe, led by Çanakkale Onsekiz Mart University in Turkey, alongside partners from Portugal (The University of Evora), Romania (The University of Bucharest), Poland (The University of Lodz), Greece (Social Cooperative of Cyclades), and Turkey (Mellis Educational Technologies). Our project responds to the evolving landscape of technology and its impact on the workforce, emphasizing the importance of equipping students with competencies essential for success in the modern world.

In a rapidly advancing technological era, automation systems and robots are reshaping various industries, resulting in shifts in job markets and skill requirements. Concurrently, the demand for both cognitive and emotional skills in business interactions has surged. Social and emotional learning (SEL) has emerged as a crucial facet, fostering skills vital for employability, social relations, resilience, and problem-solving in real-life scenarios.

Objectives of the Project

The primary objectives of COMPUSEL are:

Integrating Computational Thinking and SEL: By merging computational thinking and SEL, we aim to empower students to approach challenges systematically and develop problem-solving abilities across all facets of life.

Teacher Training and Curriculum Development: Our project focuses on training primary school teachers to employ computational thinking skills to reinforce SEL among students. Through this training, teachers will be equipped to guide students in structuring problems effectively for resolution.

Supporting Social Inclusion and Student Success: COMPUSEL seeks to support teachers in fostering full social inclusion and enhancing students' SEL skills, enabling them to strive for success in a holistic sense.

The Importance of Computational Thinking and SEL in Education

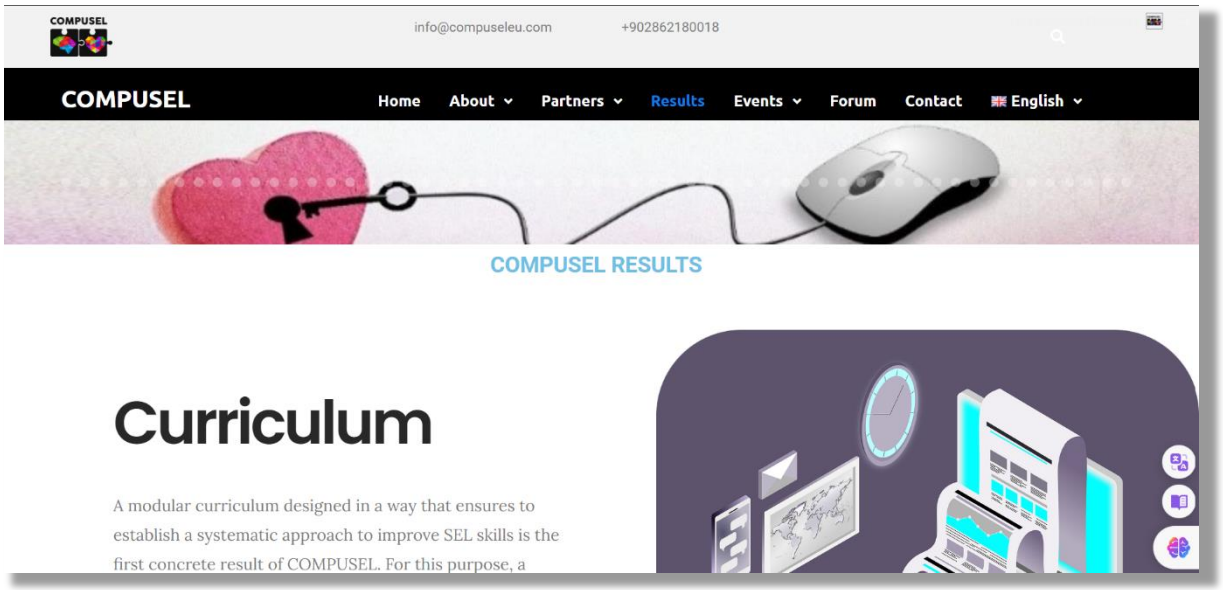
Computational thinking involves problem-solving processes applicable across disciplines, emphasizing skills such as decomposition, abstraction, pattern recognition, and algorithmic thinking. By integrating these skills, alongside the development of SEL, we aim to empower students to navigate complex challenges while fostering a compassionate, inclusive, and forward-thinking society.

Project Deliverables

COMPUSEL delivers a comprehensive curriculum for teachers, digital stories in the form of cartoons, and this teacher's guide. These resources are designed to facilitate educators in effectively integrating computational thinking and SEL within the primary school educational framework.

Let's join this transformative educational journey. Together, we will equip students with the essential skills and mindset needed to thrive in a dynamic, technology-driven world while nurturing empathy, resilience, and holistic success.

Click on the image below for more information about the project results.



COMPUSEL LEARNING MODEL

The COMPUSEL learning model, outlined comprehensively in this section of the teacher's guide, serves as a pioneering framework designed to integrate the realms of Social and Emotional Learning (SEL) with the principles of Computational Thinking (CT) within primary education. This model is an intricate blend of pedagogical innovation, drawing upon seven key components to facilitate a holistic approach to student development and learning outcomes.

1. **COMPUSEL Knowledge Paper:** Acting as the cornerstone of our conceptual framework, this reference provides an insightful introduction to the underpinning theories and principles shaping the development of the learning model.
2. **Curriculum, Lesson Plans, and Worksheets:** This segment offers an introduction to the structured curriculum that forms the foundation of the COMPUSEL educational experience.
3. **Teaching and Learning Strategies for SEL Dimensions:** Focused on the dimensions of SEL this section delineates effective strategies empowering educators to foster crucial skills among students.
4. **Teaching and Learning Strategies for CT Concepts:** Addressing the core concepts of Computational Thinking, this segment equips educators with innovative methodologies to nurture problem-solving, decomposition, pattern recognition, abstraction, and algorithmic thinking skills.
5. **Why Integrate CT into SEL:** Delving deeper, this section elucidates the rationale behind the seamless integration of Computational Thinking into Social and Emotional Learning, highlighting the synergies between these domains.
6. **Implementation Strategies:** Offering practical guidance, this part explores how Computational Thinking can be effectively intertwined with Social and Emotional Learning, enabling educators to create a cohesive and enriched learning environment.
7. **Teaching and Learning Activities:** Concluding with a rich compilation of activities, the annexed Activity Book from Mellis provides a treasure trove of engaging exercises, allowing for the practical integration of Computational Thinking into Social and Emotional Learning.

The COMPUSEL learning model stands as a testament to our commitment to fostering a generation of students equipped not only with academic knowledge but also with the cognitive tools and emotional intelligence essential for navigating the complexities of the modern world.

COMPUSEL knowledge paper discusses the intersection of computational thinking and social-emotional learning (SEL) skills in the context of education. It highlights the increasing role of automation in various industries and the emergence of new jobs that require both cognitive and affective skills.

The importance of SEL skills is emphasized for students in both academic and real-life settings. The concept of SEL is defined as the development of skills related to emotional awareness, problem-solving, relationship-building, and empathy.

The paper proposes a structural approach to fostering SEL skills, integrating computational thinking as a problem-solving process. Computational thinking involves the following skills seen as a valuable tool in solving diverse problems across disciplines.

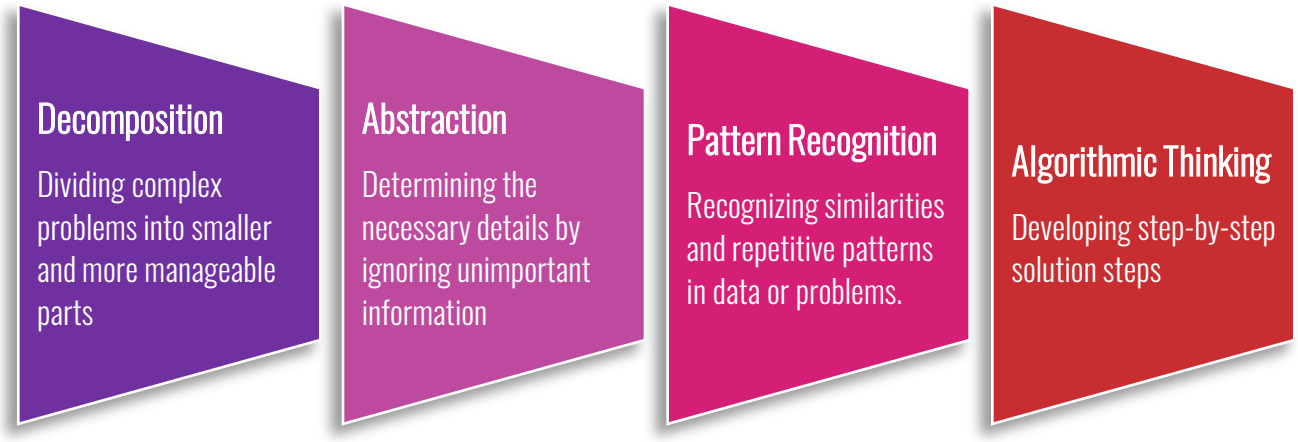


Chart 1: Dimensions of Computational Thinking Skills

The first section of the paper discusses the concept of SEL and its emergence in the context of learning theories such as Multiple Intelligences and Emotional Intelligence. SEL is defined as the process through which individuals acquire key knowledge, skills, and attitudes to identify and regulate emotions, achieve goals, improve empathy, establish positive relationships, and make responsible decisions. The core competencies of SEL include self-awareness, social awareness, self-management, relationship skills, and responsible decision-making based on CASEL.

The fundamentals of SEL are further explored, focusing on key competencies:

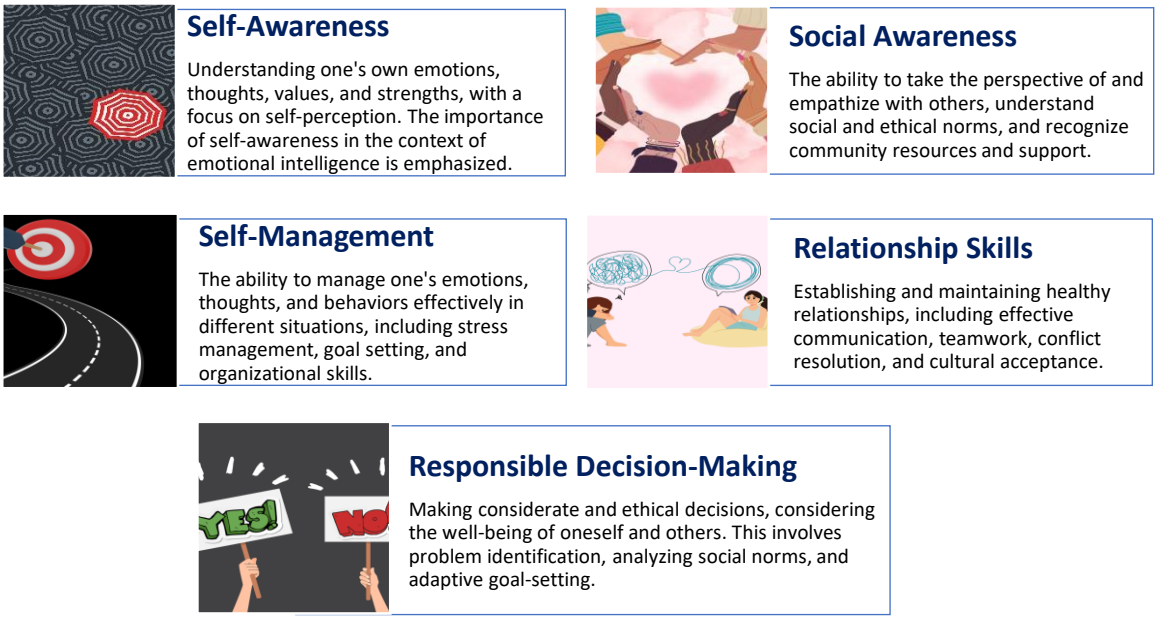


Figure 1: SEL Skills

COMPUSEL knowledge paper highlights the importance of SEL in education, focusing on its impact on personal success, well-being, and the overall school climate. Theoretical linkages of SEL with various learning theories are explored, and a call for empirical investigation into its strengths and contributions is mentioned.

Additionally, practical aspects of SEL implementation in primary schools are discussed, providing insights into the components of SEL. The importance of holistic leadership guidance, creating a peaceful learning environment, and addressing inequitable discipline practices within SEL programs is emphasized.

The first section of the paper concludes with an overview of SEL practices in primary schools in Europe, citing examples from Greece, Poland, Portugal, Romania, and Turkey. It highlights the growing recognition of SEL as a crucial aspect of curricula across European countries and discusses various approaches, including the adoption of existing interventions and the development of country-specific SEL programs.

The second section of the paper discusses the concept of computational thinking and its significance in the context of modern education. It begins by tracing the roots of thinking skills back to Ancient Greece and the Age of Enlightenment, highlighting the growing importance of thinking skills in today's technology-driven and rapidly changing world. Computational thinking, coined by Seymour Papert in 1980, is introduced as a process that systematizes effective thinking to solve problems encountered in daily life. The core skills of computational thinking are explored in detail. And

the explanations for these dimensions are also provided in Section “Teaching & Learning Strategies for CT Skills Dimensions” in this book.

The examples provided in the paper illustrate how these computational thinking skills can be implemented in educational activities. For instance, the "Help Mike the Cat get to the milk bowl" activity is presented as a way to foster social-emotional skills through decomposition. The text also discusses different strategies for decomposition, such as means-end decomposition, bottom-up decomposition, multivariate decomposition, multi-level parsing, and comparative decomposition.

In summary, the knowledge paper emphasizes the relevance of computational thinking in education, particularly in developing thinking skills that are crucial in addressing complex problems in various aspects of life. It provides a detailed exploration of decomposition, abstraction, and pattern recognition, highlighting their integration into social-emotional learning and practical examples for implementation in educational settings

Additionally, the paper introduces design thinking as a user-centred problem-solving approach distinct from computational and algorithmic thinking. Design thinking addresses vague and open-ended problems, beginning with understanding user needs and culminating in unique deliverables. The process involves empathizing, defining, ideating, prototyping, testing, and improving, and is non-linear, allowing for iterative development.

The paper briefly touches on optimization problems and swarm intelligence algorithms, inspired by animal social behaviours. It introduces artificial neural networks for machine learning, emphasizing their basis in biological neural networks and their application in forecasting output responses of complex systems.

Lastly, the paper explores emotional computation, an interdisciplinary field involving computer science, psychology, and cognitive science. It discusses the role of the limbic system in emotions, highlighting parts like the amygdala, hypothalamus, cortex prefrontal, gyrus syngvlat, and hippocampus. Emotional computation involves recognizing, processing, and interpreting emotions using sensors, speech patterns, facial expressions, and body language analysis.

The paper highlights the pivotal role of schools in shaping individuals' social-emotional development, asserting that social-emotional skills are integral to inclusive and diverse education. In the context of the COVID-19 pandemic, the need to adapt existing approaches and develop a curriculum for social-emotional learning became evident. The paper

emphasizes the importance of teacher training in fostering social-emotional skills, with a focus on integrating computational thinking for problem-solving and enhancing digital competencies for the future.

The recommendations for future actions in school contexts and curriculum development include:

1- Urgent definition of an integrated strategy to promote socio-emotional skills and psychological health in schools.
2- Explicit learning of socio-emotional skills in a transversal and longitudinal model, incorporating them into the curriculum.
3- Encouraging the learning of socio-emotional skills in informal contexts.
4- Implementing interventions for well-being and psychological health, starting from pre-school education.
5- Valuing student participation.
6- Promoting healthy school climates.
7- Commitment to developing socio-emotional skills for teachers, principals, and other stakeholders in the school ecosystem.
8- Positive disciplinary management.

Table 1: Recommendations for future actions

In summary, the paper underscores the need for a comprehensive approach to social-emotional learning in schools, involving curriculum integration, teacher training, and a focus on well-being and psychological health. The recommendations provide a roadmap for developing an inclusive and supportive learning environment.

Curriculum

In recent years, European school curricula have integrated social-emotional learning (SEL), taking two main approaches: adapting international SEL programs and creating tailored programs for individual countries. Despite efforts to enhance students' SEL skills, many still face social-emotional challenges in school. SEL hasn't attained primary curriculum status in Europe, though its importance is acknowledged. Hence, there's a call for it to be prioritized and adequately resourced. Additionally, there's a need for culturally responsive SEL education in Europe.

COMPUSEL has developed a novel curriculum catering to European students' needs, considering their unique characteristics. The curriculum development emphasized computational thinking as a creative method to address complex social-emotional issues.

COMPUSEL endeavours to enhance the social-emotional abilities of primary school students and provide training for teachers toward this end. Through this initiative, students will be empowered to gain insight into their emotions, thoughts, and values, and understand how this influence their behaviour, regulate their emotions, thoughts, and actions effectively, foster empathy and cultivate healthy relationships. Moreover, COMPUSEL will offer support to teachers in assisting their students to strive for success by nurturing their social-emotional learning abilities and promote social inclusion.

Recognizing that social-emotional learning skills are essential for holistic human development, COMPUSEL integrates computational thinking skills and digital storytelling into the teaching of social-emotional learning. This integration will enable students to frame and tackle problems effectively. By instilling social-emotional skills during the primary school years, COMPUSEL aims to internalize these abilities within students, thereby significantly enhancing their academic and life success.

Modular Lesson Plans

The program created as part of the COMPUSEL project is addressed to students aged 9-12 and can be implemented by teachers, educators, pedagogist and/or school psychologists. Individual Modules can be included in the school curriculum and conducted with the entire class or be a topic during additional classes in groups of students created for this purpose, the aim of which is to build social-emotional competences and personal development. For the comfort of work and the expected efficiency, large classes can be divided into two groups.

The Structure of the Programme:

- The program includes five thematic areas (called Modules), each of which is dedicated to developing one SEL dimension.
- Each module consists of two parts (Sessions 1 and 2), and each session is divided into two sub-sessions lasting 50 minutes (cultural differences should be considered - for example, in a Polish school, the duration of one teaching hour is 45 minutes).
- Since each Module of the program is devoted to a different topic and is used to build different social-emotional skills, it can be used selectively, but the best effect is achieved by conducting the entire series of classes in the order written in the textbook.
- Each session has a similar structure, which allows to develop a work ritual. The chart showing the structure can be seen as follows.

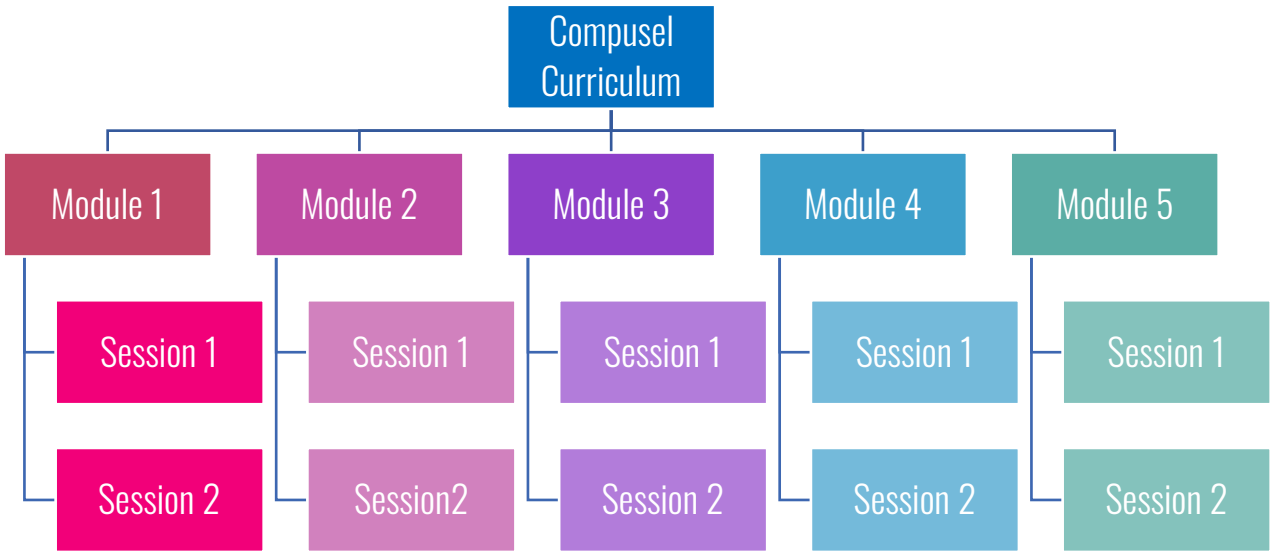


Chart 2: Curriculum Structure

Course Delivery Process:

- At the beginning, students (participants) watch a film presenting a problem situation referring to the social-emotional skill developed in each Module (Situation).
- Then they talk freely about this situation with the teacher (Introduction), who introduces information needed for further work related to the main topic of a given Module (e.g. explains the importance of observing moral norms, dealing with one's own and others' emotions, etc.).
- Next, students work to solve complex socio-emotional problems presented videos, using the assumptions of computational thinking, which includes four stages: Decomposition, Abstraction, Pattern recognition and Algorithmic thinking.
- After this part is completed, the ending takes place. Since the tasks are based on experience and revealing one's own beliefs, it is very important to have summary rounds, which facilitates drawing personal conclusions, reflection, and "anchoring" the experience related to a given exercise.
- Finally, students evaluate if their solutions are efficient either by discussing or observing social relations and situations.

The course delivery process is visualised in Chart 3 as follows.

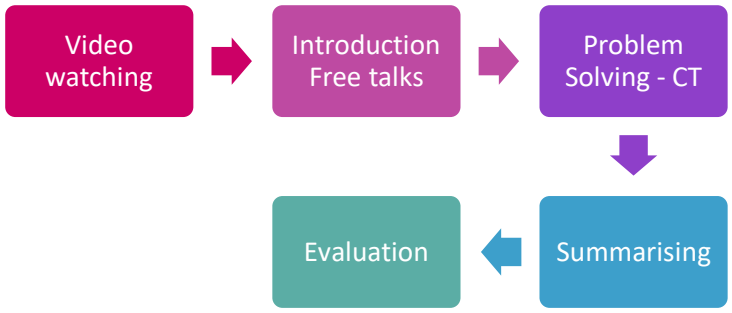


Chart 3: Course Delivery Process

The achievement of goals pursued during individual modules will be more effective thanks to the use of various activating work methods, such as:

Sitting in a circle

Sitting in a circle allows everyone to see others and be visible, the leader can observe the entire group. This is a different form of work than in the classroom, during typical learning, where students sit at desks. Sitting in a circle gives the feeling that everyone is "equal" and has the same rights.

Round

Each participant of the group speaks, usually summarizing the exercise. This form of work helps you name your feelings and thoughts and verbalize them. It gives everyone the right to speak but also not to speak.

Individual work, in pairs or small groups

Because not every student may be ready to reveal their opinions in front of the whole class (e.g. shy students for whom disclosing their personal reflections may be risky due to the lack of a sense of security) it is worth proposing another form enabling you to express yourself and reveal your feelings and thoughts.

Brainstorming

Brainstorming activates the entire group, involves expressing unrestrained ideas, without judgment, criticism, real and unrealistic, even absurd ideas. What matters is the number of associations and ideas on a given topic, every idea is good, only then do we choose the best ones from the multitude of ideas. This form of work increases energy in the group, stimulates creativity and encourages people who are usually afraid to speak up in a group.

Role-playing

Role-playing is a method that creates an opportunity to get out of the intellectual considerations towards affective and emotional involvement in experiencing a fictitious problem, which, at the moment of action, becomes a real experience. Role-playing gives students the opportunity to expand their repertoire of behaviours and helps them better understand themselves and others.

Class discussion

It should be moderated by the teacher so that students do not deviate from the topic being discussed. However, they should not be completely limited, because often a statement on a seemingly different topic can become a good starting point for participants to come to interesting new conclusions. It is important that the teacher moderating the discussion (and the entire program) ensures the introduction and compliance with basic group norms, such as: physical and mental safety (i.e.: we do not criticize, we do not judge, but we give feedback about specific behaviors); maintaining a friendly atmosphere; the right of each participant to have their own opinion and be heard; discretion (personal things happening in the group remain secret group); here and now - what happens during classes, e.g. conflicts, should be resolved during classes and not commented on after them; regularity and punctuality.

Worksheets

An additional tool helpful in implementing individual topics are Worksheets created for each Module.

The exercises included on the cards are related to the analysed situation. The use of Worksheets increases the effectiveness of the program because it gives the opportunity to deepen students' reflections necessary to build and/or develop the social-emotional skills being trained. Thanks to this reflection, participants may find it easier to understand themselves, their behaviours, and the behaviours of others, as well as their positive and negative consequences.

Thanks to using Worksheets, it will also be easier for students to recognize what emotions help in each situation and how they can manage their emotions. Thanks to this, they gain tools to build positive relationships with peers and adults, increase their empathy and improve communication skills.

Using worksheets also helps students:

- Learn about your agency and influence on the course of events.
- Stimulate reflection on what led to this difficult situation.
- Learn to participate in a dialogue or prepare for a conversation.
- Submit your own ideas for solving a difficult situation.
- Think about their own situations to work on.

Figure 2: A Selection from the Worksheets

Relevance

Social and Emotional Learning (SEL) includes critical skills for personal and academic success, such as managing emotions, setting and achieving goals, showing empathy, establishing positive relationships, and making responsible decisions. Research by Durlak et al. (2011) underscores the positive impact of SEL programs on students' social and emotional well-being, as well as academic performance, highlighting the importance of integrating SEL into educational curricula.

The research conducted by Jones and colleagues (2013) highlights the importance of integrating SEL into educational institutions. Complementary studies also show the importance of teaching training trough models of personal development and socioemotional competences from teachers (Cristovão et al., 2020; Candeias & Portelada, 2022; Candeias et al., 2023) Doing so, creates a supportive learning environment and helps students develop skills to navigate the complexities of the modern world. This underscores the necessity of providing comprehensive SEL instruction.

SEL programs have been increasingly recognized for their role in enhancing students' academic and life success. Taylor et al. (2017 and Cristovão et al. 2019) provide a comprehensive review, demonstrating that SEL programs not only improve social-emotional skills but also lead to positive attitudes toward self and others, increased positive social behavior, and reduced emotional distress and improve school achievement (Verdasca et al., 2013; Candeias et al., 2017). This body of evidence supports the integration of SEL into educational settings as a means to foster well-rounded, socially competent individuals.

Recent studies conducted by Mahoney et al. (2020) highlight the long-term advantages of SEL. The research demonstrates that the early development of SEL competencies can predict adult outcomes such as educational attainment, employment status, and mental health. This highlights lasting benefits of investing in SEL from an early age.

Direct Instruction with Demonstration and Guided Practice

Direct instruction, when systematically applied to SEL, involves clear, explicit teaching of social and emotional skills, followed by demonstration and opportunities for guided practice. Hattie (2012) identifies direct instruction as a highly effective teaching strategy that, when applied to SEL, can lead to significant improvements in student outcomes by offering structured learning experiences that build upon each other. Knight (2013) further elaborates on the power of demonstration and modelling as part of direct instruction, highlighting how teachers can effectively illustrate SEL skills

in action. By engaging in guided practice, students internalize these skills, making them more adept at navigating social and emotional situations.

- Direct Instruction: Start with clear, straightforward explanations of SEL concepts. Use age-appropriate language and examples to introduce ideas like empathy, resilience, and cooperation. This method sets a solid foundation for understanding SEL principles (Fisher et al., 2020).
- Demonstration: Model the SEL skills yourself. For instance, show how to resolve a conflict with empathy or how to express feelings appropriately. This visual learning is crucial for young learners (Pianta & Hamre, 2016).
- Guided Practice: After demonstrating, engage students in activities where they can practice these skills. Role-plays, simulations, and group discussions provide safe spaces for practice and reinforcement.

Collaborative Learning

Collaborative learning is a dynamic classroom approach where students work together in small groups to achieve learning objectives, fostering SEL skills; communication, and conflict resolution. Slavin (2014) supports this approach, noting its effectiveness in promoting academic and social success, as it mirrors real-world interactions and dependencies.

Gillies (2016) extends this notion by illustrating how collaborative learning environments encourage students to engage in dialogue, negotiate with peers, and develop empathy, thereby enriching their social and emotional learning experiences.

- Group Projects: Design activities that require teamwork to achieve a common goal. This can include collaborative art projects, science experiments, or group presentations, emphasizing the importance of each member's contribution (Slavin, 2014).
- Peer Learning: Pair students for peer-assisted learning tasks. They could teach each other a new skill or concept, fostering a sense of responsibility and enhancing their understanding through teaching (Kwon et al., 2020).

Reflection and Journaling

The practice of reflection and journaling in SEL has gained additional support from recent studies. Schonert-Reichl et al. (2019) found that structured reflection and journaling activities contribute significantly to students' emotional well-being, helping them articulate feelings and challenges, thereby enhancing emotional literacy and self-regulation.

Reflective practices promote mindfulness among students, supporting emotional and social competencies. Jennings et al. (2021) highlight the interconnectedness of reflective practices, mindfulness, and SEL.

- Class Reflections: Regularly allocate time for students to reflect on their experiences and emotions related to SEL activities. This could be through a class discussion or a quiet moment of personal reflection, helping students process and internalize their learning (Schonert-Reichl et al., 2019).
- Journaling: Encourage students to keep personal journals where they can express their thoughts and feelings. Provide prompts to guide their entries, such as "Write about a time you helped a friend" or "How did it feel when you worked together with your classmates?" (Jennings et al., 2021).

Storytelling

Recent research underscores the role of storytelling in SEL, with studies by Perkins et al. (2018) showing how narrative-based learning can enhance empathy, perspective-taking, and moral reasoning. By engaging with diverse stories, students are exposed to a wide range of human experiences and emotions, fostering a greater capacity for empathy and social understanding.

Additionally, Green and colleagues. (2019) highlights the transformative power of storytelling in developing critical thinking and emotional intelligence, noting that stories can serve as a mirror and window into the self and the world, respectively, enriching students' emotional and social insights.

- Using Literature: Incorporate books and stories that highlight SEL themes. Discuss the characters' actions and emotions to help students understand and empathize with different perspectives (Perkins et al., 2018).
- Sharing Personal Stories: Create opportunities for students to share their own experiences through storytelling circles, where students take turns fostering a supportive classroom environment (Green et al., 2019).

Implementing SEL in Daily Routines

SEL Morning Circles: Start the day with a morning circle, where students can share their feelings, set goals for the day, and engage in a brief SEL activity or discussion. This routine helps build a strong, supportive classroom community.

Integrating SEL in Academic Content: Find opportunities to weave SEL themes into academic lessons. For example, when teaching math, discuss the importance of perseverance in solving difficult problems, or in history lessons, explore the emotions and perspectives of historical figures.

Computational thinking dimensions and definitions

Computational thinking (CT) is a fundamental skill set that enables individuals to approach complex problems systematically and formulate efficient solutions by drawing on concepts from computer science

Decomposition

Problem-solving strategy that involves breaking down complex problems into smaller, more manageable parts. In the context of primary education, decomposition encourages students to analyze tasks or problems into simpler components.

For example, when solving a problem in mathematics, students can decompose it into smaller steps such as understanding the question, identifying key information, and selecting appropriate operations. By teaching decomposition, teachers help students develop critical thinking skills and learn to approach challenges systematically. Incorporating activities like breaking down a multi-step task into smaller achievable goals can scaffold students' understanding of decomposition.

Abstraction

Entails focusing on essential details while ignoring irrelevant information to simplify complex problems. In primary education, abstraction encourages students to identify common patterns or general principles across different contexts.

For instance, when learning about shapes, students can abstract the concept of a triangle by recognizing its defining characteristics regardless of size or orientation. Teachers can promote abstraction by providing simplified representations of concepts and encouraging students to identify commonalities among them. Activities such as categorizing objects based on shared attributes or summarizing stories into key points can help students practice abstraction skills.

Pattern recognition

Involves identifying similarities or recurring structures within data or problems. In primary education, pattern recognition nurtures students' ability to recognize and predict patterns in various subjects, including mathematics, language, and science.

For example, students can identify patterns in number sequences, detect rhyming words in poetry, or observe recurring themes in literature. Teachers can foster pattern recognition skills by presenting students with diverse patterns to analyze and encouraging them to articulate the rules or relationships underlying those patterns. Engaging activities like completing pattern sequences, creating pattern-based artwork, or solving pattern-based puzzles can reinforce pattern recognition abilities.

Algorithms

Step-by-step procedures or instructions for solving problems. In the context of primary education, algorithms help students develop logical thinking skills and understand sequential processes.

For instance, when learning to solve addition problems, students follow a set of steps such as identifying numbers to be added, aligning them vertically, and performing column-wise addition. Teachers can introduce algorithms through hands-on activities and visual aids, emphasizing the importance of following instructions in a precise order. Activities like creating and executing algorithms for everyday tasks, such as making a sandwich or tying shoelaces, can help students grasp the concept of algorithms and their practical applications.

Psycho-behavioural portrait of the 10-year-old child (schoolchild)

In human development, personality is seen as a bio-psycho-social construction, which is consolidated during a process of interactions and relationships that take place between individuals and within this frame, we can identify several views regarding the stages of development.

Here we refer to the period of development of the child between the ages of 6-11 years, which is called in the specialized literature according to some authors the third childhood or middle childhood, and according to other authors, the period of early schooling. We are mainly concerned with the evolution and development of the child in the school space, so we will use the term schoolchild when we refer to the subjects of our approach.

Entering school is an extremely important moment in the formation of the individual's personality. This stage represents, on one hand, the beginning of a new learning period, which obviously requires a considerable intellectual effort, but also great physical resistance. Within the third childhood, being a period of transition, we can observe dysfunctions and crises of growth and development.

This period involves a major change in the life and work regime for children, the following of a certain schedule, plans, programs, actions with moral, aesthetic, cognitive, psychophysical and intellectual values. Specialist research refers to the fact that the school environment prepares and supports the student for an intellectual, organized, continuous work and differs from the family one, which has as its main characteristic the fact that it satisfies emotional needs, material comfort and more.

In this period of early schooling, there is a change in the entire mental activity, the child's thinking goes from the contemplation and intuitive understanding of a phenomenon, to the logic of the rule, of the law expressed by the case, the phenomenon and the operation of it, something that can be considered a revolution in the act of knowledge, a structure of understanding (Verza&Verza, 2017, p. 376).

If we make an analysis related to the imagination of the young student, then we can say that the young school age offers fertile ground for the development of imagination, which will give the child the opportunity to dominate any time and space. This can be an explanatory premise of the fact that, at this moment of age, if conflictual situations arise in the family, it is possible for the student to imagine possible fatalistic scenarios related to his future. For example, it is important for separated parents to create a realistic horizon of expectations for the child, so that his rich imagination does not generate states of increased anxiety. This is reinforced by Anca Munteanu (2003): "on the background of his curiosity, the little student is fond of fairy tales and stories, which he experiences with great emotional intensity. In close filiation with reproductive imagination, the creative imagination also develops, especially after the psychic energy, diverted for a while by the imperatives of school integration, is released. For the young students, even moments of fabulation may appear. (Munteanu, 2003, p.213)

Regarding affectivity, Anca Munteanu (2003) states that entering school also changes the child's affective universe. Their emotional life becomes more balanced. Along with games, learning triggers numerous positive or negative affective states. School rules diversify the affective register, its formation requires direct, elastic guidance from the adult and, finally, the crystallization of a balanced work regime.

Early schooling also provides fertile ground for the development of moral, intellectual and aesthetic feelings. This is the moment when the expression of emotional reactions also changes. The schoolchild generally becomes more censored,

more discreet. However, the picture also has some nuances depending on age: at 7 years old, they are restrained, meditative; at 8 years old they become more expressive, in a better mood; at 9 years old they fall back into a meditative state; at 10 years old they acquire a great expressiveness of the face. The essence of individuality lies in the dynamic arrangement of psychophysical systems governing one's distinctive thought processes and actions, as Allport mentioned (Allport, 1937). Education accelerates the development process of the individual's personality, by ensuring favorable environmental conditions, by creating a climate with strong educational values, which depends on the hereditary dispositions, concerns and motivations of the subject.

Learning strategies for CT

Learning activities that foster the development of computational thinking abilities can vary greatly for children in primary school and can make use of a number of complex abilities such as creativity and the ability to compete with one another either as an individual or as part of a team and to understand organized settings and rules, but their overall form will trace back to basic coding related activities. In this sense, we will refer to the situation of an robotic coding toy in the shape of a mouse for exemplifying these types of learning strategies for computational thinking.

There are numerous such toys that introduce children of all ages and stages to coding and the very form that they have allows for increasing difficulty and complexity in school activities. Their typical setting would be a robotic figure (animal, robot etc) accompanied by an adjustable mat made out of squares that helps with envisioning necessary steps in order to complete a simple coding sequence. Apart from this, some will have helping coding cards with the possible steps that the toy can make: forward, backward, left and right as exemplified below.

The mechanics of this experience is that the mouse is designed with special buttons that allow for coding or writing the path of the toy before it actually sets out to its desired goal (spot on the mat). There will also be a button that will erase all previous programming.

While this toy is more suited for such applications, the purchase of such a toy is not necessary as they can easily be made from paper (a printed mat) accompanied by a cut-out mouse or any other creature and additional objects as well as helping coding cards. Furthermore, these resources can be found online or they can just be drawn and used as such in a variety of children's programming platforms such as Scratch. The examples below can be applied to both the printed or drawn mat and the many coding toys found on the market and online children coding platforms.

In terms of learning strategies the very first one that comes to mind is children's physical interaction with the toy mouse, understanding its purpose in the context (the need to pursue a path in the designated template), its needs (to get to the square that holds the cheese, cookie etc) and desired outcome. The whole of the activity is designed as experiential learning or hands on experience where children learn by doing, but the example featured here serves as an introduction

to the unplugged (does not require a computer) coding activities. It is also a great manner through which decomposition (the very first component of CT thinking) of elements can be applied: breaking down the very steps that the mouse can make on the board. Instructions. Jake the Mouse is hungry and he needs to get to the cheese as fast as possible.

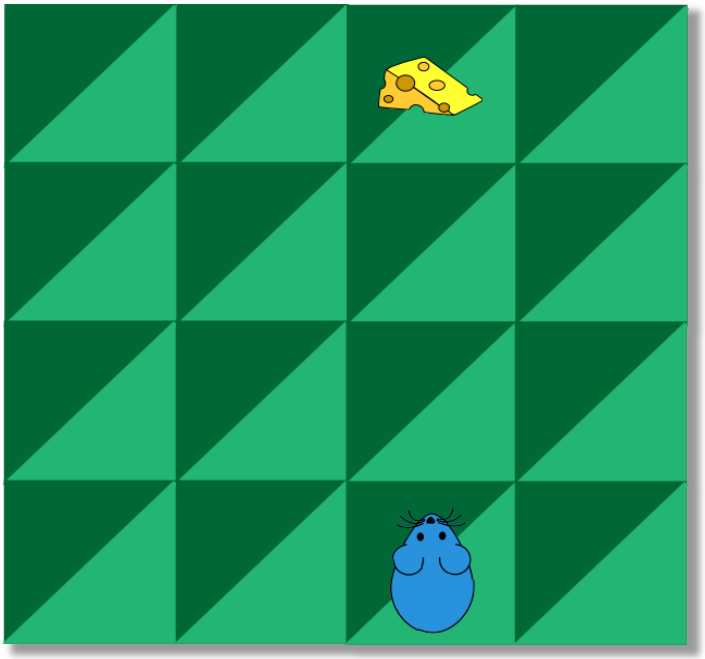


Figure 3. Coding mouse on square mat

Proposed steps:

FORWARD	FORWARD	FORWARD

Alternatively, proposed steps using coding cards for cut out activities:

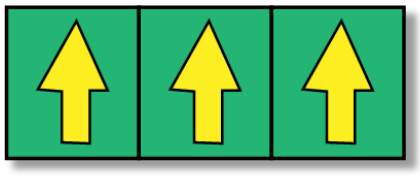


Figure 4. Instruction cards for mouse steps

As mentioned previously the resources that constitute the coding mouse activity can vary, but it is more engaging to interact with the robotic ones that have the programming buttons features where children observe, touch and may even write a test sequence to see how the mouse moves and understand its capabilities and limitations better.

Increased difficulty can be introduced through storytelling, another learning strategy which is often used in primary school activities for expanding language abilities. The narration of the mouse's goal will now be accompanied by other

events that might obstruct it in its path after children have understood the way he can move. The obstacle itself should be named by children in a coherent and situation appropriate manner and it must be made clear that the mouse will have to go around it and as such it will be positioned on the shortest path between the mouse and the cheese. This is the right moment to introduce the left and right orientations for the mouse's position. It is essential at this point to only focus on one possible path, although there are other options.

Instructions. Jake the Mouse is hungry and he needs to get to the cheese. However, something happens that throws him off his path. Can you tell me what it is? What would his path look like then? He really needs to get there through the shortest way.

Proposed storytelling answers: A cat appears, a wall that wasn't there before, another mouse that wants to chat etc.

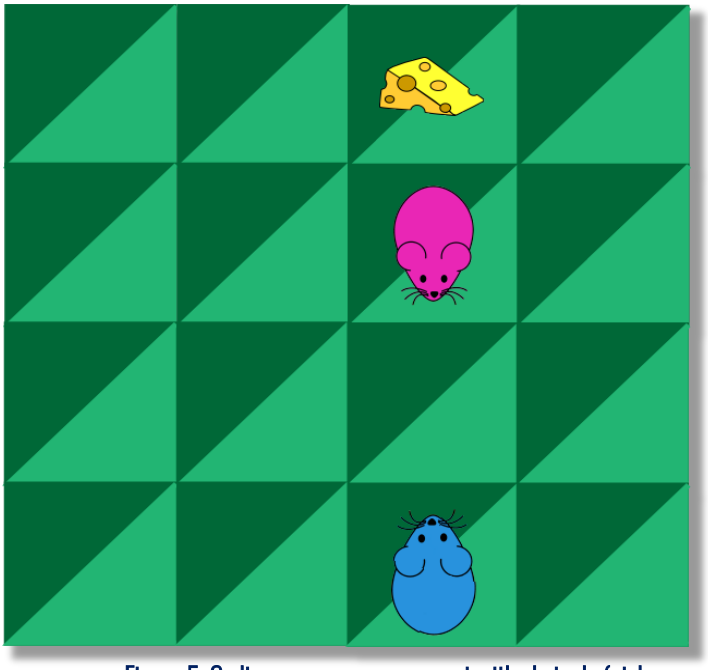


Figure 5. Coding mouse on square mat with obstacle (pink mouse)

Proposed sequence steps:

FORWARD	RIGHT	FORWARD	LEFT	FORWARD	FORWARD	LEFT	FORWARD

Alternatively, proposed steps using coding cards for cut out activities:

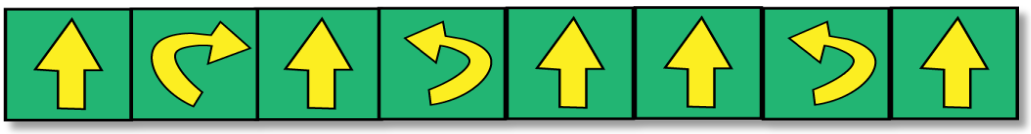


Figure 6. Instruction cards for mouse steps

This development also makes use of other CT components namely pattern recognition represented here as understanding that only the first two steps of the previous sequence apply in this situation. Subsequently, it gives way to algorithmic thinking which is highlighted in writing steps after encountering the obstacle. All of these activities should be followed by reflection and iteration moments where children are invited to envision alternative paths in overcoming the obstacle.

Instructions. Jake the Mouse is hungry and he needs to get to the cheese. However something happens that throws him off his path. Can you tell me what it is? What would his path look like then? He really needs to get there though the shortest way.

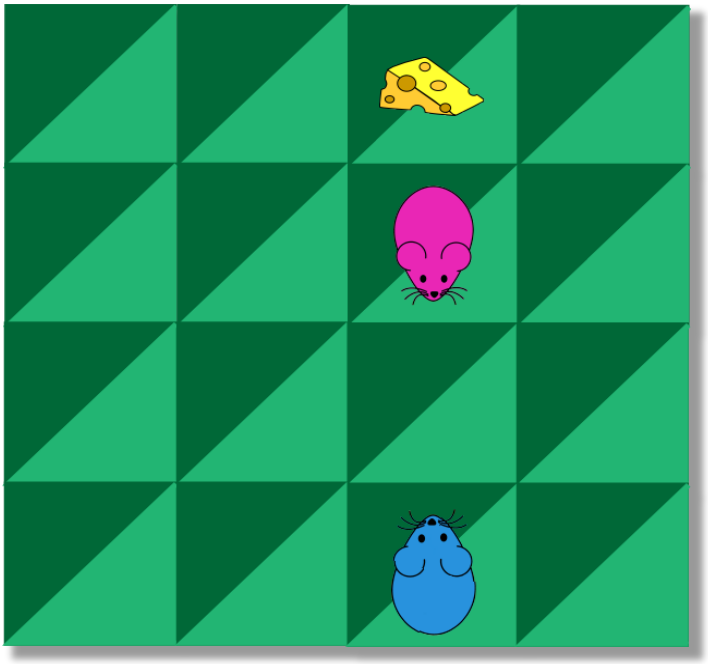


Figure 7. Coding mouse on square mat with obstacle (pink mouse)

Proposed sequence steps:

FORWARD	LEFT	FORWARD	RIGHT	FORWARD	FORWARD	RIGHT	FORWARD

Alternatively, proposed steps using coding cards for cut out activities:

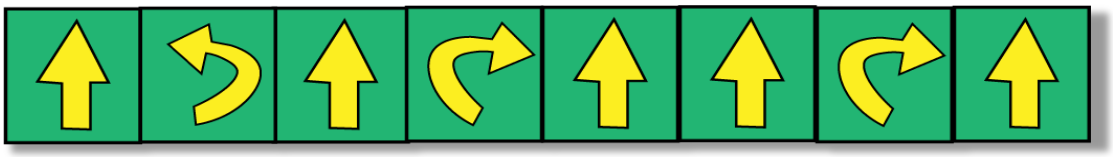


Figure 8. Instruction cards for mouse steps

At this point, the teacher should make clear that both the path in the second activity and the one in this activity are similar in number of steps in achieving the desired goal of getting the cheese as fast as possible, with the slight change in the mouse's orientation.

However, the teacher should also continue the activity by introducing another path such as the one below and emphasizing that while this particular path gets the mouse where he needs to be, it is not the shortest way as it has two extra steps and as such it provides opportunity to further demonstrate abstraction and efficient sequencing.

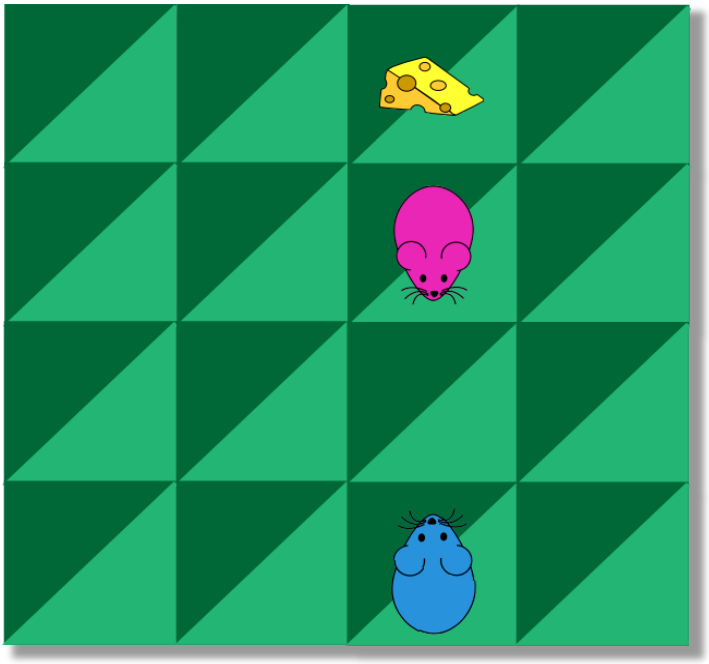


Figure 9. Coding mouse on square mat with obstacle (pink mouse)

Proposed sequence steps:

FORWARD	LEFT	FORWARD	FORWARD	RIGHT	FORWARD	FORWARD	RIGHT	FORWARD	FORWARD

Alternatively, proposed steps using coding cards for cut out activities:

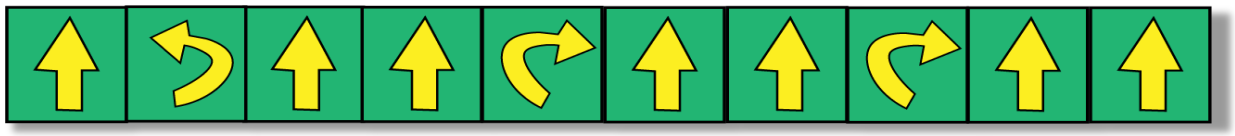


Figure 10. Instruction cards for mouse steps

Another learning strategy that can follow right after these ones is gamification of the whole experience by introducing other instructions such as having the mouse make at least one backward step, having him start with a different orientation or introducing more obstacles in its path that may or may not be necessary for it to go around them in order

achieve its goal and even to have a different shaped mat. This provides a setting for competitions between students that can compete as individuals or in teams to find the most efficient sequence of steps. Furthermore, they two can be invited to think of increasingly complicated instructions.

Instructions. Jake the Mouse is hungry and he needs to get to the cheese. However something happens that throws him off his path. He meets Lucy (pink mouse) who has to tell him something urgently. I wonder what it is. We will know when he gets to her. Jake also has to take one backward step because he forgot his backpack. What would his path look like then? He really needs to get there though the shortest way.

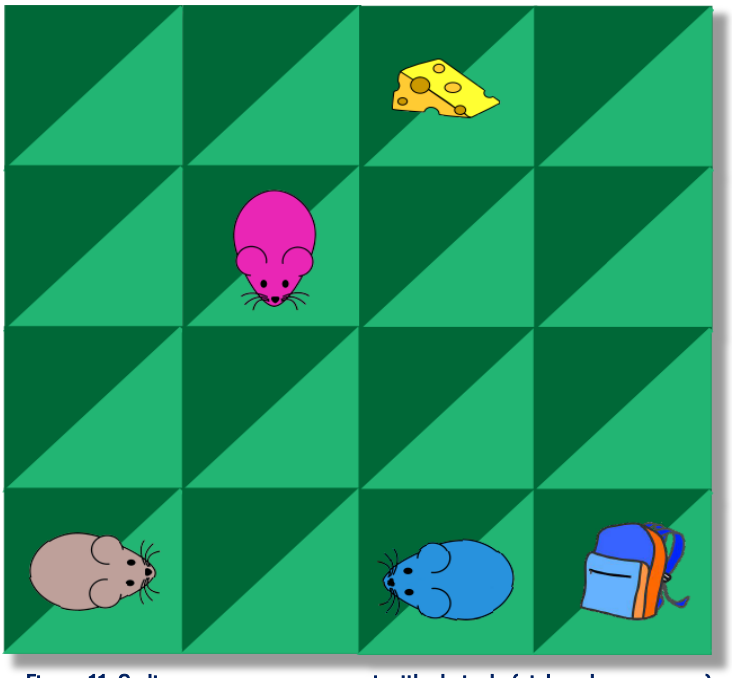


Figure 11. Coding mouse on square mat with obstacle (pink and gray mouse)

Sequence steps:

FORWARD	RIGHT	FORWARD	BACKWARD	RIGHT	FORWARD	FORWARD	LEFT	FORWARD	FORWARD	FORWARD	LEFT	FORWARD

Alternatively, proposed steps using coding cards for cut out activities:

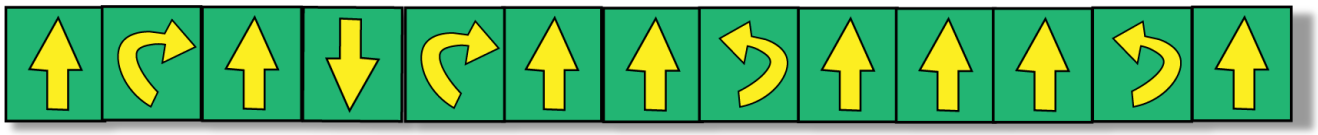


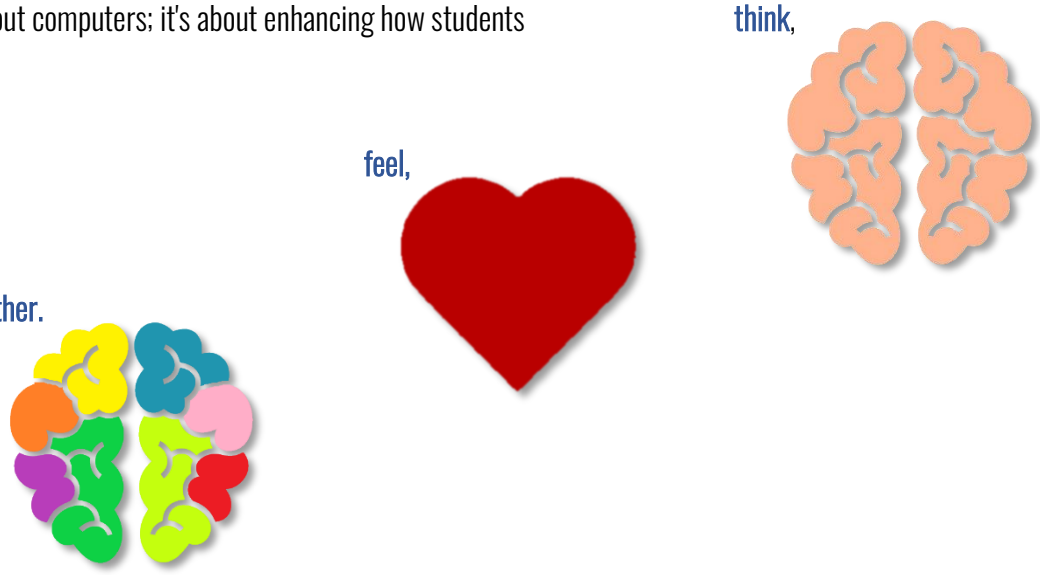
Figure 12. Instruction cards for mouse steps

All of these situations make use of the abstraction component of CT where useless elements in an experience are discarded or ignored in achieving the desired goal.

Lastly computational thinking learning can be integrated with other subjects through envisioning for example in natural sciences, the process of how the caterpillar becomes a butterfly thorough rigid but undeniable steps, or combining strategies, such as emphasizing storytelling in language classes in describing the steps that a prince undertakes in order to fight the dragon to achieve and his goal of rescuing the princess and attention to be drawn on unnecessary elements in the story. The activities proposed here should be seen as starting points for innovative ways on helping children understand any process (mental, mathematical, natural, language related etc.)

Why Should We Integrate Computational Thinking into Social-Emotional Learning?

In today's education, blending CT with SEL is like offering teachers a powerful toolkit for students' overall development. It's not just about computers; it's about enhancing how students think, feel, and work together.



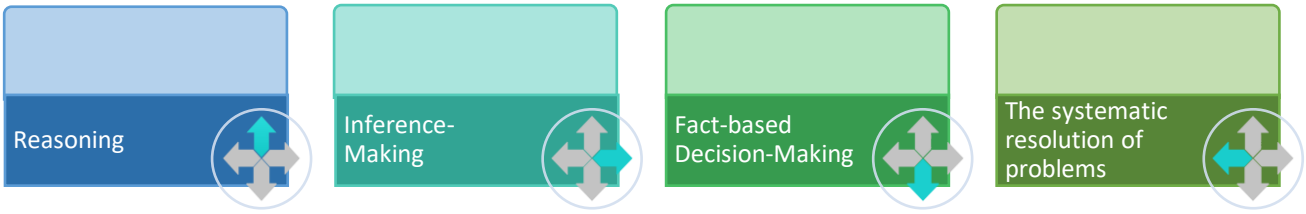
From sharpening problem-solving skills to helping students handle emotions, it prepares them for the demands of our changing world. The exploration of how weaving CT into SEL can empower students and make teaching even more impactful is detailed below:

Enhancing Analytical and Logical Reasoning

In the contemporary landscape, the widespread adoption of computer technology has ushered in a paradigm shift in problem-solving methodologies. Central to this shift is the concept of CT, a cognitive approach that emulates the systematic problem-solving methods employed by computers. CT skills encompass the ability:

- to deconstruct complex problems into manageable components,
- identify recurring patterns,
- and apply logical reasoning in diverse contexts.

Logical thinking, a key component, involves the evaluation of cause-and-effect relationships, propositions, and arguments, requiring an understanding of logical connections and the discernment of potentially misleading information. This cognitive skill set extends to the realm of the following shown in the diagram.



The essence of logical thinking lies in a structured reasoning process, enabling a nuanced comprehension of situations by methodically solving problems or arriving at accurate conclusions. This capacity empowers students to make informed and effective decisions in both academic and social spheres, as they adeptly infer and evaluate information.

For instance, a student navigating a disagreement with a peer can leverage logical thinking to arrive at a rational resolution, exercising control over emotions.

CT skills not only facilitate logical problem-solving in social-emotional contexts but also find application in academic subjects like mathematics and science. Consequently, students engage in more profound cognitive processes, moving beyond rote application to discerning underlying reasons, fostering enhanced problem-solving abilities and academic success.

The facets of CT, namely decomposition, pattern recognition, abstraction, and algorithmic thinking, offer a systematic framework for addressing SEL problems. This systematic problem-solving approach nurtures students towards greater independence and self-assurance. Delving into the specifics:

- Decomposition aids in internalizing problems by breaking them down into more manageable components.
- In the pattern recognition stage, students cultivate the ability to discern connections between events and their repercussions.
- The abstraction stage necessitates a focus on the core problem.
- Subsequently, in the algorithmic thinking stage, students systematically identify cause-and-effect relationships in problem-solving, sequentially arriving at viable solutions.

This methodical approach seamlessly integrates logical thinking skills. To illustrate, logical thinking skills manifest in the meticulous determination of steps to solve a problem. Moreover, the integration of these CT stages within a meticulously designed SEL Program for Primary Schools reinforces the interplay between analytical and logical thinking

skills. Consequently, the cultivation of CT skills not only fortifies students' ability to navigate academic challenges but also equips them to adeptly address real-life problems through effective and informed solutions from a social-emotional perspective.

Enhancing Creativity and Innovation

CT stands as a pivotal problem-solving skill, fostering the development of 21st-century competencies. This skill set involves a comprehensive understanding and analysis of information processing, coupled with the ability to solve problems and generate novel knowledge. Students who acquire skills in CT demonstrate an enhanced capacity to interpret challenges from diverse perspectives, thereby contributing to their ability to devise unique and creative solutions.

The utilization of CT skills entails the collection and processing of information relevant to encountered problems. Approaching problems with an analytical perspective, particularly during the decomposition stage, proves instrumental in generating original and creative solutions. Breaking down complex problems into manageable parts not only facilitates a detailed understanding but also defines the precise scope of the encountered problem, expediting the identification of innovative solutions and fostering creativity.

The integration of CT into SEL becomes a strategic catalyst for students to develop creativity and innovative idea-generation skills, particularly in addressing social-emotional problems.

Skills such as decomposition, pattern recognition, abstraction, and algorithmic thinking, integral to CT, not only empower students to understand and articulate their emotions but also guide them in harnessing these emotions for creative processes.

A detailed examination reveals that:

- During the decomposition stage, students dissecting complex problems into manageable components can pave the way for creative problem-solving.
- Pattern recognition, as a skill, aids students in identifying similar situations and draws support from past experiences, laying the groundwork for innovative solution development.

For instance, a student grappling with self-expression challenges can draw upon past strategies, recognize their efficacy or inefficacy, and devise novel methods to address the issue.

- Abstraction skills empower students to distil problems to their fundamental features, fostering abstract thinking and a broadened perspective that, in turn, contributes to creativity.
- The algorithmic thinking stage entails creating a logical sequence for problem resolution, providing students with a structured approach to addressing complex issues. These stages collectively exemplify how CT supports and nurtures creativity.

Furthermore, advocating for the utilization of CT to enhance emotional intelligence is recommended. Integrating CT skills into drama or storytelling activities aids students in comprehending and expressing emotions creatively, fostering the imaginative development of scenarios and characters.

For instance, students can transform personal experiences into artistic expression through reinterpretation. Enhanced social-emotional skills enable students to overcome emotional barriers, such as fear and anxiety, facilitating the generation and open sharing of innovative ideas with peers and teachers.

Consider a scenario where a student, having overcome internal barriers during a technology project, conceives more courageous and innovative products. Students, employing CT to bolster social-emotional skills, not only consider scientific data but also factor in societal and individual emotional reactions during the learning and idea development process.

CT equips students with flexible and systematic thinking skills, enabling quick adaptation to changing situations or unexpected problems, and leading to innovative solutions.

For instance, in a group project, unexpected challenges may arise, such as a team member falling ill on the day designated for the project presentation. CT skills enable students to swiftly review their presentation strategy, leveraging creativity to devise alternative solutions.

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and the determination of steps to mitigate the absence effectively. This showcases the proficiency of CT in generating rapid, systematic, and creative solutions when confronting unforeseen circumstances.

In the contemporary digital era, CT skills empower students to utilize technological tools creatively and effectively, preparing them for future technologies.

For instance, students proficient in algorithmic thinking can conceive innovative technology-related project ideas. The amalgamation of CT with SEL, such as in a mobile app development project, empowers students to create designs that are not only technologically effective but also empathetic, considering users' emotional experiences.

The seamless integration of CT skills ensures that students comprehend not only specific problems but also the overarching processes of problem-solving. This transformative approach nurtures individuals who champion creative thinking and consistently generate innovative solutions.

Encouraging Collaborative Problem-Solving

CT serves as a cornerstone for the collaborative resolution of social-emotional issues within an educational context. Emphasizing collaborative learning, which necessitates students working together in small groups towards shared objectives, fosters a sense of shared responsibility for both individual and collective learning outcomes. When CT skills are strategically integrated into social-emotional contexts, they play a pivotal role in augmenting effective collaboration and communication skills among students.

In practical scenarios, such as group projects, students can leverage cognitive thinking skills to comprehensively analyze multifaceted problems and engage in effective communication with fellow group members. This inclusive approach not only underscores the importance of each student's contribution but also cultivates an environment that encourages the active participation of all individuals. Socially and emotionally, students learn to express their thoughts openly and respectfully, thereby nurturing a healthier communication dynamic within the collaborative setting. The cumulative effect is the creation of a positive and inclusive learning atmosphere within the classroom.

Furthermore, the application of CT skills in tackling social-emotional challenges aligns seamlessly with the principles of collaborative learning. This methodology empowers students to approach problems from diverse vantage points, utilizing an array of solution strategies.

For instance, during the abstraction stage, where the focus is on delineating the principal problem, students can engage in in-depth discussions aimed at achieving a thorough understanding. Similarly, in the algorithmic thinking stage, characterized by step-by-step problem-solving, students can articulate their perspectives on problem resolution before initiating strategies.

This comprehensive approach encourages students to navigate social-emotional challenges through a spectrum of angles and explore diverse solution trajectories, thus fostering the inclusive involvement of all participants. Particularly during the algorithmic thinking stage, students are compelled to collaboratively work through the intricate steps of resolving social-emotional issues, reinforcing the collaborative ethos.

Within this pedagogical framework, introducing varied characters or scenarios to students, prompting role-play in diverse social situations and problem-solving scenarios, proves to be a beneficial practice. Such activities not only cultivate empathy but also enhance students' understanding of different perspectives and their ability to devise creative solutions. The incorporation of project-based learning methodologies for addressing authentic problems contributes to heightened awareness of social responsibility among students, concurrently harnessing CT, and social-emotional skills. The explicit instruction of conflict resolution and mediation skills through dramatic applications further supports students in honing collaborative problem-solving skills underpinned by CT principles.

* The infusion of CT skills in a social-emotional context facilitates the refinement of collaboration and communication abilities among students, exemplified in instances such as group projects.
* By utilizing cognitive thinking skills to analyze problem facets and fostering effective communication, students learn to appreciate each other's insights and bolster the engagement of all participants.
* In a collaborative setting, each student brings unique skills to the table, and the collaborative process serves as a conduit for amalgamating these diverse strengths, thereby contributing to the formulation of comprehensive and efficacious solutions.

In conclusion, the adoption of collaborative learning methodologies, underscored by CT skills, for addressing social-emotional challenges positions students to gain multifaceted insights into these issues. Collaborative learning practices allow students to thoroughly deliberate on approaches to resolving social-emotional problems through constructive peer

discussions. This proactive approach mitigates the risk of mutual misunderstandings and nurtures a shared comprehension of the subject matter. CT systematically navigates problems, and instances of conflict during collaborative problem-solving, approached with resilience, and provides students with the skill set to discern the root cause of conflicts and collaboratively engineer constructive solutions. This synergy contributes tangibly to the establishment of a positive team dynamic within the educational environment.

Enhancing Resilience and Emotional Regulation

CT, encompassing skills such as decomposition and pattern recognition, plays a pivotal role in fortifying students against challenges and fostering resilience, a quintessential attribute for effective problem-solving. Consequently, CT emerges as a valuable tool in aiding students in navigating the social-emotional challenges they encounter. To illustrate, students can be assigned tasks involving the identification and formulation of step-by-step plans to address specific social-emotional issues they confront, such as disappointment, anxiety, or fear. This structured approach serves as a scaffolding mechanism, facilitating students in managing social-emotional challenges while concurrently cultivating resilience in the face of adversity.

Emotional regulation, entailing the adept management of emotions and appropriate responses, represents a critical facet of personal development. Conversely, CT necessitates a structured analysis of problems, fostering logical and systematic decision-making. The integration of CT skills into the resolution of social-emotional challenges compels individuals to impartially analyze information about the challenges and make informed, rational decisions. This approach, marked by a calm and logical problem-solving demeanour, mitigates the impact of emotional responses, thereby contributing significantly to the process of emotional regulation.

The error debugging process intrinsic to CT, involving the identification and rectification of errors, can be strategically employed to assist students in addressing social-emotional problems. In this context, students are empowered to discern the root causes of problems and devise corresponding solutions. In instances where an initially proposed solution proves ineffective, the iterative nature of the problem-solving process encourages students to persevere, fostering a willingness to experiment with diverse approaches. The assimilation of CT principles equips students with the ability to approach social-emotional situations akin to navigating a computer program.

For example, when grappling with feelings of anxiety, students can be guided to employ the 'error debugging' process, systematically analyzing emotions to understand the specific thoughts or events that triggered the emotional response. This utilization of CT processes serves as a supportive mechanism for students to manage complex social-emotional situations effectively.

In conjunction with these insights, it is imperative to offer guidance to students on the regulation of their emotions in the face of challenges. A pedagogical approach involving the collective discussion of challenges encountered during group work sessions facilitates an environment where students can collaboratively develop strategies to regulate their emotional responses. Moreover, structured opportunities should be provided for students to hone their skills in managing challenges encountered in their daily lives.

For instance, when confronted with situations where a task assigned by the teacher cannot be completed within the stipulated timeframe, students can be encouraged to contemplate strategies for maintaining composure and formulating a resolution.

Practical exercises addressing real-life scenarios are instrumental in imparting to students the application of emotional regulation skills in authentic contexts.

Resilience, characterized by the capacity to adapt to changing conditions and navigate challenges effectively, is fostered through CT skills, particularly pattern recognition. This skill empowers individuals to discern elemental components within encountered challenges and recognize patterns across diverse situations. The abstraction skill within CT enables individuals to concentrate on the core problem, facilitating the adaptation of problem-solving strategies to new contexts. Additionally, resilient individuals embrace difficulties as opportunities for growth and development. The utilization of CT skills instils in individuals the understanding that solutions may necessitate refinement and that setbacks are inherent components of the learning process. This amalgamation of CT and resilience principles equips individuals with a robust framework for confronting challenges with a growth-oriented mindset.

Supporting students' cognitive and social and emotional development is among the essential objectives of primary school education. COMPUSEL supports the argument that CT can be effective in the development of social and emotional skills in terms of facilitating problem solving skills that contribute to cognitive development.

In general, the integration of the dimensions of CT with SEL elements can positively affect students' academic achievement and personal development. In this respect, teachers' knowledge about the ways of integrating these two important components provides the opportunity for students to gain the skills they will need throughout their lives in effective learning environments.

In this section, the process of integrating CT and SEL is defined, general principles are mentioned, and practical application ideas are given with examples.

Defining the Process

Integrating CT skill dimensions into SEL skills is a progressive approach that enhances cognitive and emotional development. Therefore, a clear framework will strengthen the effect to be achieved. With a reference to Section "Curriculum, Lesson Plans and Worksheets" the below steps are proposed for complex problem-solving processes in social interactions.

Steps that can be taken in solving a complex problem:

1. Existence and identification of a problem developing in the social and emotional field.
    - What is the problem?
    - What is the reality of the problem (perceived and actual)?
2. Decomposition of the problem
    - What are the elements of the problem?
    - What are the development processes of the problem?
    - Is it possible to decompose the problem into smaller problems that are easier to solve?
3. Abstraction of the important/focused element in the problem
    - What is the main problem to be focused on within the problem and the events it contains?
    - What is/are the solution suggestion(s) that differ according to the perspective brought to the problem?
    - Are there any elements that should be neglected in the problem?
4. Discovering the patterns in the problem

- Does the problem experienced involve similar processes with the problems in the same subject experienced before?
- Are the emotions felt during the experience/definition of the problem similar?
- What are the patterns in feelings, ways of thinking or behaviour?
- Are there other problems with a similar pattern?
- What changes in the pattern could solve the problem?
- Can the pattern be rearranged?

5. Algorithmic (stepwise) thinking to produce solutions.
    - What are the measures to be taken in the light of the data obtained?
    - In which order should these be done?
    - Are there any steps that need to be repeated (Loops)?
    - Could some steps differ according to the conditions? What would those be? (If, then)
6. Implementation of the specified steps and evaluation of the results obtained.
7. Generalization or restructuring of the steps according to the results.

While solving social problems, it should be kept in mind that the same results may not be obtained every time in connection with the differentiation of human characters and behavioural styles, but following certain algorithms through trial and error can lead to positive results in general.

The development of behavioural patterns through CT will help individuals to increase their individual and social awareness and to strengthen their decision-making mechanisms in the problems they experience and will provide an opportunity to develop their ability to act objectively.

Students need to acquire advanced thinking skills in this way to realise that change is in their own hands and to get rid of learned helplessness.

Principles

The following principles are required for the best possible functioning of the CT and SEL integration.

Provision of learner-centred learning environment

Teachers can create this environment both in terms of applying active learning methods and techniques appropriate to the constructivist learning approach and working on situations based on students' daily life experiences.

For instance, in a study focusing on the solution of a problem encountered in daily life, the teacher can ensure that students engage in decomposition, abstraction, pattern recognition and algorithmic thinking and recognise the emotional states experienced in the process of problem-solving or managing a difficult situation.

Considering continuous ways of making connections between skills

Teachers can help students to better understand a complex emotional situation by breaking it down into parts through decomposition and realising how they can react to it.

For instance, students can analyse a stressful situation by breaking it down into parts through guidance with basic questions such as "why, how, when". Teachers can support students to see which patterns similar emotional states follow. Understanding these patterns can help them make more responsible decisions when they face similar situations in the future. They can develop their self-management skills by working on creating a step-by-step plan to manage the situation. With this plan, students can develop a specific algorithm or strategy to better understand emotional states. Thus, students who develop the ability to understand the emotional states of others can also increase their social awareness.

Providing a learning environment that is flexible and offers choices

Teachers need to be aware of the individual differences of each student and create flexible learning environments that allow them to work on various sample situations according to their characteristics and interests.

For instance, while one student may develop these skills more in a discussion environment where academic subjects are the focus, another may benefit more from an art project. It is crucial to create different experience options by focusing on students' strengths.

Working on concrete examples and scenarios

Teachers need to associate abstract concepts with concrete situations. For instance, students can discuss how they can adapt algorithmic thinking steps to the process of communicating effectively in a group. Or students can evaluate the causes, consequences and possible reactions of these emotional states by breaking them down into parts in sample situations dealing with an injustice experienced by a student in his/her relations with his/her friends or a feeling of failure in a sports competition.

Teachers can ask students to visualise what can be done to cope with this situation with linear, cyclic, or branching algorithmic thinking types. They can concretise what needs to be done on the decision tree. Thus, they can have the opportunity to develop their self-management skills through algorithmic thinking.

It is important to handle sample situations in a way that includes different perspectives. For instance, understanding the perspectives of the winners and losers of the competition can support empathy and enable the development of relationship skills.

Considering flexibility in sequencing

Teachers should be flexible in sequencing when teaching how to integrate the dimensions of CT to excel in SEL. In other words, they do not always have to go in the same order of decomposition, abstraction, pattern recognition and algorithmic thinking. These skills are interrelated and complement each other. However, we suggest that algorithmic thinking should be handled in the last order. This is because algorithmic thinking may require solving more complex problems, thinking from a broader perspective and even generalisation skills. On the other hand, regardless of the order in which it is given, algorithmic thinking by its nature requires sophistication in decomposition, abstraction, and pattern recognition. In this respect, it would be more appropriate to include algorithmic thinking at the last stage.

Practical Application Ideas

Self-management

To support self-management skills through CT, the following activities can be carried out on a sample case involving:

A child experiencing exam stress.

- Working on the sources and consequences of exam stress and other emotions that develop with stress (decomposition).
- Identifying items that are not effective on stress or less effective (abstraction).
- Finding out what other stressful situations may be and the common characteristics of these situations. Identifying individuals' own thinking styles and patterns in these thinking styles in stressful situations (pattern recognition).
- Ensuring that strategies for coping with stress are recognised. For instance, positive suggestion, breathing exercises, sharing feelings with a trusted person, etc. and creating a step-by-step plan showing what to do and/or not to do in a stressful situation (algorithmic thinking).

Responsible Decision Making

To integrate responsible decision-making skills through CT dimensions, consider the following example.

A child used his pocket money thoughtlessly and unplanned, so he wanted to buy a birthday present for his friend but did not have enough money because of his unheeded spending.

- Thinking about situations in which they or their friends have had difficulties with decisions made when spending money, thinking about how similar situations might have arisen. Making a weekly budget planning chart (pattern recognition).
- Discussing the problem in the example situation, the desire to attend the birthday party and the relationships between these situations in small group work (decomposition).
- Giving students the opportunity to think about other financial problems they may face. In this process, emphasize the management of limited resources, the importance of prioritising wants and needs and the factors to be considered when making financial decisions (abstraction).
- Planning the steps to be taken to solve the problem in the example situation in the short and long term (algorithmic thinking).

Social Awareness

To support social awareness skills through computational thinking, the following situation can be examined:

A class picnic is organised, a student knows that he/she can't bring the necessary materials due to family problems and another student wants to help him/her, but these two students have not communicated much before.

- Discussing the given sample situation in terms of different aspects such as the conditions of the student in need, the feelings and characteristics of the student who wants to help, lack of communication, and divide the problem into smaller problems that can be solved more easily (decomposition).
- Enabling students to share the examples of helping that they have experienced before, to think about what common features there are in different helping situations, (this problem can also be handled by discovering the patterns within itself) (pattern recognition).
- Helping people with their needs, avoiding behaviour that may be humiliating, or discussing general values and what to do in helping others (abstraction).
- Planning the steps to be taken by the student who wants to help in the example situation with alternatives (algorithmic thinking).

Self-awareness

To support self-awareness skills by integrating CT dimensions, the following situation can be analysed:

A student with high academic performance experiences difficulty in participating in social activities, communicating, and making friends.

- Role-playing this situation and discussing what they feel at certain moments, discussing what other problems and emotions different students and themselves may experience (abstraction).
- Identifying the repetitive behaviours of the student who has a problem in the sample situation through small group work. Thinking whether similar patterns exist in their own life (pattern recognition).
- Dividing the difficulties of the student who has a problem in the sample situation (self-expression, withdrawal, etc.) into sub-headings (decomposition).
- First planning individually what to do and what not to do in order not to experience the sample situation and then working on plans as a group (algorithmic thinking).

Relationship skills

To support relationship skills through CT, the following situation can be taken as an example.

Two students working on a project have disagreements and problems in sharing tasks.

- While addressing the problem in the sample case, discuss as a group by taking into consideration components such as the content of the project, which tasks it requires, how time management should be, and individually list the sources of disagreements (decomposition).
- Based on the example, discussing concepts such as rules of working together, cooperation, empathy, and open communication, and discovering the problem or problems that need to be focused on, weeding out situations that can be neglected (abstraction).
- Finding out what other problems may occur between students when working together, what are the recurring behaviours in these problems and the problems in the given situation and indicating these repetitions with colours in a visual (pattern recognition).
- First, specifying what needs to be done to solve the problem in the sample situation, and then creating a decision tree (algorithmic thinking) for solution suggestions for other problems that students may experience with their friends.

The teachers can differentiate the examples presented above and find new ones and enrich them with various learning methods and techniques in line with the needs of the students. Active learning techniques, which are an important element in reflecting the constructivist learning approach to the classroom, will be handy in this process.

Below are some examples of using methods and techniques in the development of SEL skills through CT. The techniques in which a specific CT step is matched for a SEL skill can be adapted for different SEL and CT skills and in this way, some integrative methods can be generalised.

Technique Examples

Emotion Cards

In developing self-awareness skills, the decomposition stage of CT can be effective. The teacher prepares cards for different emotions. There may be pictures or writings on the cards. The teacher explains to the class that each emotion is natural and normal. After giving specific examples, students are required to show which emotion/s they are feeling by pointing to the card/s that displays that emotion/those emotions.

At this stage, the ability to separate the emotions from each other in complex situations is essential. To be able to differentiate the opposite emotions in a certain situation is also necessary for a healthy thinking process. In addition to the cards, if there are students who want to express themselves verbally, they should have the opportunity. The group discusses which emotions they feel, how often and in which situations.

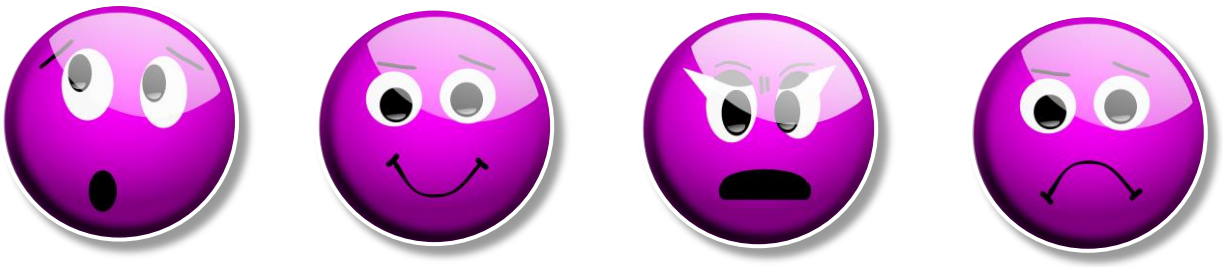
Sample Narration

Once upon a time, in a primary school, there was a boy named Alex who adored his pet hamster, Whiskers. They were inseparable companions, sharing every joyful moment. However, one day, an unexpected mishap unfolded.

During recess, when Alex was engrossed in a class activity, his friend Lily accidentally left Whiskers' cage door ajar. When Alex returned, his heart sank as he discovered Whiskers missing. A mix of intense emotions surged within him, swirling like a storm.

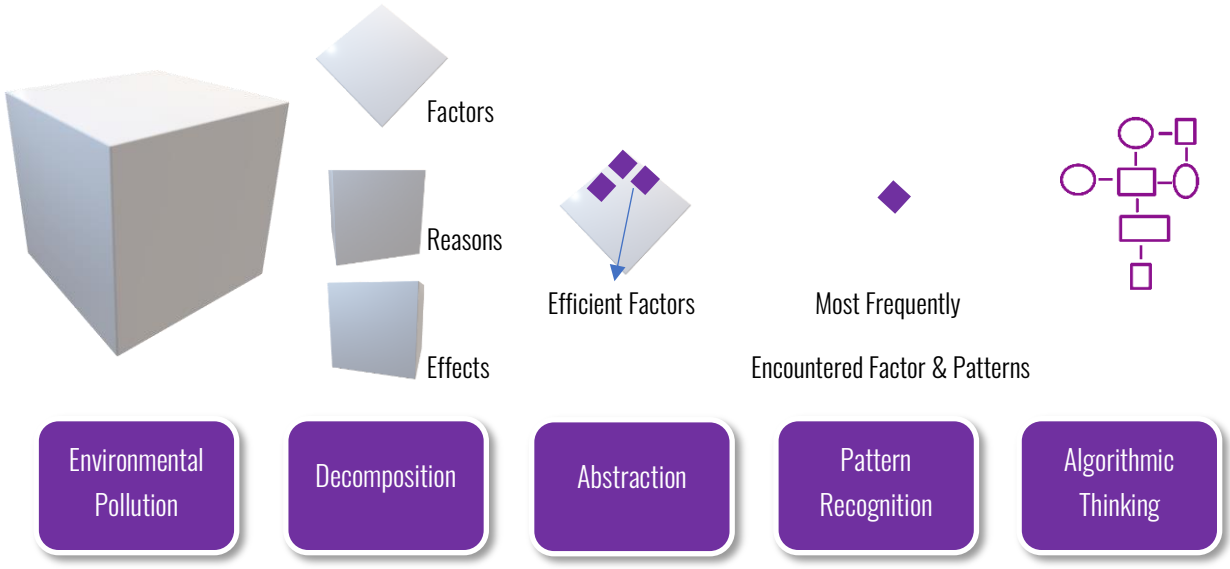
As Alex looked at Lily, he noticed tears brimming in her eyes. She was devastated and frantically searching for Whiskers too.

Emotion Card Samples



Four Corners

With this technique, let's discuss how CT can be used to raise social awareness as a SEL dimension. The teacher starts the lesson by mentioning a problem related to environmental pollution and students discuss which types of environmental pollution problems they have experienced so far and analyse those problems with their factors, reasons, and effects (decomposition). They identify the efficient factors in environmental pollution (abstraction). They also analyse the most frequently encountered pollution factor and the similarities and differences of this factor's formation processes (pattern recognition). Solution suggestions are written on cartons and hung in various corners of the classroom. The students gathered in the corner where the same solution proposal is located, creating linear, branching, and cyclic flow visualizations for the steps on how this solution proposal can be implemented, and how these steps can be overcome in case of obstacles that may arise against these steps (algorithmic thinking).

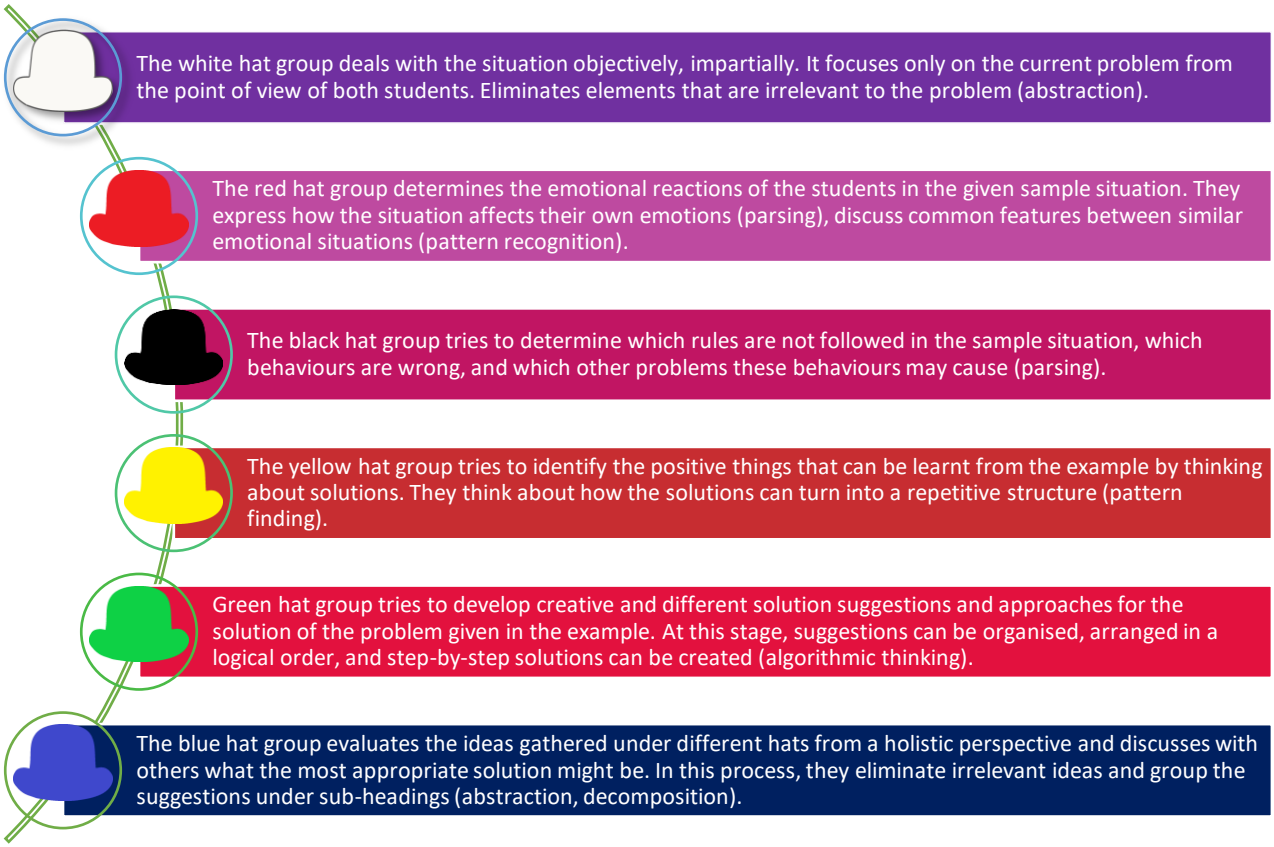


6-Hat Thinking

Let's consider the following situation.

> Two students playing in the school playground have an argument, one of them accuses the other for not following the rules, and the student who follows the rules tries to solve this problem on his own and realises that he really needs to decide which behaviour is the right one.

Students are divided into 6 groups to develop SEL skills such as responsible decision-making, self-awareness, and relationship skills.



Card Showing

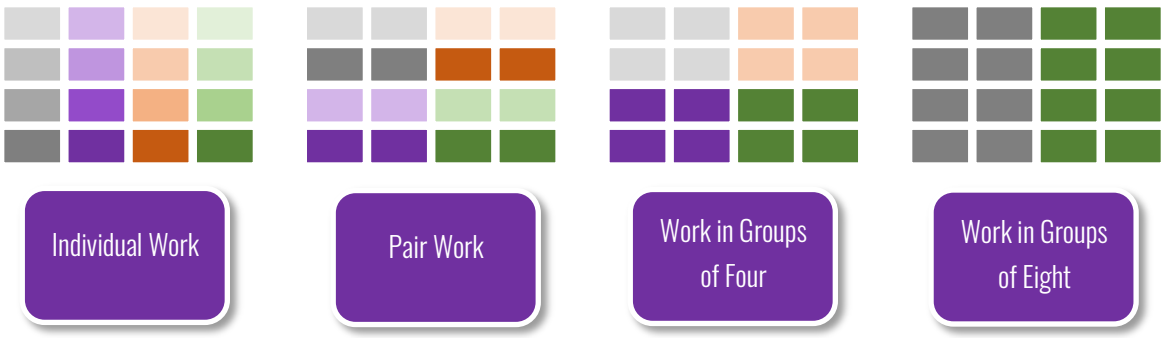
The students choose and show the cards of the colour that represent the emotions they feel about the topic under investigation or the given example situation. They explain why they chose this card(s) (abstraction, self-awareness). Explain the common structure of the cards representing similar emotions (pattern recognition). Cards showing agreement with the proposed solutions to a problem can also be used. In this case, students are asked to defend their decision and explain the suggestions they disagree with (abstraction, responsible decision-making). Determine how cards representing which emotions can be put together to establish good relationships with friends (algorithmic thinking, relationship skills).

Colour Card Samples

Snowball

The snowball technique develops as follows.

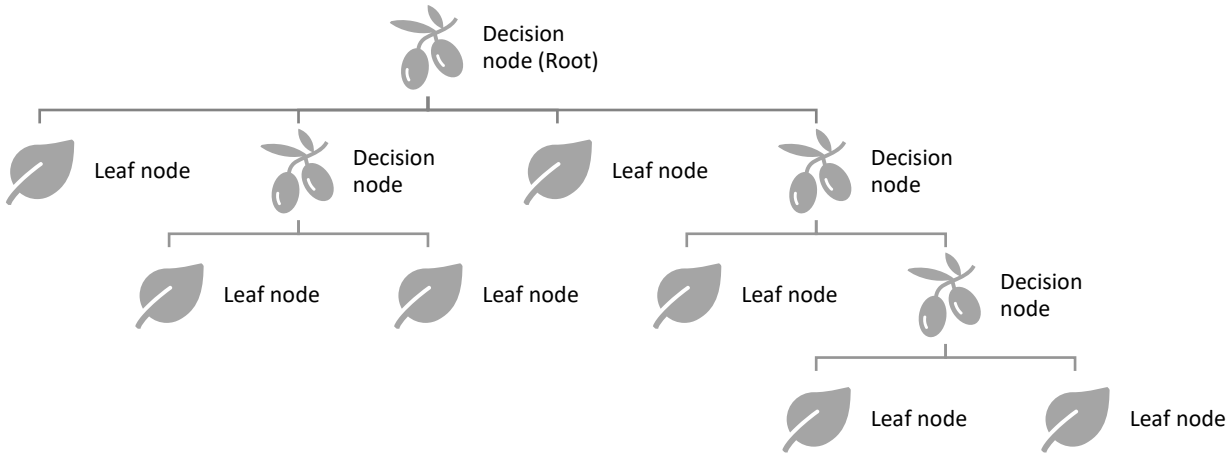
- To develop SEL skills, a case study is reproduced and distributed to the number of students.
- Students first read the case individually, analyse the case part by part (decomposition).
- They think about what should be taken into consideration and what should be ignored in the problem-solving process (abstraction).
- When the students form pairs, each of them identifies similar and different aspects of their works (pattern recognition).
- Then, groups of four are formed and the solution proposals are arranged in a logical order (algorithmic thinking).
- When groups of eight are formed, each group discusses the order of the proposed solutions.



Decision Tree

It is especially useful in developing SEL skills through algorithmic thinking. Students can create decision trees individually or in groups. By dividing the sample situations into small parts (decomposition), they determine different solutions, discuss the situations that may be encountered during the implementation of these solutions and which alternatives can be applied in this case (algorithmic thinking). Considering all these, they create a decision tree.

Sample Decision Tree



Decision node: can lead to other decisions.
Leaf node: refers to final decisions.

Think – Pair - Share

Students individually analyse step by step the problem in a scenario where they can develop their SEL skills (decomposition). Then, pairs of students are given the opportunity to think about the solutions together. After reaching a common decision, they create the stages of solving the problem in the scenario (algorithmic thinking) and explain it to other students.

Aquarium

In this technique, students sit in 2 circles inside each other. Those sitting in the inner circle talk about the given situation, and when they are finished, they move to the outer circle. Those who want to talk move from the outer circle to the inner circle. Students in the inner circle talk about a given situation, share their experiences and feelings (self-awareness-abstraction). Those in the outer circle listen to them, they can ask questions to those in the inner circle.

While responding to questions from the outer circle, students can understand the emotional situation and the problem addressed more clearly by using decomposition and abstraction skills. Since students are free to express their feelings and experiences, they can develop their skills of recognising their own (self-awareness) and others' feelings (social awareness). In addition, the structure and application of the aquarium technique contribute to the development of algorithmic thinking skills.

Speech Tickets

This technique supports students to develop their time management and emotion control skills. In addition, equal participation is ensured in the learning environment. Cards representing a limited number of tickets (1-2 or 3) are distributed to each student. Time is determined for each ticket (1-2 or 3 minutes). The student who wants to speak should give his/her ticket to the teacher and all tickets should be used in the lesson. Students can exchange ideas about how the tickets could be used. In this process, relationship skills are supported. To use the time effectively, students should rethink the relevant and irrelevant things to say and eliminate the irrelevant ones to support their abstraction skills.

These techniques can be diversified and combined and can provide ideas for determining new ways of utilising CT stages in supporting SEL skills.

TEACHING & LEARNING ACTIVITIES

The Activity Book "Integrating Social and Emotional Learning with Computational Thinking"!" is annexed to this guidebook to ease the implementation process for both primary school teachers and students.

This book is a comprehensive practical guide designed to bridge the realms of Social and Emotional Learning (SEL) with the 4 powerful problem-solving dimensions of Computational Thinking (CT) within the educational landscape.

About the Activity Book

The COMPUSEL Activity Book is a resource curated for educators, parents, and facilitators dedicated to nurturing not only academic success but also the essential social, emotional, and cognitive skills crucial for students' holistic development. It's a combination of thought-provoking scenarios, and practical strategies aiming to intertwine SEL dimensions and CT principles in a learning environment.

Purpose and Scope

The primary objective of this activity book is to offer a structured framework that brings together the synergy between SEL and CT. By blending these domains, students are empowered to employ critical skills such as self-awareness, social awareness, responsible decision-making, self-management, and relationship skills—all through the lens of computational problem-solving.

What to Expect

Within these pages, educators and learners will discover:

1. **Problem-Centric Approach:** Engaging scenarios focused on real-life situations pertaining to SEL dimensions, encouraging active participation and problem-solving.
2. **CT-oriented Problem-Solving:** Guidance on applying Decomposition, Abstraction, Pattern Recognition, and Algorithmic Thinking to address social and emotional challenges.
3. **Diverse Learning Techniques:** Varied activities and learning methodologies, from role-playing scenarios to visual mapping exercises, fostering an immersive and engaging learning experience.
4. **Practical Application Ideas:** Insights into integrating CT dimensions into SEL skills, accompanied by real-world examples and practical implementation strategies for educators.

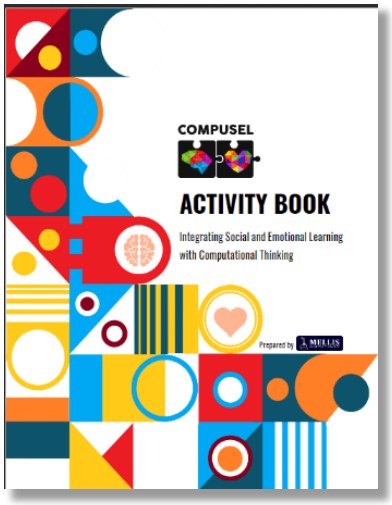
5. **Continual Skill Development:** Strategies for continual growth in SEL competencies and CT problem-solving skills, adaptable to different learning styles and learning environments.

Who Can Benefit?

This book caters to educators, parents, counselors, and anyone involved in nurturing young minds. It serves as a versatile tool for fostering not just academic excellence but also the socio-emotional competencies crucial for navigating the complexities of the modern world.

The COMPUSEL Activity Book endeavors to empower educators and learners alike, fostering a dynamic learning environment where cognitive, emotional, and social development converge harmoniously. Through these integrated activities, the aim is to equip students with a holistic skill set essential for success in both academic and real-world scenarios.

Click on the book image below to see the Activity Book



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