

CULTIVATING PRESCHOOL CHILDREN'S SOCIAL-EMOTIONAL
LEARNING THROUGH COMPUTATIONAL THINKING ACTIVITIES

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Learning Through Computational Thinking Activities

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ABSTRACT

Cultivating Preschool Children's Social-Emotional Learning Through Computational Thinking Activities

This qualitative case study aimed to explore how preschool children's participation in Computational Thinking (CT) activities facilitated the development of Social-Emotional Learning (SEL) skills. The study was conducted in an early childhood education center with four children aged 4–5. Over eight weeks, participants engaged in CT activities designed based on Positive Technological Development (PTD) and SEL frameworks. The first four weeks involved unplugged activities, while the following four weeks incorporated plugged-in activities. Data was collected through video recordings of the class sessions and analyzed using thematic analysis. The findings indicated that CT activities supported the development of key SEL skills such as self-awareness, social awareness, relationship skills, self-management, and responsible decision-making. These skills emerged through three interconnected characteristics of CT activities: collaborative design, the nature of teacher guidance, and step-by-step progression. Collaborative tasks helped children work together, solve problems, and make group decisions. Teacher guidance supported emotional expression, encouraged children to notice others' feelings, and helped them communicate and cooperate. Step-by-step activities allowed children to focus on small parts of a task, reflect on their actions, and manage their emotions. The findings suggest that when carefully designed and implemented, CT activities offer a developmentally appropriate and engaging context for nurturing social-emotional skills in early childhood.

ÖZET

Okul Öncesi Çocukların Sosyal-Duygusal Öğrenme Becerilerinin Bilgi İşlemsel Düşünme Etkinlikleriyle Geliştirilmesi

Bu nitel durum çalışması, okul öncesi çocukların Bilgi İşlemsel Düşünme (BİD) etkinliklerine katılımının Sosyal Duygusal Öğrenme (SDÖ) becerilerinin gelişimine nasıl katkı sağladığını incelemeyi amaçlamaktadır. Araştırma, 4–5 yaş aralığındaki dört çocukla bir üniversiteye bağlı erken çocukluk eğitim merkezinde yürütülmüştür. Sekiz haftalık uygulama sürecinin ilk dört haftasında bilgisayarsız (unplugged) BİD etkinlikleri, sonraki dört haftasında ise robot destekli (plugged-in) etkinlikler gerçekleştirilmiştir. Veriler, video kayıtları ve yapılandırılmış gözlem formları aracılığıyla toplanmış, tematik analiz yöntemiyle değerlendirilmiştir. Bulgular, BİD etkinliklerinin öz farkındalık, öz yönetim, sosyal farkındalık, ilişki becerileri ve sorumlu karar verme gibi temel SDÖ becerilerinin gelişimini desteklediğini göstermektedir. Bu beceriler, üç ana tema etrafında ortaya çıkmıştır: BİD etkinliklerinin iş birliğine dayalı tasarımı, öğretmen rehberliğinin doğası ve etkinliklerin aşamalı ilerleyişi. İşbirlikçi görevler, çocukların birlikte çalışmasını, problem çözmesini ve grup kararları almasını sağlamıştır. Öğretmen rehberliği, duygusal ifadeyi destekleyerek, çocukların başkalarının duygularını fark etmelerini sağlamış ve iletişim kurmalarına, işbirliği yapmalarına yardımcı olmuştur. Adım adım aktiviteler, çocukların görevlerin küçük bölümlerine odaklanmalarını, eylemlerini gözden geçirmelerini ve duygularını yönetmelerini sağlamıştır. Bulgular, dikkatle tasarlanıp uygulandığında BİD etkinliklerinin, erken çocukluk döneminde sosyal-duygusal yeterlikleri desteklemek için gelişimsel olarak uygun ve ilgi çekici bir öğrenme ortamı sunduğunu göstermektedir.

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CHAPTER 1

INTRODUCTION

In recent years, the rapid development of technology has significantly reshaped various aspects of society, including education. As digital tools and computational methods become increasingly integral to daily life, there is a growing need for individuals with strong analytical and problem-solving capabilities. One critical skill set that has gained prominence in response to these societal demands is Computational Thinking (CT). Defined as the process of breaking down complex problems into manageable parts, recognizing patterns, and developing step-by-step solutions, CT extends its value beyond computer science to broader applications across diverse fields (Wing, 2006).

Educational systems globally have started integrating CT into curricula across various educational levels (Grover & Pea, 2013; Shute et al., 2017), particularly highlighting its importance in early childhood education. Research has shown that young children can effectively acquire foundational CT skills through age-appropriate activities, supporting their cognitive, spatial, and social-emotional development (Angeli & Valadines, 2020; Bers et al., 2014; González-Calero et al., 2019). Also, social-emotional learning (SEL) is increasingly recognized as essential for children's overall growth and well-being. Both CT and SEL are critical in preparing young learners for academic success as well as personal and social flourishing. While the cognitive advantages of CT are extensively documented, the connection between CT activities and the promotion of social-emotional skills in early childhood remains relatively underexplored. This study aims to bridge this gap by investigating how various CT activities facilitate preschool children's social-

emotional development. By examining these connections, this research will provide insights into effective educational strategies to support holistic development in early childhood settings.

1.1 Significant of the study

CT has been identified as an important skill for 21st-century citizens. Recognizing its significance, CT is increasingly emphasized across various education levels, including early childhood education. Through the integration of CT activities in early childhood, children can develop vital skills like problem-solving (Bers et al., 2014), spatial relationship abilities (Angeli & Valadines, 2020), and mental rotation skills (González-Calero et al., 2019).

To investigate the impact of CT activities on the development of young learners, researchers and educators have employed various teaching methods, including both unplugged activities (teaching CT concepts without technological devices, such as games and puzzle) and plugged-in activities (which offer a hands-on approach to learning coding and programming, often utilizing educational robots) (Lee & Junoh, 2019). These methods have been widely utilized to enhance CT skills, influencing developmental areas such as cognition, spatial understanding, and mental rotation skills in children (Angeli & Valadines, 2020). In addition to these cognitive aspects, it is essential to recognize the significance of social-emotional development in children's overall success in life (Rafique et al., 2020). Alongside cognitive, spatial, and mental rotation skills, the mastery of one's emotions plays a crucial role. Children are required to develop social-emotional skills, encompassing self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (Mondi et al., 2021). Recent research has further established a close

link between socio-emotional learning and CT skills. Maitz et al. (2022) found that collaborative programming activities, such as Scratch, help children articulate their emotions and reasoning during coding tasks. While the study by Maitz et al. (2022) has begun to explore the link between CT activities and social-emotional development, there remains a gap in the literature regarding the role of unplugged and plugged CT activities in promoting children's social-emotional learning on solid frameworks. Thus, this study aims to address this research gap and provide valuable insights into the intersection of CT and social-emotional development in young learners.

1.2 Purpose of the study

This study aims to explore the role of CT activities in fostering young children's social-emotional learning by examining how specific unplugged and plugged-in activities facilitate children's social-emotional learning abilities which are self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The outcomes of this study may yield significant implications for educators involved in developing CT curricula for early childhood education.

Furthermore, it is expected that these findings would be of relevance to teachers who seek to integrate CT activities into their instructional practices, thereby enhancing the social-emotional learning experiences of their students.

1.3 The research question

The current study aims to answer the following research question: How does the integration of CT activities facilitate the development of preschool children's social-emotional skills in early childhood education?

1.4 Organization of the sections

Chapter 2 covers a literature review of the definition of the CT, teaching CT in early childhood, social-emotional learning in early childhood education, the role of CT activities in early childhood children's social emotional learning skills and theoretical framework of the study. Chapter 3 consists of the research methodology: research design, the context and participants, data sources, data collection procedures, and data analysis. Chapter 4 presents the findings of the study and introduces three main themes that emerged through the analysis. Chapter 5 provides a discussion of the findings in relation to the research question and existing literature. It also outlines the study's implications for practice, recommendations for future research, the transferability of findings, and the limitations of the study.

CHAPTER 2

REVIEW OF THE LITERATURE

In this section, firstly different definitions of CT are investigated and the CT concept in early childhood education will be explained. Then, the importance and features of social-emotional learning in early childhood are discussed, highlighting its critical role during developmental years. Then, the influence of CT activities on young children's social-emotional development will be explored. Lastly, the theoretical foundations guiding the study, including Positive Technological Development (PTD) and SEL frameworks, are explained, emphasizing relevant research on the intersections between technology, CT, and SEL in early childhood.

2.1 Definition of computational thinking

CT has become popular in education. Despite this popularity, there is no agreed-upon definition of CT. Papert first used the expression of CT in the context of mathematics education. According to Papert (1996), CT is not just about learning to use computers but developing a new way of thinking and problem-solving. Also, Jeannette Wing built on Papert's work and expanded on the CT concept. Wing (2006) defined CT as the ability to identify and solve problems, break them down into smaller parts, and design algorithms to solve them. She identified four key elements of CT. These are decomposition, pattern recognition, abstraction, and algorithmic thinking. These elements are important for enhancing CT abilities. Also, according to Bers (2017), CT should be approached through a broad conceptual lens that promotes children's different developmental areas. Instead of simply being a technical skill, CT is viewed as a problem-solving process with expressive qualities

that enable students to develop not only cognitive skills but also social skills.

Furthermore, Bers (2017) suggests that CT can be taught from an early age in order to maximize its educational benefits. Therefore, in the next section, we focus on CT in early childhood.

2.2 Teaching computational thinking in early childhood

According to Jean Piaget's Cognitive Development Theory, kindergarten children are in the preoperational stage. Children typically exhibit concrete, self-centered thought processes during the preoperational stage, which spans from approximately two to six years of age (Piaget, 1953). In light of Piaget's Cognitive Development Theory, some researchers argued that because CT skills require abstract thinking rather than only concrete thinking, this skill is not appropriate for children who are in the preoperational stage (Gibson, 2012). Also, some research claims that learning CT can be particularly challenging for young learners, as it demands a deep understanding of problem-solving, computer programming, and handling abstract concepts, which may be difficult for children at this developmental stage (Buitrago Flórez et al., 2017; Looi et al., 2018). However, there are also some studies (e.g. Gibson) that contradict with this view. According to Gibson (2012), abstract learning skills are more advanced than previously thought, because children can explain the features of simple diagrams they draw and think critically about them. The important thing is whether the CT concept is integrated into the activities in accordance with the development of the children. Therefore, researchers propose two different methods for the development of CT skills in early childhood: unplugged activities and plugged activities such as educational robots (Saxena et al., 2020; Sullivan & Bers, 2016).

Unplugged activities refer to CT activities that do not require computers or technology. These activities are suitable for children in early childhood because they do not confine them to the constraints of learning from a screen (Battal et.al., 2021). Unplugged activities are designed using games, collaboration, or other entertaining techniques that enhance children's enthusiasm, motivation, and curiosity. Also, educational robots are used to enhance children's CT skills. Research has suggested that the use of educational robots in activities in early childhood supports children's significant learning outcomes (González & Muñoz-Repiso, 2018). Educational robots can provide an engaging way for young children to develop CT skills. By interacting with robots and unplugged activities, children can learn about programming, coding, and problem-solving in a hands-on, experiential way. Although both methods are widely used to support CT development, there is still a lack of research comparing the role of these methods in fostering young children's social-emotional skills. Therefore, this study aims to explore the role of these two methods in children's social-emotional development.

2.3 Social-emotional learning in early childhood

SEL is a fundamental aspect of early childhood education, aimed at helping children acquire the ability to understand and manage their emotions, establish positive relationships, and make responsible decisions. As Denham (2003) highlights, SEL is integral to children's emotional competence, including emotional understanding, empathy, and emotion regulation, which are essential for building meaningful social connections and effectively navigating their social environments. Moreover, SEL serves as the foundation for other developmental areas, such as cognitive growth and social skills.

The Collaborative for Academic, Social, and Emotional Learning (CASEL) provides a comprehensive framework for SEL, defining it as the process through which individuals acquire and apply the knowledge, attitudes, and skills necessary to manage emotions, achieve goals, empathize with others, build relationships, and make responsible decisions. It comprises five core competencies: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (Zins et al., 2007). These competencies are not only essential for emotional development but also for fostering positive social interactions and enhancing children's ability to cooperate and resolve conflicts effectively.

Integrating these competencies within school-family and community partnerships is also crucial for holistic development. As Bierman & Motamedi (2015) suggest, SEL programs designed for preschool children can effectively enhance emotional and social skills when they are supported by parents, teachers, and peers. This holistic approach ensures that SEL is reinforced across various social environments, promoting consistency and sustainability.

Play-based activities are widely recognized as effective tools for supporting SEL skills in early childhood. Games that involve cooperation and participation offer opportunities for children to recognize their strengths, discover their abilities, and learn leadership skills through teamwork. According to Brackett et al., (2015), such activities encourage children to express their emotions, communicate their thoughts, and engage in collaborative problem-solving. Additionally, through interactive play, children are encouraged to empathize with others and develop social awareness, both of which are essential for building healthy relationships.

Research indicates that integrating SEL into early childhood education yields significant benefits. Nathanson et al. (2016) found that SEL programs enhance

children's academic performance, improve their attitudes and behaviors, and reduce emotional distress. Furthermore, Ulutas and Omeroglu (2007) demonstrated that targeted SEL interventions can significantly improve children's emotional intelligence, leading to better social interactions and academic outcomes. Their study, which involved a 12-week educational program, showed that children who participated in the program exhibited marked improvements in emotional intelligence as measured by the Sullivan Emotional Intelligence Scale.

The importance of SEL in early childhood education is further emphasized by Goleman and Boyatzis (2013), who argue that emotional intelligence is as critical as cognitive skills for children's overall development. They describe emotional intelligence as comprising four dimensions: self-awareness, self-management, social awareness, and relationship management. Developing these competencies from an early age contributes to children's emotional and social well-being, promoting long-term success in various life domains.

Incorporating SEL into early childhood curricula not only fosters emotional and social competencies but also lays the foundation for lifelong learning and well-being. Educators and policymakers are encouraged to prioritize SEL to support holistic child development. As noted by Brackett et al. (2015), effective SEL programs must be intentionally designed and implemented within educational settings to maximize their impact.

2.4 The role of CT skills in children's social-emotional learning

CT is becoming an increasingly important skill for young children, as it relates to problem-solving and logical reasoning, as well as for purposes related to social-emotional learning (Bers, 2012). As educational approaches evolve, there has been an increasing interest in examining whether children engage in CT activities that may help them develop emotional intelligence, collaboration, and social skills in early childhood education. With technological advancements, children's experiences have expanded to include screen-based interactions through tablets and screen-free engagements with robots. These days, educational robots are a great learning tool at all levels. The use of robotics in educational institutes tends to improve the learning of students from kindergarten to the university (Rafique et al., 2020). Recent studies (e.g. Barron et al., 2011) suggest that technology and robotics are being incorporated to a greater extent to promote emotional intelligence development in children. However, research shows that robots can serve as a more interactive and engaging platform than traditional screen-based experiences. Spaulding et al. (2016) found that children demonstrated greater emotional expressiveness when engaging in an interactive educational task with a social robot compared to using only a tablet. These findings suggest that hands-on engagement with tangible learning tools, such as educational robots, may enhance children's ability to recognize, understand, and regulate their emotions more effectively than passive digital interactions.

Moreover, examining the broader range of skills that children acquire while learning programming is also a significant area of research. Popat and Starkey (2019) examined which skills beyond programming skills students develop when learning programming in schools. One of the key themes they identified in their literature review was social skills, including collaboration. These findings point to the fact that

there are certain overlaps between social-emotional skills and CT or programming skills, respectively. Similarly, Bers (2017) emphasized that CT is not just a technical skill but a framework that inherently promotes collaboration and social interaction, reinforcing its broader educational value. These findings suggest that integrating collaborative learning elements into CT activities can provide children with valuable opportunities to practice and refine their interpersonal skills in a structured environment. Maitz et al. (2022) found that collaborative programming activities, such as Scratch, help children articulate their emotions and reasoning during coding tasks, thereby enhancing their social-emotional skills. The collaborative nature of programming environments facilitates positive social interactions, allowing children to develop teamwork, negotiation, and conflict resolution skills (Bers, 2017; Maitz et al., 2022).

Recognizing this gap, recent studies have begun to explore how integrating social-emotional learning with CT abilities can create a more holistic learning experience for children. New data shows that developing an emotional learning component to CT-based learning activities can yield dual benefits: (a) supporting cognitive development; and (b) supporting moral values, ethical decision-making, and socio-emotional competencies (Rafique et al., 2020). According to this research, as children engage in programming and computational tasks, they not only develop technical skills but also encounter situations that require emotional learning skills. Emotional learning, defined as the process of developing self-awareness, emotion regulation, and interpersonal skills, is a critical element of children's development as they learn to navigate social interactions (Maitz et al., 2022). Educationally, robotics-based learning experiences are ideal for promoting opportunities to develop the desired SEL skills within the CT learning process. Through interactive storytelling

opportunities and multidisciplinary problem-solving tasks that involve robots, children can experience learning collaboratively, strengthen their logical reasoning skills, and develop emotional intelligence, all in meaningful ways that rely on contexts (Leite et al., 2015). Research has shown that carefully structured interactions with robots are effective at facilitating children's own learning.

Furthermore, structured CT activities incorporating emotional reflection have been found to support young learners in understanding and expressing emotions both verbally and non-verbally (Sullivan & Bers, 2017). Additionally, Wu (2024) argues that decomposition in problem-solving not only aids in skill acquisition but also fosters emotional resilience, as children learn to manage frustration and adjust their strategies when faced with increasing difficulty. The ability to break down complex problems into manageable parts teaches children perseverance and adaptability, which are essential components of emotional resilience. Educators play a critical role in ensuring that collaborative programming tasks lead to meaningful relationship-building. Nathanson et al. (2016) emphasized that teacher facilitation is crucial for guiding children's social interactions, ensuring that structured activities promote meaningful relationship-building and SEL development. This perspective aligns with research suggesting that CT activities guided by teachers can strengthen emotional literacy by providing concrete opportunities for children to process and express their emotions (Bers, 2017). Additionally, Bers and Horn (2010) stress that tangible programming activities extend beyond computational skill development, promoting peer engagement and social awareness. Moreover, Wallbaum et al. (2020) demonstrated that tangible interfaces and robotics allow children to participate in collaborative problem-solving, either in pairs or small groups, reinforcing teamwork and communication.

In summary, the integration of CT activities and social-emotional learning skills in early childhood education presents a promising approach to fostering both cognitive and emotional growth in young learners. Research suggests that beyond problem-solving and logical reasoning, CT activities—particularly those involving robotics—offer valuable opportunities for developing emotional intelligence, collaboration, and ethical decision-making (Rafique et al., 2020; Popat & Starkey, 2019). Compared to traditional screen-based interactions, hands-on engagement with tangible learning tools like educational robots enhances children’s ability to recognize, understand, and regulate their emotions (Spaulding et al., 2016). As children engage in structured programming and interactive storytelling activities, they not only strengthen their CT skills but also develop key SEL competencies such as self-awareness, empathy, and cooperative problem-solving (Leite et al., 2015). Given these findings, future educational frameworks should emphasize a more holistic approach, leveraging the benefits of CT to support SEL development through robotics-based and collaborative learning experiences. The current study builds on this perspective by examining how CT activities, both unplugged and robotics-based, contribute to preschool children’s SEL development, focusing on key competencies such as emotional awareness, decision-making, and relationship skills.

2.5 Theoretical framework

To situate the exploration of how CT activities facilitate development within a broader context, it is essential to consider Positive Technological Development (PTD) as a framework. Technology in early childhood is often debated, with concerns about its impact on skill development, particularly social-emotional development (Strawhacker & Bers, 2018). Nevertheless, research suggests that

specific computer technologies can enhance young children's social, emotional, and cognitive domains (Bers, 2012). Leite et al. (2015) found that educational robots can positively influence emotional intelligence and social skills in young children.

Bers' Positive Technological Development Framework emphasizes using technology to promote positive behaviors, including socio-emotional development, during digital learning experiences (Strawhacker & Bers, 2018). This framework identifies intrapersonal and interpersonal skills, with the latter encompassing communication, collaboration, and community building. In the context of this study, these skills align with SEL objectives, including self-awareness, self-management, social awareness, relationship skills, and responsible decision-making.

SEL is paramount in early childhood, fostering essential skills for recognizing and managing emotions, understanding others' feelings, and building positive relationships (Zins et al., 2007). CASEL's SEL framework highlights five core competencies: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. Research indicates a relationship between social-emotional skills and CT skills (Maitz et al., 2022). Given the study's focus on social-emotional learning, CASEL's framework provides a suitable evaluation tool for children's socio-emotional development.

In summary, this study not only investigates the impact of unplugged activities and educational robots on children's social-emotional development but also places this exploration within the context of Positive Technological Development and SEL frameworks. By examining the intersections of these areas, the study seeks to contribute valuable insights into enhancing children's holistic development through CT activities. The next subsections present these frameworks.

2.5.1 Positive Technological Development (PTD) Framework

The use of technology in early childhood is a controversial issue. Research discusses how technology should be used for this age group. In addition, some researchers argue that technology may hinder children's skill development, such as social-emotional development (Strawhacker & Bers, 2018). Although there is a lack of research in the literature that shows how teaching programming may support students' development, there are some studies that have found the positive effect of technology use on children. According to research, using specific computer technologies can help young children develop in their social, emotional, and cognitive domains (Bers, 2012). Leite et al. (2015) conducted a study to investigate emotional skills in children using educational robotics. They found that educational robots can encourage young children's emotional intelligence and social skills (Leite et al. 2015). On the other hand, although some behaviors involving social-emotional learning in children have been examined in the literature, there is still a lack of research on which areas of social-emotional learning can be developed with unplugged activities and educational robots. Also, according to several studies, developmentally appropriate screen-based technologies have the ability to improve the self-reflection, scientific curiosity, creativity, peer-to-peer socializing, and verbal communication skills of 4- and 5-year-old children (Strawhacker & Bers, 2018). According to Bers, the ideal method to develop these skills with technology is to take into account the context and goal of digital exposure and connect to other child-safe domains and activities (Bers, 2012). In this context, she created the Positive Technological Development Framework and described six positive behaviors that are displayed by children engaging in a developmentally appropriate digital environment.

PTD is an educational framework that emphasizes the use of technology to promote positive behaviors, including socio-emotional development when children engage in digital learning experiences (Strawhacker & Bers, 2018). Children who engage in developmentally appropriate digital explorations display six positive behaviors, which are elements of PTD (Bers, 2012). These behaviors are categorized into two groups. These are intrapersonal skills and interpersonal skills (Caballero-Gonzalez et. al., 2019). According to Bers (2012), skills of content creation, creativity, and behavior choices are the elements of intrapersonal skills, and communication, collaboration, and community building are the elements of interpersonal skills. Intrapersonal skills are connected to a child's own growth (Strawhacker & Bers, 2018). Interpersonal behaviors are connected to children's ability to enhance relationships and emotional connection with other people (Strawhacker & Bers, 2018). This study focuses on these six positive behaviors. In the following sub-section, each behavior is described in detail.

Interpersonal behaviors in PTD

PTD supports a technology environment with a variety of communication media (such as text, voice, and picture) in order to aid children in developing strong interpersonal relationships (Strawhacker & Bers, 2018). Therefore, Bers describes three interpersonal behaviors (Bers, 2012). These are communication, collaboration, and community.

In the PTD framework, communication means children's skill to share their own ideas with others and interpret the work of other people (Strawhacker & Bers, 2018). Moreover, collaboration transforms shared ideas in an organized way into shared action. For young children, this ability is a crucial developmental milestone showing their growing sense of mutual connection (Strawhacker & Bers, 2018).

Finally, community building exemplifies the integration of the other PTD assets because it allows children to use their interpersonal and social competencies to create supportive communities of collaborators in both physical and digital environments (Strawhacker & Bers, 2018). Therefore, using this framework for designing CT activities is assumed to be effective for the development of CT skills. Along with CT skills, these activities will support children's self-awareness, self-management, social awareness, relationship skills, and responsible decision-making skills which are essential for social-emotional learning.

Intrapersonal behaviors in PTD

The PTD framework also emphasizes the development of intrapersonal competencies. Bers defines three core intrapersonal behaviors: content creation, creativity, and choices of conduct (Bers, 2012). Content creation refers to children's ability to produce personally meaningful digital artifacts, which positions them as active creators rather than passive consumers of technology. By constructing original projects that reflect their interests and values, children begin to develop a sense of authorship, autonomy, and intrinsic motivation (Strawhacker & Bers, 2018).

Creativity, in this context, is supported by offering opportunities for children to express themselves freely, explore ideas, and reflect on their own work. Such experiences not only encourage self-expression but also promote self-efficacy, helping children believe in their capacity to think and act creatively (Strawhacker & Bers, 2018). Lastly, choices of conduct are fostered by providing a bounded environment where children are allowed to make their own decisions, take risks, and explore the consequences of their actions. These structured opportunities allow children to experiment with moral reasoning, reflect on ethical issues, and internalize social norms at an early age (Strawhacker & Bers, 2018). Therefore, including these

intrapersonal dimensions in the design of CT activities is expected to support both computational thinking and essential social-emotional learning outcomes.

2.5.2 Social-emotional learning framework

SEL is the process of teaching essential skills like recognizing and managing emotions, understanding others' feelings, and forming positive relationships (Zins et al., 2007). According to researchers, these skills are crucial for early childhood because they develop rapidly during this stage and have a profound impact on a child's future social, academic, cognitive, and health outcomes (Zins et al., 2007). Early childhood SEL sets the foundation for children to succeed in school, build healthy relationships, make responsible decisions, and navigate life's challenges effectively, promoting their overall well-being and resilience as they grow into adulthood.

A socio-emotional learning (SEL) framework was created by the Collaboration for Academic, Social, and Emotional Learning (CASEL) in the early 1990s (Mondi et al., 2021). CASEL researchers tried to organize research on socio-emotional development into a socio-emotional learning (SEL) framework. Researchers from CASEL claim that SEL is the process of learning to integrate thinking, feeling, and behavior to complete critical life tasks (Zins et al., 2007). Five main areas of competence are highlighted in CASEL's SEL: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (Mondi et al., 2021). Zins et al. (2007) identified five core competency areas that encompass key aspects of social and emotional learning. Self-awareness refers to the capacity to appropriately assess one's own thoughts, feelings, skills, and values. In addition, self-management involves the ability to effectively regulate one's own

ideas, emotions, and behaviors under various circumstances. Moreover, social awareness encompasses an understanding of cultural standards for conduct and the capacity to empathize with people from diverse backgrounds. Furthermore, relationship skills refer to the ability to establish and maintain healthy relationships. Finally, responsible decision making is defined as the capacity to make healthy and constructive choices.

According to research, social-emotional skills and CT are related (Maitz et al., 2022). Because this study focuses on social-emotional learning, using CASEL's SEL framework is appropriate to evaluate children's socio-emotional learning in this study. The development of (CT) has a significant impact on various areas of child development. By incorporating CT activities in early childhood, children can acquire important life skills such as problem-solving (Bers et al., 2014). Their mental rotation skills also improve while engaging in map-reading tasks (González-Calero et al., 2019), and their spatial relationship abilities are enhanced through CT activity training (Angeli & Valadines, 2020). Additionally, apart from cognitive, spatial, and mental rotation development, understanding and managing one's emotions are crucial factors for success in life (Rafique et al., 2020). Therefore, children also need to develop their social-emotional development. However, there is limited research on the role using CT activities to promote children's social-emotional development. This study aims to address this gap by exploring the CT activities on children's social-emotional development.

CHAPTER 3

METHOD

3.1 Research design

The purpose of this study is to explore the role of unplugged activities and educational robotic activities in fostering young children's social-emotional learning. In line with this purpose, a curriculum tailored to the ages and developmental stages of preschool children was developed to support their CT skills and social-emotional learning skills. CT is often considered a complex process appropriate for older children, particularly in mathematics and computer science, leaving limited understanding of its foundations in young children (Lee et. al., 2022). As CT is a relatively recent and complex concept within early childhood education, this study aligns with Creswell's (2013) assertion "we conduct qualitative research because we need a complex, detailed understanding." Therefore, employing a qualitative research design is both appropriate and essential for this inquiry.

It was argued that this study was more suitable for a case study, distinguishing it from other qualitative studies. The other types of qualitative study such as ethnography, phenomenology, narrative, and so on are defined by the topic of investigation and this type of studies focus on the study, not the unit of analysis (Merriam, 2009). However, the unit of analysis, not the topic of investigation, characterizes a case study. In addition, according to Merriam (2009) if the unit of analysis is a bounded system, a case, one would label such a study a qualitative case study. For example, if the question was how preschoolers gain CT skills would probably be a qualitative study but not a case study, the unit of analysis would be the preschoolers experiences, and an indefinite number of preschoolers and their

experiences gaining CT skills could be selected for the study. According to Merriam (2009), “for it to be a case study, one particular program or one particular classroom of learners (a bounded system), or one particular learner selected on the basis of typicality, uniqueness, success, and so forth, would be the unit of analysis” (p.41). Therefore, according to this definition, this study is suitable for a case study because it has chosen to apply the newly designed program (a bounded system) to a specific child as the unit of analysis.

According to Yin (2009), a case study involves an empirical investigation of a current phenomenon in its real-life context, especially when the distinction between the phenomenon and its context is not clearly evident. Given the complex interplay between unplugged activities, educational robots, and the social-emotional learning of preschool children in early childhood education, employing a case study approach enables an in-depth exploration of these dynamics and their interconnected influences.

In addition, this research can be explained by taking into account the specific features of the design case study. Case study has some special features and Merriam (2009) defines these features as being particularistic, descriptive, and heuristic. Therefore, these characteristics can be used to justify that this study is suitable as the case study.

This study exemplifies the particularistic feature of a case study by focusing on the impact of a specific program that integrates unplugged activities and educational robotics on preschool children's social-emotional learning. By narrowing the scope to a particular curriculum designed for early childhood, the study emphasizes a unique and defined context, making it suitable for in-depth

investigation. This specificity aligns with Merriam's (2009) description of case studies focusing on situations, events, or phenomena.

The research also reflects the descriptive characteristics of a case study by providing a rich and detailed account of how the curriculum influences children's CT skills and social-emotional learning over a defined period of eight weeks. This in-depth analysis incorporates multiple variables, such as the type of CT activities and the developmental stages of the participants, ensuring a comprehensive portrayal of the phenomenon under investigation.

Finally, the study embodies the heuristic feature of case studies by exploring the largely unexamined intersection between CT activities and social-emotional learning in early childhood education. While prior research highlights the cognitive benefits of CT activities, such as improved spatial and problem-solving skills (Angeli & Valanides, 2020; González-Calero et al., 2019), this study contributes new insights into their role in fostering emotional intelligence and social-emotional development. By addressing this gap, the research enhances understanding and opens new avenues for further exploration in this field.

Case studies are effective when examining complex and multifaceted phenomena, like the integration of CT in early childhood education, as they enable researchers to explore the unique experiences and contexts of the participants. This depth of analysis is crucial when studying the development of specific social-emotional skills in this context, where the boundaries between the phenomenon and its context are not always clear. Therefore, the case study design provides a comprehensive understanding of these skills within the intricate dynamics of these educational settings.

3.2 The case

This study was conducted to explore how CT activities can support the SEL development of preschool children at an Early Childhood Education Center in İstanbul. The selected research site was chosen for its existing emphasis on developmentally appropriate and technology-integrated learning environments, as well as the availability of a dedicated technology classroom equipped with screen-free educational robots (Bee-Bots) and unplugged activity materials as shown in Figure 1. The participants included four 4-year-old children from two classrooms at the center. These children shared common characteristics such as age, school enrollment, and residence in the same city. Participants were selected through purposive sampling, and both parents and children provided consent to participate.



Figure 1. Classroom environment

The structured eight-week program consisted of four unplugged activities followed by four plugged-in activities using Bee-Bots, preceded by an introductory session to familiarize children with the robots. The unplugged sessions included gamified tasks and group activities to introduce basic CT concepts like sequencing

and decomposition. In the robotics sessions, children used Bee-Bot robots to apply these skills in hands-on, technology-supported activities.

At the beginning of the program, an introductory session was conducted to help children become familiar with the Bee-Bot robots. During this session, the researcher introduced the children to the physical components and basic functions of the robots, such as the directional buttons and how each input command corresponded to the robot's movements. The session was designed to be exploratory and child-centered, allowing children to interact freely with the Bee-Bot. Children were encouraged to explore freely, press buttons, and observe the robot's responses at their own pace.

Data for the study were primarily collected through video recordings of the CT activity sessions. Two fixed cameras were strategically placed in the technology classroom to capture both audio and visual data, focusing on the children's verbal expressions, gestures, and interactions with peers and materials. These recordings served as the main source for analyzing the participants' social-emotional learning throughout the program. After each session, the researcher reviewed the video recordings and created detailed transcripts, which included both verbal utterances and non-verbal cues such as body language and facial expressions. In addition to transcripts, analytical memos and observation notes were kept immediately after each session to document first impressions, contextual details, and emerging patterns related to SEL competencies. This multimodal data collection approach allowed for a rich and nuanced analysis of how children demonstrated self-awareness, self-management, social awareness, relationship skills, and responsible decision-making across various CT activities.

To provide a deeper understanding of participant characteristics and their initial SEL profiles, the researcher conducted a semi-structured interview with the classroom teacher prior to the study. Below are brief narrative profiles of the four participants—Anna, Chen, Amy, and Sam—based on the teacher’s observations prior to the intervention.

Anna is a self-aware and verbally expressive child who confidently states her emotions and preferences. She is highly persistent and does not easily give up when faced with challenges. However, she struggles significantly with self-regulation, often acting impulsively in group situations and requiring adult intervention during conflicts. Her empathy and awareness of others' perspectives are still developing, and she frequently resorts to physical actions when frustrated.

Chen is a calm and cooperative child who demonstrates strong social awareness and empathy. He prefers harmony and often seeks to mend peer conflicts. Although he occasionally avoids challenging tasks and has difficulty maintaining focus, he responds well to reminders. His motivation is largely extrinsically driven, and while he does not usually take initiative in group decision-making, he adapts well and follows classroom expectations when guided.

Amy is highly focused, goal-oriented, and competitive. She shows persistence in task completion and is eager for recognition. Although socially engaged, she tends to dominate group activities and struggles with patience and impulse control. She has difficulty managing emotional reactions and resolving conflicts independently. Her empathy and collaboration skills are still in development, and she often seeks validation from adults.

Sam is emotionally mature and socially aware. He recognizes and responds to both his own and others’ emotions and is known for his helpfulness and support in

group tasks. He follows routines, expresses himself clearly, and uses effective strategies for conflict resolution. Though reserved with unfamiliar adults, he maintains strong peer relationships and plays a positive role in group collaboration. He shows intrinsic motivation and a strong sense of responsibility.

These detailed participant profiles provide valuable insight into the baseline SEL competencies that each child brought into the study. Understanding these individual differences was crucial for interpreting how each participant engaged with the CT activities and how the structured experiences influenced their growth across CASEL's five domains.

3.3 Data sources

Two types of data sources used in this research. These were the video recordings taken during the implementation of the activities and the SEL observation checklist (See Appendix A).

Video recordings

Consent obtained from both families and children before the study to record videos during the activities. After receiving approvals, the researcher carried out the activities designed for this study with the children and took video recordings with two cameras placed in certain parts of the classroom. In total, eight activity sessions were recorded during the research process. These consisted of four unplugged activities and four plugged-in activities. Each session lasted between 30 and 40 minutes, resulting in a total of 282 minutes, which corresponds to approximately 4 hours and 42 minutes of video data. These recordings were transcribed and analyzed to examine the development of children's social-emotional learning throughout the study.

Observation checklist for Social-Emotional Learning

The observation checklist was used by the researcher immediately after each activity session was completed and the children had left the classroom. Since the researcher was actively involved in guiding the activities and directly interacting with the children during the sessions, it was not feasible to document observations in real time. Instead, initial reflections were recorded right after the session, while the events were still fresh in mind. For each session, the checklist was used to identify which of the five core SEL competencies—self-awareness, self-management, social awareness, relationship skills, and responsible decision-making—were most prominently observed in each participant. This process allowed the researcher to form an initial understanding of the social-emotional dynamics present in each activity. Before reviewing the video transcripts, the checklist served as a valuable reference for identifying which SEL skills were likely to emerge more strongly, guiding subsequent analysis and interpretation of the data. Table 1 presents the observation checklist.

Table 1. Example Observation Checklist for Social-Emotional Learning

Core competency	Chen	Anna	Amy	Sam
Self-awareness			✓	✓
	✓			
Self-management		✓		
Social awareness	✓			✓
Relationship skill	✓			
Responsible decision-making				

3.4 Data collection procedure

The study involved preschool children who were 4 years old and attended the Early Childhood Education Unit during the 2023-2024 fall and spring semesters. There was a technology classroom, specifically designed for coding activities in this Early Childhood Education Unit. This technology classroom served as a coding class, where various activities were conducted with children during designated workshop hours. This research was carried out in this technology classroom, and data was collected in this classroom.

Before collecting the data, a consent form containing information explaining the purpose of the study and the importance of participation was given to the parents by hand (see Appendix B). Also, an illustrated consent form designed to be age-

appropriate for children was distributed to them, and their consent was obtained. All children in the 4-year-old class were informed of the activities, and it was explained that the children would be divided into two groups. It was explained that each child could participate in these activities according to their groups. In this way, activities involving children participating in the research were recorded on video, while no video recording was made during activities with other children. Therefore, children who had obtained consent from both their families and them participated in the research, while other children also chose to participate in workshops based on their preferences.

Activities were held during school hours, which was the time when children were at school. Upon reviewing the kindergarten curriculum, it was found suitable to schedule activities for children when they were not attending specialized courses like English lessons but were in their regular classrooms with their classroom teachers. For this reason, after consulting with classroom teachers, it was decided that these activities would be conducted on Thursday mornings from 10:00 to 11:00. While activities were carried out with the children participating in the research, other children who did not participate in the research continued their routine classroom activities with their classroom teachers. In the afternoon of the same day, when all children were again with their classroom teachers and not engaged in specialized courses, similar activities were conducted with those who did not participate in this research. However, no video recordings were made during these sessions. At the same time, classroom teachers re-implemented the activities with the children who did not participate in the morning routine so that the children did not fall behind the curriculum prepared by the teacher and the kindergarten. This approach ensured that children who did not participate in the research were given the opportunity to

participate in these activities, and no child was left behind in the curriculum organized by the teacher for his or her class.

Also, the activities were led by the researcher, and when one group of children participated in an activity, the classroom teacher attended to the children who remained in the class. While doing activities with children participating in the research, video recording was made throughout the activities. In this study, a camera was placed in the technology classroom, where all activities took place, for both image and audio data collection. This camera enabled the collection of both image and audio recordings during activities.

In this study, children took part in unplugged and plugged-in educational robotic activities designed by the researcher. Bee-bot educational robots were used for plugged-in educational robotic activities. These robots were appropriate for early childhood children because they were screen-free robots. For unplugged activities, there were gamified activities suitable for children in early childhood. These activities were designed to improve their social-emotional learning and CT skills.

This program was developed based on the integration of the PTD framework and the SEL framework. The final program consisted of 8 sessions over 8 weeks, structured as 4 unplugged activities and 4 educational robotics activities using Bee-Bot. The activities were planned for half an hour, and as stated above, video recording was made via camera during the activities of the children who participated in the research. Before starting the developed 8-week program, an introductory session was held, and Bee-bot was introduced to the children in this session. During this session, children were given detailed information about how the Bee-bot moved, what the buttons on it did, and how to use this robot during activities. Thus, children

became familiar with the robot and how to use it in the next activities where the robot was used.

After this introductory session, the 8-week program began. The unplugged activities were implemented across four sessions. The Emotion Sorting activity lasted 30 minutes, Colorful Journey was conducted over 30 minutes, Emotion Collage Story lasted 40 minutes, and Friendship Bracelet Making was completed in 30 minutes. Similarly, the plugged-in activities were carried out in four separate sessions. The Dance of the Bee-Bots session lasted 35 minutes, Bee-bot Shape Adventure was conducted over 37 minutes, Bee-Bot's Treasure Hunt lasted 30 minutes, and Bee-bot Pattern Pathways was completed in 40 minutes. Video recording was taken during all these activities, and data was collected from each of the 8 activities implemented for 8 weeks.

Table 2. Weekly Plan of CT Activities

CT Activities	Week	Activity name
Unplugged activities	Week 1	Emotion Sorting
	Week 2	Colorful Journey
	Week 3	Emotion Collage Story
	Week 4	Friendship Bracelet Making
	Week 5	Dance of Bee-bot
	Week 6	Bee-bot Shape Adventure
Plugged-in activities	Week 7	Bee-Bot's Treasure Hunt
	Week 8	Bee-bot Pattern Pathways

3.5 Researcher's position

It is very important to explain how the researcher's position and aspects may have affected the study. I can say that I have taken on many different roles as a researcher.

First, after graduating from Boğaziçi University's Department of Early Childhood Education, I started the M.A. program in Educational Technology at the same school. My adventure of working with children started during my undergraduate studies and continued later. I had previously interned at the Boğaziçi University Early Childhood Unit used in this study and was used to both the research environment and the teachers. Therefore, conducting research in this environment was very valuable for me as a researcher.

In this study, I took on both the researcher and teacher roles. Before starting to collect data, I prepared the curriculum to be used in the study and wrote each of the 8 activities considering both SEL skills and CT skills. While writing these activities, I used the experiences I gained from the CT-related activities I had previously organized with this age group, namely the 4-year-old group, in different institutions to ensure that the activities supported these skills at the highest level. I can say that having previously conducted CT related activities with children supported me a lot as a researcher. These prior experiences helped me anticipate potential challenges in social emotional learning observed in this age group. Thus, I was able to design activities that were both developmentally appropriate and responsive to children's needs.

After designing the activities, I was in the role of a teacher during the data collection phase, and I carried out the activities I prepared with the children. First, I placed the cameras in the classroom environment, then I started recording and started the activity with the children. As a researcher, being an instructor who also carried

out the activities is also valuable for this research. This dual role was particularly valuable, as being present during the activities enabled me to observe the children's behaviors more accurately, while also allowing for a deeper understanding of the data during the analysis phase. However, I remained aware of the potential for bias in interpreting the children's behaviors, especially since I was both facilitating and observing. To minimize this risk, I maintained detailed observation memos after each session, which allowed me to reflect on and separate my instructional role from my analytic stance.

After the data collection process was completed, I watched the videos one by one and created the transcripts. I later used the transcripts of these activities actively in the data analysis process as a researcher. In this research, as a researcher, I took an active role in both preparing, carrying out and analyzing the activities of the research. To further strengthen the trustworthiness of the findings, I cross-referenced my video analyses with the SEL observation notes and triangulated them with patterns emerging from the transcripts. Additionally, I engaged in regular memo-writing to reflect on my assumptions and interpretations throughout the thematic analysis.

3.6 Data analysis

Thematic analysis is a widely recognized qualitative analytic method for identifying, analyzing, and reporting patterns within data (Braun & Clarke, 2006). Its flexibility, which allows researchers to work across a range of epistemological approaches and research questions, makes it particularly suited to studies seeking to explore complex, nuanced phenomena (Braun & Clarke, 2006). This approach was especially appropriate for exploring the social-emotional development of preschool children through CT activities, as it enabled a comprehensive analysis of both explicit

interactions and underlying contextual factors. Therefore, the analysis of this research followed the six phases of Thematic analysis proposed by Braun and Clarke (2006) as shown Figure 2.

Phase	Description of the process
1. Familiarizing yourself with your data:	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas.
2. Generating initial codes:	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3. Searching for themes:	Collating codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes:	Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis.
5. Defining and naming themes:	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
6. Producing the report:	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

Figure 2. Phases of thematic analysis

Note. Adapted from *Using thematic analysis in psychology*, by V. Braun & V. Clarke, 2006, *Qualitative Research in Psychology*, 3(2), p. 87.

Building on Braun and Clarke's (2006) framework, the present study adapted these six analytical phases to fit the specific context of analyzing preschool children's SEL development through CT activities. The analytic process was carefully tailored to reflect both the structure of the implemented CT tasks and the targeted SEL competencies. A detailed account of how each thematic analysis phase was operationalized is provided in Table 3.

Table 3. The Phases of Thematic Analysis in the Current Study

Phase	Key actions
1. Familiarization	Transcribed 282 minutes of video; reviewed data 3 times.
2. Generating Initial Codes	Used a hybrid approach (deductive + inductive); based on SEL framework.
3. Searching for Themes	Clustered related codes into initial themes.
4. Reviewing Themes	Merged overlapping themes; finalized into 3 overarching themes.
5. Defining & Naming Themes	Clarified theme meanings; ensured alignment with data extracts. Collaborative design of CT activities, the nature of teacher guidance in CT activities, step-by-step progression through CT activities.
6. Producing the Report	Reported themes in relation to CT & SEL integration, supported with examples.

3.6.1 Familiarizing yourself with your data

The first phase of analysis consisted of watching and transcribing each video recording (Braun & Clarke, 2006). This phase is the key stage in becoming familiar with video recording data. The transcripts of the data included all words, gestures and non-verbal behavior. Therefore, this transcription included more than just writing all words, no transcription tool was used. All data transcribed by the researchers. A sample transcript is included in Table 4. It is recommended to conduct a comprehensive review of the entire dataset at least once prior to initiating the coding process (Braun & Clarke, 2006). In this phase of the study, the researcher thoroughly reviewed the entire dataset three times to gain a more detailed understanding of the data. Additionally, the fact that the researcher also served as the instructor who conducted the activities contributed to their familiarity with the data, which ensured the efficient completion of this stage.

Table 4. Sample Transcript from Plugged-in Activity: Bee-Bot Shape Adventure

Participants	Verbal utterance	Non-verbal behavior
Anna	The teacher: Okay, first everyone brings your robot to the place you drew.	
Amy	What's the first task?	
	Anna: One, two, three, four.	[Anna bent down and tried to measure the distance between her robot and the shape she had drawn.]
	The teacher: Tell your friends too, share it.	
	Anna: I'm counting.	
	The teacher: Why did you count, Anna?	[Anna tried to measure the distance using her finger.]
	Anna: To get there.	
	The teacher: You can help your friends too. Everyone can start. If you finish the task, raise your hand.	
	Amy: Thirteen!	
	The teacher: No, you haven't finished the task yet.	[Anna pressed the Bee-Bot's forward button as many times as she had counted, but hers was also turned off, so she turned it on.]
	Anna: One, two, three, four, five, six, seven, eight, nine, ten.	

3.6.2 Generating initial codes

The second phase is identifying initial code (Braun & Clarke, 2006). Boyatzis (1998) describes a code as “the most basic segment, or element, of the raw data or information that can be accessed in a meaningful way regarding the phenomenon” (p. 63). There are different approaches to determining the codes in the second step. This can be done in an inductive or bottom-up method, which means the themes identified are strongly linked to the data themselves (Patton, 1990). In contrast, a theoretical or deductive or top-down approach can be used, in which thematic analysis is driven by

the researcher's theoretical framework. Braun and Clarke (2006) suggest that the researcher should make a decision on the level in which the themes are to be identified. In this study, the method of analysis was a hybrid approach that incorporated the two main philosophical methods of reasoning: a top-down, deductive, theoretical process and a bottom-up, inductive, data-driven process.

Through the application of these two analytical strategies, the hybrid approach to coding not only achieved a comprehensive interpretation of qualitative data but also greatly emboldened scientific rigor and reliability in drawing conclusions. As a first step in the hybrid analysis, a priori coding template was developed based on the study's theoretical framework and core research questions. This template contained predefined categories relating to both social-emotional learning and computational thinking skill development. It provided a structured means for arranging similar or related sections of data. Use of a coding framework like this provided open mechanisms and principles by which the process could be traced back. Fereday and Muir-Cochrane (2006) further emphasized that the credibility of research projects lay in how easily they could be audited.

During the coding process, data analysis was carried out using this predetermined coding scheme, though not restricted to it. As new themes emerged from the data set, additional inductive codes were added to reflect fresh insights and patterns that had not been foreseen in the initial coding structure. These emergent codes often extended previous categories or introduced entirely new themes which were grounded in participants' lived experience (Fereday & Muir-Cochrane, 2006).

By using a combination of deductive coding (derived from theoretical constructs) and inductive coding (arising from the expression of participants), this approach ensured that we maintained both empirical grounding and theoretical

meaningfulness in our use of themes. The hybrid approach was especially useful for analyzing the intersection of social-emotional learning and cognitive skill development. In this way predefined constructs could be validated while new insights unique from the data were also captured (Fereday & Muir-Cochrane, 2006).

Therefore, the choice of a code manual for the study was important, because it served as a data management tool for organizing segments of similar or related text to assist in interpretation (Crabtree & Miller, 1999). The use of a template provided a clear trail of evidence for the credibility of the study. For this study, the template was developed a priori, based on the SEL Framework. Five broad code categories formed the code manual which are self-awareness, self-management, social awareness, relationship skill, responsible decision making.

For this study, as shown in table 5 codes were written with reference to Boyatzis (1998) and identified by the code label or name, the definition of what the theme concerns, and a description of how to know when the theme occurs.

Table 5. SEL Framework Related Codes

Code 1	
Label	Expressing emotion
Definition	Child expresses/verbalizes a range of emotions/ his or her emotions
Description	Children can express their own feelings verbally or behaviorally during activities and talk about their feelings.

A critical step in the development of an analytical framework for analysis is to determine the applicability of the code to the raw information (Boyatzis, 1998). To ensure reliability in the coding process, the codebook and datasets were shared with a researcher specializing in this field, who was tasked with conducting the coding. This

researcher is a teacher at the school where the study was conducted and is also a master's student in the Educational Technology program at Boğaziçi University. Their knowledge and experience in early childhood education and computational thinking activities made them a suitable choice for this task.

After the researcher completed the coding, a meeting was held to compare their results with those of the primary researcher. The meeting, which lasted about three hours, involved a detailed review of all eight activities. During the discussion, the code "appreciating each other's works/efforts" was added to the social-awareness theme, while the code "listen to peers/active listening" was included under the relationship skills theme.

During this process, it was also determined that the self-awareness theme codes "expressing feeling" and "verbalizing feeling" were conceptually similar, leading to the conclusion that one should be removed. After careful consideration, it was decided that "expressing feeling" was the more comprehensive code and should be retained.

Additionally, the placement of existing codes in the dataset was reviewed, and any differences in the interpretation of code meanings were addressed. For codes that were unclear or inconsistently interpreted, their definitions and positions in the dataset were refined collaboratively. Following this meeting, as shown in Appendix C, the codebook was finalized.

Subsequently, a validation meeting was held with an expert in the Social and Emotional Learning (SEL) framework. During this session, the original framework-based codebook, the dataset, and the refined codebook from the previous meeting were critically reviewed. Particular attention was given to the self-awareness theme, specifically re-evaluating the previously removed code "verbalizing feeling." The

expert clarified that, while these codes appeared similar, they diverged significantly within the SEL framework. Specifically, "expressing emotions" referred to recognizing and expressing feelings through non-verbal cues such as gestures or facial expressions, whereas "verbalizing feelings" required explicit articulation of emotions through language. Based on these discussions and a detailed review of examples from the dataset, it was decided to reintroduce the "verbalizing feeling" code into the framework.

The second revision aimed to address conceptual overlaps between the social-awareness and self-management themes. The code "managing frustration or anxiety appropriately during the activities," which was initially categorized under social awareness, was identified as closely related to the self-management code "demonstrating self-control in challenging situations during the activities." Upon further analysis, it was determined that the behaviors described by this code align more closely with self-management competencies. Therefore, to maintain conceptual clarity and avoid redundancy, this code was removed from the social-awareness theme.

Similarly, the code "child begins to show empathy for others," categorized under relationship skills, was found to overlap with the social-awareness code "taking the perspective of others/showing empathy towards others." Upon further examination, it was determined that the latter code more accurately reflected the behaviors associated with social-awareness competencies. As a result, the overlapping code was removed from the relationship skills category to ensure clarity and avoid redundancy.

In addition, the code "child participates in healthy interactions," also within the relationship skills category, was examined in greater detail. Examples from the

dataset were analyzed to clarify the specific contexts in which this code should be applied. It was concluded that this code is most appropriate when children, particularly during challenging moments, engage in constructive communication aimed at expressing themselves and collaboratively resolving conflicts.

Lastly, the code "awareness of peers' being different from each other," categorized under social awareness, was discussed to evaluate its presence in the dataset. It was determined that this code was not observed within the given context and is more likely to emerge in settings where children from diverse backgrounds come together. Consequently, the decision was made to remove this code from the framework. These decisions contribute to the finalization of the codebook as shown in Appendix D.

3.6.3 Searching for themes

The third phase of thematic analysis, as defined by Braun and Clarke (2006), represents a critical step where the focus transitions from individual codes to the broader conceptualization of potential themes. This phase involves systematically organizing and interpreting coded data to explore meaningful patterns and relationships. During this stage, initial themes were identified based on the code derived from the data, forming the foundation for deeper analysis in subsequent phases.

The identification of themes in this phase was guided by an iterative review of the coded data. Themes emerged as a result of clustering related codes and interpreting their collective significance in the context of the research questions. The process involved examining how codes interacted within and across data points, with attention given to areas of convergence and divergence. These themes reflect the

preliminary organization of data before further refinement in Phase 4. Before the themes were finalized, seven main themes were identified at this stage. These themes are detailed below.

Teacher's Guidance Accelerates SEL Skills

Teacher guidance emerged as a pivotal theme, emphasizing the role of educators in fostering SEL through scaffolding, modeling, and targeted prompts. Teachers facilitated emotional articulation by guiding children to recognize, label, and express emotions within structured activities. This involvement provided a supportive framework for children to connect non-verbal cues with emotional vocabulary. For instance, during the "Emotion Sorting" activity, the teacher used prompts like "Why did you make a heart?" to help children reflect on their actions and emotions. Amy's response, "Because it makes me so happy when I smile. demonstrated her ability to link a gesture to her feelings. Similarly, the teacher encouraged observational skills by asking children to identify visual features, such as facial expressions, that convey emotions. These interactions highlight how teacher interventions bridge gaps between observation, reflection, and verbal expression, accelerating SEL development.

Children Reflect on Their Strengths and Challenges During Step-by-Step Activities

This theme captured how children's engagement in step-by-step activities facilitated self-reflection on their strengths and limitations. The structured nature of these tasks provided opportunities for children to evaluate their performance dynamically as tasks progressed in complexity. For example, during the bead sequencing task, Anna remarked, "Yes, we can see it, but now it's starting to get a little bit difficult." illustrating her awareness of increasing difficulty. Similarly, Chen's progression from confidently stating, "This is very easy" to expressing frustration at more

complex stages demonstrated how iterative tasks encouraged children to reflect on their capabilities. This reflective process fostered emotional resilience and a deeper understanding of their growth and challenges.

Collaboration Enhances Decision-Making

Collaboration emerged as a key theme, highlighting how group interactions supported decision-making and problem-solving. Activities requiring collective input provide children with opportunities to navigate disagreements, propose solutions, and refine their ideas through negotiation. In the "Unplugged Colorful Journey" activity, children resolve conflicts over material shortages by discussing alternatives and reaching consensus. For instance, Amy's suggestion to "Let's think and use other colors" demonstrated her ability to contribute constructively to group discussions. Such interactions underscored the importance of collaborative tasks in developing decision-making and interpersonal skills.

Problem Solving Through Trial and Error

The iterative nature of CT activities encouraged children to engage in trial-and-error processes, promoting critical thinking and adaptive problem-solving. Participants revisited and revised their approaches when faced with challenges, reflecting on their strategies and learning from errors. For example, during the Dance of Bee-Bot activity, children experimented with programming sequences, adjusting their commands after observing incorrect outcomes. This iterative engagement reinforced their ability to evaluate their decisions and persist through difficulties, cultivating problem-solving skills essential for SEL development.

Independent Work Enhances Self-Management Skills

Independent tasks provided children with opportunities to develop self-management skills, including focus, accountability, and perseverance. These activities allowed

children to take ownership of their learning, fostering autonomy and self-regulation. During the "Friendship Bracelet" activity, children worked individually to thread beads, managing their time and concentration to complete the task. Instances where children independently identified and resolved mistakes demonstrated their growing ability to self-monitor and adapt their behaviors without external prompts.

Social Awareness Through Exploring Emotions

Exploring diverse emotions within CT activities helped children develop social awareness by recognizing and empathizing with others' feelings. Activities designed to depict and discuss emotional states created a platform for children to connect with their peers on an emotional level. For instance, during the "Emotion Collage Story" activity, children analyzed facial expressions and shared their interpretations. Chen's observation that "Because her cheeks are red, she feels sad." highlighted his ability to link visual cues to emotional states, fostering empathy and understanding.

Conflict Resolution and Negotiation Skills

Conflict resolution and negotiation were recurring themes, with children demonstrating growth in their ability to address disagreements and propose equitable solutions. Structured activities provided a controlled environment for practicing these skills. For example, during the "Bee-Bot Treasure Hunt" activity, children independently initiated discussions to resolve disputes over group roles. Their ability to negotiate and reach agreements reflected their increasing confidence and competence in handling interpersonal conflicts constructively.

The themes identified in Phase 3 provided a comprehensive framework for understanding how CT activities supported the SEL development of preschool children. These preliminary themes, while subject to refinement in later phases,

offered valuable insights into the dynamics of teacher guidance, individual reflection, collaboration, and emotional growth within structured educational contexts.

3.6.4 Reviewing themes

Phase 4 of thematic analysis involves critically evaluating candidate themes to ensure they accurately represent the dataset (Braun & Clarke, 2006). This stage is essential for refining the thematic structure by examining the coherence of themes, consolidating overlapping concepts, and eliminating weak or unsupported themes. The primary objective of this phase is to enhance the clarity, consistency, and conceptual robustness of the thematic map before finalizing the findings.

The preliminary analysis of the dataset initially identified seven broad themes that reflected key patterns in how preschool children's social-emotional learning developed through CT activities. However, through an iterative review process, these themes were consolidated into three overarching themes that more effectively captured the interplay between SEL competencies and CT activities. The first theme, Collaborative Design of CT Activities, encompasses how structured group interactions foster self-awareness, relationship skills, and responsible decision-making. The second theme, Teacher Guidance in CT Activities, highlights the role of teacher support in reinforcing self-awareness, social awareness, relationship skills, and responsible decision-making. The third and final theme, Step-by-Step Progression Through CT Activities, illustrates how structured task progression enhances self-management and responsible decision-making. This refinement process ensured that themes were distinct yet interconnected, aligning with Patton's (1990) criteria of internal homogeneity (coherence within themes) and external heterogeneity (clear distinction between themes).

A critical aspect of this phase was the consolidation of themes that shared conceptual overlap. Specifically, the theme “Children Reflect on Their Strengths and Challenges During Step-by-Step Activities” was integrated into Theme 3 (Step-by-step progression of CT activities encouraged young children’s emotional resilience, self-regulation, and collaborative decision-making) to emphasize how structured task breakdowns facilitated self-awareness and self-regulation. Similarly, “Problem Solving Through Trial and Error” was merged with Theme 3, as it aligned with the iterative learning processes that reinforced self-management and decision-making. Additionally, “Conflict Resolution and Negotiation Skills” was subsumed under Theme 1 (Collaborative design of CT activities fostered social and emotional growth) since it was inherently tied to peer interactions within group tasks. These modifications streamlined the thematic framework, ensuring a clearer representation of the data.

3.6.5 Defining and naming themes

Once the thematic map was finalized, the themes were further refined to ensure they accurately represented the dataset (Braun & Clarke, 2006). This phase involved reviewing previously selected data extracts and comparing them with the final themes. If new data extracts were found to be more representative of a theme, they were replaced to strengthen the overall coherence of the thematic structure. This process ensured that each theme captured the essential patterns within the data while maintaining consistency across themes. According to Braun and Clarke (2006), defining and refining themes involves identifying the core meaning of each theme and ensuring that it does not become too broad or complex. In this study, the refined themes were structured to clearly articulate the relationship between CT activities

and the development of social-emotional skills. Thematic refinement also required re-examining the relationship between themes, ensuring that each theme contributed to the broader research narrative without excessive overlap.

During this phase, some data extracts were replaced with more relevant ones, as they provided clearer examples of how preschool children demonstrated self-awareness, self-management, social awareness, relationship skills, and responsible decision-making during CT activities. This iterative process aligns with Braun and Clarke's (2006) recommendation that researchers should revisit data to ensure the most meaningful extracts are used in the final analysis.

Finally, themes were given concise and descriptive names that immediately conveyed their core meaning. Braun and Clarke (2006) emphasize that theme names should be clear, engaging, and informative. In this study, the theme names were refined to ensure they effectively communicated the specific aspects of SEL that emerged through CT activities. This refinement process allowed for a more precise and impactful presentation of the findings.

3.6.6 Producing the report

After themes had been fully refined, the final phase to report production then took place. This involved giving a coherent, structured account of research output (Braun & Clarke, 2006). In this phase, only a high-level overview was provided to illustrate how CT activities contributed to the development of SEL skills in an engaging, non-repetitive, and logical arrangement. Data extracts were purposefully included to illustrate key findings and highlight moments when children exhibited self-awareness, self-management, social awareness, relationship skills, and responsible

decision-making. Rather than simply presenting a series of excerpts, these were embedded within a broader analytical framework to emphasize their significance.

To further deepen the analysis, thematic relationships were explored, demonstrating how collaborative learning, teacher guidance, and step-by-step progression collectively facilitated SEL growth. In this way, the final report was not merely a compilation of findings but rather an organized, theory-driven interpretation of CT activities aligned with preschool children's social-emotional development.

3.7 Trustworthiness

To establish trustworthiness, this research focuses on Lincoln and Guba's (1985) criteria emphasizing credibility, dependability, confirmability, and transferability. The researcher's continued involvement throughout the entire research process, which includes the design of the curriculum, implementation of activities, and data collection, is consistent with the basic principle of long-term involvement as suggested by Lincoln and Guba (1985).

This approach serves not only to immerse the researcher in the natural environment but also to develop a more detailed understanding of the participants' experiences, thus reducing potential biases that may arise from the role of a more detached observer. In this research, the researcher performs the activities with the children and participates in the natural environment where the situation takes place, thus reducing any biases that may occur and increasing trustworthiness.

The criterion of confirmability necessary for trustworthiness is emphasized by careful documentation of the entire research process, in line with Lincoln and Guba's (1986) call for open and transparent reporting. The researcher will keep detailed records and notes throughout the study, ensuring that each step from

conceptualization to data analysis will be meticulously documented. This transparency not only facilitates assessment of the internal consistency of the study but also provides a roadmap for future researchers who wish to replicate or build upon this research. In this research, the researcher has designed the process in detail in advance and will report it step by step in detail during the analysis. Thus, this study focuses on the confirmability criterion necessary for trustworthiness.

Additionally, a thorough explanation of each phase, starting from the commencement of the study to the conclusion of reporting the findings, enhances the confirmability as proposed by Lincoln and Guba (1986). Detailed depiction of the sampling process, participant characteristics, and context allows readers to evaluate the applicability of the study's findings to different settings or populations. By providing such rich contextual information, the researcher contributes to broader scientific debates on early childhood education and CT skills, allowing for a more detailed understanding of the potential generalizability of the study's results.

In essence, the intelligent integration of prolonged engagement, triangulation, meticulous documentation, and detailed case descriptions collectively strengthen the credibility of this research. The study not only increases the trustworthiness of its findings in accordance with established criteria but also contributes to the broader methodological discourse in the field of educational research.

CHAPTER 4

FINDINGS

The analysis identified three key themes illustrating how CT activities support SEL development in preschool participants. These themes demonstrate how participants engaged in self-awareness, self-management, social awareness, relationship skills, and responsible decision-making within structured CT activities. The findings are organized around three primary themes: Collaborative design of CT activities fostered social and emotional growth (Theme 1), Teacher-guided CT activities nurtured emotional expression, empathy, and interpersonal understanding among young children (Theme 2), and Step-by-step progression of CT activities encouraged young children's emotional resilience, self-regulation, and collaborative decision-making (Theme 3). Figure 3 presents how these themes collectively support SEL competencies, with self-awareness and responsible decision-making emerging as foundational across all three.

Collaborative design of CT activities fostered social and emotional growth (Theme 1) and teacher-guided interactions (Theme 2) fostered relationship skills, while teacher-supported activities particularly enhanced social awareness. Step-by-step CT activities (Theme 3) primarily reinforced self-management, helping participants persist in goal-oriented tasks and regulate emotions. The following sections examine these themes in detail, providing examples of how CT activities facilitated SEL development.

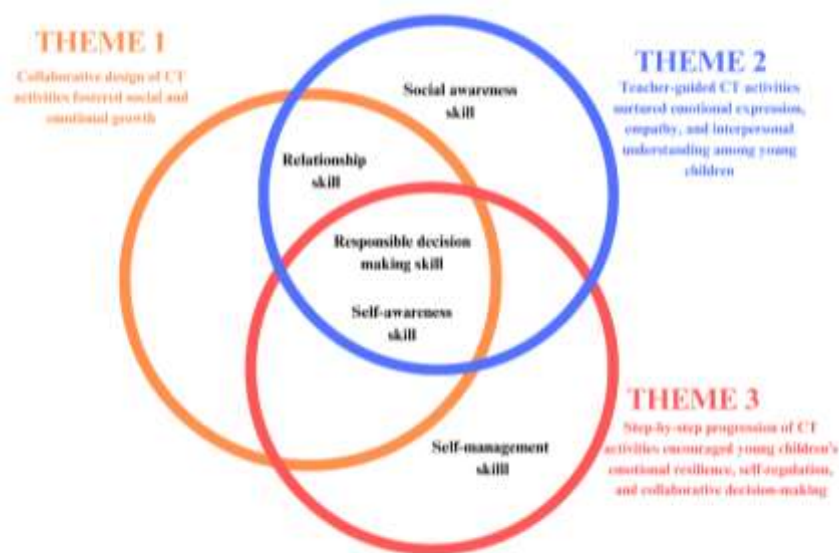


Figure 3. Overview of key SEL skills across CT activity themes

4.1 Theme 1: Collaborative design of CT activities fostered social and emotional growth

CT activities were designed in this study to foster collaboration among preschool participants to support the development of essential social-emotional skills. Through these activities, participants engaged in cooperative problem-solving, decision-making, and interpersonal communication, all of which are fundamental to their social-emotional learning. In this study, the collaborative nature of these tasks encouraged participants to a) develop self-awareness by articulating their emotions, b) responsible decision making by cooperating with daily routines and requests, making informed decision making in group settings and c) build positive relationships by seeking and offering help from others, cooperating, communicating, and negotiating conflict with their peers. By requiring participants to work together towards shared objectives, these activities create meaningful opportunities for them to develop self-awareness, responsible decision making, and relationship skills. The

following sub-sections present findings regarding how collaborative nature of CT activities fostered these specific SEL skills.

4.1.1 Self-awareness

The collaborative nature of CT activities provided participants with opportunities to express their emotions and thoughts while engaging with their peers. These activities required participants to communicate openly, listen to others, and respond to social interactions as they work together to complete shared tasks. Through this process, participants gradually became more aware of their emotions and develop the confidence to articulate their feelings within a supportive group setting. The necessity of working together may encourage even hesitant participants to voice their thoughts, as collaboration is essential for the group's progress. Participants navigated peer interactions within CT activities, and they encountered situations that challenged them to express themselves clearly and consider the perspectives of others. Over time, repeated engagement in these collaborative tasks may foster self-awareness, helping participants recognize their own emotional responses and communicate them effectively within a social environment. For instance, during the Colorful Journey activity (unplugged activity in week 2), which involved physical movement as participants navigated through a colorful path, Anna's unintentional movement accidentally bumped into Chen. This physical aspect of the activity highlighted the potential for interpersonal interactions to occur. Chen initially hesitated to express his discomfort with Anna's actions, illustrating how the collaborative structure of the activity required him to engage in peer interaction to move forward:

Chen: Teacher, Anna did like this, it hurt me. [Chen held his head with his hand, expressing pain, as shown in Figure 4]

The teacher: Would you like to tell your friend about it? [Chen shook his head to indicate "no."]

The teacher: Why not? Maybe Anna would like to apologize to you.

Chen: Anna, you did like this, and it hurt here. [Chen held his head again to show the spot that hurt.]

Anna: Okay, I'm sorry.



Figure 4. A child indicating pain by pointing to his head

In this scenario, the collaborative nature of the CT activity placed Chen in a situation where expressing emotions became essential for maintaining the task as a group. Chen expresses his emotions in order to maintain the task as a group. In this activity, participants needed to remain side by side and continue to engage together to accomplish the task. The interactive environment encouraged Chen to communicate emotions, leading to a peer-mediated resolution. In this instance, after initially hesitating to express his discomfort, Chen was encouraged by the teacher to communicate directly with Anna, which he eventually did by verbalizing his feelings by saying ‘Anna did like this, it hurt me.’ Anna’s immediate response, ‘Okay, I’m sorry.’ demonstrated how the activity structure facilitated effective emotional

expression and resolution. Through these structured interactions, participants engage in expressing themselves within a social context, fostering self-awareness skills.

By the fifth week, Chen demonstrated noticeable progress in articulating his emotions during the Dance of Bee-Bot activity, as he voiced his discomfort directly to his peers, saying, ‘But her head touched my leg, I didn't like it.’ Unlike earlier weeks, he expressed his feelings without hesitation, aiming his words at his peers rather than the teacher, which showed increased confidence in self-expression within the group. In response, the teacher encouraged him by saying, ‘Then you can tell them.’ This approach facilitated peer communication, as evidenced by Anna’s apology, Chen, I’m sorry.’ This progression highlights how the repetitive and collaborative structure of CT activities provides consistent opportunities for participants to engage in peer communication and emotional expression. As shown in Table 6, children expressed their emotions openly to their peers in order to complete the collaborative tasks, demonstrating the development of self-awareness.

Table 6. Self-awareness Skills Facilitated by Collaborative Design

SEL Skills	Sub-Skills	Observed Example
		Colorful Journey Activity
Self-awareness	Child expresses emotions	Chen: Teacher, Anna did like this, it hurt me. [Chen held his head with his hand, expressing pain.] The teacher: Would you like to tell your friend about it? [Chen shook his head to indicate "no."] The teacher: Why not? Maybe Anna would like to apologize to you. Chen: Anna, you did like this, and it hurt here. [Chen held his head again to show the spot that hurt.] Anna: Okay, I'm sorry

These examples illustrate how the collaborative structure of CT activities created emotionally safe spaces for children to practice expressing their feelings. Initially reluctant to communicate discomfort, participants like Chen gradually developed the ability to verbalize emotional experiences directly to peers. This shift from teacher-mediated to peer-directed communication reflects a meaningful growth in self-awareness. As children encountered socially dynamic situations that required emotional articulation for task completion, they increasingly recognized and shared their own emotional states.

4.1.2 Responsible decision making

In this study, CT activities aimed to create a structured environment where preschool participants could engage in collaborative problem-solving through peer discussions. The design of these activities encouraged participants to communicate, negotiate, and collaboratively explore solutions at various stages of the tasks. While progress often depended on cooperation, participants were given opportunities to share ideas, consider peer input, and work toward consensus. This structure is aimed to help participants develop a sense of responsibility within their groups by encouraging them to listen to one another, adjust their thinking when needed, and contribute to collective decision-making. Through these interactions, participants gradually practiced skills related to teamwork and mutual support, which are considered valuable for achieving shared objectives. These activities appeared to contribute to the development of social-emotional skills by promoting practices such as active listening, cooperation, and collective responsibility.

During the Colorful Journey activity (unplugged activity in week 2) in the second week, a deliberate shortage of black-colored materials introduced a challenge

that required participants to engage in collective problem-solving. The iterative design of the activity demanded participants to address the issue collaboratively before proceeding, emphasizing the importance of expressing their ideas and reaching a consensus. The teacher's facilitation prompted the participants to consider and share their solutions:

The teacher: Sam, there's no more black, what should we do? Chen, what do you think we can do? [Amy, Betül, and Sam were looking at the colors on the carpet and pointing at them while thinking.]

Amy: I think, I think we shouldn't go to those. [She pointed at some spots on the carpet, indicating areas that were not black.]

The teacher: How can you help your friend if there's no more black? [She encouraged Sam to come up with a solution while looking at the carpet.]

Sam: I think we should imagine these, let's think of all of them as black. [He gestured toward the carpet, suggesting a new approach by pointing at the black spots.]

Amy: Teacher, teacher, let's imagine these, let's go to these because they are kind of black. [She eagerly pointed at certain spots that resembled black on the carpet.]

This exchange highlights how the activity's structure created opportunities to Amy and Sam to actively propose solutions. Instead of abandoning the task due to the lack of black markers, they adapted their decision-making process by redefining the available options. For example, Sam suggested showing the other colors and thinking of them as black and continuing the activity. Amy suggested not going to the black colors at all. The children suggested different options they thought of regarding the absence of the color black.

By the fifth week, in the Dance of Bee-Bot activity, participants exhibited even greater confidence and creativity in proposing ideas for decision making. The task's design required them to collaboratively decide on the movements of the Bee-Bot, creating opportunities for every child to contribute:

The teacher: Now, I'm thinking of making these robots dance a little. But how should I make them dance? For example, the yellow color could have a specific move. What should it be? [Everyone started looking at the colorful cards, thinking.]

Chen: Let it be like this.

Sam: Let it be like this. [Chen and Sam demonstrated different dance moves, as shown in Figure 5.]

Sam: It should turn. One to the right, one to the left, one to the back.

Amy: Do you know what I want it to do? It should take two steps forward, then turn right.

Anna: Umm, first it should turn left, then go straight, and then...



Figure 5. Children collaboratively design dance moves for the Bee-Bot activity

This interaction demonstrates how the collaborative nature of CT activities engages participants in creative problem-solving while reinforcing their ability to articulate and refine their ideas as a group in this study. Participants actively shaped the decision-making process by taking initiative and contributing their ideas. For instance, when the teacher prompted the participants to suggest dance moves for Bee-Bot associated with different colors, children actively contributed by offering ideas, physically demonstrating suggestions, and building on one another's input. Rather than relying on the teacher for direction, they proposed movement sequences for the Bee-Bot, built on each other's suggestions, and collaboratively refined their plan.

By the seventh week's Bee-Bot Treasure Hunt activity, participants displayed increased autonomy and confidence in cooperating with daily routines by making meetings. They actively contributed to group discussions, as seen when Anna suggested, "Oh, you two, you pair up with Chen, and I will pair up with Amy, then we can have a team meeting afterward." Sam also participated actively by proposing, "I have an idea. You pair up with Amy, and I'll pair up with Chen."

During these activities, participants were encouraged to share their ideas, consider different perspectives, and participate in group discussions. These experiences allowed them to engage in making informed decisions in a group setting, as they evaluated options, responded to peer input, and contributed to collective choices. This interaction also shows how participants actively engaged in decision-making—another important SEL skill—by discussing their options, proposing alternatives, and adjusting their choices based on peer feedback. Instead of resorting to adult intervention, they worked through the problem autonomously, demonstrating their ability to make informed decisions in a group setting. As shown in Table 7, such group-based interactions provided opportunities for children to make decisions collaboratively, reinforcing their responsible decision-making skills. As a result, participants became more confident in expressing their thoughts and played a more active role in shaping group decisions.

Table 7. Responsible Decision-making Skills Facilitated by Collaborative Design

SEL Skills	Sub-Skills	Observed Example
Responsible decision making	Child makes decision in group settings	Dance of Bee-Bot Activity The teacher: Sam, there's no more black, what should we do? Chen, what do you think we can do? [Amy, Betül, and Sam were looking at the colors on the carpet and pointing at them while thinking.] Amy: I think, I think we shouldn't go to those. [She pointed at some spots on the carpet, indicating areas that were not black.] The teacher: How can you help your friend if there's no more black? [She encouraged Sam to come up with a solution while looking at the carpet.] Sam: I think we should imagine these, let's think of all of them as black. [He gestured toward the carpet, suggesting a new approach by pointing at the black spots.] Amy: Teacher, teacher, let's imagine these, let's go to these because they are kind of black. [She eagerly pointed at certain spots that resembled black on the carpet.]
	Child cooperates with daily routines	Bee-Bot Treasure Hunt Activity Anna: Oh, you two, you pair up with Chen, and I will pair up with Amy, then we can have a team meeting afterward. Sam: I have an idea. You pair up with Amy, and I'll pair up with Chen.

4.1.3 Relationship skills

The collaborative nature of CT activities also provided participants with a structured environment where they created natural opportunities for cooperation, negotiation, and conflict resolution, reinforcing essential relationship skills. This structured environment encouraged them to seek help when needed and offer assistance to their peers. By negotiating roles, discussing solutions, and making collective decisions,

participants enhanced their ability to cooperate effectively and resolve conflicts constructively. For example, in the Bee-Bot Treasure Hunt activity during the seventh week, participants encountered a challenge in forming groups. Instead of relying on an adult to resolve the situation, they independently recalled a previously learned strategy—holding a group meeting to make collective decisions. When the teacher prompted them by asking, “First, a group meeting. How were we solving our problems?” Amy responded confidently, “In a group meeting or through a meeting.” The teacher continued, “Yes, and how were we making our decisions?” to which Sam and Amy replied together, “Through a meeting.” This instance highlights how CT activities encouraged participants to systematically approach decision-making by establishing structured strategies for resolving conflicts. Rather than making impulsive choices, they followed a step-by-step process that involved discussion, comparison of options, and consensus-building. These activities encouraged participants engaged in identifying problems, expressing their emotions, negotiating differences, and working toward shared solutions.

Furthermore, the iterative nature of these CT activities allowed participants to develop a structured approach to conflict resolution. The expectation of holding group meetings became embedded in their interactions, reinforcing the idea that problems should be solved through structured discussion rather than immediate external intervention. Through repeated practice, participants became more confident in their ability to engage in negotiation, compromise, and collective decision-making.

Also, during Bee-bot Treasure Hunt activity (plugged-in activity in week 7) participants began resolving conflicts independently, particularly during group formation. When they encountered difficulties in deciding on team members, Anna suggested holding a meeting to find a solution:

Anna: I want to have a meeting with Chen.
Betül: Okay, you can do that. [They went to the corner of the classroom to have their meeting and started talking.]
Chen: Then I will be alone.
Anna: Wait a minute, wait a minute.
Chen: Okay, I will be alone.
Anna: We solved the problem. [They returned to the teacher.]
The teacher: How did you find a solution?
Chen: I will be alone. And Sam and Anna will be partners.

By initiating and participating in this discussion, the participants demonstrated various relationship skills such as active listening, cooperation, and constructive negotiation. Anna played a key role in fostering healthy communication by recognizing the need for a discussion and suggesting a meeting to resolve the issue. Her willingness to engage with her peers and encourage a structured conversation shows her ability to listen actively, acknowledge different perspectives, and work toward a shared solution.

Similarly, Chen contributed to conflict resolution by considering others' viewpoints and adjusting his approach to reach a fair decision. The structured nature of the meeting allowed the participants to navigate disagreements independently without relying on the teacher, reinforcing their ability to manage social interactions and resolve conflicts collaboratively.

In addition to conflict resolution, the collaborative nature of CT activities also encouraged help-seeking behaviors among preschool participants in this study. In most activities, preschoolers were paired up and encouraged to ask for help when they were struggling while working together. This provided participants with the opportunity to observe their own strength and to gain experience asking for help when they were struggling. For example, in the Colorful Journey activity (unplugged activity in week 2), participants collaborated to navigate paths and select colors. The teacher prompted them to reflect on their collaborative experiences, asking, "How

did you get help, Sam? Tell me. Who helped you? How did they help you?” Sam responded, “Chen showed me the paths. He also showed me where to go. Amy showed me which direction to go.” Similarly, Chen described how Anna assisted him, saying, “Anna came and said, ‘go this way.’ Then she said, ‘go that way.’” The activity provided a context for participants to not only seek help but also acknowledge and appreciate the support they received.

Also, during the Colorful Journey activity (unplugged activity in week 2), the teacher encouraged participants to take responsibility for guiding their peers rather than relying on direct instruction by saying “Chen, come on, let’s start with you. But who are your group members? They will help you. I’m stepping back; this is entirely your way. Come on, you can help your friend.” As the activity progressed, participants communicated with peers and used verbal cues to guide one another, corrected mistakes, and navigated the task together. For example, while guiding Amy to find the correct path, Anna encouraged her by saying, “Yes, you’re going, you’re going... the nearest red.” Anna’s guidance demonstrated her effort to help Amy progress toward the intended goal. However, when Amy pointed out, “That’s not red, wait, let me see,” it became clear that Amy was actively engaging in the process by assessing and evaluating Anna’s instructions. Anna responded, “Ah, wait, let’s see,” acknowledging Amy’s concern and showing her willingness to reassess the situation. Since the task required collective movement, verbal communication became essential for progress. Rather than making decisions alone, participants listened to their peers, adjusted their instructions, and ensured that everyone remained engaged in the task, as illustrated in Figure 6, which captures the children collaboratively navigating the shared activity space.



Figure 6. Children collaboratively navigate a shared task space

A similar pattern was observed in the Dance of the Bee-Bot activity, where participants had to coordinate their movements to program the Bee-Bot correctly. As they worked through each step, they communicated with peers and confirmed their choices to ensure accuracy:

Sam: We are here right now.

Teacher: Yes, you are in the purple area. Both groups can do it at the same time.

Sam: Amy, let's turn first, okay?

Teacher: Both groups can work together. Anna and Chen, go join your friends.

Amy: ... What was it?

Chen: Right, left, back, front.

Sam: One, two, three, four.

Amy: Is it this one first, then that one?

Teacher: Thank you for showing it to your friend Chen.

Here, participants relied on verbal communication to ensure that each movement was correctly executed. They asked questions, repeated instructions, and confirmed actions before proceeding. The teacher's acknowledgment of Chen's explanation reinforced the importance of verbal interaction in peer learning, encouraging participants to articulate their reasoning and support one another.

Through these structured CT activities, participants gradually developed confidence in verbal expression and active listening. As they participated in repeated exchanges, communication became a natural and necessary part of collaborative group activity.

Since these activities required participants to work together toward shared goals, they encouraged communication, collaboration and conflict resolution. During the activities, they became more confident in working as a team, demonstrating how collaborative CT activities create an environment where relationship skills can develop through meaningful social engagement, as shown in Table 8, which presents examples of how children sought and offered help to their peers during group work.

Table 8. Relationship Skills Facilitated by Collaborative Design

SEL Skills	Sub-Skills	Observed Example
Relationship skills	Child seeks and offer help to their peers	Colorful Journey Activity The teacher: Did your friends help you, Chen? How did they help you? Chen: For example, Anna... Anna came and said, "Go this way." Then she said, "Go that way." And then this way... [Chen started demonstrating on the carpet, pointing with his hand to the lines on the black stripe to explain the path.] The teacher: So, she showed you the way? How did you feel when your friend helped you? [Chen made a heart shape with his hands.] The teacher: What was that? Was it happiness? [Chen nodded his head in approval.]
	Child cooperates with their peers	Bee-Bot Pattern Pathways Activity Sam: We are here right now. Teacher: Yes, you are in the purple area. Both groups can do it at the same time. Sam: Amy, let's turn first, okay? Teacher: Both groups can work together. Anna and Chen, go join your friends. Amy: ... What was it? Chen: Right, left, back, front. Sam: One, two, three, four. Amy: Is it this one first, then that one? Teacher: Thank you for showing it to your friend Chen.

4.2 Theme 2: Teacher-guided CT activities nurtured emotional expression, empathy, and interpersonal understanding among young children

The role of teacher guidance in CT activities is crucial in fostering participants' SEL development. In this study, these activities helped participants a) develop self-awareness by articulating their emotions, assessing their own strengths and limitations, using non-verbal cues, and verbalizing their feelings, b) enhance social awareness by appreciating their peers' work and efforts, c) build positive relationships by seeking and offering help, cooperating with peers, and negotiating

conflicts constructively and d) practice responsible decision-making in group settings, and cooperating in daily routines.

4.2.1 Self-awareness

In this study, teacher guidance played a crucial role in enhancing participants' self-awareness during CT activities by providing them with structured opportunities to express emotions, use non-verbal cues, verbalize feelings and assess your own strength and limitations. By using specific questions, scaffolding, and modeling, teachers created opportunities for participants to connect their actions, emotions, and social interactions. One fundamental aspect of this activity being a CT-based task is that it consists of multiple smaller steps that participants follow in a specific order, ensuring a structured exploration of emotions. Instead of discovering emotions in a single step, participants progressively engage with them through a sequence of mini tasks, aligning with CT's sequencing and step-by-step problem-solving approach.

4.2.1.1 Expressing emotions

The teacher's role was also essential in guiding participants toward recognizing and expressing their emotions during CT activities. In the Emotion Collage Story (unplugged activity in week 3), the teacher provided structured support, prompting participants to observe facial expressions symbolizing different emotions with different people's faces and connect them to emotional states. By asking guiding questions, the teacher encouraged reflective thinking, helping participants articulate their feelings and link them to visual representations. For instance, during the activity, the teacher prompted the children by saying, "Paint the card with the color that the card made you feel." In response, Anna stated, "It made me feel angry." The

teacher continued guiding her by asking, “Which color represents anger for you?” At this point, Anna demonstrated her emotional expression by showing her black marker to the teacher, indicating her association of anger with the color black. By prompting Anna to identify and associate emotions with concrete visual elements, the teacher made abstract emotional concepts more accessible. Through these structured interactions, participants were not only able to expand their emotional vocabulary but also gained confidence in recognizing and verbalizing their own feelings, reinforcing the role of teacher scaffolding in developing self-awareness.

4.2.1.2 Using non-verbal cues

In this study, teacher guidance encouraged participants to use non-verbal forms of emotional expression during CT activities. For example, the Emotion Sorting activity (unplugged activity in week 1) exemplifies how structured teacher support helped children explore emotions beyond words. Initially, participants identified and explored the emotion cards by observing and discussing their meanings. Then, they verbalized how these emotions make them feel, developing their ability to express emotions explicitly. In the next stage, they used facial expressions or body movements to further reinforce their emotional understanding in a more embodied way. This activity enabled participants to gradually develop their emotional expression skills. During the session, the teacher actively guided participants by prompting them to demonstrate emotions. For instance, when Sam identified happiness from a card by saying, "From the face" the teacher asked, "How is the face, Sam? Can you show us your face?" Sam then looked around, smiled, and demonstrated a smiling face effectively expressing emotion through non-verbal cues. Furthermore, the teacher guided participants in verbalizing their emotions and

associating them with their actions. The teacher asked, “Why did you make a heart shape?” As shown in Figure 7, Amy responded, “Because when I smile, it makes me so happy, so I make a heart shape with my hands for everyone.”



Figure 7. The child forming a heart shape to express happiness non-verbally

This response demonstrated Amy’s effort to communicate her positive emotions through gestures, reinforcing her emotional expression skills. In the next stage, participants used facial expressions or body movements to further reinforce their emotional understanding in a more embodied way. When the teacher asked Anna if the card made her feel happy as well, Anna confirmed by nodding her head. This nonverbal response reflected Anna’s ability to recognize and acknowledge her own emotional state, contributing to her self-awareness and emotional expression skills. Through these CT activities specifically designed to be guided by the teacher, participants engaged in both understanding their emotions and expressing them in different ways. By guiding them to verbalize their emotions and connect them with specific actions, the teacher helped enhance their emotional awareness. Overall, by acknowledging and expanding on the participant's non-verbal expressions, the

teacher facilitated a more comprehensive understanding of how emotions can be communicated in multiple ways.

4.2.1.3 Verbalizing feeling

In the current study, teacher guidance supported participants to express their feelings verbally. The teacher's guidance and questioning techniques were key to this process. By creating a structured approach, expanding on the participants' answers, and fostering a safe and supportive atmosphere, the teacher made it easier for kids to express their emotions. One example of this occurred during the first week's activity, Unplugged Emotion Sorting, where the teacher initiated a conversation to identify participants' prior knowledge about emotions. When the teacher asked if they knew anything about emotions, the participants nodded in a way that indicated that they did. The teacher then encouraged them to talk about their feelings by asking, "So, what do you know about emotions? Would you like to tell me?" to elaborate on what they knew about emotions. Chen explained, "For example, when I'm angry, umm, I hug my mom." Amy added, "Me too, me too! When I cry, I go quickly to my dad, and when I cry, I quickly hug my mom. Anna paused before saying, "Umm, when I'm surprised, I open my mouth a little and take a deep breath. Then she added, "When I'm happy, I actually send hearts to everyone." These responses illustrate how participants naturally associate emotions with specific actions during the activities. The teacher's role in guiding this discussion helped participants reflect on their emotional experiences and recognize patterns in how they expressed their feelings. In the Bee-bot Treasure Hunt activity, (plugged-in activity in week 7) the impact of this supportive approach on the participants became clear. As Sam became more confident in verbally expressing his feelings, he openly

expressed his reluctance to participate in an activity. He said, “I want to say something, I don’t want to do it.” Instead of pressuring him to participate, the teacher said, “Okay, you don’t want to write a story. It’s okay if you don’t want to. Thank you for telling me that.” This validation strengthened trust and autonomy, allowing Sam to feel that his feelings were respected. Later in the session, after observing his peers, Sam changed his mind and asked, “Can I take it now?” The teacher confirmed his decision by responding, “Yes, you can take whatever you want from here.” This interaction demonstrated how accepting feelings without judgment encouraged Sam to make independent choices at his own pace. This interaction demonstrated how the teacher’s supportive response encouraged Sam to verbalize his feelings without fear of judgment and reinforcing his ability to articulate emotions.

4.2.1.4 Assessing own strength and limitations

Recognizing personal strengths and limitations is also a critical aspect of participants’ social-emotional development. When participants are encouraged to assess their abilities and express their challenges, they develop self-awareness. In this study, CT activities were designed to support participants in identifying and verbalizing their own strengths and difficulties. However, the teacher’s role was essential in fostering this awareness, as the teacher actively created an environment where participants felt safe to express their struggles and reflect on their progress. Through scaffolding and guided questioning, the teacher encouraged participants to persist through challenges while validating their emotions and efforts. One example of this was observed during the Emotion Collage Story activity (unplugged activity in week 3). In this activity, participants were asked to cut out facial expressions from magazines and create a collage representing different emotions. Chen, who found

cutting difficult, expressed his frustration by saying, "I could only cut this much." Instead of correcting him or offering direct help, the teacher acknowledged his effort and encouraged him to continue by asking, "How many emotions do you have?" This simple yet strategic prompt redirected Chen's focus from his struggle to his progress, motivating him to stay engaged in the task. By recognizing and validating his challenge while encouraging him to reflect on his progress, the teacher supported Chen in developing persistence and emotional regulation. Similarly, in the four-week activity, Friendship Bracelet, the teacher helped participants reflect on their abilities and challenges in a supportive way. As Chen struggled with threading beads, he expressed his frustration by saying, "This is very hard." Instead of intervening immediately, the teacher encouraged him to reflect on what might make the task easier, asking, "Does it get easier when your friend gives you the beads, Chen?" This question prompted Chen to analyze his difficulty and reconsider his approach, fostering understanding of his own strength and difficulties. He responded with "Hard" indicating that he was still struggling, but the teacher's question led him to re-evaluate his experience and think critically about his limitations and strengths.

The structured and reflective nature of CT activities not only encouraged participants to recognize their strengths and limitations but also provided them with tools to navigate challenges in a constructive way. By fostering an environment where participants felt comfortable expressing their struggles and receiving guidance rather than direct solutions, the teacher played a key role in their social-emotional growth. Through these guided interactions, participants navigated their difficulties, expressed their challenges, and developed an understanding of their strengths and limitations, as shown in Table 9, which illustrates how teacher prompts supported children's self-awareness.

Table 9. Self-awareness Skills Facilitated by Nature of Teacher Guidance

SEL Skills	Sub-Skills	Observed Example
Self-awareness	Child express emotions	Emotion Sorting Activity The teacher: Paint the card with the color that the card made you feel. Anna: It made me feel angry. The teacher: Which color represents anger for you? (Anna showed her black marker to the teacher.)
	Child use non-verbal cues	Emotion Sorting Activity The teacher: Isn't this the happy card? Why? How did you figure that out? Sam: From face. The teacher: How is the face, Sam? Can you show us your face? (Sam demonstrated a smiling face)
	Child verbalize feeling	Emotion Sorting Activity The teacher: Why did you make a heart shape? Amy: Because when I smile, it makes me so happy, so I make a heart shape with my hands for everyone.
	Child asses own strength and limitation	Emotion Collage Story Activity Chen: I could only cut this much. The teacher: How many emotions do you have?

4.2.2 Social-awareness

Social awareness, which includes recognizing and appreciating others' efforts, is an important skill for young participants' social-emotional development. In this study, CT activities were structured to create opportunities for participants to appreciate each other's work and effort.

Our analysis indicated that it was the teacher's guidance that actively reinforced these behaviors, ensuring that participants learned to appreciate their peers' work in a meaningful way. A related example of this was observed during the Friendship Bracelet activity (unplugged activity in week 4), where the teacher encouraged participants to evaluate each other's work. Rather than simply completing

their own bracelets, the teacher directed their attention to their peers' efforts by saying, "Check each other's work." This prompt led Anna to observe her friend's work and respond with, "Oh, you did it nicely." Here, the teacher's intervention played a critical role in shifting the focus from individual work to collective appreciation, encouraging participants to recognize and acknowledge each other's contributions.

Similarly, during the same activity, the teacher reinforced the importance of peer validation by reminding the participants, "Don't forget to check each other's work." This additional prompt guided the participants toward further engagement with their peers' work. In response, Anna noticed Sam's progress and stated, "Ah, Sam is doing it right." This simple exchange illustrates how teacher guidance can encourage participants to actively recognize and validate their peers' efforts, reinforcing a supportive and cooperative learning environment.

By embedding these moments into CT activities, the teacher created structured opportunities for participants to practice social awareness. Through the guided prompts, participants not only focused on their own tasks but also paid attention to their peers, fostering a culture of encouragement and positive reinforcement. Over time, these interactions contributed to the development of a classroom environment where appreciation for others became a natural part of collaborative work. This highlights the critical role of teacher guidance in nurturing young participants' ability to recognize and acknowledge the efforts of their peers, strengthening their social awareness in meaningful and practical ways. An illustrative example of this interaction is presented in Table 10.

Table 10. Social-awareness Skills Facilitated by Nature of Teacher Guidance

SEL Skills	Sub-Skills	Observed Example
		Friendship Bracelet Activity
Social awareness	Child appreciate each other works/effort	The teacher: Don't forget to check each other's work. Anna: Oh, you did it nicely.

The teacher's intentional guidance within CT activities played a pivotal role in promoting social awareness. By prompting children to observe and appreciate one another's efforts, the teacher fostered a classroom culture rooted in mutual respect and recognition. These guided interactions gradually helped participants internalize the value of acknowledging their peers, making social awareness an integral part of collaborative learning.

4.2.3 Relationship skills

Teacher guidance plays a key role in developing participants' relationship skills, particularly in encouraging them to seek help and offer support to their peers, cooperate with their peers and negotiate conflicts. By creating structured opportunities for participants to assist and learn from each other, teachers help build an environment where collaboration and mutual support become natural parts of their social interactions. One example of this was observed during the Emotion Collage Story (unplugged activity in week 3). While working on the task, Amy noticed that Chen was struggling with scissors and said, "You have to hold the scissors like this." The teacher acknowledged her effort and asked, "Did you want to teach by showing?" This question encouraged Amy to reflect on her approach to helping and reinforced positive peer interactions. By guiding Amy to demonstrate her help

effectively, the teacher not only validated her effort but also encouraged constructive support among peers. Similarly, in the Friendship Bracelet activity (unplugged activity in week 4), the teacher encouraged participants to support each other while also promoting independence. When Amy was making a bracelet, the teacher prompted her to guide Chen by saying, "Amy, show Chen, but he needs to do it by himself." Amy responded by demonstrating the process, saying, "You're going to pass it through like this..." while showing Chen how to thread the beads. This teacher-guided moment helped Amy practice offering help effectively while allowing Chen to actively engage in learning the skill. Through these guided interactions, participants were encouraged to both seek and offer help, promoting cooperation within the group. By consistently reinforcing these behaviors, the teacher helped create a learning environment where participants felt comfortable supporting one another.

Furthermore, cooperation is a fundamental skill that enables participants to work together, share responsibilities, and contribute to a common goal. Throughout the eight-week session, the teacher actively supported participants in developing these skills by encouraging them to collaborate, communicate, and assist one another in group activities. By the eighth week, participants demonstrated these abilities more independently, applying their understanding of teamwork and peer support without direct teacher intervention. Instead of approaching the activity individually, they encouraged one another to participate and contribute:

The teacher: I'm saying make a triangle by working all together.

Amy: Anna, come on, let's do it all together.

Anna: We are all making one big triangle together. Chen, you are doing it separately.

Amy: Sam, can I do it too?

Anna: Sam, can I do it too? We are already doing group work, right? We are all making one triangle together.

This interaction illustrates how the structured guidance provided by the teacher throughout the activity played a crucial role in reinforcing cooperation and relationship skills. Teacher's prompt encouraged participants to see the task as a collective effort rather than an individual one, leading them to self-organize and actively engage in teamwork. Anna took on a leadership role by ensuring that everyone worked toward the shared goal of constructing a triangle together, reinforcing her relationship skills by including and directing her peers. Amy's request to join the group reflects her growing understanding of collaborative participation and the importance of shared efforts. The participants' repeated emphasis on working together suggests that they had internalized the teacher's earlier guidance on cooperation and group problem-solving.

In addition, the role of teacher guidance played a pivotal role in fostering participants' conflict resolution and negotiation skills during CT activities. A central strategy employed is the consistent use of "small meetings," which encourage participants to collaboratively address disagreements and develop problem-solving strategies. This approach gradually transitioned from teacher-facilitated discussions to child-initiated problem-solving, illustrating the development of critical social-emotional learning competencies. For example, in the second week, during the Unplugged Colorful Journey activity, the teacher introduced meetings as a tool for group decision-making. The activity required participants to collaboratively decide on the next steps, creating opportunities for guided conflict resolution through discussion. The teacher emphasized collective decision-making, as demonstrated in the following interaction:

The teacher: Hmm, do the browns look a bit like black? Okay, make a joint decision, all four of you. This was a group activity, right? Chen, you should help your friends too. Amy, if you want, ask all your friends. I want you to

make a collective decision. Gather around and make a decision. But speak out loud so I can hear you. I want to hear from you.

This excerpt exemplifies how the teacher framed meetings as an inclusive and collective approach to problem-solving. Initially, some participants hesitated to participate, highlighting the importance of teacher encouragement in fostering active involvement.

The teacher: Chen, help Anna. Anna, try asking your friends for help. Have a meeting. A little meeting. This time, speak out loud so I can hear you.

Chen and Sam: No.

The teacher: It's small meeting time, small meeting time. Sam and Chen, don't you want to attend the meeting?

Sam: We do. (As shown in Figure 8)

The teacher: Then hurry up. Anna, gather your friends and have a meeting. This time, loud meeting time.



Figure 8. Children gather in a circle for a group meeting during the activity

These interactions demonstrate the initial reliance on teacher guidance to facilitate meetings. The structured nature of the activity and the teacher's consistent reinforcement helped participants understand the purpose and format of meetings, creating a foundation for collaborative conflict resolution.

By the third week, during the Emotion Collage Story activity, the participants exhibited a growing understanding of meetings as a practical strategy for problem-solving. The teacher's prompt encourages the children to think about how they would approach the task, which involved creating a collage by placing cut-out images under corresponding emotions. To initiate their planning process, the teacher asked, "Now, we are going to create a collage by placing the cut-out pictures under these emotions. So, how are you going to decide on that?" Anna responded enthusiastically by shouting, "Meeting!" in a cheerful and excited manner. This shift in behavior reflects the participants' increasing familiarity with meetings as a strategy. Anna's confident response indicated that the repeated practice in earlier activities allowed her to perceive meetings as a natural and effective tool for group decision-making. The iterative, collaborative nature of CT activities provided repeated opportunities for participants to practice resolving conflicts in a structured manner.

By the fifth week, in the Dance of bee-bot activity, participants held meetings to resolve interpersonal conflicts. For instance, when Chen expressed frustration over Anna switching his robot, the teacher guided them toward resolving the issue through discussion:

Chen: Teacher, Anna, changed my robot.

The teacher: Then you can talk about it in a small meeting. Go over there and discuss why Anna wanted to change it. [Anna and Chen stood side by side. Anna put her arm around Chen's shoulder and whispered something in his ear.]

The teacher: But what are we doing? We are having our meeting a bit louder. Chen, what did your friend say to you?

Anna: I wanted to change my robot, too.

The teacher: Oh, did you solve the problem? How did you solve it?

Sam: We are problem-solvers.

This example highlights the progression from teacher-led discussions to semi-independent problem-solving, where participants took the initiative to engage in dialogue and reach a resolution. The teacher's role shifted to that of a facilitator, allowing the participants to take ownership of the process. CT activities, which require participants to sequence actions and debug errors collaboratively, naturally created moments of negotiation. These task features align with SEL development by fostering relationship skills.

In the Bee-bot Treasure Hunt (plugged-in activity in week 7) activity, participants demonstrated autonomy in initiating meetings without teacher prompts. This progression reflects the culmination of weeks of practice and reinforcement, as participants now perceived meetings as a part of conflict resolution: For example, while planning how to proceed with the activity, Anna independently suggested, "Ah, you and Chen pair up, and I'll pair up with Amy, then we can have a team meeting together." Later, when disagreements persisted, participants independently initiated meetings and resolved issues.

The teacher: Okay. So, how did you solve the problem? You will be in pairs, so choose your group members together.

Chen: But we will be with Sam.

The teacher: How will that work, Anna?

Anna: I want to have a meeting with Chen.

The teacher: Okay, you can do that.

Anna: We solved the problem.

The teacher: How did you find the solution?

Chen: I will be one. And umm... Anna will be with Sam.

Moreover, during the Emotion Collage Story activity, Chen expressed

discomfort about an interaction with Anna. When the teacher noticed his hesitation, she asked Chen.

Teacher: What happened, Chen?

Chen: Anna, I have done something here. But Anna immediately said, 'What did you do?' but I didn't like it.

Teacher: Uh-huh, did you tell this to Anna? [Chen shook his head, indicating 'no.']

Teacher: So, would you like to tell her? [Chen hesitated.]
Teacher: Why? Maybe Anna would like to apologize to you.
Teacher: Anna, your friend is upset. Would you like to say something?
Anna: I'm sorry, Chen.
Teacher: Why don't you have a little meeting? Turn around over there. We'll wait for you here. [Chen and Anna turned around and started talking. Anna began tickling Chen, and shortly after, they returned with the issue resolved.]

This example illustrates how teacher guidance helped participants navigate interpersonal misunderstandings and find resolutions. Instead of solving the issue for them, the teacher encouraged both participants to communicate, fostering emotional awareness and problem-solving skills.

Another situation occurred during the Colorful Journey activity (unplugged activity in week 2) when Chen struggled with his peers' movements affecting his participation. During this activity, Chen struggled to participate effectively due to his peers' movements interfering with his actions. As his friends tried to help him, Chen expressed his frustration by saying, "But their hands are blocking me." Noticing his difficulty, the teacher encouraged Chen to communicate directly with his peers by saying, "Their hands? You can tell your friend about it. Go ahead, tell them." Following the teacher's guidance, Chen addressed Anna directly, saying, "Anna, your hands are blocking me." Anna responded positively and acknowledged the issue by saying, "Okay, I moved them." By encouraging Chen to express his concern directly, the teacher guided him in using communication to resolve the issue. Instead of stepping in immediately, the teacher helped Chen recognize that he could address his discomfort in a constructive way.

These findings indicated that teachers' guidance during CT activities fostered the development of conflict resolution and negotiation skills in participants. By embedding opportunities for problem-solving within interactive tasks, these activities enable participants to internalize essential SEL competencies, such as effective

communication, teamwork, and self-regulation. Over time, participants transitioned from reliance on teacher guidance to independently applying these skills, reflecting increased confidence and capacity to navigate interpersonal challenges, as shown in Table 11, which provides examples of how children demonstrate relationship skills such as helping and cooperating with peers during guided activities.

Table 11. Relationship Skills Facilitated by Nature of Teacher Guidance

SEL Skills	Sub-Skills	Observed Example
Relationship skills	Child seek and offer help to their peers	Emotion Collage Story Activity Amy: You have to hold the scissors like this. The teacher: Did you want to teach by showing? (Amy nodded in agreement.)
	Child cooperate with their peers	Bee-Bot Pattern Pathways Activity The teacher: I'm saying make a triangle by working all together. Amy: Anna, come on, let's do it all together. Anna: We are all making one big triangle together. Chen, you are doing it separately. Amy: Sam, can I do it too? Anna: Sam, can I do it too? We are already doing group work, right? We are all making one triangle together.
	Child negotiate conflict	Bee-bot Treasure Hunt Activity The teacher: Okay. So, how did you solve the problem? You will be in pairs, so choose your group members together. Chen: But we will be with Sam. The teacher: How will that work, Anna? Anna: I want to have a meeting with Chen. The teacher: Okay, you can do that. Anna: We solved the problem. The teacher: How did you find the solution? Chen: I will be one. And umm... Anna will be with Sam.

4.2.4 Responsible decision-making

Responsible decision-making skills are also an important part of social and emotional development. Teacher guidance plays a key role in helping participants develop these skills by encouraging structured discussions, prompting them to think through their choices, and guiding them toward fair solutions. In this study, CT activities were designed to promote responsible decision-making by providing opportunities for participants to engage in collaborative problem-solving. Rather than giving direct answers, the teacher encouraged participants to talk through their decisions, listen to their peers, and take an active role in resolving conflicts. Over time, participants became more confident in making decisions together, showing a greater ability to discuss, negotiate, and take responsibility for their choices. For example, during the Friendship Bracelet activity (unplugged activity in week 4), participants demonstrated adaptability and ownership in their decision-making. When Sam encountered a challenge after accidentally dropping a bead, he suggested an alternative approach, showcasing his developing ability to make responsible decisions. Sam stated, "Look, I want to say something, my orange bead fell to the ground. Look. What if we don't use those colors and try another color instead?" The teacher, acknowledging Sam's suggestion, responded by asking, "Are you saying we shouldn't follow the order?" to which Sam confirmed, "Yes." This instance reflects how CT activities encourage critical thinking and problem-solving by allowing participants to assess challenges and explore different solutions. The teacher played a crucial role in fostering this process by prompting reflection rather than providing direct answers. By responding to Sam's suggestion with an open-ended question, "Are you saying we shouldn't follow the order?" The teacher encouraged him to articulate his reasoning and evaluate possible alternatives. This guided approach

helped Sam develop confidence in his decision-making while also reinforcing the value of flexibility and problem-solving in collaborative tasks.

A key strategy the teacher used to support responsible decision-making was the introduction of structured meetings as a tool for collective problem-solving. From the very first activity, the teacher consistently encouraged participants to hold meetings to discuss and decide on their next steps together. By embedding this routine into various tasks, participants became familiar with the idea that decision-making is a shared process. Over time, they began to organize these meetings independently, demonstrating their ability to engage in structured cooperation. For example, during the Unplugged Colorful Journey (unplugged activity in week 2) activity, the teacher reinforced this practice by prompting participants to consult with their peers before making decisions. When Anna initially stated, "I'm going to all of them," the teacher encouraged her to consider the group's perspective by asking, "But did you ask your friends?" This led Anna to actively involve her peers, calling out, "Friends, come on, it's meeting time." This moment highlighted the teacher's role in helping participants recognize the value of collective decision-making and shared responsibility. As the activity progressed, participants became more accustomed to organizing themselves through meetings. At one point, the teacher asked, "Which color are you choosing? Gray. Now it's meeting time." to which Anna promptly responded, "Meeting time." This demonstrated how meetings had become a natural and expected part of their collaborative process. Through consistent teacher guidance, participants gradually internalized the importance of structured discussions in group decision-making. Meetings became a key tool for resolving conflicts, organizing teamwork, and ensuring that all voices were heard. The teacher's encouragement of this practice allowed participants to take increasing responsibility

for coordinating their actions, ultimately fostering their ability to engage in cooperative, structured decision-making processes.

Moreover, developing the ability to make informed decisions in a group setting is an essential aspect of participants' social-emotional learning. Through teacher guidance, participants learn how to express their opinions, listen to others, and reach a collective decision that reflects group consensus. In this study, CT activities were designed to encourage participants to engage in shared decision-making, with the teacher providing structured support to ensure that all voices were heard and considered. For example, during the Colorful Journey activity (unplugged activity in week 2), the teacher prompted the participants to engage in a collaborative decision-making process. Rather than making choices individually, the teacher encouraged them to discuss and determine a plan together, saying, "Okay, make a joint decision." This cue led Anna to quietly suggest, "I think the browns." while Sam confidently stated, "We already did it." Amy further contributed by summarizing the group's choice, "We decided to go to all of them." The teacher, ensuring that all participants were actively involved, asked, "Is everyone agreeing with this decision?" to which Sam confirmed, "Yes." This structured interaction highlights how teacher guidance helped participants engage in a group discussion, allowing them to voice their opinions, consider different perspectives, and reach a consensus collectively. As the weeks progressed, the participants became more independent in making group decisions. Also, during the Dance of Bee-Bot activity (plugged-in activity in week 5), the teacher once again encouraged discussion when the participants faced a disagreement regarding group formation. Instead of deciding for them, the teacher instructed, "How are you going to solve this problem?" prompting Amy to express her preference, "I will be with Anna." However, Anna

had a different opinion, responding, “But I want to be with Sam.” Rather than allowing one child to dominate the decision, the teacher emphasized fairness and encouraged them to hold a meeting: “We need to make an agreement. Everyone should have a big meeting and decide. I’m waiting for you.” This guidance reinforced the idea that decisions should be made collectively, ensuring that each child had an opportunity to contribute. Eventually, Anna proposed a compromise, “Then let’s be three, or all four of us can be a team. Come on, let’s be a group of four.” demonstrating how teacher-supported discussions helped participants navigate decision-making in a fair and inclusive manner.

Through continuous teacher support, participants engaged in structured decision-making processes. The teacher's role in prompting discussions, ensuring inclusivity, and fostering a respectful exchange of ideas helped participants develop key skills such as listening, negotiation, and consensus-building. Over time, these guided interactions enabled them to take ownership of their choices, consider different viewpoints, and make collective decisions that balanced individual preferences with group needs, as shown in Table 12, which presents an example of how children made group decisions during a teacher-supported CT activity.

Table 12. Responsible Decision-making Skills Facilitated by Nature of Teacher Guidance

SEL Skills	Sub-Skills	Observed Example
Responsible decision making	Child make decision in group settings	Dance of Bee-Bot Activity The teacher: How are you going to solve this problem? Amy: I will be with Anna. Anna: But I want to be with Sam. The teacher: We need to make an agreement. Everyone should have a big meeting and decide. I'm waiting for you. Anna: I want to be in a group with you (to Sam). Sam: But I want to be with Chen. Anna: Then let's be three, or all four of us can be a team. Come on, let's be a group of four Amy: Teacher, the four of us will be a group.
	Child cooperates with daily routines	Colorful Journey Activity The teacher: Ok, now make a joint decision. Anna: I'm going to all of them The teacher: But did you ask your friends? Anna: Friends, come on, it's meeting time.

4.3 Theme 3: Step-by-step progression of CT activities encouraged young children's emotional resilience, self-regulation, and collaborative decision-making

This theme highlights how CT activities support preschool participants' social emotional learning skills through a structured and scaffolding progression of tasks. The CT skill of decomposition plays a central role in enabling participants to break down challenges into smaller parts, fostering reflection on their performance and building emotional resilience. These step-by-step activities helped participants a) develop self-awareness by articulating their emotions, using non-verbal cues, and assessing their own strengths and limitations, b) enhance self-management by

working towards achieving goal, and regulating social-emotional responses, c) practice responsible decision-making by making decisions in group settings.

4.3.1 Self-awareness skills

In this study, tasks were carefully designed to begin at a simple level and gradually increase in complexity. The step-by-step progression and task breakdown allowed preschool participants to focus on smaller, more achievable goals before tackling the task as a whole. One of the fundamental benefits of step-by-step CT activities is that they provide participants with the opportunity to express emotions, use non-verbal cues and assess their own strengths and limitations in a structured manner. This gradual progression allowed participants to recognize their capabilities in simple tasks before moving on to more complex challenges, promoting self-awareness and emotional regulation.

The step-by-step structure of CT activities provides participants with opportunities to gradually assess their own abilities, recognize their strengths, and identify challenges as they progress through a task. By engaging in activities that unfold in incremental stages, participants can reflect on their own performance at each step, developing an awareness of what they can do easily and where they might need support. For instance, in the Friendship Bracelet activity (unplugged activity in week 4), participants were tasked with arranging beads in a specific order. The activity was intentionally designed as a step-by-step process, requiring them to complete simpler arrangements before progressing to more complex sequences. This structure allowed them to recognize their strengths in following patterns at the beginning while gradually encountering more challenging steps that required greater concentration. At one point, the teacher prompted the participants to check their

progress by asking, “Can everyone see the order?” This question aimed to ensure that all participants were following the task effectively. Anna responded, “Yes, we can see it, but now it’s starting to get a little difficult.” Anna’s response illustrates how the structured nature of the task encouraged her to assess her own abilities in real time. Initially, she successfully followed the sequence, recognizing her strengths in completing the earlier, more straightforward steps. However, as the number of beads increased and the pattern became more complex, she began to have trouble. By expressing that the task was becoming challenging, she demonstrated self-awareness by identifying her own limitations in the moment.

Similarly, in the Bee-Bot Shape Adventure (plugged-in activity in week 6), the incremental design of the task allowed Chen to approach each stage with confidence. At the outset, Chen stated, “This is very easy, this.” demonstrating his ability to recognize and articulate his strengths during the simpler stages. As complexity increased, Chen had to reassess his abilities. When the teacher encouraged the participants by saying, “One last task. Let’s see who will complete this challenging task.” Chen responded, “One last task. Challenging. Ooof, I wish it wasn’t difficult.” This shift from confidence to hesitation highlights how step-by-step CT activities support participants in managing their emotions and reassessing their capabilities. The structured progression of the activity provided a clear moment for self-reflection, allowing Chen to express both his initial confidence and his later recognition of the challenge. These examples highlight how the step-by-step design of the activity provided participants to evaluate their own progress and express both confidence in their abilities and recognition of difficulties. Rather than encountering the challenge all at once, the structured sequencing allowed Anna to reflect on her

abilities at different stages, making self-assessment an ongoing process rather than a single realization.

Also, the step-by-step nature of CT activities provided structured opportunities for participants to recognize, articulate, and reflect on their emotions throughout the learning process. Because CT activities progress incrementally, participants encounter new challenges at each stage, prompting emotional responses that they must navigate within a social setting. This gradual progression ensures that participants regularly express their feelings and so develop self-awareness skills. As previously discussed in the Unplugged Emotion Sorting activity, (see Theme 2, Section 1. Self-awareness) preschoolers were encouraged to identify and express their emotions as part of a step-by-step categorization task. In this activity, preschoolers identified and categorized emotions while considering their own emotional experiences in different situations. The structured design allowed participants to gradually engage with the task, moving from recognizing emotions on cards to relating them to their personal feelings. Throughout the process, the teacher facilitated discussions to encourage deeper reflection by asking, “Do you know anything about emotions?” This open-ended question prompted the children to share their personal experiences related to emotions. Chen responded by saying, “For example, when I’m angry, I hug my mom.” Similarly, Amy added, “When I cry, I hug my dad.” Anna also contributed, explaining, “When I’m happy, I send hearts to everyone.” This step-by-step structure allowed participants to gradually engage with the task, first by recognizing emotions on cards, then by connecting them to their own feelings, and finally by verbalizing their emotional experiences in a peer-supported setting.

This interaction illustrates how the structured nature of the activity helped participants engage in gradual self-reflection. By prompting them to analyze facial expressions step by step, identifying, then explaining, and finally demonstrating, the teacher supported their ability to recognize and express emotions more consciously. Through this guided approach, participants developed an awareness of their own emotional expressions and how they are perceived by others, as shown in Table 13, which provides examples of children’s social awareness development.

Table 13. Social-awareness Skills Facilitated by Step-by-step Progression

SEL Skills	Sub-Skills	Observed Example
Self-awareness	Child expresses emotions	Emotion Sorting Activity
		The teacher: “Do you know anything about emotions?” Chen: “Do you know anything about emotions?” Amy: When I cry, I hug my dad. Anna: When I’m happy, I send hearts to everyone.
		Emotion Sorting Activity
	Child uses non-verbal cues	The teacher: This is the happy card, right? Why? How did you figure that out? Sam: From the face. The teacher: How is the face, Sam? Can you show us your face? (Sam made a smiling face)
	Child assesses own strength and limitation	Friendship Bracelet Activity The teacher: Can everyone see the order? Anna: Yes, we can see it, but now it’s starting to get a little difficult.

4.3.2 Self-management

Self-management is a critical component of SEL, encompassing participants’ ability to regulate their emotions, persist in goal-oriented tasks, and maintain self-control in

challenging situations. The step-by-step nature of CT activities provides a structured environment that guides participants through incremental challenges, enabling them to develop self-regulation strategies and goal-oriented behavior. By breaking down complex tasks into smaller, manageable steps, these activities prevent participants from feeling overwhelmed and instead foster persistence and emotional control as they progress towards a final goal. For example, in the Bee-Bot Pattern Pathways activity (plugged-in activity in week 5), participants were required to program the Bee-Bot to follow a specific sequence of movements. Rather than rushing through the programming process, the activity structure encouraged a step-by-step approach, ensuring that participants focused on one segment of the pattern before proceeding. The teacher reinforced this methodical approach to goal achievement by instructing, "Let's think about the first two steps first, and then we'll continue." Sam responded by breaking down the task into smaller parts, stating, "Okay, first it will turn right, then move two steps forward." This interaction illustrates how the structured sequencing of CT activities prevents participants from becoming overwhelmed, allowing them to work persistently toward their goal while ensuring each completed step provides motivation for the next.

Also, in the Colorful Journey activity (Unplugged activity in week 2), participants navigated a path using sequential decisions, adjusting their movements step by step to reach their final destination. As they worked through the task, Amy verbally retraced their journey, explaining, "For example, now from here, here, here, we came like this, went, then we went from here, went, went, went, and I helped him. Then we came here." Her description shows how she actively tracked each movement, recalling previous steps while ensuring that her peers followed the correct path. By articulating the sequence of their actions, she demonstrated an

awareness of the structured nature of the task and how each movement contributed to reaching the goal. Similarly, Anna assessed their current position and identified the next steps necessary to move forward. She pointed out, "You are here, so now to go to the nearest black, you should go here, then here. Then to get to the closer black. If there's no more black, we need to come up with a plan." Her response highlights how she stayed committed to the task by continuously moving forward, ensuring that each action contributed to reaching the final objective. Rather than making impulsive decisions, they broke the task into manageable actions, continuously evaluating their progress and refining their approach. The step-by-step structure of the activity ensured that each completed movement reinforced their understanding of how to persist through challenges, helping them remain focused and engaged as they worked toward the final objective.

Also, a crucial component of self-management is the ability to demonstrate self-control when encountering challenges, particularly when faced with frustration or unexpected obstacles. The step-by-step nature of CT activities provides a structured and predictable framework that allows participants to regulate their emotions and responses in a gradual manner. By ensuring that tasks are broken into manageable, sequential steps, CT activities reduce the likelihood of overwhelming frustration, instead encouraging participants to pause, reassess, and adapt rather than reacting impulsively. Because CT activities require participants to engage in progressive problem-solving, they repeatedly encounter small-scale difficulties within a structured setting, which offers consistent opportunities to practice self-control. Through this iterative learning process, participants develop patience, frustration tolerance, and the ability to persist through challenges. For example, in the Bee-Bot Treasure Hunt activity (plugged-in activity in week 6), participants had

to program the Bee-Bot to navigate a complex route. The step-by-step nature of this activity encouraged them to focus on small movements first, gradually working toward more complex sequences. However, at one point, Chen encountered an error in his programming, which led to visible frustration. He exclaimed, “Ah, I made a mistake, I can delete it right away.” Recognizing Chen’s frustration, the teacher calmly responded, “If you made a mistake, you can delete it.” This simple reassurance allowed Chen to feel more comfortable with making mistakes and attempting corrections, fostering a sense of resilience and problem-solving.

Here, the incremental task structure seemed to reduce potential overwhelming frustration by allowing a systematic correction process. The activity’s design permitted Chen to identify and correct his mistake without discarding all previous efforts, which helped reduce his frustration. By allowing him to address errors one step at a time, the activity reinforced his ability to manage his emotions and persist through challenges, demonstrating patience and adaptability. Instead of requiring Chen to restart the entire task, the activity design allowed him to fix mistakes step by step, reinforcing patience, adaptability, and emotional regulation, as shown in Table 14, which highlights how children demonstrated goal persistence and emotional self-regulation through structured CT activities.

Table 14. Self-management Skills Facilitated by Step-by-step Progression

SEL Skills	Sub-Skills	Observed Example
Self-management	Child works toward achieving goal	Bee-Bot Pattern Pathways Activity The teacher: Let's think about the first two steps first, and then we'll continue. Sam: Okay, first it will turn right, then move two steps forward.
	Child regulates social-emotional responses	Bee-Bot Treasure Hunt Activity Chen: Ah, I made a mistake, I can delete it right away. The teacher: If you made a mistake, you can delete it.

4.3.3 Responsible decision making

Step-by-step CT activities created structured moments for participants to engage in collective decision-making, ensuring that they routinely cooperated with group expectations and requests. By incorporating regular checkpoints for discussion and planning, these activities reinforced the importance of participation, communication, and accountability within a group setting. The predictable nature of CT activities, where participants had to make choices at each step before proceeding, allowed them to develop habits of cooperation and structured decision-making. For instance, during the Friendship Bracelet activity (unplugged activity in week 4), the participants made informed decisions about bead colors and sequences while working collaboratively. The teacher facilitated the process by guiding them through sequential decision-making, ensuring that each step was built upon the previous one.

The teacher: Now, there are five different things here, right? I can put five different ones, can't I? Chen, can you come here for a moment? For example, Anna, which color do you think should be in the first row?

Anna: I want every color.

The teacher: But which one should be in the first row? Choose one.

Anna: Pink.

The teacher: Okay.

Anna: Are we making a bracelet? Uh, what kind of bracelet will it be?

The teacher: Uh, what about the third row?

Anna: Yellow.

The teacher: Which one will be in the fourth row? Let Sam say this one.

Sam: I think green.

The teacher: Let it be green. I took the green one.

In this structured step-by-step approach, participants practiced responsible decision-making. Instead of making arbitrary choices, they had to actively participate in group decision-making and ensure that each choice contributed to the final outcome. As participants progressed through this step-by-step structure, they learned to collaborate effectively, recognize patterns, and organize their decision-making process in a structured way. The requirement to first decide on bead colors as a group before moving on to the next stage of the activity reinforced their ability to make collective decisions based on prior steps. Rather than making individual choices, participants had to consider how each selection would impact on the final design, strengthening their responsible decision-making skills.

The step-by-step nature of CT activities provided an environment where participants engaged in logical and informed decision-making. Because tasks require incremental choices at each stage, participants must engage in frequent discussions to determine their next steps. In this structured process of decision-making, participants had multiple opportunities to articulate their thoughts, evaluate alternatives, and negotiate solutions before proceeding, as shown in Table 15, which presents an example of how children participated in shared decision-making during a step-by-step CT activity.

Table 15. Responsible Decision-making Skills Facilitated by Step-by-step Progression

SEL Skills	Sub-Skills	Observed Example
Responsible decision making	Child make decision in group settings	Friendship Bracelet Activity The teacher: Now, there are five different things here, right? I can put five different ones, can't I? Chen, can you come here for a moment? For example, Anna, which color do you think should be in the first row? Anna: I want every color. The teacher: But which one should be in the first row? Choose one. Anna: Pink. The teacher: Okay. Anna: Are we making a bracelet? Uh, what kind of bracelet will it be? The teacher: Uh, what about the third row? Anna: Yellow. The teacher: Which one will be in the fourth row? Let Sam say this one. Sam: I think green. The teacher: Let it be green. I took the green one.

4.4 Summary of the findings

This study explored how CT activities support the social-emotional learning development of preschool participants by fostering self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. Through an eight-week intervention that combined unplugged and robotics-based activities, participants engaged in structured, collaborative, and teacher-guided tasks that allowed them to develop key SEL competencies in meaningful ways.

In order to gain a deeper understanding of how each CT activity supported the development of social-emotional competencies, the observed frequencies of SEL skills were systematically analyzed across the eight-week intervention. As demonstrated in Figure 8, Emotion Sorting and Emotion Collage Story were particularly effective in fostering self-awareness, as they provided opportunities for children to recognize and articulate emotions. Activities such as Colorful Journey

and Bee-Bot's Treasure Hunt prominently supported responsible decision-making, with participants collaboratively addressing challenges and proposing group-based solutions. Furthermore, Friendship Bracelet Making and Bee-Bot Pattern Pathways emphasized relationship skills, as they encouraged children to seek and offer help, negotiate roles, and coordinate actions with peers. This distribution highlights the differentiated contribution of each activity type and suggests that the design features embedded within CT activities play a critical role in shaping the emergence of specific SEL competencies. Figure 9 visually represents the alignment between SEL sub-skills and the pedagogical orientations of the activity themes.

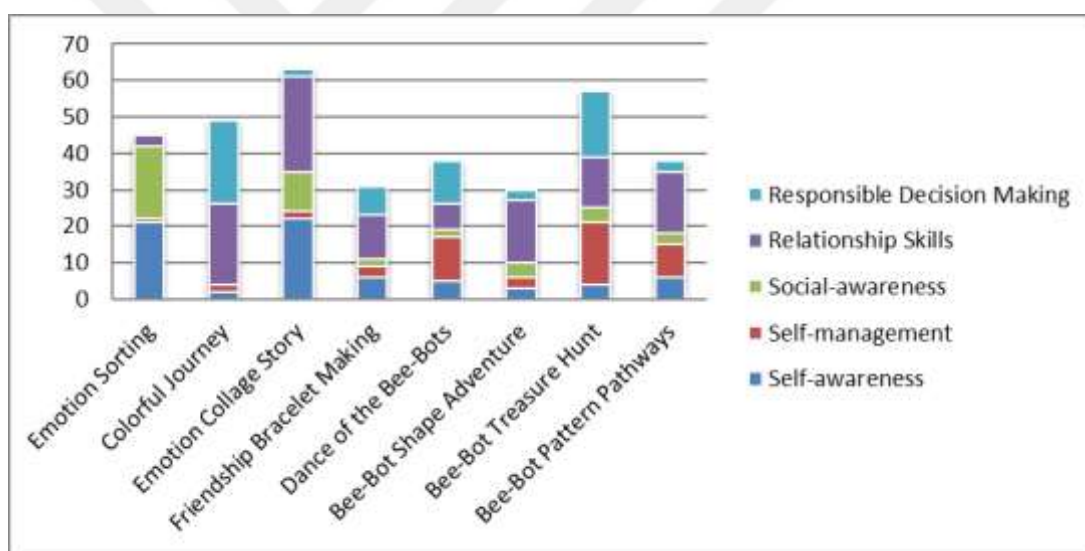


Figure 9. Distribution of SEL sub-skills observed across unplugged and plugged-in CT activities

Moreover, findings revealed that self-awareness and responsible decision-making were foundational skills that emerged across all CT activities, enabling participants to reflect on their emotions and make informed choices within group settings. The collaborative nature of CT activities provided structured opportunities for participants to express their thoughts, listen to peers, and coordinate their actions

within a shared task. These activities encouraged participants to verbalize their ideas, seek clarification, and respond to others' input, making communication an essential part of group work. As they engaged in repeated peer interactions, they became more comfortable communicating with peers. Teacher guidance played a critical role in reinforcing social awareness, helping participants appreciate their peers' contributions and verbalize their emotions. Additionally, the step-by-step progression of CT activities supported self-management, as participants learned to regulate their emotions, persist through challenges, and work toward goals.

The findings of this study suggest that the way CT activities are structured significantly influences which SEL competencies participants develop, reinforcing the importance of intentional design in early childhood education. Figure 8 provides a more detailed breakdown of how these skills emerged across different themes. Some skills, such as expressing emotions (self-awareness) and making informed decisions (responsible decision-making), were common across all activities, while others were specific to certain instructional approaches. Collaborative activities emphasized peer communication, teacher guidance encouraged verbalizing feelings, and structured CT tasks supported self-regulation and goal-directed behavior.

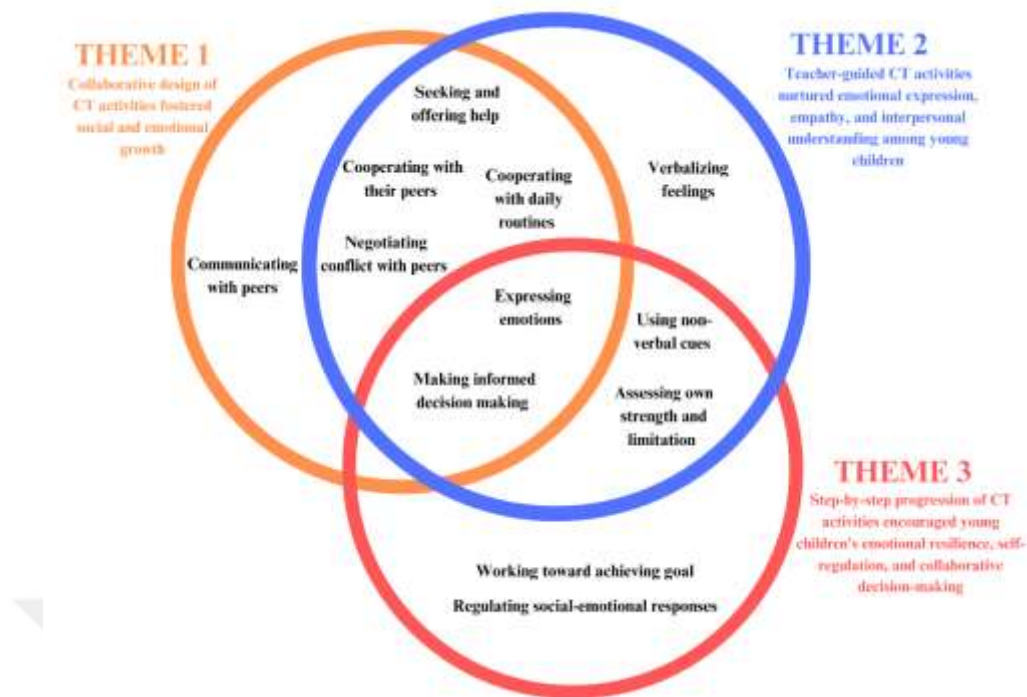


Figure 10. Distribution of SEL sub-skills across CT activity themes

By integrating collaborative, teacher-guided, and structured step-by-step learning approaches, CT activities provide a rich environment for young participants to strengthen self-awareness, self-management, social awareness, relationship skills and responsible decision making.

CHAPTER 5

DISCUSSION AND CONCLUSION

This study examined the role of CT activities in fostering preschool children's SEL. The findings provide unique insights into the practical and pedagogical implications of integrating CT and SEL in early childhood education. CT activities were designed to create meaningful social interactions, encouraging children to develop self-awareness, relationship skills, self-management, responsible decision-making, and social awareness. This section explains the connection between the research questions and the findings, discusses their practical implications, proposes areas for future research, and highlights the study's limitations.

5.1 Self-awareness

Self-awareness is a critical component of SEL, allowing children to recognize and express their emotions (Zins et al., 2007). Developing self-awareness in young children requires providing them with consistent opportunities to identify, articulate, and reflect on their emotions within social contexts. Bers (2017) emphasized that CT is not merely a technical skill but a broader framework fostering collaboration and social interaction. Her research suggests that engaging children in CT activities provides opportunities for social learning, such as turn-taking, teamwork, and conflict resolution. This perspective aligns with the current study's findings, which demonstrated that through collaborative CT tasks, children engaged in expressing emotions and verbalizing feelings and reflected on their problem-solving strategies, ultimately strengthening their self-awareness skills. Moreover, Maitz et al. (2022) found that collaborative programming activities, such as Scratch, help children

articulate their emotions and reasoning during coding tasks. This finding parallels the observations in this study, where young children, when engaged in unplugged and plugged-in CT activities, gradually became more comfortable expressing their emotions within peer interactions. At the beginning weeks of this study, many children hesitated to voice discomfort directly to their peers, instead relying on the teacher for mediation. Over time, as children continued engaging in collaborative CT tasks, they became more comfortable talking about their emotions in the classroom settings. For instance, in the Colorful Journey activity (week 2), Chen hesitated to voice discomfort when bumped by Anna, relying on teacher mediation. During the Dance of Bee-Bot activity, he directly told peers, “But its head touched my leg, I didn’t like it” showing increased self-expression. This progression also aligns with the findings of Harlow and Leak (2017), who found that primary school children working in pairs on programming tasks developed self-reflection abilities as they had to explain their thought processes and consider alternative solutions presented by their peers. While their study primarily focused on older children, the present findings extend this argument by demonstrating that preschool children can also develop self-awareness through appropriately scaffolding collaborative CT activities.

In addition to the collaborative nature of CT activities, the CASEL framework (Zins et al., 2007) underscores the importance of adult guidance in helping young learners develop self-awareness and emotional regulation. Nathanson et al. (2016) emphasize that how educators’ structure emotional learning experiences can either support or hinder children’s development, underscoring the importance of scaffolding in helping children recognize and articulate their feelings. Also, Bers (2017) argues that teacher guidance in CT activities can strengthen emotional literacy

by providing children with concrete opportunities to process and express their emotions. The current study's findings align with this perspective, highlighting how teacher-facilitated CT activities create structured opportunities for preschoolers to develop self-awareness. A key example from this study was the Emotion Collage Story activity, where teacher scaffolding encouraged children to explore and communicate their emotions through visual representation. During this activity, the teacher prompted children to reflect on how images made them feel and to associate those emotions with colors. Initially, some children struggled to articulate their feelings, but with teacher encouragement, they gradually gained confidence in expressing themselves. Therefore, teacher-led discussions supported children in labeling emotions and encouraged them to share and validate their feelings in a safe, peer-supported environment during the activities.

Like the current findings, Rafique et al. (2020) suggested that interactive learning environments, particularly those incorporating structured teacher facilitation, foster children's self-awareness and confidence in emotional expression. However, while studies such as Bravo Sánchez et al. (2017) and Wallbaum et al. (2018) emphasize the benefits of robotics-based interactions, other research cautions that technology alone does not inherently promote social-emotional learning. For instance, Nathanson et al. (2016) argued that teacher facilitation is crucial in guiding children's social interactions and ensuring that collaborative programming tasks lead to meaningful relationship-building. This aligns with the findings in this study, where teacher-guided discussions and structured meetings provided children with essential scaffolding to enhance their cooperation and conflict-resolution skills. This progression suggests that unplugged activities provide a crucial foundation for relationship skill development, which can be further refined

through plugged-in tasks. These findings highlighted the importance of carefully sequencing CT activities, combining direct peer interactions and technology-enhanced collaboration to maximize young children's social-emotional learning outcomes. Furthermore, the importance of teacher scaffolding was echoed by Gibson (2012), who found that young children benefit most from CT experiences when educators provide structured guidance rather than taking a passive role. In this study, teacher interventions—such as prompting children to discuss their emotional responses and helping them verbalize problem-solving strategies—played a crucial role in strengthening self-awareness. For example, in the Unplugged Emotion Sorting activity, children were encouraged to describe their emotions before categorizing them, reinforcing the connection between emotional identification and verbalization.

Moreover, Bravo Sánchez et al. (2017) demonstrated that human-robot interactions support emotional expression and self-recognition by allowing children to engage in incremental problem-solving experiences. The findings of this study extended these perspectives by illustrating how step-by-step CT activities create structured opportunities for preschool children to develop self-awareness through step-by-step CT activities. This study's gradual increase in task complexity gave children a tangible framework to assess their capabilities and emotional responses. For example, during the Friendship Bracelet activity (unplugged activity in week 5), children were first asked to arrange beads in a specific order according to a simple pattern. As the sequence became more complex, some children began experiencing difficulties and verbalizing their struggles. This moment of reflection demonstrates how CT activities help children identify their cognitive limits, assess challenges, and articulate their emotional responses. Wu (2024) argues that decomposition in

problem-solving not only aids in skill acquisition but also fosters emotional resilience, as children learn to manage frustration and adjust their strategies when faced with increasing difficulty. Research by Sullivan and Bers (2017) suggests that structured CT activities incorporating emotional reflection support young learners in understanding and expressing emotions both verbally and non-verbally. The current study's findings reinforce this claim by illustrating that when emotional reflection is embedded in CT tasks, children develop deeper self-awareness and an improved ability to interpret and communicate emotions.

These findings suggest that CT activities, whether unplugged or plugged-in, provide structured opportunities for young children to develop self-awareness by engaging in reflective, social, and problem-solving experiences. Collaborative CT tasks bridge computational and social-emotional learning by supporting verbal expression, perspective-taking, and decision-making, reinforcing the argument that early childhood CT education should incorporate technical and interpersonal developmental goals (Bers, 2017). Table 16 presents a thematic comparison between findings from previous research and those emerging from this study, highlighting how CT activities support SEL competencies.

Table 16. Literature and Study Findings Related to Self-awareness Skills Through CT Activities

Theme	Literature findings	Findings of the study
Collaborative Design of CT Activities	Collaborative programming activities help children articulate emotions and reasoning during coding tasks (Maitz et al., 2022). Children working in pairs on programming tasks developed self-reflection abilities as they explained thought processes and considered peers' solutions (Harlow & Leak, 2017).	Children initially hesitated to express emotions gradually became comfortable through collaborative CT tasks. Collaborative CT tasks provided structured emotional reflection opportunities.
The Nature of Teacher Guidance in CT Activities	Interactive environments incorporating structured teacher facilitation foster self-awareness and emotional expression (Rafique et al., 2020). Teacher facilitation ensures collaborative programming tasks lead to meaningful relationship-building (Nathanson et al., 2016).	Teacher-guided discussions and structured meetings provided scaffolding essential for enhancing self-awareness, cooperation, and conflict-resolution skills.
Step-by-Step Progression through CT Activities	Human-robot interactions support emotional expression and self-recognition through incremental problem-solving (Bravo Sánchez et al., 2017). Structured CT activities incorporating emotional reflection support young learners' emotional understanding (Sullivan & Bers, 2017).	Incremental, step-by-step CT activities created structured frameworks for children to assess emotional responses and cognitive limits.

5.2 Responsible decision-making

Responsible decision-making is also a key component of SEL (Zins et al., 2007), enabling children to cooperate with daily routines and requests, actively engage in decision-making, identify problems, and make informed choices in a group setting. Rafique et al. (2020) showed the role of CT activities in promoting decision-making and problem-solving. Their study demonstrated that children engaging in CT-based

tasks learned computational concepts such as sequencing and looping and developed empathy, sharing, and conflict-resolution skills through collaborative programming exercises. Similar to these findings, in the current study, during the Colorful Journey activity (unplugged activity in week 2), children were confronted with a material shortage that required them to negotiate and make collective decisions on how to proceed. Initially, some children struggled with reaching a consensus, with individual preferences dominating group discussions. However, as children continued participating in collaborative CT tasks, they became more adept at discussing options, proposing solutions, and collectively deciding on a course of action. In line with the findings of Demirtaş et al. (2009), the implementation of active learning strategies in early childhood education significantly enhances children's decision-making processes. The research highlighted that children in active learning environments, particularly those with experienced teachers, produced more alternatives and engaged in cooperative problem-solving. This mirrors the collaborative nature of CT activities, where children not only learn computational concepts but also develop essential social emotional skills such as responsible decision making. The overlap between collaborative tasks and active learning approaches underscores the importance of structured peer interactions in fostering responsible decision-making skills among young learners. By creating opportunities for children to engage in discussions and negotiate solutions, both active learning and collaborative programming exercises contribute to their overall social and emotional development, reinforcing the significance of these educational strategies in early childhood settings.

Furthermore, Rafique et al. (2020) emphasized the role of educational robotics in fostering decision-making skills. The present study extends this argument

by demonstrating that a progressive sequence of unplugged CT activities followed by plugged-in activities may be more effective in supporting young children's decision-making, problem-solving and communication which are the key competencies in both SEL development. In this study, in the Unplugged Colorful Journey, children engaged in problem-solving through direct peer interaction without using the Bee-bot. This required them to verbalize their reasoning, negotiate with peers, and manage disagreements, aligning with SEL competencies such as responsible decision-making and relationship skills. While initially challenging, this process provided an essential foundation for understanding the cognitive and social aspects of collaborative decision-making. Subsequently, in the plugged-in activity, Dance of Bee-Bot, children applied their prior experiences to a structured, technology-mediated task. The robot's presence provided a concrete and systematic context for their decision-making process, allowing them to execute choices more efficiently, demonstrate improved coordination, and regulate their interactions more effectively. Therefore, the current study's findings align with the research conducted by Meral et al. (2024), which indicated that STEM-based robotic coding education positively affected primary school students' decision-making skills. The study revealed that students who participated in robotic coding activities improved their decision-making and problem-solving skills and their willingness to share ideas. This aligns with the notion that engaging in collaborative tasks, as seen in both the Colorful Journey and the Dance of Bee-Bot activities, fosters essential social-emotional and computational thinking skills. This progression suggests that unplugged activities serve as a critical preparatory phase, enabling children to develop essential social-emotional and computational skills before transitioning to robotics-based tasks that reinforce and refine these abilities. These findings align with research advocating for a scaffolded

approach to early childhood CT education (Nathanson et al., 2016), where initial engagement with unplugged activities fosters foundational SEL and CT skills, which are then strengthened through technology-enhanced learning experiences.

Previous research has shown that structured learning environments enhance children's ability to make informed decisions by reinforcing logical reasoning, collaborative problem-solving, and negotiation skills (Maitz et al., 2022; Bers, 2017). This study provided further insights into how structured CT activities facilitated young children's decision-making processes, offering them opportunities to assess options, seek peer input, and refine their plans within interactive group settings.

Maitz et al. (2022) emphasizes the importance of structured step-by-step learning approaches, arguing that breaking tasks into incremental steps enables children to engage in independent decision-making while experimenting with different solutions. Their study found that when tasks lacked clear procedural steps, children struggled to make informed choices and relied more on adult intervention. This finding aligns with observations from this study, where CT activities structured around incremental decision points provided children with multiple opportunities to weigh alternatives, communicate their reasoning, and revise their plans before implementation. For instance, in the Bee-Bot Treasure Hunt activity, the teacher prompted the children to hold a group meeting to discuss their preferences and reach a consensus. Following the teacher's guidance, the children conducted a meeting, exchanged ideas, and ultimately agreed on group pairings, demonstrating their ability to engage in structured decision-making and collaboration. This structured negotiation process mirrors the approach suggested by Maitz et al. (2022), who advocate for step-based collaboration in learning activities to promote independent reasoning and cooperative problem-solving. In the current study, by incorporating

structured pauses for decision-making, children were required to negotiate, assess different perspectives, and reach a collective agreement, reinforcing their ability to cooperate within group settings. These findings support prior research that emphasizes the role of structured learning environments in promoting independent and collaborative reasoning (Bers, 2017; Rafique et al., 2020).

Step-by-step CT activities also help children anticipate consequences and make logical choices rather than relying on trial and error. This aligns with findings from Bers (2017), who argue that structured problem-solving tasks provide a critical foundation for decision-making skills by reinforcing systematic evaluation and prediction. The structured nature of CT activities supports young learners in making reasoned decisions rather than impulsive or arbitrary ones. The Bee-Bot Pattern Pathways activity demonstrated how step-by-step CT tasks support predictive reasoning and strategic decision-making in this study. As children programmed their Bee-Bots, they encountered a moment of uncertainty, prompting teacher-guided reflection: The teacher: “What happens if it goes in this order? Let's take a guess first” This moment of guided prediction encouraged children to evaluate potential outcomes before executing their decisions, reinforcing their ability to consider consequences and refine their choices accordingly. This structured process aligns with Wing’s (2016) assertion that computational thinking and social-emotional learning rely on forward-thinking and planned decision-making strategies. These observations suggest that structured CT activities may offer supportive contexts for fostering responsible decision-making in early learners—a relationship further outlined in Table 17, which summarizes related literature and study findings.

Table 17. Literature and Study Findings Related to Responsible Decision-Making Through CT Activities

Theme	Literature findings	Findings of the study
Collaborative Design of CT Activities	CT-based tasks foster decision-making, empathy, sharing, and conflict-resolution through collaborative programming (Rafique et al., 2020). Active learning environments support cooperative problem-solving and decision-making in early childhood (Demirtaş et al., 2009).	Children became more adept at discussing options, proposing solutions, and collectively deciding on a course of action.
The Nature of Teacher Guidance in CT Activities	Teacher-guided learning environments support children in reasoning collaboratively and making informed decisions (Maitz et al., 2022; Bers, 2017). Educators' structuring of emotional learning experiences can either support or hinder children's development (Nathanson et al., 2016).	Teacher-facilitated meetings and guided group discussions enabled children to share preferences, listen to peers, and reach group consensus, supporting structured and collaborative decision-making.
Step-by-Step Progression through CT Activities	Step-based learning encourages independent decision-making and experimentation (Maitz et al., 2022). Structured problem-solving promotes systematic thinking and prediction (Bers, 2017)	CT activities structured around incremental decision points provided children with multiple opportunities to weigh alternatives, communicate their reasoning, and revise their plans before implementation.

5.3 Relationship skills

Relationship skills, such as active listening, cooperation, and conflict resolution, were also strengthened through collaborative nature of CT tasks in this study. The structured nature of CT activities ensured that children had to work together to achieve shared goals, naturally facilitating positive peer interactions. Prior research supports the role of CT activities in enhancing social relationships. Wallbaum et al. (2020) found tangible programming interfaces, such as educational robotics,

facilitated cooperative problem-solving by requiring children to exchange ideas, build on peer suggestions, and negotiate differences. Similarly, Bravo Sánchez et al. (2017) demonstrated that robotics-based activities promoted peer-to-peer communication and teamwork, as children had to coordinate their actions to achieve programming objectives. However, these studies primarily focused on elementary-aged children. In contrast, this study extends these findings to preschool children, showing that structured CT tasks can be a foundation for developing relationship skills at an earlier stage.

In this study, children engaged in structured discussions during the Bee-Bot Treasure Hunt activity to plan their programming sequences. The requirement for collective decision-making encouraged them to listen to each other, offer help when needed, and acknowledge peer contributions. Initially, some children struggled with balancing their ideas with group consensus, mirroring findings by Maitz et al. (2022), who observed that children learning programming needed guidance in collaborative interactions. However, as children continued participating in CT tasks, they demonstrated increasing autonomy in cooperative problem-solving. Children could negotiate disagreements independently by the study's final weeks, indicating a developmental shift in their relationship skills.

Furthermore, this study suggests that a structured sequence of unplugged and plugged-in activities is critical in relationship-building. In the early weeks, children engaged in unplugged activities that required direct verbal negotiation, such as in the Unplugged Colorful Journey task. This process helped children practice verbalizing their reasoning, listening actively, and understanding peers' perspectives. Later, in plugged-in tasks such as the Dance of Bee-Bot, children applied these relationship skills in a technology-mediated environment, reinforcing their ability to collaborate

within structured programming exercises. These findings align with studies by Leite et al. (2015), who demonstrated that young children interacting with socially assistive robots developed more substantial emotional intelligence and collaboration skills. Similarly, Rafique et al. (2020) found that children engaged in programming activities with robots learned to express empathy, negotiate group roles, and offer peer support, highlighting the importance of structured, interactive learning environments. This is consistent with the emergent SEL skills in this study, where children first engaged in unplugged problem-solving experiences and later transitioned to plugged-in environments, further refining their cooperative behaviors.

By reinforcing positive peer interactions through structured CT experiences, young children develop computational thinking abilities and cultivate the foundational social-emotional skills necessary for lifelong learning and collaboration. These findings highlight the importance of integrating CT into early childhood education for cognitive and technical benefits and its capacity to enhance social interactions and relationship-building among young learners.

In the current study, teacher guidance was fundamental in shaping children's relationship skills within CT activities. Prior research highlights the importance of structured educator involvement in fostering collaboration and peer interaction. Wallbaum et al. (2020) demonstrated that tangible interfaces and robotics allow children to participate in collaborative problem-solving in pairs or small groups, reinforcing teamwork and communication. Similarly, Bers and Horn (2010) emphasized that structured CT activities help children develop cooperation and negotiation skills. These findings align with the results of this study, where teacher-supported interactions encouraged preschool children to engage in collective decision-making and navigate social relationships effectively.

One key aspect of teacher guidance in this study was the implementation of 'small meetings' as a conflict resolution strategy. Teacher prompts like 'Have a small meeting' in Colorful Journey (week 2) taught children to resolve conflicts systematically, a skill they applied independently by week 7 when Anna initiated a meeting to address Chen's pairing concerns. This mirrors the structured peer interactions observed in research by Bers and Horn (2010), where young learners engaged in collaborative programming exercises that required ongoing communication and negotiation. The small meeting approach facilitated children's ability to work through social conflicts and reinforced their understanding of cooperative problem-solving as an essential SEL skill. According to Arcaro-McPhee, Doppler, & Harkins (2002), children can develop more complex and effective negotiation skills when provided with opportunities to practice in a supportive environment. In this study, the implementation of the small meetings approach served to reinforce this idea by creating a supportive context for children to navigate their social conflicts and enhance their cooperative problem-solving abilities.

Additionally, the results of this study support Rafique et al.'s (2020) assertion that teacher-facilitated CT activities develop computational problem-solving and promote social-emotional competencies. The small meetings introduced by the teacher evolved into an independent problem-solving mechanism used by the children, demonstrating their growing autonomy in managing social interactions. Throughout the study, children transitioned from relying on teacher intervention to initiating peer-led discussions when disagreements arose, illustrating the long-term impact of structured teacher guidance on relationship skill development.

Thus, these findings contribute to the broader discussion on the intersection of CT and SEL by demonstrating that teacher-guided collaborative CT activities

create a practical framework for strengthening children's relationship skills. Teachers can enhance young learners' ability to navigate social relationships, cooperate with peers, and resolve conflicts effectively within computational learning environments by incorporating structured teacher interventions, such as small meetings and reflective discussions. This relationship between teacher-guided CT activities and the development of relationship skills is further illustrated in Table 18, which compares literature findings with results from the current study.

Table 18. Literature and Study Findings Related to Relationship Skills Through CT Activities

Theme	Literature findings	Findings of the study
Collaborative Design of CT Activities	Tangible programming interfaces such as robotics promote peer communication and teamwork (Bravo Sánchez et al., 2017). Robotics-based collaborative tasks support cooperative problem-solving and negotiation (Wallbaum et al., 2020). Children need support when learning collaborative programming to balance group needs (Maitz et al., 2022).	Structured CT tasks facilitated active listening, cooperation, and conflict resolution by requiring children to work together toward shared goals. Children initially struggled with balancing individual ideas with group consensus but developed autonomy in cooperative problem-solving across the study.
The Nature of Teacher Guidance in CT Activities	Structured educator involvement supports teamwork and communication in robotics tasks (Wallbaum et al., 2020). CT activities with teacher support promote negotiation and cooperation (Bers & Horn, 2010). Teacher-facilitated CT activities promote problem-solving skills (Rafique et al., 2020).	Teacher guidance, particularly through structured interventions like small meetings, helped children resolve conflicts, engage in decision-making, and shift from teacher-led to peer-led social problem-solving. Teacher-led strategies transitioned into child-initiated conflict resolution and collaboration, showing increased autonomy in relationship management.

5.4 Self-management

Self-management, a key component of SEL, involves a child's ability to regulate emotions, persist through difficulties, and maintain self-control in challenging situations (Zins et al., 2007). Maitz et al. (2022) emphasize incorporating step-by-step activities to enhance students' ability to work independently and engage in deeper experimentation. Their study suggests that broad introductions alone may not provide adequate scaffolding, making it essential to structure learning tasks incrementally to support self-management skills better. By breaking down complex concepts into smaller, manageable steps, children are given more opportunities to regulate their learning process, persist through challenges, and refine their problem-solving strategies.

The findings of the current study align with the perspective that structured CT activities can significantly enhance self-management skills among preschool children. As highlighted by Pasterk and Benke (2024), the relationship between CT and self-regulated learning skill is synergistic; not only do self-regulated learning strategies support the acquisition of computational thinking competencies, but engaging in computational thinking activities can also foster self-regulated learning skills (Pasterk & Benke, 2024). In the context of the Bee-Bot Pattern Pathways activity, the step-by-step structure of the task encouraged children to slow down, plan ahead, and revise their approach when necessary. Although children initially approached the task with the intention of completing the entire sequence at once, they gradually shifted to a more reflective and strategic approach by breaking the task into smaller steps and progressing incrementally, especially with the supportive guidance of the teacher. This shift reflected growth in self-management, as children

learned to regulate their actions, remain focused, and adapt strategies to complete the activity more effectively.

This shift illustrates how structured sequencing prevented children from feeling overwhelmed, allowing them to work persistently toward their goal while learning to regulate frustration. Pasterk and Benke (2024) emphasize that the planning phase of self-regulated learning involves careful consideration of the problem at hand, which aligns with the children's ability to break down the task into manageable components. By engaging in this iterative process, children not only developed their computational thinking skills but also enhanced their self-regulation capabilities, demonstrating the interconnectedness of these two constructs in educational settings. In the Bee-Bot Treasure Hunt activity (plugged-in activity, week 7), children faced challenges programming the Bee-Bot to navigate a complex route. Initially, they tried completing the entire sequence at once but became frustrated when errors occurred. The step-by-step nature of the activity allowed them to correct specific steps where they struggled before progressing. This approach encouraged incremental adjustments, promoting self-regulation, patience, and adaptability—key aspects of self-management. Table 19 offers an overview of how the step-by-step structure of CT activities aligns with literature on self-regulated learning and supports children's development of self-management skills.

Table 19. Literature and Study Findings Related to Self-management Skills Through CT Activities

Theme	Literature findings	Findings of the study
Step-by-Step Progression through CT Activities	Step-by-step activities enhance students' ability to work independently and engage in experimentation (Maitz et al., 2022). Engaging in CT activities fosters self-regulated learning skills (Pasterk & Benke, 2024). The planning phase of self-regulated learning involves careful consideration of the problem at hand, which aligns with the children's ability to break down the task into manageable components (Pasterk & Benke, 2024).	Structured sequencing helped children manage their learning more effectively. They learned to regulate their emotions, persist through challenges, and refine their problem-solving strategies over time.

5.5. Social awareness

Social awareness involves recognizing and appreciating the efforts of others (Zins et al., 2007). The findings of the current study underscore the role of structured CT activities, particularly those incorporating teacher guidance, in developing social awareness. These activities ensure that children recognize and validate the efforts of their peers in group work, thereby promoting social awareness. This intentional focus on promoting social awareness aligns with previous research suggesting that teacher involvement enhances cooperative problem-solving and strengthens social awareness within computational learning settings (Wallbaum et al., 2020; Bers & Horn, 2010).

Nathanson et al. (2016) also argue that teacher guidance plays a critical role in children's understanding of peer effort and their ability to recognize and value it. This perspective was evident in the Friendship Bracelet activity (unplugged activity in week 4). In this activity, the teacher's structured prompts, such as encouraging children to evaluate each other's work, actively led participants to notice

and appreciate their peers' contributions. By directing their attention to their peers' work with prompts such as “Don't forget to check each other's work,” the teacher created an environment where children paid more attention to appreciating peer efforts. This finding supports Bers & Horn's (2010) assertion that tangible programming activities can promote social engagement and social awareness beyond only computational skill development.

According to Rafique et al. (2020), teacher guidance in CT environments is also crucial in enhancing emotional intelligence and promoting social awareness. In the current study, the gradual increase in children's ability to recognize and acknowledge their peers' efforts throughout the activities supports these findings. In the current study, the teacher's intentional guidance created structured opportunities for children to engage in social validation, appreciation, and positive peer interactions. By repeatedly participating in guided activities, children internalized social awareness skills as a natural part of their collaborative work.

These findings suggest that integrating structured teacher guidance within CT activities is instrumental in cultivating social awareness in early childhood education. Teachers foster individual SEL competencies by embedding strategies that encourage peer validation and recognition and contribute to a more empathetic and collaborative classroom environment. This supports the broader discourse on the intersection of CT and SEL, demonstrating that computational activities can be a powerful medium for reinforcing essential interpersonal skills in young learners. A comparative overview of these findings and supporting literature on social awareness is provided in Table 20.

Table 20. Literature and Study Findings Related to Social Awareness Through CT Activities

Theme	Literature findings	Findings of the study
The Nature of Teacher Guidance in CT Activities	Teacher involvement enhances cooperative problem-solving and strengthens social awareness within CT settings (Wallbaum et al., 2020; Bers & Horn, 2010). Teacher guidance is critical in helping children understand and value peer effort (Nathanson et al., 2016). Teacher guidance enhances emotional intelligence and social awareness (Rafique et al., 2020).	The teacher's structured prompts encouraged children to recognize and validate each other's work. Over time, children showed increasing ability to acknowledge and appreciate peer contributions, demonstrating growth in social awareness. Teacher-guided CT activities provided consistent opportunities for social validation, appreciation, and empathetic interaction, reinforcing social awareness as a natural part of collaborative tasks.

5.6. Summary of the discussion

The findings of this study contribute to the growing body of research on the intersection of CT and SEL, supporting the argument that CT activities serve a dual purpose: fostering computational thinking development while enhancing social-emotional competencies. Theoretically, this study builds upon Bers' (2017) PTD Framework, which suggests that technology can be leveraged to promote positive social behaviors (Strawhacker & Bers, 2018). The results align with PTD's emphasis on interpersonal behaviors such as communication, collaboration, and community building, indicating that structured CT activities can serve as a medium for fostering these essential social skills.

From a practical perspective, this study has significant implications for early childhood education. Educators designing CT curricula should consider embedding structured collaborative tasks to encourage peer interactions and emotional expression. For example, by integrating unplugged activities before introducing robotics-based CT tasks, children may develop foundational social-emotional

competencies, such as self-regulation and negotiation, which can later be reinforced through plugged-in programming experiences. This sequential approach aligns with developmental theories emphasizing gradual skill acquisition through scaffolding learning experiences (Piaget, 1953).

Moreover, these findings provide insights into teacher training programs, emphasizing the role of educators in facilitating effective social interactions during CT activities. Since the study demonstrated that children initially relied on teacher mediation for conflict resolution but later developed autonomous communication strategies, it highlights the importance of structured teacher guidance in supporting children's transition toward independent problem-solving and emotional regulation. Teacher professional development programs should incorporate strategies for scaffolding SEL through CT activities, ensuring educators can foster computational and social-emotional competencies in young learners.

Furthermore, this study underscores the need for early childhood educational policies that promote the integration of CT into SEL curricula. Policymakers should recognize the dual benefits of CT education and advocate for resources that support implementing unplugged and plugged-in activities in preschool classrooms (Leite et al., 2015). Future curriculum guidelines should emphasize technical proficiency and developing relationship skills, responsible decision-making, and emotional expression, ensuring a well-rounded approach to early childhood learning. By reinforcing positive peer interactions through structured CT experiences, young children develop computational thinking abilities and cultivate the foundational social-emotional skills necessary for lifelong learning and collaboration. The connections between SEL skills and the specific findings from this study is presented in Table 21.

Table 21. Summary of The Discussion

SEL Skill	Main Findings	Consistent with	Extension / Difference
Self-awareness	Children expressed emotions, recognized limits, and reflected on actions.	Zins et al. (2007); Bers (2017)	Integrated across collaborative, guided, and step-by-step CT activities.
Self-management	Structured CT tasks supported emotional regulation and persistence.	Zins et al. (2007); Maitz et al. (2022)	Emphasized socially supported self-regulation, not just individual strategies.
Relationship skills	Cooperative problem-solving and conflict resolution improved over time.	Wallbaum et al. (2020); Bers & Horn (2010)	Highlighted the role of sequenced unplugged and plugged-in activities.
Responsible decision-making	Participants gradually organized meetings and made collective decisions.	Zins et al. (2007); Nathanson et al. (2016)	Stressed teacher scaffolding over technology alone for decision-making.
Social awareness	Participants recognized and validated peer efforts, developing empathy.	Zins et al. (2007); Rafique et al. (2020)	Underlined importance of teacher guidance alongside CT structures.

5.7. Recommendations and implications for future studies

This study's results have important implications for future research and educational approaches that aim to integrate CT and SEL in early childhood education. Since CT activities led and structured by the teacher appear to promote important SEL skills, it is worth investigating the long-term effects of using CT activities. Though this study was limited to short-term intervention, future studies should take a longitudinal approach to explore how SEL skills fostered through CT activities are maintained and refined over time.

Previous research has demonstrated that doing step-by-step CT activities supports children's social-emotional skill development by giving children structured opportunities for reflection, persistence, and collaboration (Bers, 2017; Maitz et al.,

2022). However, studies have primarily focused on short-term interventions, leaving gaps in understanding how these skills are sustained over extended periods. As Wu (2024) suggested, engaging in progressively challenging tasks can promote both emotional resilience and self-regulation. Therefore, longitudinal studies are needed to understand the degree to which these competencies are maintained over time and to inform curriculum design and instructional practices that provide enduring benefits of integrated CT-SEL programming.

Additionally, comparative studies are needed to examine the role of unplugged versus plugged-in CT activities in promoting SEL skills. This study's findings suggest that unplugged activities effectively support initial SEL skill development, while plugged-in activities enhance these skills through structured programming tasks. In line with these findings, Messer et al. (2018) also argue that the effectiveness of instructional methods depends on how well they are structured rather than being purely digital or non-digital. However, some studies indicate that unplugged activities offer unique advantages. For instance, Bers (2017) and Bravo Sánchez et al. (2017) highlight that robotics-based activities enhance peer-to-peer communication and teamwork. Also, Pugnali et al. (2017) and Di Lieto et al. (2017) suggest that tangible tools and robotic toys provide more hands-on experiences, enhancing learning and emotional engagement. Additionally, this current study's findings indicate that children participating in plugged-in activities such as the Dance of Bee-Bot demonstrated improved decision-making and coordination, suggesting that plugged-in tasks can effectively reinforce the SEL skills initiated through unplugged activities.

Similarly, Pekarova (2008) found that well-structured contexts using tools like Bee-Bot effectively support children's programming skills, reinforcing the

importance of foundational skills established through unplugged tasks before transitioning to more complex, plugged-in activities. Furthermore, Fessakis et al. (2013) emphasize the need for integrating appropriate learning experiences facilitated by well-prepared teachers. Combining unplugged and plugged-in tasks may enhance children's learning environments by creating a balanced approach that caters to their developmental needs. While the current study's findings highlight the importance of teacher guidance in both unplugged and plugged-in activities, providing structured facilitation through questioning techniques, reflective discussions, and scaffolding is crucial for promoting SEL skills effectively.

In addition to their contribution to social-emotional learning, the CT activities implemented in this study were also observed to foster the development of core CT skills, including sequencing, pattern recognition, decomposition, and debugging. This dual role of CT activities shows that they can support both social-emotional skills and basic problem-solving abilities related to CT. Future research should explore how CT activities contribute to both areas together, using methods that can assess multiple types of learning. Therefore, future research needs to examine the integrated impact of CT activities on both SEL and CT outcomes through multi-dimensional assessment frameworks.

Furthermore, the role of teacher guidance within CT activities requires further investigation. This study highlighted the importance of structured facilitation in promoting SEL skills, mainly through questioning techniques, reflective discussion, and scaffolding. Previous research by Nathanson et al. (2016) and Rafique et al. (2020) emphasized that structured teacher guidance is critical for fostering emotional expression and cooperation. According to Fessakis et al. (2013), while various tools exist for supporting computer education, the real need lies in learning experiences

that can be seamlessly integrated into children's environments by knowledgeable educators. Similarly, Strawhacker and Bers (2018) emphasized that teacher support and the physical learning environment complement each other in fostering positive technological development. Future studies need to examine the unique contributions of various types of teacher support to developing specific SEL skills. A deeper understanding of these processes will be critical to developing effective teacher training programs that support young learners' holistic development.

Another important topic for future research concerns adapting collaborative CT activities across different learning contexts, such as inclusive classrooms with children with different developmental abilities. While previous studies have demonstrated the benefits of structured CT tasks for fostering empathy, negotiation, and collaborative problem-solving (Bers & Horn, 2010; Leite et al., 2015), more research is needed to explore how these activities can be tailored to meet the diverse needs of all learners. Understanding how CT activities can be adapted to meet the social-emotional needs of children with special educational needs or different cultural backgrounds will contribute to creating more equitable and inclusive learning experiences. As noted by Bati (2021), what is primarily needed are studies focused on identifying learning environments that are developmentally appropriate for young children. Such studies will be essential in ensuring that all children benefit from the social-emotional and computational advantages of integrated CT programs.

Furthermore, as technology becomes increasingly integrated with CT practices, its implications require further investigation. As educational robotics and programming tools continue to advance, investigating how these technologies can enhance both computational and social-emotional learning for young children remains an important topic of research. Researchers such as Bravo Sánchez et al.

(2017) and Wallbaum et al. (2020) have demonstrated the potential of robotics-based activities to promote collaboration and social awareness. Moreover, the integration of robots has been found to increase student involvement and performance without relying heavily on-screen time (Rafique et al., 2020). However, it will be critical to explore how these tools can be intentionally designed and employed to further SEL competencies to advance the field of CT.

In terms of practical implications, the findings of this study may inform classroom practice in larger preschool settings. By intentionally embedding CT activities within structured, collaborative, and developmentally appropriate environments, early childhood educators can foster both SEL and CT skills among diverse groups of children. Future studies should explore how these practices scale in real-world classrooms with larger and more heterogeneous populations to ensure feasibility, equity, and effectiveness.

This study's findings underscore the need to intentionally integrate SEL competencies into CT activities. When appropriately bridging unplugged and plugged-in activities, with the right teacher interaction and productive group work, early childhood educators can create spaces where foundational social-emotional skills and CT skills will flourish. Therefore, future studies need to investigate this intersection further to provide a fuller picture of how CT activities can facilitate holistic learning in early childhood education. Key research directions emerging from this study are summarized in Table 22.

Table 22. Future Research Directions on SEL and CT Integration

Topic	Recommendation
Longitudinal Research	Investigate the long-term effects of CT activities on sustaining SEL skills (Bers, 2017; Wu, 2024; Maitz et al., 2022).
Unplugged vs. Plugged-in CT	Compare the effectiveness of unplugged versus plugged-in CT activities for SEL development (Bers, 2017; Bravo Sánchez et al., 2017; Pugnali et al., 2017).
Teacher Guidance	Examine how different types of teacher scaffolding influence SEL growth during CT activities (Nathanson et al., 2016; Rafique et al., 2020; Fessakis et al., 2013).
Inclusive Education	Adapt CT activities to support diverse learners, including children with special needs (Bati, 2021; Leite et al., 2015; Bers & Horn, 2010).
Educational Robotics and Technology	Explore how robotics and educational technologies can intentionally promote SEL skills (Bravo Sánchez et al., 2017; Wallbaum et al., 2020; Rafique et al., 2020).

5.8 Transferability of the findings

This study was conducted with a small group of four preschool children enrolled in the same early childhood education center. The participants came from similar socio-economic backgrounds and had not participated in any curriculum-based instruction in either CT activities or educational robotics. This homogeneity in terms of age, socio-cultural context, and educational history enhances the internal coherence of the findings and may increase their transferability to similar preschool settings, particularly those that serve demographically comparable populations. In contexts where children share similar cognitive developmental stages and environmental experiences, educators may expect comparable responses to CT activities in terms of SEL outcomes.

Moreover, the structure of the curriculum implemented in the study adds to its potential for adaptation across early childhood programs. The intervention

consisted of eight sessions conducted over eight weeks, where the first half focused on unplugged activities and the second half on plugged-in activities using Bee-Bot robots. This dual-modality approach not only allows for a progressive introduction of CT concepts but also accommodates different developmental needs. Therefore, the curriculum may be particularly transferable to programs aiming to scaffold young children's CT skills gradually while simultaneously supporting SEL competencies.

This study is also transferable to contexts where early childhood teachers possess some degree of pedagogical knowledge in CT. The presence of a classroom teacher who was experienced in early childhood pedagogy and who had a supporting role in guiding the activities played a critical role in mediating children's learning experiences. Teachers in other educational contexts with a similar profile, particularly those who are open to integrating technology into their instruction, may find the observed strategies and outcomes achievable in their own classrooms. However, in settings where teachers have limited exposure to educational robotics or SEL-oriented curricula, additional training and professional development may be required to yield comparable outcomes.

Additionally, the use of qualitative data collection tools, specifically video recordings and a structured SEL observation guide based on the CASEL framework, enhances the methodological transferability of the study. Thematic analysis was employed to identify patterns of social-emotional behaviors emerging throughout CT activities, such as peer interaction, emotional expression, and collaborative decision-making. This analytic approach offers a replicable framework for other researchers or educators aiming to explore the integration of CT and SEL in early childhood contexts. By presenting detailed descriptions of both activity content and children's

observed behaviors, the study provides a foundation for assessing how similar methods may be applied in comparable educational environments.

5.9 Limitations

This study has potential limitations. The study relied on video recordings of class sessions and observational checklists to explore children's social-emotional development as data. While in-depth analyses of these sessions enabled the researcher to capture detailed social interactions, peer communication, and emotional behaviors in real-time, they provided limited access to children's inner thoughts, perspectives, or motivations behind their behaviors. Since young children may not always express their feelings through observable actions, relying only on external behaviors may not fully reflect the depth of their social-emotional experiences. Future research could enhance the richness and trustworthiness of findings by incorporating additional data sources such as interviews with children and pre- and post-intervention interviews with parents. These approaches can offer deeper insight into the children's internal experiences and changes observed outside the classroom context, contributing to a more holistic understanding of their social-emotional growth.

While teacher guidance significantly facilitated children's social-emotional engagement during CT activities, the study did not systematically analyze the specific characteristics or variations of these interactions. As is often the case in qualitative research, the importance of teacher facilitation emerged inductively during the data analysis process rather than being an initial focus of the study design. Therefore, although teacher-child interactions were observed and recognized as influential, they were not examined in terms of specific facilitation styles, strategies,

or scaffolding patterns. Future studies could address this by explicitly investigating how different teachers approach, such as modeling, emotional support, or questioning, shape children's social-emotional learning in CT-based activities. A more focused analysis of facilitation styles would offer deeper insight into the mechanisms through which teacher guidance supports SEL development in early childhood contexts.

Another potential limitation concerns the interpretive attribution of observed SEL outcomes specifically to CT activities. While the study was designed to integrate CT principles, the activities also adopted a play-based, exploratory approach that is commonly used in early childhood education. Therefore, it remains unclear whether the observed improvements in social-emotional competencies were primarily driven by the CT components (e.g., sequencing, problem decomposition, algorithmic thinking) or by the inherently interactive and playful nature of the tasks. Given the intertwined nature of CT and play-based pedagogies in this context, the distinct contributions of each remain analytically indistinct. Future research could benefit from comparative designs that explicitly contrast CT-based interventions with other pedagogical approaches—such as free play, structured storytelling, or arts-based SEL programs—to more clearly delineate the specific affordances of CT in promoting social-emotional development. Such studies would help clarify whether CT offers unique advantages beyond those already embedded in well-established play-based practices.

Lastly, this study utilized a single type of educational robot (Bee-Bot) during the plugged-in phase of CT activities. While this robot was developmentally appropriate and effective in engaging children, the use of only one type of robot may limit the exploration of how different robotic tools might influence children's

engagement and social-emotional responses. Future research could explore the use of a broader range of educational robots to better understand how the characteristics of different tools shape children's social emotional development.



APPENDIX A

OBSERVATION CHECKLIST FOR SOCIAL-EMOTIONAL LEARNING (SEL)

CASEL defines social-emotional learning as the process of learning to integrate thinking, feeling, and behavior to complete critical life tasks. It consists of five core competency areas.

1. Self-awareness

Definition: The capacity to appropriately assess one's own thoughts, feelings, skills, and values.

Coding Examples:

- Expressing awareness of one's own emotions.
- Demonstrating knowledge of peer strengths and weaknesses during the activities.

2. Self-management

Definition: The capacity to effectively regulate one's own ideas, emotions, and behaviors under various circumstances.

Coding Examples:

- Demonstrating self-control in challenging situations during the activities.
- Managing frustration or anxiety appropriately during the activities.

3. Social awareness

Definition: Understanding of cultural standards for conduct and the capacity to empathize with people from various backgrounds.

Coding Examples:

- Demonstrating empathy towards peers during the activities.
- Recognizing and respecting differences among peers.

4. Relationship skills

Definition: The capacity to establish and maintain healthy relationships.

Coding Examples:

- Collaborating effectively with peers during the activities.
- Resolving conflicts in a positive manner during the activities.

5. Responsible decision-making:

Definition: The capacity to make healthy choices.

Coding Examples:

- Making informed decisions in a group setting.
- Demonstrating ethical decision-making.

APPENDIX B

PARTICIPANT INFORMATION AND CONSENT FORM

VELİ ONAM FORMU

Araştırmayı destekleyen kurum: Boğaziçi Üniversitesi

Sayın Veli,

Bu bilgi formu, Boğaziçi Üniversitesi Eğitim Teknolojisi Yüksek lisans programı öğretim üyesi Dr. Mutlu Şen-Akbulut tarafından yürütülen "Eğitsel Robotlarının Çocukların Sosyal Duygusal Öğrenmelerine Etkisi" adlı bilimsel araştırma projesine katılımınızı talep etmek amacıyla hazırlanmıştır. Bu çalışma, okul öncesi dönemdeki çocukların kodlama eğitimi sırasında sosyal duygusal becerilerinin nasıl etkilendiğini incelemeyi hedeflemektedir. Kararınızı vermeden önce araştırma hakkında sizi bilgilendirmek istiyoruz. Aşağıdaki bilgileri okuduktan sonra araştırmaya katılmak isterseniz lütfen bu formu imzalayıp araştırmacıya ulaştırınız.

Bu araştırma, çocukların kodlama eğitimi boyunca sosyal duygusal becerilerini nasıl kullanıp geliştirdiklerini ve eğitsel robotların bu süreçteki etkisini anlamayı amaçlamaktadır. Çocukların sosyal ve duygusal öğrenmelerinin teknoloji destekli eğitimlerle nasıl şekillendiği, eğitim ortamlarının tasarımında önemli bir rol oynayabilir ve etkili öğrenme aktivitelerinin geliştirilmesine katkı sağlayabilir.

Bu araştırmayı onayladığınız takdirde araştırmaya katılan çocuğunuz 10 haftalık bir kodlama eğitimine dahil olacaktır. Bu eğitimlerin temel amacı çocuğunuzun kodlama becerilerini sosyal duygusal gelişimlerini desteklemektir. Bu amaç için hazırlanan eğitimler iki farklı yöntem izlenerek uygulanacaktır. Birinci yöntem ekransız kodlama etkinlikleri ile hazırlanan oyun temelli eğitimlerdir. İkinci yöntem ise okul öncesi dönemdeki çocukların gelişimlerine uygun bir eğitsel robot olan Bee-bot robotu ile hazırlanan eğitimler olacaktır. Bu eğitimler yaklaşık 30 dakika süren seanslar halinde Boğaziçi Üniversitesi Erken Çocukluk Biriminde gerçekleştirilecektir. Araştırmaya katılan çocukların kodlama eğitimi sırasında sosyal duygusal becerileri, araştırmacının gözlem notları ve video kayıtlar aracılığıyla incelenecektir. Araştırma süreci boyunca çocukların gizliliği ve anonimliği esas alınacak, video kayıtlarının yazılı dökümünde çocukların kimlik bilgileri yerine bir takma isim kullanılacaktır. Video kayıtlarının olduğu klasörler araştırma projemiz süresince parola korumalı bir dizüstü bilgisayarda, kilitli bir dolapta muhafaza edilip araştırma sona erdiğinde silineceklerdir. Araştırma sonuçları sadece bilimsel amaçlarla kullanılacak ve araştırmaya katılan çocukların kimlik bilgileri açıklanmayacaktır.

Araştırmaya katılım tamamen gönüllülük esasına dayanmaktadır. Çalışmanın herhangi bir aşamasında herhangi bir sebep göstermeden çocuğunuzun katılımı için verdiğiniz onayınızı çekmek hakkına sahipsiniz. Araştırma projesi hakkında ek bilgi almak istediğiniz takdirde lütfen Boğaziçi Üniversitesi Eğitim Teknolojileri Bölümü Öğretim Üyesi Mutlu Şen-Akbulut ile temasa geçiniz (Telefon: 02123596789, Adres: Boğaziçi Üniversitesi, Kuzey Kampüs, 34342 Bebek, İstanbul). Araştırmayla ilgili haklarınız konusunda Boğaziçi Üniversitesi Sosyal ve Beşerî Bilimler Yüksek

Lisans ve Doktora Tezleri Etik İnceleme Komisyonu'na (SOBETİK)
(xxxxxxxxxxxxxx) danışabilirsiniz.

Eğer çocuğunuzun bu araştırma projesine katılmasını kabul ediyorsanız, lütfen bu formu imzalayıp araştırmacıya teslim edin.

Ben, ... (katılımcının adı) (çocuğun adı)'nın velisi olarak, yukarıdaki metni okudum ve çocuğumun katılımı istenen çalışmanın kapsamını ve amacını, gönüllü olarak çocuğumun üzerine düşen sorumlulukları tamamen anladım. Çalışma hakkında soru sorma imkânı buldum. Bu çalışmayı istediğim zaman ve herhangi bir neden belirtmek zorunda kalmadan bırakabileceğimizi ve bıraktığımızı takdirde herhangi bir olumsuzluk ile karşılaşmayacağımızı anladım.

Bu koşullarda söz konusu araştırmaya çocuğumun katılımını kendi isteğimle, hiçbir baskı ve zorlama olmaksızın katılmayı kabul ediyorum.

Formun bir örneğini aldım / almak istemiyorum (bu durumda araştırmacı bu kopyayı saklar).

Katılımcının Velisinin Adı-

Soyadı:.....

İmzası:.....

Adresi (varsa Telefon No, Faks No):.....

.....

Tarih (gün/ay/yıl):...../...../.....

VIDEO VEYA SES KAYDI ALINACAKSA:

☐ Ses kaydı alınmasını kabul ediyorum.

☐ Video kaydı alınmasını kabul ediyorum.

Araştırmacının Adı-Soyadı:.....

İmzası:.....

Tarih (gün/ay/yıl):...../...../.....

Çocuk Onam Formu

Merhaba arkadaşlar,

Bugün size okulda düzenleyeceğimiz etkinlik grubunu tanıtmak için buradayım. Sizler okula geliyorsunuz ve hem öğretmeninizle hem de arkadaşlarınızla oyunlar oynayıp etkinlikler yapıyorsunuz değil mi? Bu oyunlara ve etkinliklere benzer oyunları ben de sizin için hazırladım ve ana binada yer alan, sizin kodlama derslerini yaptığınız teknoloji sınıfında oynamak istiyorum. Bunun için haftada bir gün okula geleceğim ve 10 hafta boyunca sizinle toplamda 10 tane etkinlik yapmış olacağım. Bu etkinliklerde bazen sizin daha önce kodlama derslerinizde kullandığınız robotlara benzer robotlar kullanacağız bazen de hiçbir teknolojik alet kullanmadan oyunlar oynayacağız. Bu etkinlikleri yaparken sınıfın belirli yerlerinde minik kameralar olacak ve bu video kayıtlarında etkinlikler sırasında arkadaşlarımızla beraber robotlarımızla nasıl oynadığınıza bakacağız.. Ama bu kayıtlar kimseyle paylaşılmayacak ve sizin görüntüleriniz sadece bu etkinliklerin ne kadar yardımcı olduğunu anlamak için incelenecek. Bu etkinlik grubunda hem oyunlar oynayıp eğleneceğiz hem de çeşitli etkinlikler yaparak yeni şeyler öğreneceğiz. Ama siz herhangi bir sebep olmadan herhangi bir zamanda bu oyunları oynamaya devam etmek istemezseniz bırakabilirsiniz. Eğer bizimle beraber bu 10 oyunlara ve etkinliklere katılmak istersen aşağıdaki mutlu yüzü boyayabilirsin. Katılmak istemezsen de aşağıdaki üzgün yüzü boyayarak ne hissettiğini bana söyleyebilirsin. Teşekkür ederim.



APPENDIX C

INITIAL VERSION OF THE CODEBOOK DEVELOPED FOR CODING SEL BEHAVIORS

	Theme	Codes description	Codes
Social Emotional Learning (SEL)	Self-awareness	Child expresses/verbalizes a range of emotions/ his or her emotions	SA_expressing his/her emotions
		Child assess own strength and limitation	SA_assessing own st/limit
		Child uses non-verbal cue (facial expression) for expressing emotions	SA_using non-verbal cues
	Self-management	Child regulates social-emotional responses	SM_regulating social-emotional responses
		Working toward achieving goal	SM_work/achiving goal
		Demonstrating self-control in challenging situations during the activities	SM_showing self-control in challenging situation
	Social awareness	Taking perspective of others	SA_taking perspective of others
		Demonstrating knowledge of peer strengths and weaknesses during the activities/	SA_peer strength/weak awareness
		Managing frustration or anxiety appropriately during the activities	SA_managing frustration/anxiety
		Awareness of peers' being different from each other	SA_awareness of different
		Appreciating each other's work/efforts	SA_appreciating each other
	Relationship skills	Child participates in healthy interactions	RS_healty interaction

		Child begins to show empathy for others	RS_show empathy
		Seeking and offering help	RS_seeking/offering help
		Communicate with their peers	RS_communicate w/peers
		Listen to the peers/active listening	RS_active listening
		Cooperate with their peers	RS_cooparete w/peers
		Negotiating conflict	RS_Negotiating conflict
	Responsible decision making:	Child cooperates with daily routines and requests	RD_coopareting daily routines and requests
		Making informed decisions in a group setting	RD_making decision in group
		Child takes active role in decision-making	RD_active role in decision-making
		Identifying problems	RD_identifying prob.

APPENDIX D

FINAL VERSION OF THE CODEBOOK DEVELOPED FOR CODING SEL BEHAVIORS

THEMA	Theme	Codes description	Codes
Social Emotional Learning (SEL)	Self-awareness	Child expresses/verbalizes a range of emotions/ his or her emotions	SA_expressing his/her emotions
		Child assess own strength and limitation	SA_assessing own st/limit
		Child uses non-verbal cue (facial expression) for expressing emotions	SA_using non-verbal cues
		Verbalizing feeling	SA_verbalizing feeling
	Self-management	Child regulates social-emotional responses	SM_regulating social-emotional responses
		Working toward achieving goal	SM_work/achiving goal
		Demonstrating self-control in challenging situations during the activities	SM_showing self-control in challenging situation
	Social awareness	Taking perspective of others	SA_taking perspective of others
		Demonstrating knowledge of peer strengths and weaknesses during the activities/	SA_peer strength/weak awareness
		Appreciating each other's work/efforts	SA_appreciating each others
	Relationship skills	Child participates in healthy interactions	RS_healty interaction
		Child begins to show empathy for others	RS_show empathy

		Seeking and offering help	RS_seeking/offering help
		Communicate with their peers	RS_communicate w/peers
		Listen to the peers/active listening	RS_active listening
		Cooperate with their peers	RS_cooparete w/peers
		Negotiating conflict	RS_Negotiating conflict
	Responsible decision making:	Child cooperates with daily routines and requests	RD_coopareting daily routines and requests
		Making informed decisions in a group setting	RD_making decision in group
		Child takes active role in decision-making	RD_active role in decision-making
		Identifying problems	RD_identifying prob.

APPENDIX E

UNPLUGGED AND PLUGGED-IN ACTIVITIES

Unplugged Activities

1. Emotion Sorting

Grade: Preschoolers Age: 4-5	PTD component: Collaboration SEL component: Relationship skills
Activity Name: Emotion Sorting	CT Learning objectives: • Preschoolers will practice sorting basic emotions. • Children will learn to create a sequence of sorting emotions. SEL Learning objectives: • Preschoolers will practice identifying basic emotions. • Preschoolers will enhance their ability to recognize and express emotions. • Preschoolers will develop collaboration and communication skills Collaboration (PTD): In the PTD framework, collaboration involves transforming shared ideas into shared action. In the "Emotion Sorting" activity, children work in groups to identify and express emotions. They collaborate by sharing their thoughts, observations, and guesses to correctly sort the emotion cards. This collaboration helps children develop a sense of mutual connection and teamwork, aligning with the PTD collaboration component. Relationship Skills (SEL): Within the SEL framework, the focus on "Relationship Skills" is relevant to this activity. Children in the activity need to communicate, listen, and cooperate with their peers to successfully identify and sort emotions. These are essential skills for building and maintaining healthy relationships, which is a key aspect of relationship skills in SEL. Computational Thinking (CT) connection: Children engage in activities that involve problem decomposition and pattern recognition. CT is a foundational skill that introduces young learners to problem-solving methodologies. For instance, when sorting and identifying emotions, children are essentially breaking down complex emotional understanding into manageable parts, a process known as problem decomposition. When a child is faced with the task of identifying an emotion; they would need to decompose this emotional state into recognizable facial cues and patterns, a CT concept applied to the understanding of human emotions. This CT skill encourages them to

	approach emotions systematically, making it easier to comprehend and categorize them accurately. Additionally, the activity enhances pattern recognition, another CT component. As children observe different facial expressions and emotions, they recognize visual patterns and cues associated with each emotion, like a recurring smile for joy or furrowed brows for anger. These CT skills lay the groundwork for more advanced computational and logical thinking as children progress in their learning journey. By identifying the CT aspects of this activity, we acknowledge the early steps in developing computational thinking skills in young children, setting the stage for their future problem-solving abilities.
Materials used: • Basic emotion cards (e.g., joy, sadness, anger, fear, surprise, tolerance) • Sorting charts (one for each child)	

Description of the activity:

Emotion Sorting is a group activity that helps children improve their skills in recognizing, expressing, and sorting emotions. This activity aims to foster the recognition of basic emotions, teamwork, and communication skills.

Step 1: Form Groups and Introduce the Task (5 minutes)

- Divide the children into groups of four.
- Ensure that each child has emotion cards and a sorting chart in front of them.

Step 2: Selecting and Expressing Emotions

- Each group takes turns allowing one child to randomly select an emotion card from the set.
- The selected child tries to convey the chosen emotion using facial expressions for 30 seconds while the other three children in the group observe.

Step 3: Sorting and Verification (10 minutes)

- Observing children guess which emotion is being expressed and select the corresponding emotion card from their set to place on their sorting chart.

Step 4: Evaluation and Discussion (15 minutes)

- The entire class gathers to discuss their sorting experiences and observations.
- Children are encouraged to share the patterns and cues they used to identify the emotions.
- A discussion takes place regarding the importance of correct sorting and how it helps in understanding emotions.

Step 5: Transition to Another Group

- After the discussion and evaluation, each group moves to another group to repeat the activity.
- This process is repeated for all groups.

2. Bridge Design

Grade: Preschoolers	Unplugged activity example
Activity name: Bridge Design	CT Learning objectives: • Children will practice decomposition by breaking down the bridge design project.

	• Preschoolers will use problem-solving skills to find and fix issues in their bridge design project. • Preschoolers will debug their problems with bridge design. • Preschoolers will recreate bridges after completing their debugging process in the technology circle. SEL Learning Objectives: • Preschoolers will work together on their bridge design projects in the technology circles. • Preschoolers will share their strategies with peers for creating their bridge design. Collaboration (PTD): In this activity, preschoolers work together in small teams to design and construct paper bridges. They need to discuss, share ideas, and collaborate to create a successful bridge. This collaboration aligns with the PTD framework's emphasis on transforming shared ideas into shared action. By working together towards a common goal, children develop a sense of mutual connection with their peers. It's a hands-on example of teamwork, cooperation, and communication, essential aspects of collaboration. Computational Thinking (CT): The process of designing and constructing a paper bridge inherently involves CT skills. Preschoolers are tasked with creating a sequence of steps, considering materials and techniques, and solving problems. Algorithmic thinking is showcased as they design and build the bridge, breaking down a complex task into manageable steps. The activity also encourages them to engage in debugging, a core CT skill. When issues arise with their bridges, children need to identify problems and devise solutions, replicating the debugging process. These CT aspects provide an early introduction to computational and logical thinking skills that will benefit them as they encounter more complex challenges in the future. Relationship Skills (SEL): Within the SEL framework, the focus on "Relationship Skills" can be related to this activity. Preschoolers need to communicate and cooperate effectively within their teams to successfully design and construct their bridges. By sharing strategies, presenting technical problems, and collaborating on debugging, they are practicing valuable relationship skills. This helps in establishing and maintaining healthy peer relationships, a crucial aspect of SEL's relationship skills component.
Materials used:	1. Paper 2. Pen or paint 3. Glue or tape

	4. Weights (e.g., small books)
Description of the activity:	Description of the activity: Each group needs to devise a plan or set of instructions to create their paper bridge. They need to consider the order of steps, the materials, and the techniques they'll use. This reflects algorithmic thinking, which involves creating a series of steps to solve a problem. Step 1: Form Groups and Introduce the Task (5 minutes) • Divide the children into small teams. • Present the task to the groups: Design and create a paper bridge. Step 2: Bridge Design (5 minutes) • Provide each group with a piece of paper and a pen or paint. • Instruct the groups to design and draw a paper bridge within a specific time frame. Step 3: Bridge Construction (15 minutes) • After the design phase, provide each group with paper, glue, or tape. • Groups start constructing the paper bridge based on their design. Step 4: Testing and Adding Weight (10 minutes) • Give each group a few small books or similar weights. • Groups use the weights to test their paper bridges' durability and the glue or tape's strength. Step 5: Evaluation and Improvement (5 minutes) • After testing their bridges, groups discuss what worked and why certain things did not. • Groups evaluate their design and construction processes, discussing how they can strengthen their bridges. Assessment (5 minutes) • The teacher starts the technology circle by asking children to show their projects and asking questions: • "What worked as expected and what didn't?", • "What are you trying to accomplish?",

	• “What do you need to know to make it happen?” • Groups listen to ideas from other groups and brainstorm ways to enhance their bridge designs. • Researchers can score each group's bridges based on durability and design originality. • After the activity, groups share what they learned and how to improve their design and construction processes.
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3. Colorful Journey

Grade: Preschoolers	Unplugged activity example
Activity name: Colorful Journey	CT Learning objectives: • Preschoolers will develop the ability to sequence different colors in order. • Preschoolers will apply their sequencing skills concretely with colors. SEL Learning Objectives: • Preschoolers will experience teamwork within their groups. Collaboration (PTD): This activity strongly emphasizes collaboration, as preschoolers work in teams to complete their colorful journeys. They need to decide the order of colors and work together to guide their travel-themed toy vehicles along the correct paths. Collaboration is a key element of the PTD framework, as it involves transforming shared ideas into shared action. In this activity, preschoolers demonstrate their growing sense of mutual connection with their peers by working together towards a common goal. Relationship Skills (SEL): Within the SEL framework, the focus on "Relationship Skills" is relevant to this activity. Preschoolers need to communicate effectively, cooperate, and appreciate the contributions of their team members to successfully complete their colorful journeys. These are essential skills for establishing and maintaining healthy relationships, which align with the relationship skills component in SEL. Computational Thinking (CT) connection: CT involves breaking down complex problems into simpler steps and systematically solving them. In this activity, preschoolers develop algorithmic thinking as they create a sequence of colors for their toy vehicles to follow. They plan

	and execute the steps required to complete their colorful journeys, which is a fundamental aspect of computational problem-solving. By working together in teams, they collectively design a series of instructions, enhancing their algorithmic thinking skills. Additionally, CT emphasizes recognizing patterns and using them to solve problems, and in this activity, children follow the color sequences to accomplish their journeys, fostering pattern recognition as a CT skill. Therefore, this activity cultivates algorithmic thinking and pattern recognition, key components of Computational Thinking.
Materials used:	• Colored cardboard or large colored paper strips (at least 4 different colors) • Journey-themed toy vehicles (e.g., cars, trains, airplanes) • Colored labels or cut-out vehicle shapes from colored paper (one for each color) • A large play area or carpet
Description of the activity:	Description of the activity: Children work together to create a sequence of colors that their toy vehicles will follow. This process involves algorithmic thinking, which means breaking down a task into a series of steps. They plan the order of colors, and the actions needed to complete their journeys, applying algorithmic thinking, a fundamental component of Computational Thinking (CT). Step 1: Recognizing Colors (5 minutes) • Show each colored cardboard or paper strip to the children and name the colors. • Help them understand what each color is before playing the game. Step 2: Journey-Themed Vehicles (5 minutes) • Show journey-themed toy vehicles to the children and tell them that these vehicles are associated with different colors. • For example, a blue car or a yellow train. Step 3: Preparation for Colorful Journey (10 minutes) • Place large colored cardboard or paper strips on the play area or carpet. Create a separate path for each color. • At the end of each path, place a journey-themed vehicle and a label or cut-out shape of the same color. Step 4: Colorful Journey Game (20 minutes)

	• Divide the children into groups and give each group a journey-themed vehicle. • Their task is to take a colorful journey in the correct color sequence! • Ensure they follow the sequence of colored strips to complete their journey. • Children can use labels or cut-out vehicle shapes to help them follow the color sequence. Step 5: Assessment and Discussion (10 minutes) • At the end of the game, when each group completes their journey, gather the children together. • Discuss how well they followed the color sequence and completed their journeys. • Talk about why sequencing colors is important and how it can be helpful. Assessment (5 minutes) • Evaluate the children's ability to follow colors in sequence. • Observe their teamwork and group interactions. • Encourage them to understand color sequencing concretely and motivate them to further develop this skill.
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4.Emotion Collage Story

Grade: Preschoolers	Unplugged activity example
Activity name: Emotion Collage Story	CT Learning objectives: • Preschoolers will utilize decomposition skills to express complex emotions through art by breaking them down into simpler components (problem decomposition). • Preschoolers will identify and categorize different emotions represented by their peers' artwork (pattern recognition). • Children will apply sequencing skills as they arrange emotion images in their colleges, creating a meaningful narrative (sequencing abilities).

	• Preschoolers will work collaboratively to identify and correct any sequencing errors while creating and sharing emotion-based stories (debugging skills). SEL Learning objectives: • Children will explore and identify various emotions by selecting and arranging facial expressions from printed materials (self-awareness): • Children will share their collages with peers, expressing the emotions depicted (communication). Communication (PTD): This activity encourages communication as children not only create their emotion collages but also share them with their peers. By discussing their choices of emotions, explaining why they chose specific expressions, and narrating their emotion-based stories, children develop their communication skills. They learn to express their ideas, listen to others' perspectives, and engage in meaningful dialogues with their friends. This communication component aligns with the PTD framework, which emphasizes children's ability to share their own ideas and interpret the work of others through various media, in this case, visual and verbal communication. Self-awareness (SEL): This activity promotes self-awareness by encouraging children to explore and express their own emotions through the creation of the emotion collage. Discussing their choices and why certain emotions are meaningful to them enhances their emotional self-awareness. Computational Thinking (CT) connection: Children engage in decomposition by identifying and breaking down complex emotions into tangible components. They practice sequencing emotions to create logical narratives, showcasing their ability to think systematically. Additionally, when collaborating to identify and correct sequencing errors in their stories, they engage in debugging, promoting resilience and problem-solving. These skills foster logical thinking and problem-solving.
Materials used:	• Magazines, newspapers, or printed materials with facial expressions and a variety of emotions. • Scissors • Glue • Large sheets of paper or poster boards • Markers or crayons

Description of the activity:	Description of the activity: The "Emotion Collage Story" activity encourages children to explore and express different emotions through art and storytelling. Step 1: Emotion Collage Creation (20 minutes) • Provide children with magazines, newspapers, or printed materials that feature various facial expressions and emotions. Ensure there is a variety of emotions represented. • Instruct the children to browse through the materials and cut out images of facial expressions that depict different emotions. Encourage them to collect around 10 emotion images each. • Provide large sheets of paper or poster boards and art supplies (markers or crayons) for each child. • Ask the children to create a collage by gluing emotional images onto their paper or board. They can arrange the images in any way they like. Step 2: Emotion Exploration (15 minutes) • Once the collages are complete, each child displays their collage to the group. • Invite the children to discuss the emotions they choose and why those emotions are important or relevant to them. Step 3: Creating an Emotion Story (20 minutes) • Pair up the children, and each child should exchange their collage with their partner. • Instruct each child to examine their partner's collage and observe the sequence in which the emotions are arranged. • Encourage them to use the sequence of emotions as inspiration to create a short story or narrative. They can write or verbally share their stories. Step 4: Story Sharing (10 minutes) • Bring the children back together as a group. • Invite each child to share the emotion-based story they created using their partner's collage as inspiration. Assessment (5 minutes) • Observe how children express themselves through their collages and stories. • Evaluate their ability to identify and sequence emotions effectively.
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	• Encourage discussion about the importance of understanding and expressing various emotions.
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5. Friendship Bracelet Making

Grade: Preschoolers	Unplugged activity example
Activity name: Friendship Bracelet Making	CT Learning objectives: • Preschoolers will identify and create simple patterns in their bracelet designs (Pattern recognition abilities) • Children will engage in basic problem decomposition as they break down the overall bracelet design into simpler components (Problem Decomposition). • Preschoolers will identify the connections between specific bead colors and shapes, enhancing their understanding of visual patterns (Pattern Recognition). SEL Learning Objectives: • Preschoolers will share their creative bracelet ideas with their friends (Communication). • Children will choose colors and patterns for their bracelets (Responsible Decision Making). Communication (PTD): This activity encourages children to communicate their creative ideas and choices in bracelet design with their friends. By explaining their patterns and color selections, they develop essential communication skills. They also practice listening as they understand and remember their friend's pattern, further enhancing their communication abilities. Responsible Decision Making (SEL): The activity fosters responsible decision-making as children make choices about bead colors and patterns for their bracelets. They learn to make decisions while creating their friendship bracelets, aligning with the SEL component of responsible decision-making. Computational Thinking (CT) connection: In this activity, children engage in basic pattern recognition as they observe and replicate patterns in the bracelets created by their peers. This foundational skill introduces them to the concept of identifying and repeating visual patterns, which is an essential aspect of computational thinking. It encourages children to develop an eye for recognizing and working with patterns, which is a crucial skill in problem-solving and logical thinking.

Materials used:	• Beads in different colors and shapes • Elastic or stretch cord • Safety scissors • Small containers for beads • Work mats or trays
Description of the activity:	Description of the activity: In this creative and skill-building activity, preschoolers will make friendship bracelets while enhancing their pattern recognition skills. They will not only express themselves through their bracelet designs but also develop important communication and decision-making abilities. Step 1: Pattern Creation (10 minutes) • Provide each child with a set of assorted beads in different colors and shapes. • Encourage them to create their own unique bracelet patterns with the beads on their work mats. Step 2: Pattern Swap (5 minutes) • Have children move to a different spot, exchanging their pattern designs with another child. • Instruct them to look at the pattern created by their friend and remember it. Step 3: Bracelet Making (15 minutes) • Now, each child will use the pattern they received from their friend to make a bracelet. • They should string the beads onto the elastic cord to replicate the pattern they observed. Step 4: Sharing and Communication (10 minutes) • Encourage children to share their finished bracelets with their friends. • Ask them to explain the patterns and color choices they made, promoting communication and self-expression.

	Step 5: Responsible Decision Making (5 minutes) • Discuss the importance of making safe and responsible decisions when choosing beads and creating patterns. • Highlight the idea that each bracelet represents friendship and should be made with care. Assessment (5 minutes) • Observe how children communicate their ideas to their peers while sharing their bracelets. • Evaluate their responsible decision-making skills in selecting beads and patterns. • Assess their ability to recognize and replicate patterns in their bracelet designs.
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B. Plugged- in Activities

1. Dance of the Bee-Bots

Grade: Preschoolers	Plugged-in Activity example
Activity Name: Dance of the Bee-Bots	CT Learning objectives: • Preschoolers will apply decomposition skills to break down the overall Bee-Bot dance choreography into smaller, manageable parts. • Preschoolers will demonstrate problem-solving abilities by systematically planning and sequencing the Bee-Bot's dance movements in collaboration with their peers. • Preschoolers will utilize pattern recognition skills to identify and create dance moves associated with specific-colored hoops, enhancing their understanding of computational thinking concepts. • Preschoolers will engage in logical thinking as they program Bee-Bots to follow the sequence of colored hoops, demonstrating the application of systematic processes in technology-related activities. SEL Learning Objectives • Preschoolers will develop relationship skills through effective communication, cooperation, and appreciation

	of their team members' contributions to the Bee-Bot dance. • Preschoolers will strengthen their social awareness by engaging in a shared experience of planning, programming, and showcasing the Bee-Bot dance, contributing to the development of a supportive community. Collaboration (PTD): This activity strongly emphasizes collaboration, as preschoolers work in teams to plan and sequence the dance movements for the Bee-Bots. They decide the order of the dance sequence collaboratively and also create rhythm and music to enhance the dance performance. Collaboration is a key element of the PTD framework, as it involves transforming shared ideas into shared action, and this activity demonstrates preschoolers' growing sense of mutual connection with their peers. Relationship Skills (SEL): Within the SEL framework, the focus on "Relationship Skills" is relevant to this activity. Preschoolers need to communicate, cooperate, and appreciate the contributions of their team members to successfully plan and execute the Bee-Bot dance. These are essential skills for establishing and maintaining healthy relationships, which align with the relationship skills component in SEL. Computational Thinking (CT) connection: Preschoolers plan and sequence the dance movements, a process that involves breaking down the overall choreography into smaller, manageable parts. This aspect of problem decomposition introduces children to fundamental CT concepts, which involve breaking down complex problems into simpler, more understandable components. It encourages systematic thinking and collaboration to synchronize Bee-Bots with the dance moves and rhythm.
Materials used:	1. Colored floor stripes or hoops (representing dance moves) 2. Bee-Bots (one for each team) 3. Music or rhythm instruments
Description of the activity:	In this activity, children plan and sequence dance movements for the Bee-Bots. They decide the order in which the Bee-Bot will follow the colored hoops, and this sequence determines the dance performance. Planning the Bee-Bot dance involves breaking down the performance into individual dance moves associated with specific hoops. Each dance move becomes a component of the overall choreography.

	Step 1: Setting up Bee-Bot Dance Grid (5 minutes) • Create an area using colored floor strips or hoops (e.g., red, blue, green). • For example, a teacher can associate a red hoop with taking a step blue hoop with spinning. Step 2: Bee-Bot Loop Dance Teams (5 minutes) • Divide the children into teams, ensuring each team has a Bee-Bot and different colored hoops. • Provide each team with colored hoops representing dance moves (e.g., red hoop for jumping, blue hoop for spinning). Step 3: Designing Bee-Bot Loop Dance (10 minutes) • For instance, one team plans a Bee-Bot dance sequence that starts from a red hoop and goes sequentially through blue and green hoops. • Another team designs a loop where their Bee-Bot begins with a blue hoop, and then transitions to a red hoop, forming a loop. Step 4: Programming Bee-Bots with Rhythm (15 minutes) • Children create a rhythm or music that fits the pace of their Bee-Bot's dance sequence. • They program the Bee-Bot's movements to align with the rhythm, enhancing the dance performance. Step 5: Bee-Bot Loop Dance Showcase (5 minutes) • Each team takes turns showcasing their Bee-Bot's unique loop dance on the grid. • The Bee-Bot repeats dance moves by following the colored hoops within the loop. Step 6: Evaluation and Discussion of Bee-Bot Showcases (5 minutes) • Other teams evaluate each Bee-Bot performance based on creativity, collaboration, and effective use of loops. Assessment (5 minutes) • Observe how children use the concept of loops to program Bee-Bots and collaborate to create a creative dance performance during the showcases.
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	Teams can share their creative processes, collaboration experiences, and how they synchronize Bee-Bots with dance moves.
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2. Bee-bot Shape Adventure

Grade: Preschoolers	Plugged-in Activity example
Activity Name: Bee-bot Shape Adventure	CT Learning objectives: - Preschoolers will use problem decomposition skills when collaborating to guide Bee-bot through the maze, breaking down the navigation task into smaller, manageable steps. - Children will apply pattern recognition when sequencing the collected shapes, identifying the logical order in which the shapes were discovered and arranging them accordingly. - Preschoolers will arrange collected shapes in a logical order (Sequencing). SEL Learning Objectives: - Preschoolers will enhance their collaboration skills by working together to decide Bee-bot's path, solving problems as a team during the shape recognition adventure. - Children will practice effective communication as they discuss and decide which shape Bee-bot should search for next, fostering clear and expressive dialogue among peers. Collaboration (PTD): Children collaborate and make decisions together to guide Bee-bot, fostering a sense of mutual connection. Relationship skills (SEL): The activity encourages relationship-building as children work together, communicate, and appreciate each other's contributions. Computational Thinking (CT) connection: When children collaborate to guide Bee-bot through the maze, they engage in problem-solving and decision-making processes. They must think logically and systematically about the best path for Bee-bot to collect shapes. This involves breaking down the problem of navigating the maze into smaller, manageable parts, a fundamental CT concept known as problem decomposition.

	Additionally, by programming Bee-bot to follow the sequence of collected shapes, children are applying sequencing, which is another CT skill.
Materials used:	• Bee-bot • Shape cards or shapes scattered throughout the maze • Large playing area or floor mat
Description of the activity:	In this shape recognition adventure, preschoolers will join Bee-bot on a journey to discover various shapes hidden in a maze. They will work collaboratively, developing relationship skills and enhancing their ability to solve problems together. Additionally, children will practice sequencing by arranging the collected shapes logically. Step 1: Introduction to Bee-bot and Shape Cards (10 minutes) • Introduce Bee-bot to the children, explaining how it can be programmed to move in different directions. • Show them the shape cards or shapes scattered throughout the maze that Bee-bot will seek. Step 2: Collaborative Shape Hunt (15 minutes) • Initiate the shape recognition adventure with children. • Encourage them to work together, discussing which shape Bee-bot should search for next. Step 3: Problem-Solving and Decision-Making (15 minutes) • When it's a child's turn to decide Bee-bot's path, they must engage in problem-solving and make decisions about which direction to take. • Discuss how their decisions lead to successful shape collection. Step 4: Sequencing the Collected Shapes (15 minutes) • After successfully collecting shapes, provide the children with shape cards. • Encourage them to work together to arrange the collected shapes in a logical order, reflecting the sequence of discovery. Step 5: Programming Bee-bot (10 minutes)

	- Place Bee-bot at the starting point of the maze and explain that the children will program Bee-bot to follow the sequence of collected shapes. - Children take turns programming Bee-bot's movements to revisit the shapes in the correct order. Step 6: Bee-bot's Shape Adventure (10 minutes) - Let Bee-bot follow the programmed sequence on the floor mat, reenacting the shape adventure. Step 7: Reflection and Discussion (10 minutes) - Gather the children to reflect on the Bee-bot adventure story. - Discuss the collaborative problem-solving, the choices they made for Bee-bot's path, and how those choices affected the sequence of shape collection. Assessment (5 minutes) - Observe how well children collaborate during the adventure (Collaboration and Relationship Skills). - Assess their ability to make decisions for Bee-bot's shape collection (Collaborative Problem Solving). - Evaluate their success in sequencing the collected shapes correctly (Sequencing).
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3. Bee-bot Color Sorting Challenge

Grade: Preschoolers	Plugged-in Activity example
Activity Name: Bee-bot Color Sorting Challenge	CT Learning objectives: - Preschoolers will employ problem decomposition skills to strategize and guide Bee-bot in the color sorting game, breaking down the task of reaching colored objects into manageable steps. - Children will utilize sequencing skills when programming Bee-bot's movements to navigate and interact with different colored objects in the correct order during the game. SEL Learning objectives:

	• Preschoolers will assess their own color sorting choices and make responsible decisions to guide Bee-bot (Self-awareness & Responsible Decision Making). • Children will share their ideas and decisions during the game (Communication). • Preschoolers will use different sorting methods and experiment with their own solutions (Creativity). Collaboration (PTD): Children collaborate and make decisions together to guide Bee-bot, fostering a sense of mutual connection. Relationship skills (SEL): The activity encourages relationship-building as children work together, communicate, and appreciate each other's contributions. Computational Thinking (CT) connection: When preschoolers assess their sorting choices and make decisions to guide Bee-bot, they engage in a problem-solving process. They can determine the best path for Bee-bot to reach the correct colored object. This process involves problem decomposition, a fundamental CT concept where a complex problem (color sorting) is broken down into smaller parts. Additionally, when children are challenged to find creative and unconventional sorting solutions, they are exercising their creativity, which is another CT component.
Materials used:	• Bee-bot • Colored objects or cards (e.g., colored shapes, toys, or cards) • Large playing area or floor mat • Description of the Activity:
Description of the activity:	During this activity children will communicate with each other, assess their sorting decisions, and use their creativity to find unique sorting solutions. Step 1: Introduction to Bee-bot and Colors (10 minutes) • Introduce Bee-bot to the children, explaining how it can be programmed to move. • Show them the colored objects or cards that Bee-bot will interact with during the game. Step 2: Color Sorting Game Rules (10 minutes)

	• Explain the rules of the color sorting game. For example, each child must take turns guiding Bee-bot to the correct colored object. • Emphasize that the children can use their creativity to find interesting ways to sort the objects. Step 3: Communication and Game Play (20 minutes) • Start the color sorting game. Each child takes a turn programming Bee-bot to reach and interact with the correct colored object. • Encourage communication among the children as they discuss and share their ideas for Bee-bot's movements. Step 4: Self-awareness and Reflection (10 minutes) • After completing several rounds of the game, the children gather and discuss their sorting choices. • Ask them to reflect on their decisions and how they felt about their sorting strategies. Step 5: Creative Sorting Challenge (15 minutes) • Present a creative sorting challenge, such as asking the children to find unconventional ways to group objects by color. Step 6: Open-Ended Play (10 minutes) • Allow the children to engage in open-ended play with the colored objects and Bee-bot, Assessment (5 minutes) • Observe the children's communication skills as they share ideas during the game (Communication). • Assess their self-awareness by evaluating their reflections on their sorting decisions (Self-awareness). • Encourage creativity by observing their willingness to explore unconventional sorting methods (Creativity).
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4. Bee-Bot's Treasure Hunt

Grade: Preschoolers	Plugged-in Activity example
Activity Name: Bee-Bot's Treasure Hunt	CT Learning objectives: • Preschoolers will apply problem decomposition skills by breaking down the overall treasure hunt into distinct tasks and coding sequences for Bee-Bot to complete each task. • Preschoolers will demonstrate pattern recognition abilities by identifying recurring patterns in the story, such as the specific requests made by each character (rabbit, peacock, bear) and adapting their coding strategies accordingly. • Preschoolers will engage in algorithmic thinking as they plan and execute a sequence of coded movements for Bee-Bot to navigate through the different locations and complete the treasure hunt tasks. SEL Learning objectives: • Preschoolers will enhance collaboration and teamwork skills by working together in groups to plan and execute the coding tasks for Bee-Bot during the treasure hunt. • Preschoolers will strengthen their sense of responsibility by reflecting on their coding choices, assessing their impact on the success of the treasure hunt, and adjusting their strategies accordingly. • Preschoolers will engage in effective communication by sharing ideas, discussing coding strategies, and reflecting on their experiences throughout the activity. Computational Thinking (CT) Connection: The "Bee-Bot's Treasure Hunt" activity encompasses computational thinking principles as children engage in tasks that involve problem decomposition and pattern recognition. CT is a fundamental skill that introduces young learners to problem-solving methodologies. Problem Decomposition: In this activity, each of the four tasks represents a distinct problem that needs to be solved by guiding Bee-Bot. Children are required to break down the overall problem of helping Bee-Bot complete each task into smaller, more manageable parts. For example, in the first task, the problem is to guide Bee-Bot to the rabbit, but this problem can be decomposed into sub-problems: guiding Bee-Bot to the carrot and then guiding Bee-Bot from the carrot to the rabbit. Each of these sub-problems involve sequencing and coding, which are essential components of computational thinking.

	Pattern Recognition: Throughout the activity, children are presented with different tasks and scenarios. They need to recognize patterns within the story to understand what each character (rabbit, peacock, bear) is requesting. For example, they need to recognize the pattern that the rabbit wants a carrot, the peacock wants colorful feathers, and the bear wants honey and fruits. This pattern recognition is a key component of computational thinking, as it helps children make connections and draw conclusions based on visual cues and information. SEL connection: The activity is designed for children to work in teams or groups to guide Bee-Bot through the treasure hunt. They need to communicate and collaborate effectively with their team members to plan and execute the tasks. For example, in the first task, they must work together to decide how to code Bee-Bot to get the carrots and deliver them to the rabbit. This collaboration and teamwork foster relationship skills as children learn to work harmoniously with their peers.
Materials used:	• Bee-Bot robot (one for each group) • Colored floor stripes or hoops (representing different locations or characters in the story) • Visual cues or images representing the characters (rabbit, peacock, bear, treasure) • Visual cues or images representing the tasks or items to be collected (carrots, colorful feathers, honey, fruits) • A larger visual cue or image representing the treasure • A printed or digital copy of the "Bee-Bot's Treasure Hunt" story • A map grid or mat representing the forest with different locations marked by colored stripes or hoops
Description of the activity:	This activity encourages children to enhance their collaboration, empathy, and responsibility skills while using coding skills to complete the tasks in the story, promoting their computational thinking abilities. Step 1: Storytelling (10 minutes) • The children are introduced to the Bee-Bot's Treasure Hunt story. • The story narrates the adventure of Bee-Bot and its friends in the quest to find a hidden treasure.

	Step 2: First Task: Rabbit Task (15 minutes) • To complete the first task represented by the rabbit image or symbol, children use Bee-Bot. • The task requires children to use their coding skills to guide Bee-Bot to the rabbit's location. The rabbit asks for carrots as a task. • Children direct Bee-Bot to the location of the carrots and then pick them up to deliver them to the rabbit. Step 3: Second Task: Peacock Task (15 minutes) • To complete the second task represented by the peacock image or symbol, children use Bee-Bot. • The task requires children to use their coding skills to guide Bee-Bot to the peacock's location. The peacock requests colorful feathers as the task. • Children direct Bee-Bot to the location of the colorful feathers, pick them up, and deliver them to the peacock. Step 4: Third Task: Bear Task (15 minutes) • To complete the third task represented by the bear image or symbol, children use Bee-Bot. • The task requires children to use their coding skills to guide Bee-Bot to the bear's location. The bear asks for honey and fruits as the task. • Children direct Bee-Bot to the location of the honey and fruits, pick them up, and deliver them to the bear. Step 5: Fourth Task: Finding the Treasure (15 minutes) • The fourth and final task involves finding the hidden treasure. • Children direct Bee-Bot to the location of the treasure, and there, they find a great treasure. • The treasure hunt concludes successfully when they find the treasure. Step 6: Evaluation and Discussion (10 minutes) • Children evaluate the different stages of the treasure hunt and tasks, emphasizing how they improved collaboration, empathy, and responsibility skills.
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	- At the end of the activity, children realize that the treasure hunt was not only about finding the treasure but also about gaining valuable social-emotional skills. Assessment (5 minutes) - Observe the children's communication skills as they share ideas during the game (Communication). - Assess their self-awareness by evaluating their reflections on their sorting decisions (Self-awareness). - Encourage creativity by observing their willingness to explore unconventional sorting methods (Creativity).
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5. Bee-bot Pattern Pathways

Grade: Preschoolers	Plugged-in Activity example
Activity Name: Bee-bot Pattern Pathways	Learning objectives: - Preschoolers will program patterned pathways for Bee-bots (Collaboration). - Children will make decisions about the sequence of patterns in their Bee-bot's pathway (Responsible Decision Making). Preschoolers will break down complex patterns into smaller, manageable segments (Computational Thinking: Problem Decomposition) - Children will sequence the Bee-bot's movements to follow the designated pattern (Computational Thinking: Sequencing). Computational Thinking (CT) Connection: Problem Decomposition: This activity encourages children to break down the overall pattern into smaller, more manageable segments (Computational Thinking: Problem Decomposition). Children must dissect patterned pathways into individual components to program Bee-bots effectively. For example, they might decompose a complex sequence of patterns into a series of steps that the Bee-bot will follow. Sequencing: Children need to understand the importance of sequencing the Bee-bot's movements accurately to align with the chosen pattern (Computational Thinking: Sequencing). The sequence of patterns they create determines the Bee-bot's dance, fostering an understanding of logical order.

	Pattern Recognition: Children will enhance their pattern recognition skills by working with various patterns and shapes to design the Bee-bot's pathway. This involves identifying and creating simple patterns using colors or shapes, a fundamental aspect of computational thinking (Computational Thinking: Pattern Recognition). SEL Connection: This activity fosters collaboration as children works together in teams to design and program Bee-bots to follow specific patterned pathways (Collaboration). They collaborate in planning the pattern sequences, programming the Bee-bots, and executing the dance performance, demonstrating the growing sense of mutual connection with their peers (Relationship Skills). Effective communication is essential for successful collaboration in this activity. Children must cooperate, share ideas, and appreciate each other's contributions, which aligns with the "Relationship Skills" component of SEL (Relationship Skills). Additionally, children have the opportunity to appreciate and recognize the efforts of their team members in executing the pattern pathways, reinforcing their relationship skills (Relationship Skills, Collaboration).
Materials used:	• Bee-Bot robot (one for each group) • Colored floor strips or shapes (representing patterns)
Description of the activity:	In "Bee-bot Pattern Pathways," children collaboratively design and program Bee-bots to follow specific patterned pathways on the floor. This activity not only reinforces pattern recognition and sequencing skills but also emphasizes collaboration, relationship skills, and computational thinking. Step 1: Setting Up Pattern Pathways (5 minutes) • Create an area using colored floor strips or shapes to represent the patterns (e.g., squares, circles, triangles). • Ensure that each team has access to a Bee-bot. Step 2: Step 2: Bee-bot Pathway Teams (5 minutes) • Divide the children into teams, with each team having a Bee-bot and a designated pattern. • Provide colored floor strips or shapes representing the patterns they will work on.

	Step 3: Designing Pattern Pathways (15 minutes) • In teams, children plan the sequence of patterns for their Bee-bots to follow. • For example, one team may design a sequence where their Bee-bot follows a pattern of squares, circles, and triangles. • Encourage children to break down the overall pattern into smaller segments and discuss the sequencing of patterns. Step 4: Programming Bee-bots (10 minutes) • Children program their Bee-bots to follow the designated patterned pathways. • Emphasize the importance of sequencing the Bee-bot's movements to align with the chosen pattern. • Encourage collaboration and effective communication within each team. Step 5: Pattern Pathways Showcase (5 minutes) • Each team takes turns showcasing their Bee-bot's successful execution of the patterned pathways. • Teams watch and appreciate each other's work, reinforcing relationship skills. Step 6: Evaluation and Discussion (10 minutes) • Facilitate a group discussion on the patterns created and the collaborative aspects of the activity. • Children share their experiences, including the challenges they faced and how they overcame them through collaboration. Assessment (5 minutes) • Observe how children effectively use pattern recognition and sequencing to program Bee-bots and work together in teams. • Teams can reflect on their creative processes, collaboration experiences, and how they synchronize Bee-bots with pattern pathways.
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APPENDIX F

TRANSLATED QUOTES

Theme 1: Collaborative design of CT activities fostered social and emotional growth	
Chen: Öğretmenim Anna böyle yaptı benim canım acıdı. [Chen acısını ifade ederek eliyle başını tuttu.] The teacher: Arkadaşına söylemek ister misin? [Kafasını hayır anlamında iki yana salladı.] Öğretmen: Neden? Belki Anna senden özür dilemek ister. Chen: Anna böyle yaptın buram acıdı. [Chen tekrar başını tutarak ağrıyan yeri gösterdi.] Anna: Tamam özür dilerim.	Chen: Teacher, Anna did like this, it hurt me. [Chen held his head with his hand, expressing pain.] The teacher: Would you like to tell your friend about it? [Chen shook his head to indicate "no."] The teacher: Why not? Maybe Anna would like to apologize to you. Chen: Anna, you did like this, and it hurt here. [Chen held his head again to show the spot that hurt.] Anna: Okay, I'm sorry.
Chen: Ama bacağıma kafası geldi hoşlanmadım. (Direkt öğretmenine değil de arkadaşı duyacak şekilde söyledi) Öğretmen: O zaman ona söyleyebilirsin. Anna: Chen özür dilerim.	Chen: But its head touched my leg, I didn't like it. The teacher: Then you can tell them. Anna: Chen, I'm sorry.
Öğretmen: Sam başka siyah yok, ne yapalım? Chen sence ne yapabiliriz? [Amy, öğretmen ve Sam halının üzerindeki renklere bakıyor ve düşünürken onları işaret ediyorlardı.] Amy: Bence, bence şunlara gitmeyelim. [Halının üzerinde siyah olmayan bazı noktaları işaret etti.] Öğretmen: Arkadaşına nasıl yardım edebilirsin? Başka siyah yoksa? [Halıya bakarken Sam'i bir çözüm bulmaya teşvik etti.] Sam: Bence bunları düşünelim, bunların hepsini siyah düşünelim. [Halıya doğru işaret etti, siyah noktaları işaret ederek yeni bir yol önerdi.] Amy: Öğretmenim öğretmenim bunları düşünelim bunlara gidelim çünkü bunlar birazcık siyah gibi., [Halıda siyaha benzeyen bazı noktaları heyecanla işaret etti.]	The teacher: Sam, there's no more black, what should we do? Chen, what do you think we can do? [Amy, the teacher, and Sam were looking at the colors on the carpet and pointing at them while thinking.] Amy: I think, I think we shouldn't go to those. [She pointed at some spots on the carpet, indicating areas that were not black.] The teacher: How can you help your friend if there's no more black? [She encouraged Sam to come up with a solution while looking at the carpet.] Sam: I think we should imagine these, let's think of all of them as black. [He gestured toward the carpet, suggesting a new approach by pointing at the black spots.] Amy: Teacher, teacher, let's imagine these, let's go to these because they are kind of black. [She eagerly pointed at certain spots that resembled black on the carpet.]

Öğretmen: O zaman bir karar verin bakalım. Hep beraber karar verin. Nasıl bir yoldan gitmek istiyorsunuz? Anna: Benim aklıma çok güzel bir fikir geldi. [Düşüncesini paylaşıırken heyecanlı görünüyordu.] Öğretmen: Anna, arkadaşlarınla sesli paylaş. Anna: Hepsine gidebiliriz.	The teacher: Then make a decision, let's see. Make a decision all together. Which path do you want to take? Anna: I have a really great idea. [She looked excited as she shared her thoughts.] The teacher: Anna, share it out loud with your friends. Anna: We can go to all of them.
Öğretmen: Ben şimdi diyorum ki, ben biraz bu robotları dans ettireyim. Ama nasıl dans ettireceğim? Mesela sarı rengin bir hareketi olsun. Mesela ne olsun? [Herkes renkli kartlara bakmaya ve düşünmeye başladı.] Chen: Böyle olsun. Sam: Böyle olsun. [Chen ve Sam bir dans hareketi gösterdiler.] Sam: Dönsün. Bir sağ, bir sol, bir arka. Amy: Ben ne yapsın biliyor musun? İki adım öne gitsin, sonra da sağa dönsün. Anna: "Ee ilk sola dönsün, sonra düz gitsin, sonra da..."	The teacher: Now, I'm thinking of making these robots dance a little. But how should I make them dance? For example, the yellow color could have a specific move. What should it be? [Everyone started looking at the colorful cards, thinking.] Chen: Let it be like this. Sam: Let it be like this.[Chen and Sam demonstrated different dance moves.] Sam: It should turn. One to the right, one to the left, one to the back. Amy: Do you know what I want it to do? It should take two steps forward, then turn right. Anna: Umm, first it should turn left, then go straight, and then...
Anna: Aa siz, siz sen Chen'le yaklaşık olun, ben Amy'le yaklaşık olayım, sonra biz birbirimizle takım toplantısı yapalım. Sam: Aklımda bir fikir var benim. Siz Amy'le eş olun, ben Chen'le eş olayım.	Anna: Oh, you two, you pair up with Chen, and I will pair up with Amy, then we can have a team meeting afterward. Sam: I have an idea. You pair up with Amy, and I'll pair up with Chen.
Anna: Aa, siz sen Chen'le yaklaşık olun, ben Amy'le yaklaşık olayım, sonra biz birbirimizle takım toplantısı yapalım. [Bunu Sam'e söyledi ve iki ayrı grup olarak çalışmalarını önerdi.] Sam: Aklımda bir fikir var benim. Siz Amy'le eş olun, ben Chen'le eş olayım. Amy: Chen, bak şimdi, sen Sam ile ol, ben de Anna ile olayım, tamam mı? Sonra da çözülür." Öğretmen: O zaman doğru mu? Hangisini seçtiniz? Bana söyleyin. Sam: Evet.	Anna: Ah, you and Chen pair up, and I'll pair up with Amy, then we can have a group meeting together. [She said this to Sam, suggesting they work as two separate groups.] Sam: I have an idea. Why don't you and Amy be one group, and Chen and I will be the other group? Amy: Hey Chen, look. You and Sam can be one group, and Anna and I can be the other group, okay? Then we'll figure out the solution. Betül: So, is that true? Which groups did you choose? Let me know. Sam: Yeah.
Anna: Ben Chen'le bir toplantı yapmak istiyorum. Öğretmen: Tamam yapabilirsin. [Toplantı yapmak üzere sınıfın köşesine gittiler ve konuşmaya başladılar.]	Anna: I want to have a meeting with Chen. Betül: Okay, you can do that. [They went to the corner of the classroom to have their meeting and started talking.]

Chen: Ben bir tane olacağım o zaman. Anna: Dur bir dakika, bir dakika. Chen: Tamam, ben bir tane olacağım. Anna: Çözdük sorunu. [Öğretmenin yanına döndüler.] Öğretmen: Nasıl çözüm buldunuz? Chen: Ben bir tane olacağım. Sam'le de ee Anna eş olacak.	Chen: Then I will be alone. Anna: Wait a minute, wait a minute. Chen: Okay, I will be alone. Anna: We solved the problem. [They returned to the teacher.] The teacher: How did you find a solution? Chen: I will be alone. And Sam and Anna will be partners.
Öğretmen: Chen arkadaşların sana yardım etti mi? Nasıl yardım ettiler? Chen: mesela Anna Anna gelip böyle git dedi. Sonra böyle git dedi. Sonra böyle.. [Chen halının üzerine gidip anlatmaya başladı. Eliyle siyah şeritteki çizgileri göstererek yolu tarif etti.] Öğretmen: Sana yolu mu gösterdi? Nasıl hissettin peki arkadaşın sana yardım ettiğinde. [Chen eliyle kalp işareti yaptı.] Öğretmen: Neydi bu mutluluk muydu? [Chen onaylar şekilde kafasını salladı]	The teacher: Did your friends help you, Chen? How did they help you? Chen: For example, Anna... Anna came and said, "Go this way." Then she said, "Go that way." And then this way... [Chen started demonstrating on the carpet, pointing with his hand to the lines on the black stripe to explain the path.] The teacher: So, she showed you the way? How did you feel when your friend helped you? [Chen made a heart shape with his hands.] The teacher: What was that? Was it happiness? [Chen nodded his head in approval.]
Amy: Hayır... evet, evet. Anna: Evet, gidiyorsun, gidiyorsun... en yakın kırmızı. Anna: Gel, gel, gel. Amy: O kırmızı değil ki, dur bakayım. Anna: Aa, dur bakalım.	Amy: No... yes, yes. Anna: Yes, you're going, you're going... the nearest red. Anna: Come, come, come. Amy: That's not red, wait, let me see. Anna: Ah, wait, let's see.
Sam: Biz şu an buradayız. Öğretmen: Evet, mordasınız. İki grup aynı anda yapın. Sam: Amy, ilk dönelim, tamam mı? Öğretmen: İki grup beraber çalışabilir. Anna ve Chen, arkadaşlarınızın yanına geçin." Amy: Neydi? Chen: Sağ, sol, arka, ön. Sam: Bir, iki, üç, dört. Amy: Bu mu önce, sonra? Öğretmen: Arkadaşın Chen'e gösterdiğin için teşekkür ederim.	Sam: We are here right now. Teacher: Yes, you are on purple area. Both groups can do it at the same time. Sam: Amy, let's turn first, okay? Teacher: Both groups can work together. Anna and Chen, go join your friends. Amy: ... What was it? Chen: Right, left, back, front. Sam: One, two, three, four. Amy: Is it this one first, then that one? Teacher: Thank you for showing it to your friend Chen.
Theme 2: Teacher-guided CT activities nurtured emotional expression, empathy, and interpersonal understanding among young children	
Öğretmen: Neden kalp yaptın peki? Amy: Çünkü ben gülünce beni çok mutlu ediyor diye herkese böyle elimle kalp yapıyorum.	The teacher: Why did you make a heart shape? Amy: Because when I smile, it makes me so happy, so I make a heart shape with my hands for everyone.

Öğretmen: Hangi renk hissettirdiyse size arkasını boyayın. Anna: Kızgın hissettirdi bana. Öğretmen: Kızgın renk hangi renk senin için? [Anna siyah kalemini öğretmene gösterdi.]	The teacher: Paint the card with the color that the card made you feel. Anna: It made me feel angry. The teacher: Which color represents anger for you? [Anna showed her black marker to the teacher]
Öğretmen: Peki neler biliyorsunuz bana söylemek ister misiniz? Chen: Ben mesela kızgın olunca derin eee anneme sarılıyorum. Amy: Ben de ben de ağladığımda babama ben de ağladığımda çabuk anneme sarılıyorum. Anna: emm ben şaşırdığım zamanlar, ben mutlu olduğumda aslında kalp gönderiyorum herkese.	The teacher: So, what do you know about emotions? Would you like to tell me? Chen: For example, when I'm angry, umm, I hug my mom. Amy: Me too, me too! When I cry, I go quickly to my dad, and when I cry, I quickly hug my mom. Anna: Umm, when I'm surprised, when I'm happy, I actually send hearts to everyone.
Sam: Bir şey dicem ben yapmak istemiyorum Öğretmen: Tamam hikâye yazmak istemiyorsun. Yazmak istemeyebilirsin. Bunu bana söylediğin için teşekkür ederim. Sam: Ben şimdi alabilir miyim? Öğretmen: Evet istediğinizi alabilirsiniz buradan.	Sam: I want to say something, I don't want to do it. The teacher: Okay, you don't want to write a story. It's okay if you don't want to. Thank you for telling me that. Sam: Can I take it now? The teacher: Yes, you can take whatever you want from here.
Chen: Ben bu kadar kesebildim. Öğretmen: Kaç tane duygun var?	Chen: I could only cut this much. The teacher: How many emotions do you have?
Chen: Bu çok zor. Öğretmen: Arkadaşın sana boncukları verince daha mı kolay oluyor Chen? Chen: Zor.	Chen: This is very hard. The teacher: Does it get easier when your friend gives you the beads, Chen? Chen: Hard.
Öğretmen: Birbirinizi kontrol edin. Anan: Ay, güzel yapmışsın. Öğretmen: Birbirinizi kontrol etmeyi unutmayın. Anna: Aa, Sam doğru yapıyor.	The teacher: Check each other's work. Anna: Oh, you did it nicely. The teacher: Don't forget to check each other's work." Anna: Ah, Sam is doing it right.
Amy: Bu makası şöyle tutman lazım. Öğretmen: Göstererek mi öğretmek istedin? Öğretmen: Amy, Chen'e göster ama onun kendisinin yapması gerekiyor. Amy: Bunu böyle geçireceksin...	Amy: You have to hold the scissors like this. The teacher: Did you want to teach by showing? The teacher: Amy, show Chen, but he needs to do it by himself. Amy: You're going to pass it through like this..
Öğretmen: Ben hep beraber çalışarak bir üçgen yapın diyorum. Amy: Anna, gel hep beraber yapalım. Anna: Hep birlikte bir tane büyük üçgen yapıyoruz. Chen, sen ayrı yapıyorsun. Amy: Sam, ben de yapabilir miyim? Anna: Sam, ben de yapabilir miyim? Zaten	The teacher: I'm saying make a triangle by working all together. Amy: Anna, come on, let's do it all together. Anna: We are all making one big triangle together. Chen, you are doing it separately. Amy: Sam, can I do it too?

grup çalışması yapıyoruz, değil mi? Hep birlikte bir tane üçgen.	Anna: Sam, can I do it too? We are already doing group work, right? We are all making one triangle together.
Öğretmen: Hmm kahverengiler siyaha mı benziyor biraz daha. Tamam ortak bir karar verin dördünüz. Bu bir grup çalışmasıydı değil mi? Chen sen de arkadaşlarına yardım et. Amy bütün arkadaşlarına sor istersen. Ortak bir karar almanızı istiyorum. Şöyle bir toplaşın bakalım. Bir karar verin. Ama sesli konuşun ki ben duyayım. Ben sizi duymak istiyorum.	The teacher: Hmm, do the browns look a bit like black? Okay, make a joint decision, all four of you. This was a group activity, right? Chen, you should help your friends too. Amy, if you want, ask all your friends. I want you to make a collective decision. Gather around and make a decision. But speak out loud so I can hear you. I want to hear you.
Öğretmen: Chen Anna'ya yardım edin. Anna arkadaşlarından bir yardım iste bakalım. Bir toplantı yapın. Küçük bir toplantı yapın. Bu sefer sesli olsun ki ben de duyayım. Chen ve Sam: Hayır. Öğretmen: Küçük toplantı zamanı, küçük toplantı zamanı. Sam ve Chen toplantıya katılmak istemiyor musunuz? Sam: İstiyoruz. Öğretmen: Hadi koş o zaman. Anna arkadaşlarını al yanına bir toplantı yapın. Bu sefer sesli bir toplantı yapın.	The teacher: Chen, help Anna. Anna, try asking your friends for help. Have a meeting. A little meeting. This time, speak out loud so I can hear you. Chen and Sam: No. The teacher: It's small meeting time, small meeting time. Sam and Chen, don't you want to join the meeting? Sam: We do. The teacher: Then hurry up. Anna, gather your friends and have a meeting. This time, have a loud meeting.
Öğretmen: Şimdi buradaki duyguların altına kestiğimiz resimleri yaparak bir kolaj çalışması yapacağız. Peki buna nasıl karar vereceksiniz? Anna: Toplantı. [Neşeli bir şekilde bağırarak cevap verdi.]	The teacher: Now, we are going to create a collage by placing the cut-out pictures under these emotions. So, how are you going to decide on that? Anna: Meeting! [Cheerful and excited manner.]
Chen: Öğretmenim Anna benim robotumu değiştirdi. Öğretmen: O zaman bunu küçük bir toplantı ile konuşabilirsiniz. Şuraya gidin bir konuşun bakalım. Anna neden değiştirmek istemiş. [Anna ve Chen yana yana geldi. Anna Chen'in omzuna sarılarak kulağına bir şeyler fısıldadı.] Öğretmen: Ama ne yapıyoruz toplantımızı biraz sesli yapıyoruz. Chen arkadaşın sana ne söyledi? Anna: Robotum ben de değiştirmek istiyordum. Öğretmen: Aa sorunu çözdünüz mü? Nasıl çözdünüz? Sam: Biz çözen insanlarız.	Chen: Teacher, Anna changed my robot. The teacher: Then you can talk about it in a small meeting. Go over there and discuss why Anna wanted to change it. [Anna and Chen stood side by side. Anna put her arm around Chen's shoulder and whispered something in his ear.] The teacher: But what are we doing? We are having our meeting a bit louder. Chen, what did your friend say to you? Anna: I wanted to change my robot, too. The teacher: Oh, did you solve the problem? How did you solve it? Sam: We are the problem-solvers.
Öğretmen: Tamam. Sorunu nasıl çözdünüz peki? İkili grup olacaksınız beraber grup arkadaşlarınızı seçin. Chen: Ama biz Sam ile olcaz.	The teacher: Okay. So, how did you solve the problem? You will be in pairs, so choose your group members together. Chen: But we will be with Sam.

Öğretmen: Nasıl olacak peki Anna? Anna: Ben Chen’le bir toplantı yapmak istiyorum. Öğretmen: Tamam yapabilirsin. Anna:Çözdük sorunu. Öğretmen: Nasıl çözüm buldunuz? Chen: Ben bir tane olucam. Sam’le de ee Anna eş olucak.	The teacher: How will that work, Anna? Anna: I want to have a meeting with Chen. The teacher: Okay, you can do that. Anna: We solved the problem. The teacher: How did you find the solution? Chen: I will be one. And umm... Anna will be with Sam.
Öğretmen: Noldu Chen? Chen: Anna, ben buraya şey yapmışım. Anna da hemen ‘ne yaptın?’ dedi ama ben hoşlanmadım. Öğretmen: Hı hı, bunu Anna’ya söyledin mi peki?" [Chen başını sallayarak ‘hayır’ dedi.] Öğretmen: Peki, söylemek ister misin? [Chen tereddüt etti.] Öğretmen: Neden? Belki Anna senden özür dilemek ister. Öğretmen: Anna, arkadaşın üzülmüş. Bir şeyler söylemek ister misin? Anna: Özür dilerim, Chen. Öğretmen: Siz küçük bir toplantı yapın bakalım. Şurada arkanızı dönün. Biz burada sizi bekliyoruz. [Chen ve Anna arkalarını dönerek konuşmaya başladılar. Anna, Chen’i gıdıklamaya başladı ve kısa bir süre sonra sorun çözülmüş olarak geldiler.]	Teacher: What happened, Chen? Chen: Anna, I had done something here. And Anna immediately said, ‘What did you do?’ but I didn’t like it. Teacher: Uh-huh, did you tell this to Anna? [Chen shook his head, indicating ‘no.’] Teacher: So, would you like to tell her? [Chen hesitated.] Teacher: Why? Maybe Anna would like to apologize to you. Teacher: Anna, your friend is upset. Would you like to say something? Anna: I’m sorry, Chen. Teacher: Why don't you have a little meeting? Turn around over there. We’ll wait for you here. [Chen and Anna turned around and started talking. Anna began tickling Chen, and shortly after, they returned with the issue resolved.]
Chen: Ama elleri beni engeliyor. Öğretmen: Elleri mi? Arkadaşına söyleyebilirsin bunu. Söyle bakalım. Chen: Anna, ellerin beni engelliyor. Anna: Tamam, çektim.	Chen: But their hands are blocking me. The teacher: Their hands? You can tell your friend about it. Go ahead, tell them. Chen: Anna, your hands are blocking me. Anne: Okay, I moved them.
Sam: Bak bir şey diyeceğim, benim turuncum yere düştü. Baksana. O renkleri yapmasak, başka bir renk yapsak nasıl olur? Öğretmen: :Sıraya göre yapmasak mı diyorsun? Sam:Evet.	Sam: Look, I want to say something, my orange bead fell to the ground. Look. What if we don’t use those colors and try another color instead? The teacher: Are you saying we shouldn’t follow the order? Sam: Yes.
Anna: Ben hepsine gitcem. Öğretmen: Ama arkadaşlarına sordun mu? Anna: Arkadaşlar hadi toplantı zamanı. Öğretmen: Hangi renk seçiyorsun? Gri. Şimdi toplantı zamanı. Anna: Toplantı zamanı.	Anna: I’m going to all of them, The teacher: But did you ask your friends? Anna: Friends, come on, it's meeting time. The teacher: Which color are you choosing? Gray. Now it’s meeting time. Anna: Meeting time.
Anna: O zaman üçümüz olalım ya da dördümüz bir takım olalım. Hadi dördümüz bir grup olalım.	Anna: Then let’s be three, or all four of us can be a team. Come on, let’s be a group of four.
Öğretmen: Tamam ortak bir karar verin dördünüz. Anna: Bence kahverengilere.	The teacher: Okay, make a joint decision. Anna: I think the browns. Sam: We already did it.

Sam: biz yaptık bile. Amy: Hepsine gitmeye karar verdik Öğretmen: Herkes bu ortak karara uyuyor mu? Sam: Evet.	Amy: We decided to go to all of them. The teacher: Is everyone agreeing with this decision? Sam: Yes.
Öğretmen: Bu sorunu nasıl çözeceksiniz? Amy: Ben Anna ile olacağım. Anna: Ama ben Sam ile olmak istiyorum. Öğretmen: Bir anlaşma yapmamız gerekiyor. Herkes büyük bir toplantı yapıp kararlaştırın. Sizi bekliyorum. Anna: O zaman üçümüz olalım ya da dördümüz bir takım olalım. Hadi dördümüz bir grup olalım.	The teacher: How are you going to solve this problem? Amy: I will be with Anna.” Anna: But I want to be with Sam. The teacher: We need to make an agreement. Everyone should have a big meeting and decide. I’m waiting for you Anna: Then let’s be three, or all four of us can be a team. Come on, let’s be a group of four.
Theme 3: Step-by-step progression of CT activities encouraged young children’s emotional resilience, self-regulation, and collaborative decision-making	
Öğretmen: Herkes sırayı görebiliyor mu? Anna: Evet, görebiliyoruz da şimdi birazcık zor olmaya başladı.	The teacher: Can everyone see the order? Anna: Yes, we can see it, but now it’s starting to get a little difficult.
Chen: Bu çok kolay. Öğretmen: Son bir görev. Bakalım bu zorlu görevi kimler bitirecek. Chen: Son bir görev. Zorluu. Ooof keşke zor olmasaydı.	Chen: This is very easy. The teacher: ne last task. Let’s see who will complete this challenging task. Chen: One last task. Challenging. Ooof, I wish it wasn’t difficult.
Öğretmen: Duygular hakkında bir şeyler biliyor musunuz peki? Chen: Ben mesela kızgın olunca derin eee anneme sarılıyorum. Amy: Ben de ben de ağladığımda babama ben de ağladığımda çabuk anneme sarılıyorum. Anna: emm ben şaşırdığım zamanlar, ben mutlu olduğumda aslında kalp gönderiyorum herkese.	The teacher: Do you know anything about emotions? Chen: For example, when I’m angry, umm, I hug my mom. Amy: Me too, me too! When I cry, I go quickly to my dad, and when I cry, I quickly hug my mom. Anna: Umm, when I’m surprised, when I’m happy, I actually send hearts to everyone.
Öğretmen: Bu mutlu kartı değil mi? Neden? Nereden anladınız peki?” Sam: Yüzünden. Öğretmen: Nasıl yüzü Sam? Bize gösterir misin yüzünü? [Sam utanır bir şekilde masaya doğru eğildi ve gülen yüz yapmaya çalıştı.]	The teacher: This is the happy card, right? Why? How did you figure that out? Sam: From the face The teacher: How is the face, Sam? Can you show us your face? [Sam, feeling shy, leaned toward the table and tried to make a smiling face.]
Öğretmen: Önce ilk iki adımı düşünelim, sonra devam ederiz. Sam: Tamam, önce sağa dönecek, sonra iki adım ileri.	The teacher: Let’s think about the first two steps first, and then we’ll continue. Sam: Okay, first it will turn right, then move two steps forward.
Amy: Mesela şimdi buradan, buradan, buradan böyle geldik gitti, sonra buradan	Amy: For example, now from here, here, here, we came like this, went, then we went

gittik, gittik, gittik, ben de ona yardım ettim. Sonra buraya geldik. Anna: Buradasın ya, şimdi en yakın siyaha gitmek için buraya gitmelisin, sonra buraya. Sonra daha yakın siyaha gitmek için. Başka siyah yoksa bir plan düşünmemiz gerek.	from here, went, went, went, and I helped him. Then we came here. Anna: You are here, so now to go to the nearest black, you should go here, then here. Then to get to the closer black. If there's no more black, we need to come up with a plan.
Chen: Aa ben yanlış yaptım hemen silebilirim. Öğretmen: Yanlış yaptıysan silebilirsin.	Chen: Ah, I made a mistake, I can delete it right away. The teacher: If you made a mistake, you can delete it.
Öğretmen: Şimdi burada beş tane farklı şey var ya, beş tane farklı farklı koyabilirim değil mi? Chen, sen biraz buraya gelir misin? Mesela Anna, sence bu ilk sırada hangi renk olsun? Anna: Ben her renkten istiyorum. Öğretmen: Ama birinci sırada hangisi olsun, birini seç. Anna: Pembe. Öğretmen: Tamam. Anna: Bilezik mi yapacağız? Ee, nasıl bir bilezik olacak? Öğretmen: Ee, üçüncü sırada? Anna: Sarı. Öğretmen: Dördüncü sırada hangisi olacak, bunu da Sam söylesin. Sam: Bence yeşil. Öğretmen: Yeşil olsun. Yeşili aldım.	The teacher: Now, there are five different things here, right? I can put five different ones, can't I? Chen, can you come here for a moment? For example, Anna, which color do you think should be in the first row? Anna: I want every color. The teacher: But which one should be in the first row? Choose one. Anna: Pink. The teacher: Okay. Anna: Are we making a bracelet? Uh, what kind of bracelet will it be? The teacher: Uh, what about the third row? Anna: Yellow. The teacher: Which one will be in the fourth row? Let Sam say this one. Sam: I think green. The teacher: Let it be green. I took the green one.

APPENDIX G

ETHICS COMMITTEE APPROVAL



T.C.
BOĞAZİÇİ ÜNİVERSİTESİ REKTÖRLÜĞÜ
Sosyal ve Beşeri Bilimler İnsan Araştırmaları Etik Kurulu (Sbinarek)



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Hakkında

06.12.2023

Sayın Dr. Öğr. Üyesi Mutlu ŞEN AKBULUT

Tez danışmanlığımı yürüttüğünüz öğrenciniz Betül Polat'ın "Exploring The Effects of Educational Robotics on Preschool Children's Social Emotional Learning and Computational Thinking" başlıklı projesi ile Boğaziçi Üniversitesi Sosyal ve Beşeri Bilimler İnsan Araştırmaları Etik Kurulu (SBİNAREK)'e yaptığınız 2023-08T kayıt numaralı başvurunuz 20.11.2023 tarih ve 2023/09 sayılı kurul toplantısında incelenmiş ve projenize etik onay verilmesi uygun bulunmuştur.

Bu karar tüm üyelerin toplantıya on-line olarak katılımıyla ve oybirliği ile alınmıştır. Onay mektubu tüm üyeler adına Komisyon Başkanı tarafından e-imzalanmıştır. Bilgilerinizi rica ederiz.

Saygılarımızla,

Dr. Öğr. Üyesi Işıl ERDUYAN
Kurul Başkanı

Bu belge, güvenli elektronik imza ile imzalanmıştır.

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