Blending STEM and SEL for immersive learning

Lada Stavroula
Teacher, MEd, MPsy, PhD Candidate

How one can **connect STEM** (science, technology, engineering, and mathematics) education with the aspects of **Social-Emotional Learning** (SEL).

SEL is seen as the process by virtue of which learners gain mastery over emotions, they are able to communicate and share feelings of empathy, maintain the positive relationships with others and be responsible for their behavior.

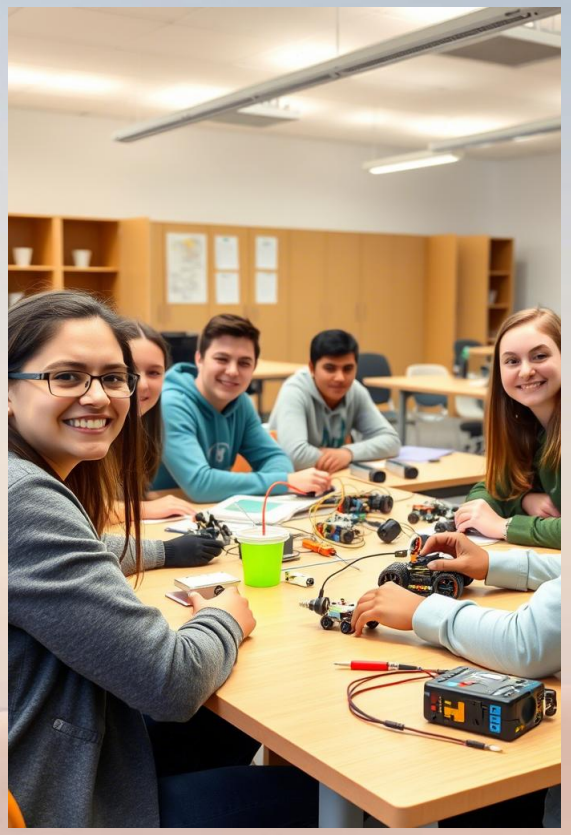
Through the study, it is under review **how SEL gets incorporated in STEM educational programs** and what are the methods of interaction that help to create a learning environment that encourages cooperation and collaboration.

1. Introduction

- In STEM education the disciplines of Science, Technology, Engineering and Mathematics are related both in teaching and learning process.
- In teaching process, the students develop relative skills, like problem-solving, critical thinking, logical thinking and technology literature.
- STEM literacy has been proved important during the last two decades. According to the OECD Learning Framework 2030, apart from the knowledge gained by the 4 disciplines of STEM, students develop cognitive and metacognitive skills , social and emotional capacities and physical and practical skills, like coding and manipulation.
- Objectivity, cooperation, and responsibility are only some of the values acquired by STEM instruction.

1. Introduction

- Literature review and practice in education have indicated that social, emotional, and cognitive development are all connected and have a **significant impact in school performance** as well as in **life skills** (Jones, McGarrah, & Kahn, 2019).
- Social and emotional learning (SEL) has become a mix of developmental and applied sciences. During the past years, SEL is a **key aspect in education** in elementary schools, because it promotes the development of **skills and competences**, which are essential in life (Jones, Barnes, Bailey, & Doolittle, 2017).
- Students who own SEL skills **improve their relationships** with others, excel in studies, and accomplish professional goals and enhanced **well-being** as mature individuals.
- The combination of SEL in STEM education improves pupils' scholastic and personal **growth and progress**. Both teaching and learning approaches augment the levels of values, attitudes and skills.
- The incorporation of SEL in STEM education tend to have **positive effects** among children with the greatest number of risks and needs, involving students from disadvantaged backgrounds or those who start school lagging behind their peers in academic or behavioral aspects (Jones, Brown, & Aber, 2011).



2. Theoretical Framework

- SEL is a mechanism through which students improve their ability to combine thinking, feeling, and behaving to accomplish important life functions.
- Efficiency in SEL leads to recognize and manage ones emotions, form healthy relationships, define positive aims, meet personal and social needs, and make accountable and moral decisions (Elias et al., 1997; Payton et al., 2000).
- Education thrives in a social setting. This fundamental premise is elaborated in the SEL conceptual framework (Zins & Elias, 2007).
- SEL initiatives concentrate on growing social-emotional competence in the context of a safe, caring, and efficient school and classroom context.
- In case SEL and STEAM are combined in educational practice, the outcomes can be more than improved in several areas.

2. Theoretical Framework

- Kim and Kim (2016) state that the integration of SEL in STEAM education leads students to obtain cognitive abilities in subjects (understanding and using convergent knowledge). They acquire advanced thinking ability, like creativity, problem-solving ability, critical thinking ability, ability to use information, and decision-making ability.
- The students achieve the ability of contributing to the community (ability to communicate, ability to engage in social relationships, and ability to cooperate), and attaining individual emotional ability like self-respect, positive emotion, consideration, and civil awareness (Perales, & Aróstegui, 2021).
- Within these details, STEM education is sustained by the SEL elements of self-awareness, self-management, social-awareness, relationship skills and responsible decision-making.
- Besdies, features a schematic connection between SEL and STEM education (Maslyk, 2023). In the left column, skills developed by SEL are displayed, including self-awareness, self-management, relationships, responsible decision-making and social awareness (Panayiotou et al., 2019; Elmi, 2020).

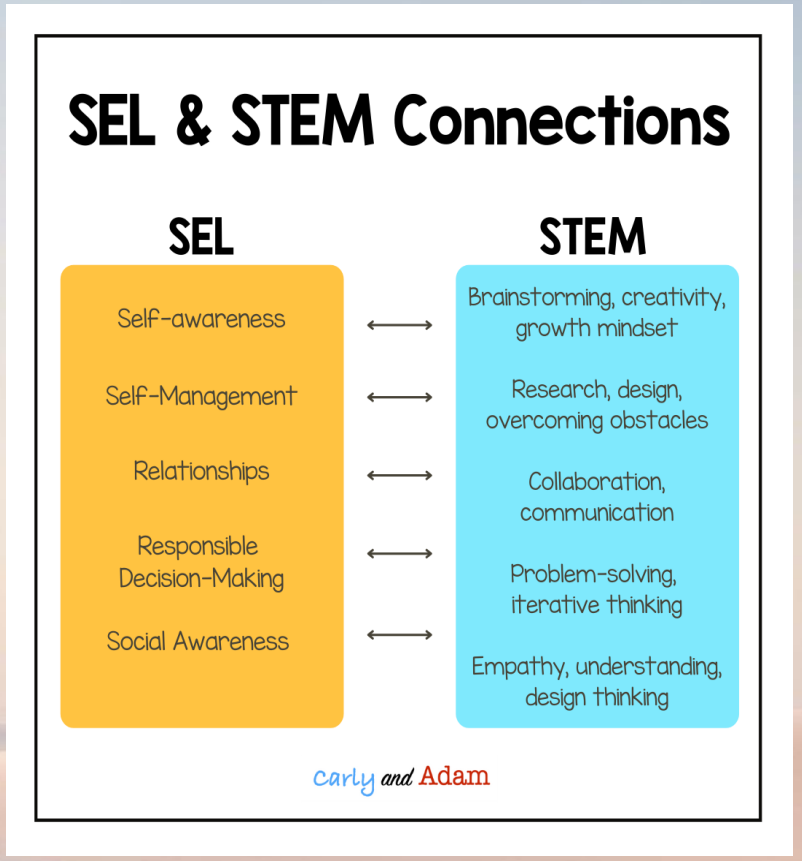


Figure 1. SEL & STEM connections (Maslyk, 2023)

3. Case Studies and Examples

- The research of Garner et al. (2017) proved the positive outcomes of infusing emotional principles into early STEM learning. According to the article, STEM education is suitable for teaching understanding and social awareness and other emotion-associated skills.
- The ratings of the STEAM and social emotional components of the interventions and the feedback of educators and students revealed that integrating the arts and social emotional learning material into science education developed a holistic STEM-related curriculum that exhibits the ability of improving students' engagement and their acknowledgment for science and its implementations.
- In the research of Elmi (2020), SEL strategies assisted the students to develop skills linked to cognitive development. The children were encouraged and motivated to concentrate more, to enhance their relationships, and increase their confidence and improvement.

3. Case Studies and Examples

- For Ozkan and Kettler (2022), the effects of social and emotional development in STEM education on the academic achievements of gifted students were more than encouraging.
- According to an action research, Ingram et al. (2021) reported the successful integration of SEL in a science classroom. The impact of the STEM and SEL curriculum intervention in one hundred pupils between 12-14 years old had positive outcomes both in intra- and inter-person skills, as well as in academic performance.
- By analyzing the relationship between SEL and STEM, Peterson (2018) in his research in early childhood, explored how STEM based curriculum combined with the SEL model can upgrade learning.

4. Challenges and Solutions

- STEM subjects usually give priority in technical skills , but leave limited time and opportunities for the integration of SEL competences, like self-awareness and empathy.
- Another challenge is the resistance of educators who sometimes show hesitation in adopting SEL practices, because of the fear of detraction from subject specific aims and due to lack of training in SEL approaches.
- An additional hurdle is the measurement of SEL outcomes.
- While STEM concepts are easy to quantify, SEL skills are more difficult to measure and the intervention cannot be assessed with ease.

However, there are strategies to overcome the potential challenges of combining STEM and SEL practices.

- First of all, targeted training sessions for educators provide a solid foundation for the implementation of SEL in STEM framework with the support of interdisciplinary workshops.
- Collaborative projects encourage communication and teamwork, and enhance SEL practices. SEL-focused conversations at the time of problem-solving activities promote empathy and critical thinking.
- Moreover, the development of measurable criteria of SEL within STEM assessment, like journals and peer review processes, offer solutions in blending SEL and STEM techniques.
- Finally, applying technological resources advocate the incorporation of SEL concepts into STEM tasks.

5. Future Directions

- An engaging aspect of blending SEL and STEM education is the integration of Arts in STEM (STEAM), an approach that fosters empathy and creativity skills along with STEM subjects.
- In addition, Artificial Intelligence tools are capable of creating a personalized learning environment, where SEL and STEM tasks coexist harmoniously, with beneficial impacts.
- Furthermore, educational directives, such as Project-Based-Learning and Gamification, that involves game-like elements, promote teamwork and resilience and enhance students' reasoning and decision-making competencies.
- Finally, community-based STEM framework, like teaming up with local agencies to develop STEM initiatives, focus on social topics and encourage mutual understanding skills and responsible citizenship.

6. Conclusion

- STEM disciplines demand more than technical competences.
- They demand collaboration, creativity, communication, self-awareness, and critical thinking—all of which are nurtured through SEL.
- Social-emotional learning can assist school cultures enhancement and soft skill development with the connection of students' academic efforts with their emotions and feelings.
- SEL plays a crucial role in the development of students' fundamental interpersonal skills, allowing them to work efficiently in STEM groups, where communication, problem-solving, and teamwork are indispensable.
- In addition, SEL educates pupils self-awareness, self-regulation, efficient communication and healthy relationships.
- Critical thinking and problem-solving skills are improved, and students tackle more effectively with real-world STEM issues. This kind of emotion-centered instruction also assist students deal with STEM projects with a human-centered perspective. This mindset is significant when producing outcomes which have social and environmental effects.

6. Conclusion

- The goal of education is to let the students get ready for success in life.
- The acknowledgment of the links between SEL and STEM, a more holistic learning framework can be developed.
- A framework that promotes academic proficiency as well as emotional intelligence, resilience, and interpersonal skills.
- By Intertwining SEL and STEM in school, students are empowered to Grow into balanced humans who are prepared to progress in both academic and personal field.
- By incorporating SEL, supervisors and educators can equip students with the required resources to succeed in their professional and personal lives, eventually producing a more engaged and motivated group of learners.
- The future workforce requests human resources with not only STEM skills, but also emotional intelligence, empathy and collaboration competences.

References

Aróstegui, J. L. (2019). Evaluation, educational policy reforms, and their implications for arts education. Arts Education Policy Review, 120(3), 121–125. https://doi.or g/10.1080/10632913.2018.1532368

Dalton, M. (2016). Stronger together: The reality of Humanities curriculum in a STEM focused era (Honor thesis). Eastern Kenctucky University. https://encompass. eku.edu/cgi/viewcontent.cgi?article=1373&context=honors_theses

Elmi, C. (2017). Integrating Social Emotional Learning Strategies in Higher Education. Eur. J. Investig. Health Psychol. Educ. 2020, 10(3), 848-858; https://doi.org/10.3390/ejihpe10030061

Garner, P.W., Gabitova, N., Gupta, A. et al. Innovations in science education: infusing social emotional principles into early STEM learning. Cult Stud of Sci Educ 13, 889–903 (2018). https://doi.org/10.1007/s11422-017-9826-0

Ingram, E., Reddick, K., Honaker, J.M., & Pearson, G.A. (2021). Making Space for Social and Emotional Learning in Science Education. Frontiers in Education, 17 August 2021 Sec. Educational Psychology, Volume 6 - 2021 | https://doi.org/10.3389/feduc.2021.712720

Jones, S. M., Brown, J. L., & Aber, J. L. (2011). The longitudinal impact of a universal school-based social-emotional and literacy intervention: An experiment in translational developmental research. Child Development, 82(2), 533–554. doi:10.1111/j.1467-8624.2010.01560.x

Jones, S.M., Barnes, S.P., Bailey, R., & Doolittle, E.J. (2017). Promoting Social and Emotional Competencies in Elementary School. The Future of Children 27(1), 49-72. https://dx.doi.org/10.1353/foc.2017.0003.

Jones, S. M., McGarrah, M. W., & Kahn, J. (2019). Social and Emotional Learning: A Principled Science of Human Development in Context. Educational Psychologist, 54(3), 129–143. https://doi.org/10.1080/00461520.2019.1625776

Maslyk, J. (2023). How Does STEM Connect with Social-*Emotional Learning (SEL)?* Carly & Adam. https://carlyandadam.com/thecarlyandadam/stem-and-sel-important-connections-for-student-development

References

OECD (2018). The future of education and skills: Education 2030. Paris: OECD.

Ozkan, F. & Kettler, T. (2022). Effects of STEM education on the academic success and social-emotional development of gifted students. *Journal of Gifted Education and Creativity*, 9(2), 143-163, June 2022 e-ISSN: 2149- 1410

Panayiotou, M., Humphrey, N. & Wigelsworth, M. (2019). An empirical basis for linking social and emotional learning to academic performance. *Contemporary Educational Psychology*, Volume 56, p.p.193-204, ISSN 0361-476X, https://doi.org/10.1016/j.cedpsych.2019.01.009.

Perales, F. J., & Aróstegui, J. L. (2021). The STEAM approach: Implementation and educational, social and economic consequences . *Arts Education Policy Review*, *125*(2), 59–67. https://doi.org/10.1080/10632913.2021.1974997

Peterson, Aaron (2018) "Connecting STEM Curriculum with Social Emotional Learning in Early Childhood," Undergraduate Research Journal: Vol. 22 , Article 5.

Zins, J & Elias, M. (2007). Social and Emotional Learning: Promoting the Development of All Students. JOURNAL OF EDUCATIONAL AND PSYCHOLOGICAL CONSULTATION. 17. 233-255. 10.1080/10474410701413152.

Images created with AI

Thank you for your attention!