

PEDAGOGICAL MODELS FOR INTEGRATING SOCIAL-EMOTIONAL LEARNING INTO STEAM EDUCATION FOR PRIMARY SCHOOL STUDENTS

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Abstract. The article examines the integration of social-emotional learning (SEL) into STEAM education for primary school students. Through theoretical and applied analysis, it outlines the main pedagogical aspects of the STEAM approach, the mechanisms of interaction between SEL and STEAM, and the implications for teaching practice and the school environment. The focus is placed on three key mechanisms - collaborative activity, experiential learning through inquiry and experimental tasks, and systematic reflection. Empirical data from international and Bulgarian studies indicate that the integrated approach enhances students' social skills, emotional resilience, motivation for learning, and ability to collaborate. The article emphasizes the importance of intentionally designing STEAM tasks with explicitly embedded SEL goals and offers guidelines for primary school teachers for effective pedagogical practice.

Keywords: social-emotional learning (SEL), STEAM education, primary school, project-based learning, pedagogical models.

ПЕДАГОГИЧЕСКИ МОДЕЛИ ЗА ИНТЕГРАЦИЯ НА СОЦИАЛНО-ЕМОЦИОНАЛНОТО УЧЕНЕ В STEAM ОБУЧЕНИЕТО НА УЧЕНИЦИ В НАЧАЛНА УЧИЛИЩНА ВЪЗРАСТ

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Резюме. Статията разглежда интеграцията на социално-емоционалното учене (SEL) в STEAM обучението на ученици в начална училищна възраст. Чрез теоретико-приложен анализ се очертават основните педагогически аспекти на STEAM подхода, механизмите на взаимодействие между SEL и STEAM и последици за учителската практика и училищната среда. Акцент е поставен върху три ключови механизма - съвместна дейност, практическо преживяване чрез опитно-експериментални задачи и системна рефлексия. Емпирични данни от международни и български изследвания показват, че интегрираният подход повишава социалните умения, емоционалната устойчивост, мотивацията за учене и способността за сътрудничество сред учениците. Статията подчертава значението на целенасочено проектиране на STEAM задачи с изрично включени SEL цели и предлага насоки за учителите в началния етап за ефективна педагогическа практика.

Ключови думи: социално-емоционално учене (SEL), STEAM обучение, начално училище, проектно базирано учене, педагогически модели.

INTRODUCTION

The contemporary educational landscape faces a complex reality characterized by rapid technological changes, global interdependence, and a constant need for innovation. These conditions require educational institutions to develop in students not only academic knowledge but also skills related to emotional intelligence, collaboration, and creativity. This necessity has led to the growing adoption of the concept of **Social and Emotional Learning (SEL)** in educational practice.

SEL represents a systematic approach to developing competencies such as self-awareness, self-regulation, social awareness, relationship skills, and responsible decision-making (Weissberg et al., 2015). Numerous studies show that implementing SEL in schools improves academic outcomes, increases motivation for learning, and reduces anxiety and aggression among students (Durlak et al., 2011).

Results from **the International Social and Emotional Skills Study (OECD SSES, 2023)**, conducted also in Bulgaria, confirm that social-emotional competencies are directly linked to school climate, academic achievement, and students' sense of well-being¹. Data indicate that Bulgarian students with higher levels of stress resilience, emotional control, and achievement motivation demonstrate better performance in academic subjects and more positive relationships at school². These findings highlight the need to integrate SEL as a structural element of the learning process starting from **primary education**, when the foundations of social and cognitive skills are being established.

At the same time, the **STEAM approach** (Science, Technology, Engineering, Arts, and Mathematics) has become a key pedagogical framework focused on interdisciplinary, project-based, and creative learning. It fosters critical thinking, research skills, and innovative behavior through hands-on problem-solving and collaboration (Yakman & Lee, 2012). In this sense, STEAM is not only a method for teaching science and technology but also a means of developing higher-order competencies such as communication, empathy, teamwork, and self-assessment. These core skills inherently align with the goals of social-emotional learning (Kim et al., 2020).

In recent years, there has been a growing body of research focusing on the **synergy between SEL and STEAM** (Barger et al., 2021; Daugherty, 2020; Uzunova, 2022). The practical nature of STEAM projects - combining design thinking, teamwork, creative problem-solving, and presentation skills - creates a natural context for developing social-emotional competencies such as empathy, responsibility, and communication (DeJarnette, 2018). When students work on projects that require inquiry, collaboration, and reflection, they not only acquire scientific principles but also build emotional resilience and social sensitivity. These very qualities prepare children for life and learning within the context of **Education 5.0**.

In the Bulgarian educational context, the integration of SEL and STEAM holds particular significance in the **primary education stage**, when the foundations of motivation and attitudes toward learning are formed. As highlighted in the **National Analytical Report of SEL Bulgaria (2024)**, it is precisely during early childhood that emotional habits and behavioral patterns are established - factors that determine future academic and social success³. Therefore, combining social-emotional learning with the interdisciplinary potential

¹ Lachezar Tsotsorkov Foundation. (2022). Final Report under the SEL Program 2020–2022.

² SEL Bulgaria. (2024). Summary of the results from the OECD Study on Social and Emotional Skills (SSES 2023). Retrieved from <https://sel.bg>

³ SEL Bulgaria, 2024

of STEAM can ensure a **holistic approach to personal development**, uniting cognitive, emotional, and social learning within a single educational framework.

The present article aims to analyze the **theoretical foundations** and **pedagogical models** for integrating social-emotional learning into **STEAM-based education** for primary school students and to outline the **practical implications** of this approach for teaching practice. The study seeks to answer the question: **Which pedagogical models and strategies are effective for integrating SEL into STEAM education in ways that support the holistic development of primary school students?**

THEORETICAL FOUNDATIONS OF SOCIAL AND EMOTIONAL LEARNING AND STEAM EDUCATION

The integration of Social and Emotional Learning into STEAM education is grounded in shared pedagogical principles that emphasize active, collaborative, and meaningful learning. To provide a solid theoretical basis for this approach, it is necessary to analyze the key concepts that define the contemporary understanding of SEL and STEAM, as well as the mechanisms through which they complement each other in the process of primary education.

1. The Importance of Social and Emotional Learning for Students in Primary Education

Social and Emotional Learning is defined as a systematic and intentional process through which children and young people develop five core competencies - self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (CASEL, 2023). These competencies are an integral part of the holistic development of the individual and play a crucial role in shaping the skills required for the 21st century. As Durlak and colleagues emphasize, social and emotional skills are not a “soft supplement” to academic knowledge but rather the foundation for effective learning, social adaptation, and well-being (Durlak et al., 2011). According to their large-scale meta-analysis, which includes over 270,000 students, programs focused on SEL lead to significant improvements in academic performance (by an average of 11%), a reduction in problem behaviors, and increased emotional resilience among children.

In the context of primary education, when the first patterns of emotional regulation, social interaction, and self-assessment are being formed, SEL becomes even more essential. This stage is critical for developing self-control, empathy, and cooperation skills, which are fundamental prerequisites for future academic success and life satisfaction (Denham, 2018). Developmentally, children aged 6 to 10 begin to recognize their own emotions more accurately, respond appropriately to frustration, and regulate their behavior according to social norms. This means that schools must purposefully support social and emotional development by incorporating such activities into everyday learning and into the broader school culture.

In Bulgarian schools, the understanding of the importance of Social and Emotional Learning (SEL) as a factor in personal development and students’ successful learning motivation is increasingly gaining recognition. As V. Uzunova notes, SEL should be regarded not merely as a set of skills but as a new pedagogical paradigm that requires a change in how the learning environment is constructed (Uzunova, 2020). The author emphasizes the importance of teacher modeling, the development of reflective mechanisms in classroom practice, and the creation of a school climate that supports emotional safety and interpersonal respect. In this context, SEL implies a systematic and integrated methodology,

in which social and emotional objectives are woven into the content of various subjects rather than treated as separate activities.

The findings from the national Social and Emotional Education Program (SEO) and the mapping of initiatives in Bulgarian schools support these conclusions. Data published by the Lachezar Tsotsorkov Foundation and SEL Bulgaria show that implementing SEL interventions in early and primary education leads to improvements in the school climate, a reduction in students' behavioral issues that hinder effective learning, and increased resilience in stressful situations. Moreover, schools that apply a systemic SEL approach report higher levels of student engagement and better cooperation between teachers and parents.

Over the past decade, Israel has emerged as one of the active countries in implementing SEL in primary education, where it is viewed not only as support for academic progress but also as a tool for social cohesion and intercultural understanding. Empirical studies indicate that brief, targeted SEL interventions (e.g., three-session programs during physical education classes) result in statistically significant improvements in emotional regulation, empathy, and teamwork among students in grades 4–6 (Sindiani, Schroeder, Dunsky, 2025). Similar outcomes have been observed in programs aimed at fostering forgiveness and interpersonal understanding between Jewish and Arab children, which demonstrate reductions in aggressive behavior and increased social sensitivity (Cohen, Bar-Tal, 2024).

In a broader sense, the Israeli experience shows that integrating SEL into the educational process, including STEAM subjects and teacher preparation, can become a sustainable mechanism for developing a school culture of collaboration, respect, and personal responsibility.

In light of these studies, Social and Emotional Learning can be regarded as a fundamental element of quality education in primary school, contributing not only to academic achievement but also to the development of individuals capable of learning, adapting, and forming positive relationships in a rapidly changing world. This sets new requirements for schools and teachers: to develop an integrative pedagogical approach in which cognitive, social, and emotional development are considered interconnected dimensions of a single learning process.

2. Pedagogical Aspects of STEAM

STEAM (Science, Technology, Engineering, Arts, Mathematics) represents an interdisciplinary pedagogical framework that combines scientific and technical knowledge with the creative practices of the arts, aiming to stimulate problem-solving abilities, creativity, and critical thinking (Yakman & Lee, 2012). In the classroom, STEAM is implemented through project-based tasks, design thinking, and problem-oriented scenarios that engage students in formulating questions and hypotheses, planning experiments, prototyping, and presenting results (DeJarnette, 2018). Such an approach requires the teacher to organize the learning environment as a laboratory for thinking and creativity, where mistakes are considered part of the learning process and reflection is a systematic component of every project.

For the primary school stage, the application of STEAM involves adapting conceptually complex ideas through playful and hands-on activities - manipulative materials, storytelling, visual and plastic expressive means, and targeted micro-projects that align with the developmental characteristics of young learners (DeJarnette, 2018). Bulgarian studies and practical analyses in this area emphasize the teacher's role as a facilitator and the need for methodological design of STEAM activities so that they are accessible, meaningful, and

emotionally engaging for students (Aleksieva, 2024; Yordanova, 2024). In this context, V. Uzunova highlights the potential of integrating STEAM with elements of emotional experience. According to her, incorporating artistic practices and reflective rituals supports the development of emotional intelligence and communication skills from an early age (Uzunova, 2020).

The main pedagogical conclusions derived from theoretical and empirical findings are threefold: (1) STEAM activities provide an authentic context for practicing social skills; (2) through active participation in hands-on and experimental activities, students encounter emotional challenges, allowing targeted training of self-regulation; (3) systematic reflection transforms learned knowledge into conscious competencies and supports their transfer to different situations (Barger et al., 2021; Uzunova, 2020). From this, it follows that an effective STEAM approach in primary education is one that is designed and planned not only for scientific knowledge and creative expression but also for emotional and social learning. This is precisely what makes the integration of STEAM activities with SEL natural and pedagogically appropriate.

3. Mechanisms of Interaction Between SEL and STEAM

The pedagogical literature identifies several key mechanisms through which STEAM environments naturally support the development of students' social-emotional competencies. The first is **collaborative activity** - group project work requires continuous communication, role distribution, conflict resolution, and joint decision-making, which fosters social awareness, empathy, and skills for effective interaction (Barger et al., 2021; Uzunova, 2020).

The second mechanism is **active learning through action ("learning by doing")**. Hands-on and experimental activities allow students to experience both positive and challenging emotions in the context of learning. This creates a safe environment for practicing self-regulation, resilience, and frustration management (Durlak et al., 2011; SEL Bulgaria, 2024). In this sense, STEAM projects are not only a way to acquire scientific concepts but also an authentic framework in which children practice emotional regulation, motivation, and social skills.

The third mechanism is **reflection**, integrated throughout the design, execution, and assessment phases of projects. Through journals, presentations, discussions, review of results, error analysis, and sharing experiences, students develop metacognitive skills, self-awareness, and emotional awareness (Kim et al., 2020; Barger et al., 2021). This reflective practice supports the integration of SEL into STEAM by enabling students to process their learning and connect academic success with personal and social development.

Empirical research confirms the effectiveness of this approach. Students participating in integrated STEAM-SEL programs demonstrate higher cooperation skills, improved communication, increased motivation for learning, and greater tolerance for failure (Kim et al., 2020; Barger et al., 2021). In the Bulgarian context, reports from SEL Bulgaria (2024) and the Lachezar Tsotsorkov Foundation (2022) indicate that primary school students develop emotional resilience, conflict resolution skills, and positive interactions within the school community when social-emotional learning is combined with project-based and research activities.

From a pedagogical perspective, these results point to the need for **purposeful design of STEAM tasks with explicitly included SEL objectives**. These can be tasks that require empathetic design, sharing ideas in a team, joint reflection and evaluation of results, as well as critical discussion of peers' decisions (Daugherty, 2020; Uzunova, 2020). In this way, SEL and STEAM become complementary strategies in which academic achievement, social

competence, and emotional well-being develop simultaneously, making learning both complex and meaningful.

4. Implications for Primary School Teachers and School Practice

In the logical sequence of integrating social-emotional learning (SEL) with STEAM, specific demands are placed on teacher competencies. The teacher no longer serves solely as a knowledge provider but becomes a facilitator of social-emotional processes in the classroom. This includes modeling effective communication, posing targeted reflective questions, managing the learning climate in a controlled way, and actively supporting collaboration among students (Uzunova, 2020). Simultaneously, the teacher must organize STEAM activities with clearly defined scientific, creative, and practical objectives while ensuring the integration of SEL competencies, such as self-regulation, empathy, and teamwork skills (Barger et al., 2021).

From a practical perspective, this means that the learning process must be flexible, interactive, and project-oriented, allowing students to engage in active learning through experiments, discussions, and collaborative creative tasks. Research indicates that such approaches develop not only academic skills but also social competence, emotional resilience, and higher levels of motivation for learning (Kim et al., 2020; Durlak et al., 2011).

Programs by SEL Bulgaria and mapped practices in Bulgarian schools show that support from school leadership, teacher professional development systems, and adapted teaching materials are key factors for sustainable implementation of SEL and STEAM integration. Schools that provide regular internal and external professional training, coaching, and mentorship for teachers exhibit a higher rate of successfully integrated projects and an improved school climate.

Teachers also need to master assessment and feedback skills that encompass not only students' academic progress but also the development of social-emotional competencies. This includes observing teamwork, conflict-resolution skills, and self-regulation abilities. As Uzunova notes, the goal is to create an environment in which learning becomes meaningful, holistic, and oriented toward the personal development of each student, with knowledge acquisition occurring alongside the growth of emotional and social skills (Uzunova, 2020).

In addition to the personal and professional competencies of teachers, organizational conditions play an important role. The availability of adapted teaching materials, STEM/STEAM equipment, access to digital resources, and interdisciplinary connections enables teachers to implement innovative projects and encourage active student participation. International experience confirms that sustainable integration of SEL and STEAM requires a systemic approach, including teacher training, leadership support, coordination across subject areas, and appropriate structuring of project time⁴ (Barger et al., 2021).

Therefore, the implementation of an integrated SEL–STEAM approach necessitates comprehensive professional development for teachers, targeting both pedagogical skills and the emotional and social support of students. Only through such measures can a sustainable and innovative learning environment be created that fosters the holistic development of students.

⁴ UNICEF Bulgaria. (2023). Mapping social-emotional learning programmes in Bulgaria. <https://www.unicef.org/bulgaria>

PEDAGOGICAL MODELS FOR INTEGRATING SEL INTO STEAM

The integration of social-emotional learning (SEL) into STEAM education requires a deliberately structured pedagogical approach that combines academic knowledge, creative processes, and the development of emotional and social competencies. Several effective models have emerged in the pedagogical literature and practice that can be applied in primary education.

1. Project-Based Learning Model with a Focus on SEL

Project-Based Learning (PBL) is considered a natural framework for integrating SEL into STEAM (Barger et al., 2021). In this model, students work on projects that require collaboration, role distribution, planning, and evaluation of outcomes. To incorporate SEL competencies, projects include structured elements such as:

- **Team roles and responsibilities** that develop social awareness and interaction skills.
- **Reflective sessions** where students discuss how they managed their emotions and responded to challenges.
- **Communication activities** that foster empathy and constructive feedback.

2. Design Thinking Model with an Emotional Component

Design Thinking offers a structured problem-solving process that includes empathy, problem definition, idea generation, prototyping, and testing (Daugherty, 2020). SEL integration occurs through **empathic design**, where students analyze the needs of others, discuss the emotional consequences of decisions, and learn to consider the social context.

In practice, this can be implemented through:

- **Emotional journals**, where students describe their experiences during the project.
- **Group discussions** about conflicts and decisions, which develop self-regulation and social competence.
- **Prototype presentations with feedback**, which stimulate critical thinking and empathy toward the audience.

3. Integration through Micro-Projects and Playful Scenarios

For younger students, a suitable approach is the model of micro-projects and playful scenarios, which combines STEAM activities with games, role-play situations, and short projects (Kim et al., 2020). In this model, social-emotional learning is included through:

- **Role-playing games** that develop collaboration and conflict-resolution skills.
- **Micro-experiments**, which allow students to safely experience success and failure, fostering resilience and self-regulation.
- **Short reflective sessions**, including discussions of emotional responses and social interactions within the group.

Implementation of this model in Bulgarian schools shows that even brief STEAM activities can support SEL development, creating conditions for a positive school climate and motivated participation of all students.

4. Methodological Conclusions

From the practical and theoretical framework, several key guidelines for applying the pedagogical models can be derived:

- **Clearly defined objectives** – each STEAM activity should have both scientific and SEL goals.
- **Structured reflective moments** – systematic assessment of social and emotional competencies, as well as academic outcomes.
- **Flexible group organization** – alternating between individual work, pair work, and group work to foster social skills development.

- **Integration of artistic elements** – visual, musical, or dramatic activities that stimulate creativity and emotional expression.
- **Support from the school system** – adequate resources, teacher professional development, and administrative support are prerequisites for the sustainability of the models (Uzunova, 2020).

By following these models, primary school teachers can create an integrated learning environment in which SEL competencies develop naturally through STEAM tasks, enabling students to acquire not only academic knowledge but also social and emotional skills.

CONCLUSIONS

Based on the presented theoretical concepts and pedagogical models for integrating social and emotional learning (SEL) into STEAM, the following conclusions can be drawn:

1. Strategic significance of SEL integration

The integration of SEL into STEAM education is not merely a methodological innovation, but a strategic approach to developing students who are both personally and socially competent. Analysis of theoretical and applied models shows that early primary education provides the most favorable conditions for cultivating skills such as collaboration, self-regulation, empathy, and critical thinking. These competencies support not only the acquisition of knowledge but also form the foundation for personal development and effective engagement in learning and social adaptation throughout life (Dimitrova, 2024).

2. STEAM as an authentic learning environment

The STEAM approach offers an authentic context for developing these skills, as it combines cognitive, emotional, and practical experiences. Through project-based and inquiry-driven activities, children not only acquire knowledge but also learn to work in teams, cope with mistakes, think creatively, and evaluate their own progress. These experiences have a lasting impact on building confidence, resilience, and intrinsic motivation.

3. Implications for primary school teaching practice

The integration of SEL and STEAM introduces new requirements for the professional role of the primary school teacher. The teacher becomes a facilitator of social and emotional processes, creates a safe and supportive environment for experimentation, and encourages reflection as part of every learning activity. Effective implementation of this approach requires both methodological preparation and organizational support from school teams and professional development systems for educators.

In conclusion, integrating SEL into STEAM-based education represents a new model of educational culture, shifting the focus from mere knowledge acquisition to the development of students who can think critically, collaborate, and adapt to a dynamically changing world. For primary education, this entails the deliberate combination of knowledge, emotion, and action - the three pillars of meaningful learning in the 21st century.

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