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# Understanding the Role of STEM in Promoting Social and Emotional Learning: A Study of Teacher Awareness in Jordan

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**ABSTRACT:** This study assessed Jordanian public-school teachers perceived awareness of how integrated STEM pedagogy can support students' social and emotional learning (SEL) competencies and examined whether this awareness differs by teacher characteristics (gender, specialization, teaching experience, grade level taught, and school location). A researcher-developed 24-item questionnaire aligned to the five CASEL competencies was administered online using a non-probability snowball approach (N = 114 valid responses). Internal consistency was acceptable (Cronbach's alpha = 0.863). Descriptive statistics indicated uniformly high perceived awareness across items (overall M = 4.96/6), suggesting strong perceived alignment between STEM practices (for example, inquiry, design thinking, collaboration, and reflection) and SEL principles. One-way ANOVA indicated no statistically significant differences by gender, specialization, grade level, or school location; a significant omnibus difference emerged across teaching-experience groups ($p = 0.018$; $\eta^2 = 0.087$), with the highest mean observed among teachers with less than five years of experience. Given the restricted variance (ceiling tendency) and non-probability sampling, results are interpreted as exploratory evidence of perceived awareness rather than demonstrated effectiveness or student outcomes. Implications are discussed for professional development that explicitly connects STEM instructional design to SEL competencies.

**Keywords**: STEM, social and emotional learning (SEL), teacher perceived awareness, integrated pedagogy, Jordan.

## I. INTRODUCTION

CASEL coined the phrase Social and Emotional Learning (SEL) around 26 years prior. Since that time, educators have been utilizing this idea and testing methods to incorporate it into classrooms and cultivate these abilities in learners. With the broadening of this term's definition, CASEL has recognized the importance of refining it and specifying the best steps for its implementation in the educational process. Consequently, CASEL [1] definition characterizes social emotional learning as a blend of education and human development, which enables individuals, both young and adult, to utilize their acquired knowledge, skills, and attitudes to cultivate a healthy human identity including the ability to manage emotions, achieve personal and collective goals, show empathy for others, establish and manage healthy supportive relationships, and make sound and responsible decisions [2]. SEL supports educational equity and excellence by fostering authentic partnerships among families, schools, and communities and by creating collaborative, trusting learning environments [2, 3].

In this study, SEL is conceptualized as a psychosocial and developmental approach that helps learners apply knowledge, skills, and attitudes to manage emotions, pursue goals, show empathy, build supportive

relationships, and make responsible decisions [2]. Accordingly, SEL is treated as a set of competencies that can be intentionally fostered through classroom pedagogy, including integrated STEM practices that emphasize inquiry, collaboration, reflection, and ethical decision-making [4, 5]. Reports from various global organizations focused on fostering academic social and emotional learning include [6, 7]. The reports show that social and emotional learning significantly contributes to enhancing collaboration, tolerance, and the social and emotional growth of students, as well as fostering citizenship behaviors, ethical values, academic learning, and motivation for success.

Numerous studies have confirmed that social and emotional learning fosters learners' sense of self-worth, empathy, and competence in taking responsibility and facing daily challenges. It also promotes the establishment of positive and meaningful relationships with individuals and groups, increases academic achievement, and reduces negative behaviors [3, 4, 7, 8]. While some believe that school learning is unrelated to emotions or the social environment, neuroscience demonstrates the opposite. This is explained by the interconnectedness of emotional centers in the brain with the neural centers responsible for cognitive learning. This means that when a child is preoccupied with problems and attempts to learn, the learning process is hindered. Researchers have also found that social and emotional learning plays a major role in the development of a child's personality and how he interacts and communicates with others, in addition to how he develops his attitudes and values towards development and change in his skills and abilities, and his progress in his professional and personal [2, 9].

Social and emotional learning helps bridge the gap between high- and low-achieving learners by providing all learners with the skills necessary to succeed in both academic and life contexts, thereby contributing positively to their academic achievement and enhancing social effectiveness among learners and other educational stakeholders. Integrating social and emotional learning into the curriculum makes learners more capable of dealing with the problems they face, whether on a personal or social level, in addition to increasing positive academic outcomes [2, 4, 8]. There are many reasons why social and emotional learning is important for a child's development [2, 5, 10].

The first reason relates to academic performance. Children work hard to focus on schoolwork, and they must feel comfortable and happy to perform to the best of their abilities. Emotionally stable children have fewer behavioral problems and are more likely to remain academically engaged [11]. The second reason students need social and emotional learning is to enhance their overall quality of life and well-being. When students are clearly taught social and emotional skills, they grow into adults capable of managing life's challenges and stressful situations. The third reason for the importance of early social and emotional learning is future careers success in the workforce. Adults frequently face challenges in the workplace, and the ability to manage problems and conflicts is essential for all adults. Learning these skills at an early age is crucial. Children who are empathetic, self-aware, and communicative grow up to be empathetic, self-aware, and communicative adults.

When social-emotional learning serves as the primary framework for a school district or educational institution, the results are beneficial and comprehensive, with the combined programs exceeding the individual contributions. People possessing robust social and emotional abilities are more prepared to tackle everyday obstacles and achieve success academically, professionally, and socially, through efficient problem-solving, self-discipline, and emotional regulation and management. Social and emotional learning establishes the groundwork for beneficial, enduring results for individuals of all ages and communities. It involves cultivating self-awareness, self-regulation, and social skills, which are essential for achievement in education, employment, and daily life [2, 4, 8].

Despite the growing international emphasis on integrating STEM instruction with whole-child and competency-based agendas, empirical evidence from Arab educational systems remains limited regarding teachers' preparedness to intentionally leverage STEM pedagogy to cultivate SEL competencies. In the Jordanian context, STEM-related professional development has expanded, yet little is known about teachers perceived awareness of how specific STEM practices map onto the five SEL competencies (self-awareness, self-management, social awareness, relationship skills, and responsible decision-making). Accordingly, this study contributes (a) a contextually grounded instrument aligned to the [6] framework and (b) baseline evidence on teachers perceived awareness patterns across key demographic and professional variables, while recognizing that awareness does not in itself constitute evidence of impact on student outcomes.

The importance of this study stems from the significance of its topic, which is of interest to educators, policymakers, associations, and international institutions that support teaching and learning practices in an effort to achieve a balance in building students' social and emotional personalities, by raising awareness among all stakeholders, such as students, teachers, and parents, focusing on the role of teachers in employing teaching strategies and interactive activities that align with the principles of social and emotional learning. Hence, this

research was conducted to identify the level of teachers' awareness regarding STEM's role in promoting social and emotional learning among students. It is hoped that the results will provide recommendations for stakeholders in the educational system teachers, supervisors, policymakers, principals, and parents, thereby enhancing the development of students as the core of the learning process.

Social and emotional learning is a significant aspect of psychosocial support that educators can incorporate to promote students' psychological and social well-being. Studies have demonstrated the value of social and emotional learning in fostering students' self-esteem and empathy, their ability to manage responsibilities and navigate everyday difficulties, and their capacity to build positive relationships. It also increases academic achievement and reduces negative behaviors [9].

Students, teachers, and even parents often ask, "What is social and emotional learning in the classroom?" and "Why is social and emotional learning important in schools?" The answer lies in its ability to promote holistic development. It provides essential "social tools" necessary for success, not only in school, but also in the workplace and personal life. In education, SEL is a fundamental component of students' overall development. Many researchers [4, 9, 12] argue that it helps them develop essential skills such as:

- Self-management: Regulating one's actions through self-motivation, self-control, and goal setting.
- Social awareness: Understanding others' perspectives, demonstrating respect, and appreciating diversity.
- Relationship skills: Forming and maintaining healthy relationships through open communication, active listening, trust, cooperation, and problem-solving.
- Responsible decision-making: Making constructive and thoughtful choices, considering cause and effect, outcomes, and the impact on others.

These skills benefit both students and teachers, as they contribute to creating a more positive and productive learning environment. Research consistently shows that young people who participate in social and emotional learning programs demonstrate improvements in their academic performance, behavior, and attitudes toward school [4, 5, 13]. These benefits extend into the long term, including improved relationships, mental health and increased academic achievement. Teachers can integrate social and emotional learning into the daily classroom environment through a range of methods and activities, including the most important of which are [3, 4, 5, 10]:

- Reading aloud in SEL: Teachers read books that highlight SEL topics, sparking discussions and fostering empathy.
- Social and emotional learning activities: Role-playing scenarios or group projects help students practice interpersonal skills in a supportive environment.
- Social stories in education: Narratives that depict social situations help students understand and navigate emotions and interactions. Effective across ages, from children learning basic cues to teens navigating peer relationships.
- Anti-bullying programs: Essential for addressing bullying behavior and promoting a positive school culture.
- Peer pressure and decision-making: Providing strategies for dealing with peer pressure and improving decision-making skills empowers children to make positive choices.
- Daily living skills and transitions: Social stories can help learners manage transitions and unexpected events and develop daily living skills.
- Relationships and social situations: Guidance on Healthy relationships and social competence helps students deal with these aspects of life more effectively.

An analysis of these practices shows that they are highly embedded in the STEM approach. This approach emphasizes the integration of knowledge across disciplines. Achieving integration requires understanding the relationships among different scientific fields. The STEM approach is also based on several strategies, including inquiry-based learning, problem solving, design thinking, project-based learning, brainstorming, all of which involve questioning and developing students' ability to identify cause and effect, observe, and identify the characteristics of objects [13, 14].

Considering the above, it is important to ask about the role of teaching practices in promoting social and emotional learning. Does adopting a STEM teaching approach based on collaborative work, problem-solving, inquiry-based learning, and engineering and technological design enhance student learning and promote social and emotional balance? This descriptive study was conducted to assess teachers' awareness of the role of STEM in promoting social and emotional learning among students by answering the following questions:

- To what extent do teachers recognize the role of STEM in promoting social and emotional learning?
- Does the level of teachers' awareness of the role of STEM in promoting social and emotional learning differ according to certain variables (gender, specialization, experience, grade level taught, and school location)?

## II. RELATED WORK

Recent international scholarship has increasingly examined how technology-enabled STEM learning environments can be designed to support both cognitive outcomes and broader competencies, including SEL-related dispositions. For example, studies on teachers' perspectives in digitally mediated STEM contexts highlight the importance of teacher preparedness and pedagogical design when integrating emerging tools (for example, generative AI and adaptive gamification) into inquiry-oriented science learning [15, 16]. These global trends underscore the need for context-specific evidence on teachers' awareness and readiness to connect STEM practices with SEL competencies, particularly in systems where STEM reforms and professional development are rapidly expanding.

Murphy [17] pointed out that the connection between modern social and emotional learning (SEL) and its present use can be traced back to John Dewey's educational principles. This philosophy has influenced educational methods, including those implemented in STEM disciplines (science, technology, engineering, and mathematics), no matter what the level of impact. As a result, the rise of SEL in education is anticipated, since it corresponds with and merges with current STEM learning experiences. Each element of social-emotional learning is integrated into the essential skills, attitudes, behaviors, and values of STEM education. For example, we recognize the importance of developing learning experiences that help young people establish an identity connected to these fields, nurture a sense of self-efficacy, enhance self-confidence, and promote a growth mindset a STEM-focused view on self-awareness. Self-management in STEM is evident when students decide how to approach failure students should view failure as an opportunity to learn and a steppingstone for developing new solutions to engineering problems or inventive experimental designs to tackle scientific questions.

Bhavna [18] discovered that SEL is vital for promoting active engagement and profound conceptual grasp in STEM education. Incorporating artificial intelligence (AI) with SEL can boost student involvement and foster a more inclusive atmosphere in STEM education. It has also been validated that combining AI with SEL approaches not only addresses varied learning requirements but also fosters equity, allowing every student to thrive in STEM disciplines. Additionally, by utilizing AI tools that align with SEL competencies, teachers can develop tailored learning experiences that cater to the emotional and academic requirements of each student, thus improving overall educational results. This method emphasizes the significance of joint initiatives among teachers, decision-makers, and tech specialists to guarantee successful application and fair access to AI-supported SEL approaches in STEM learning. Barshay [19] emphasized that STEM fields require a range of skills, including collaboration, creativity, communication, and critical thinking, all elements fostered by social and emotional learning. Studies show that STEM contributes to a better school culture and the development of interpersonal skills by connecting students' academic work to their feelings and emotions. STEM helps students develop essential interpersonal skills, enabling them to work effectively in STEM teams, where communication, problem-solving, and teamwork is crucial. It also teaches students how to manage stress, persevere in the face of challenges, and think critically about complex problems, essential skills for addressing real-world STEM issues. This type of emotion-focused learning also helps students approach STEM projects from a human-centered perspective. Pratheesh and Francis [20] conducted a study to examine the relationship between SEL, academic outcomes, and teacher support during classroom interactions. The study highlighted that SEL is essential for developing children's skills in building relationships, communicating effectively, making decisions, strengthening self-esteem, and improving behavior. It also emphasized SEL's role in narrowing the achievement gap between students with learning difficulties and their peers. Furthermore, the findings indicated that teachers could enhance student learning by fostering positive classroom interactions and integrating SEL into the regular curriculum.

In the same context, Rocha [10] found that SEL positively influences students' academic achievement and social behavior, while also reducing disciplinary issues, substance use, and mental health challenges. Although she highlighted numerous successful SEL programs implemented worldwide, Rocha stressed the urgent need to integrate these practices into Arab schools. She further recommended measures such as specialized teacher training, ongoing assessment, structured feedback systems, and active parental involvement, all of which can contribute significantly to preparing young people to become educated and engaged global citizens. Stannett [21] examined the link between the development of social and emotional skills and students' academic success, finding that these skills also contribute positively to mental and behavioral well-being. The study further proposed approaches and strategies for key stakeholders including teachers, educators, parents, and policymakers to support the development of students' social and emotional competencies. Notably, the results revealed that ten-year-old students demonstrated higher levels of social and emotional skills compared to fifteen-year-olds.

The research conducted by Matari et al. [22] investigated the social and emotional learning skills of teachers in second-cycle basic education institutions in the Sultanate of Oman following the COVID-19 pandemic. The

researchers employed a descriptive method, gathering data via a questionnaire from the Collaborative for Academic, Social, and Emotional Learning [6]. This included five competencies and 43 indicators: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The group included 380 educators (both male and female). The study's findings indicated that teachers' social and emotional learning competencies were high overall, with an average score of 2.95 (74%). Notable gender disparities in social awareness existed, benefitting female educators, yet there were no statistically significant variations in the extent of social and emotional learning competencies among teachers related to their years of service. Musleh [23] aimed to examine the effectiveness of a training program based on SEL skills in promoting psychological resilience and positive thinking among Palestinian university students. The population included 375 students enrolled in the second semester of the 2021/2022 academic year at Dar al-Kalima University. A mixed-method design was employed, combining an experimental quantitative method with qualitative focus groups. The results confirmed the effectiveness of the training program in promoting psychological resilience and positive thinking among the students. Sharma and Singh [24] believe that teachers play a fundamental role in shaping students' knowledge and skills. Therefore, STEM (science, technology, engineering, and mathematics) teachers must provide appropriate learning strategies to help students understand the STEM curriculum. They should also explore various interactive teaching methods to enhance academic achievement and higher order thinking skills.

Although educators are crucial in executing a cohesive strategy for interdisciplinary teaching and learning, significant focus has been placed on the elements shaping teachers' perspectives. The research by Papagiannopoulou and Iliopoulos [25] seeks to deliver empirical evidence illustrating the substantial influence of teachers' preparedness on forecasting attitudes by creating a conceptual framework that investigates the elements influencing individuals' perspectives on teaching STEM subjects. The research centered on self-efficacy, dedication, cognitive preparedness, emotional preparedness, and teaching perspectives. A total of 494 Greek primary and secondary school teachers took part electronically in the survey, answering the Trieste and TASET scales. The findings demonstrated a favorable relationship between all six factors. Significantly, overall perceptions of teaching have a positive impact, both directly and indirectly, on the four readiness factors and, in the end, on teachers' views regarding STEM education.

## III. MATERIAL AND METHOD

To achieve the study objectives, a descriptive analytical approach was adopted, using descriptive statistics such as arithmetic means, standard deviations, and the categories of each item of the study instrument. Inferential statistics were then applied using a one-way ANOVA test.

### *1. STUDY POPULATION AND SAMPLE*

The target population comprised teachers working in Jordanian public schools during the 2024/2025 academic year. The most recent official statistics available indicate that Ministry of Education schools employed approximately 97,128 teachers in 2023/2024 -Jordan Department of Statistics, 2024, based on Ministry of Education data-, suggesting a large national population relative to the current sample. The questionnaire was developed in Google Forms and piloted for clarity prior to dissemination. Following approval procedures aligned with the Jordanian Ministry of Education, the survey link was circulated through approved teacher WhatsApp groups using a snowball technique to reach teachers across governorates. A total of 114 complete and usable responses were obtained and treated as the final analytic sample (Table 1).

Because the survey was distributed via forwarding within WhatsApp networks, the exact number of teachers who received the invitation could not be determined; therefore, a response rate could not be computed. This non-probability sampling approach is appropriate for exploratory descriptive work but introduces self-selection and network bias; consequently, findings should not be interpreted as nationally representative estimates for all Jordanian teachers.

Ethical and consent procedures: The first page of the online questionnaire included an information statement outlining the study purpose, voluntary nature of participation, confidentiality, and contact details. Proceeding with the survey constituted informed consent. No personally identifying information (for example, names, phone numbers, school identifiers) was collected, and responses were stored on a password-protected account accessible only to the researcher. Participants could discontinue at any time without penalty.

**Table 1.** Description of the study sample by variables.

| Independent Variables | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Gender | M | 27 | 23.7 | 23.7 | 23.7 |
| | F | 87 | 76.3 | 76.3 | 100.0 |
| | Total | 114 | 100.0 | 100.0 | |
| Specialization | Science and ICT | 59 | 51.8 | 51.8 | 51.8 |
| | Social, humanity, and linguistics | 55 | 48.2 | 48.2 | 100.0 |
| | Total | 114 | 100.0 | 100.0 | |
| Experience (Years) | More than 15 | 37 | 32.5 | 32.5 | 32.5 |
| | 10 - 15 | 21 | 18.4 | 18.4 | 50.9 |
| | 5 - 10 | 22 | 19.3 | 19.3 | 70.2 |
| | Less than 5 | 34 | 29.8 | 29.8 | 100.0 |
| | Total | 114 | 100.0 | 100.0 | |
| The stage at which the teacher teaches | Grade (11-12) | 35 | 30.7 | 30.7 | 30.7 |
| | Grade (8-10) | 39 | 34.2 | 34.2 | 64.9 |
| | Grade (4-7) | 30 | 26.3 | 26.3 | 91.2 |
| | Cycle1 | 10 | 8.8 | 8.8 | 100.0 |
| | Total | 114 | 100.0 | 100.0 | |
| School location | City | 53 | 46.5 | 46.5 | 46.5 |
| | Village | 58 | 50.9 | 50.9 | 97.4 |
| | Badia | 3 | 2.6 | 2.6 | 100.0 |
| | Total | 114 | 100.0 | 100.0 | |

Table 1 shows that the study sample included 114 teachers. of whom 87 were female (76.3%) and 27 were male (23.7%), distributed across scientific and technological disciplines (51.8%) and social sciences, humanities, and linguistics disciplines (48.2%). As for the number of years of experience of the teachers, it was divided into four levels: the first level (1-5 years) included 34 out of 114 teachers, representing 29.8%; the second level (5-10 years) included 19.3%; the third level (10-15 years) with 18.4%; and the fourth level included teachers with more than 15 years of experience (32.5%). Since the study focuses on social and emotional learning it was important to consider the grade level taught. Accordingly, the number of teachers teaching in cycle one was 10 teachers out of 114, with 8.8%, while the number of teachers teaching grades 4 – 7 was 30, with 26.3%. The number of teachers in the upper elementary grades (8-10) was the highest among all categories, with 39 teachers, 34.2%. Finally, 30.7% of respondents taught in secondary school (grades 11–12). Because facilities and infrastructure may vary depending on the geographical location of the school, the researcher focused on this variable. The number of teachers who responded to the instrument and worked in schools located within cities was 53, representing 46.5%, while the percentage of teachers working in schools located in villages was slightly higher, 50.9%.

## *2. RESEARCH INSTRUMENT*

The researcher reviewed theoretical literature and previous studies related to social and emotional learning and the STEM approach. After identifying the key aspects most relevant to this study, he constructed an instrument based on a six-point Likert scale (strongly agree = 6; agree = 5; somewhat agree = 4; somewhat disagree = 3; disagree = 2; strongly disagree = 1) for positively worded items, with the scoring reversed for negatively worded items. This approach, analyzed using SPSS, was chosen over the traditional five-point scale to prevent respondents from selecting a neutral midpoint and to enhance the accuracy and reliability of the findings. The initial version of the instrument included 27 items designed to assess teachers' awareness of the role of STEM teaching in enhancing social and emotional learning.

Validity of the instrument: To ensure validity, the initial version of the instrument (27 items) was reviewed by five experts: two faculty members (from Yarmouk University and the University of Jordan), an educational supervisor, a student guardian, and a science teacher. Based on their feedback, three items were deleted, and several were amended and rewarded when more than half of the experts agreed on the revisions. The final version consisted of 24 items.

Instrument alignment with SEL competencies: To strengthen construct clarity, the 24 items were designed to reflect the five core SEL competencies articulated by [6] (self-awareness, self-management, social awareness, relationship skills, and responsible decision-making). Items were written to operationalize these competencies through concrete STEM classroom practices (e.g., inquiry cycles, engineering design thinking, collaborative problem-solving, communication, reflection, and ethical reasoning). For transparency, the items can be conceptually grouped as follows: self-awareness/self-management (Items 1–12), social awareness (Items 13–18), relationship skills (Items 19–22), and responsible decision-making (Items 23–24). Although Likert-type responses are ordinal, the use of a six-point scale with multiple items and approximately symmetric distributions supports treating composite and item means as approximately interval for descriptive reporting and one-way ANOVA, which is generally robust under these conditions. Nevertheless, results are interpreted cautiously as perceptions of awareness rather than objectively observed practice [26, 27].

Instrument reliability: Cronbach's alpha coefficient was calculated to assess the reliability of the study instrument, yielding a value of 0.863. This level is considered appropriate for data collection in the humanities and social sciences [28, 29] The grade of items was classified according to the following equation [30, 31]:

$$(Maximum - Minimum) for\ tool\ grading / Number\ of\ ranks = (6 - 1)/3 = 1.67 \quad (1)$$

Thus, the classification of items is as follows (1-2.67: low, 2.68 – 4.35: medium, and 4.36 – 6: high).

## IV. DATA ANALYSIS

Prior to inferential analyses, distributional properties of the composite awareness score were examined. Skewness and kurtosis values were close to zero, indicating an approximately normal distribution at the scale level. Given the use of independent groups and comparable standard deviations across categories (Table 3), one-way ANOVA was deemed appropriate and is considered reasonably robust for Likert-type composite scores in applied educational research [27].

To answer the first research question "To what extent do teachers recognize the role of STEM in promoting social and emotional learning?" the researcher calculated the arithmetic means and standard deviations for the twenty-four items of the instrument, based on responses from 114 teachers. The results are presented in Table 2.

**Table 2**. Arithmetic means, standard deviations, and classification of teachers' awareness regarding stem's role in promoting social and emotional learning (n = 114).

| No | Items | Mean | SD | Category |
|---|---|---|---|---|
| 1 | The STEM approach provides the knowledge, skills, and values that help students better understand themselves and the social world around them. | 5.1053 | .74511 | H |
| 2 | The STEM approach provides a safe space to learn about feelings and make decisions freely, free from judgment or pressure. | 5.0877 | .72333 | H |
| 3 | The STEM approach provides engaging teaching methods and activities that reinforce and deeply explore social and emotional learning concepts, such as emotions, the knowledge triangle, interpretation bias, inner speech, mindfulness, and emotion management. | 5.0175 | .80905 | H |
| 4 | The STEM approach transforms the cognitive content into an engaging learning experience, as the activities included in the lesson target a concept of "social and emotional learning" within an exciting plot that arouses the student's interest and invites him to interact. | 5.0263 | .83571 | H |

| | | | | |
|---|---|---|---|---|
| 5 | The STEM approach encourages learning through experience, encouraging students to think and answer questions that fulfil the concepts of social and emotional learning. | 4.9737 | .84624 | H |
| 6 | The STEM approach provides interactive activities by offering fun and engaging exercises that deepen students' understanding of social and emotional learning concepts. | 5.0789 | .90373 | H |
| 7 | The STEM approach employs a variety of assessments (diagnostic, formative, summative) using tools that consider the concepts of social and emotional learning. | 5.0702 | .72526 | H |
| 8 | The STEM approach promotes awareness of students' feelings and personalities, while demonstrating a sense of personal responsibility. | 5.0088 | .81464 | H |
| 9 | The STEM approach provides teaching activities and events that enhance students' development of self-awareness skills with the goal of recognizing individual strengths, which helps them express their thoughts and feelings clearly. | 4.9737 | .82506 | H |
| 10 | The STEM approach offers activities, experiences, and learning opportunities that foster self-management skills and resilience, enabling students to regulate their emotions and behaviours and succeed in both school and life. | 4.9386 | .82317 | H |
| 11 | The STEM approach develops students' emotional and behavioural management by fostering coping strategies (such as calming down, distancing, asking for help, or mediating), promoting integrity and honesty, and strengthening their capacity to set and achieve goals. | 4.9386 | .86511 | H |
| 12 | The STEM approach enhances students' ability to manage themselves and focus on studying, control their stress during exams, persevere in learning, and face difficulties. | 4.9123 | .89800 | H |
| 13 | The STEM approach aims to enhance students' ability to empathize with others, understand their feelings and perspectives, and recognize social norms. | 4.9035 | .83050 | H |
| 14 | Learning through a STEM approach develops students' social awareness skills necessary to establish and maintain positive relationships. | 4.8947 | .85568 | H |
| 15 | Adopting a STEM approach to education enhances students' awareness of others' feelings and perspectives. | 4.9298 | .80616 | H |
| 16 | Employing a STEM approach in education demonstrates students' ability to be considerate of others and their desire to contribute to the health of their school and community. | 4.8421 | .81555 | H |
| 17 | Students learn through a STEM approach that enhances their awareness of local, regional, and global cultural issues. | 4.8246 | .91444 | H |
| 18 | The STEM approach encourages understanding science and the issues raised in courses from different perspectives and | 4.8421 | .90797 | H |

| | | | | |
|---|---|---|---|---|
| | communicating effectively with others during discussions and dialogues. | | | |
| 19 | Learning through a STEM approach helps students communicate effectively, work as a team, and resolve conflicts peacefully. | 4.9737 | .80332 | H |
| 20 | The STEM approach encourages students to demonstrate the soft and solid skills necessary to form and maintain positive relationships. | 4.9386 | .87528 | H |
| 21 | STEM learning promotes the development of positive relationships and helps students build the skills needed to prevent and resolve interpersonal conflicts effectively. | 4.9386 | .86511 | H |
| 22 | STEM learning enables students to work together on projects, discuss ideas, and provide support to each other. | 4.9737 | .83571 | H |
| 23 | Learning with a STEM approach helps students make safe, ethical, and socially responsible decisions and take responsibility for their choices. | 4.9035 | .83050 | H |
| 24 | STEM-based learning helps students solve problems at school, at home, and in the community. | 4.8860 | .86994 | H |
| Overall | Overall | 4.9576 | 0.659 | H |

The results in Table 2 indicate that the overall average score for teachers' awareness of the role of STEM in promoting social and emotional learning falls within the high category. Seven of the twenty-four items (30%) scored above 5 on the 6-point Likert scale, while the remaining 17 items (70%) scored above 4.85. These findings demonstrate teachers' strong awareness of STEM's contribution to supporting social and emotional learning (SEL), as well as their understanding of SEL principles more broadly.

Interpretive note: The uniformly high ratings and narrow spread in item means suggest a ceiling tendency, which may reflect genuinely positive perceptions but can also limit variance and reduce the ability to detect differences across groups. Accordingly, the item-level ranking is discussed cautiously, emphasizing patterns of perceived alignment (e.g., safety, emotional decision-making, collaboration) rather than treating high scores as proof of implementation fidelity or impact on students' SEL outcomes.

The first item achieved the highest mean score (M = 5.11, SD = 0.75), reflecting teachers' recognition that STEM provides knowledge, skills, and values that help students better understand themselves and the social world around them. The second item ranked next (M = 5.09, SD = 0.72), highlighting STEM's role in creating a safe environment for learning about emotions and making decisions free from judgment or pressure. The sixth and seventh items followed closely (M = 5.08; M = 5.07), indicating that teachers value the way STEM incorporates interactive and engaging activities that deepen students' understanding of SEL concepts.

It employs various assessments (diagnostic, formative, and summative) that incorporate SEL concepts. The overall results and the mean scores of the individual items indicate a clear high level of teacher awareness of SEL principles and how STEM can be used to reinforce them. This, in turn, promotes better learning outcomes and supports the balanced development of students across cognitive, social, psychological, and emotional dimensions.

To address the second research question: "Does the level of teachers' awareness of the role of STEM in promoting social and emotional learning differ according to certain variables (gender, specialization, experience, grade level taught, and school location)?". The researcher calculated the arithmetic means and standard deviations for the independent variables. The results are presented in Table 3.

**Table 3**. Means and standard deviations (sd) for teachers' awareness of the role of stem in promoting social and emotional learning according to certain variables.

| Independent Variables | | N | Mean | SD | Std. Error | 95% Confidence Interval for Mean | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| Gender | M | 27 | 5.154 | .6565 | .1263 | 4.895 | 5.414 |
| | F | 87 | 4.897 | .6510 | .0698 | 4.758 | 5.035 |
| | Total | 114 | 4.958 | .6587 | .0617 | 4.835 | 5.080 |
| Specialization | Science and ICT | 59 | 5.019 | .7062 | .0919 | 4.835 | 5.203 |
| | Social, humanity, and linguistics | 55 | 4.892 | .6031 | .0813 | 4.729 | 5.055 |
| | Total | 114 | 4.958 | .6587 | .0617 | 4.835 | 5.080 |
| Experience (Years) | More than 15 | 37 | 4.811 | .7227 | .1188 | 4.570 | 5.052 |
| | 10 - 15 | 21 | 4.732 | .6406 | .1398 | 4.441 | 5.024 |
| | 5 – 10 | 22 | 5.017 | .4980 | .1062 | 4.796 | 5.238 |
| | Less than 5 | 34 | 5.218 | .6168 | .1058 | 5.003 | 5.433 |
| | Total | 114 | 4.958 | .6587 | .0617 | 4.835 | 5.080 |
| The stage at which the teacher teaches | Grade (11-12) | 35 | 4.918 | .7994 | .1351 | 4.643 | 5.193 |
| | Grade (8-10) | 39 | 5.024 | .6173 | .0989 | 4.823 | 5.224 |
| | Grade (4-7) | 30 | 4.864 | .5970 | .1090 | 4.641 | 5.087 |
| | Cycle1 | 10 | 5.121 | .4381 | .1385 | 4.807 | 5.434 |
| | Total | 114 | 4.958 | .6587 | .0617 | 4.835 | 5.080 |
| School location | City | 53 | 4.938 | .6695 | .0920 | 4.753 | 5.122 |
| | Village | 58 | 4.938 | .6490 | .0852 | 4.767 | 5.108 |
| | Badia | 3 | 5.694 | .1339 | .0773 | 5.362 | 6.027 |
| | Total | 114 | 4.958 | .6587 | .0617 | 4.8354 | 5.080 |

Table 3 presents the arithmetic means and standard deviations of teachers' awareness of the role of STEM in promoting social and emotional learning across selected variables. A small mean difference (0.03) found between males (M = 5.15, SD = 0.66) and females (M = 4.90, SD = 0.65), favoring males. Similarly, there was a mean difference of 0.13 between science/ICT teachers (M = 5.02, SD = 0.71) and teachers of literary, humanities, and language subjects (M = 4.89, SD = 0.60). Regarding years of experience, awareness levels varied: teachers with less than five years of experience had the highest mean (M = 5.22), while those with 10–15 years had the lowest (M = 4.73). Teachers with more than 15 years of experience reported a mean of 4.81. When comparing grade levels, teachers of cycle one (grades 1–3) showed the highest awareness (M = 5.12, SD = 0.44), followed by upper elementary teachers (grades 8–10) with M = 5.02. Teachers of lower elementary grades (4–7) had the lowest mean (M = 4.86). Finally, awareness levels were nearly identical for teachers in cities (M = 4.94) and rural areas (M = 4.94), indicating a negligible descriptive difference. Teachers in desert (Badia) schools reported a slightly higher mean (M = 5.25); however, this subgroup was very small (n = 3). Accordingly, any location-related patterns involving Badia schools should be interpreted with substantial caution, and conclusions are based primarily on the larger city and rural groups.

The results show clear differences in the arithmetic means of teachers' awareness of the role of STEM in promoting social and emotional learning across all independent variables. To assess the statistical significance of these differences, the researcher conducted a one-way ANOVA. The results are presented in Table 4.

**Table 4**. ANOV a results for teachers' awareness of the role of stem in promoting social and emotional learning across selected variables.

| Independent Variables | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Gender | Between Groups | 1.369 | 1 | 1.369 | 3.218 | .076 |
| | Within Groups | 47.655 | 112 | .425 | | |
| | Total | 49.024 | 113 | | | |
| Specialization | Between Groups | .462 | 1 | .462 | 1.066 | .304 |
| | Within Groups | 48.562 | 112 | .434 | | |
| | Total | 49.024 | 113 | | | |
| Experience (Years) | Between Groups | 4.250 | 3 | 1.417 | 3.481 | .018 |
| | Within Groups | 44.774 | 110 | .407 | | |
| | Total | 49.024 | 113 | | | |
| The stage at which the teacher teaches | Between Groups | .755 | 3 | .252 | .573 | .634 |
| | Within Groups | 48.270 | 110 | .439 | | |
| | Total | 49.024 | 113 | | | |
| School location | Between Groups | 1.673 | 2 | .836 | 1.961 | .146 |
| | Within Groups | 47.351 | 111 | .427 | | |
| | Total | 49.024 | 113 | | | |

The results in Table 4 indicate no statistically significant differences in teachers' awareness of the role of STEM in promoting social and emotional learning across most study variables - gender ($p = 0.076$), specialization ($p = 0.304$), grade level taught ($p = 0.634$), and school location ($p = 0.146$) - since all p-values are greater than 0.05. However, teaching experience yielded a statistically significant omnibus difference, $F(3, 110) = 3.475$, $p = 0.018$, with a small-to-moderate effect ($\eta^2 = 0.087$). Although the highest mean was observed among teachers with less than five years of experience (Table 3), post-hoc pairwise comparisons were not conducted; therefore, the result is interpreted as evidence of overall variation across experience groups rather than a confirmed difference between specific pairs.

The results of the current study are consistent with those of several previous studies [10, 17-23], which emphasized the importance of promoting social and emotional learning competencies and the central role of teachers in achieving this. In addition, the results are consistent with the several studies aimed at investigating how the STEM approach and social-emotional learning support each other and the role this plays in enhancing student learning and increasing their motivation to learn. The results of this study are also consistent with the studies of many studies like [24, 25] which aimed to examine the importance of awareness among teachers and students in employing diverse teaching methods that promote social-emotional learning, especially the STEM approach, which enhances all STEM competencies. However, the findings of the present study diverge from those of [22] concerning teachers' awareness of social and emotional learning principles in relation to teaching experience

## V. CONCLUSION AND RECOMMENDATIONS

Teachers perceived awareness of the role of STEM in promoting social and emotional learning was uniformly high across the 24 items. This pattern suggests that respondents conceptually recognize multiple points of alignment between integrated STEM pedagogy and the five SEL competencies. Importantly, the current findings are based on self-reported awareness and therefore should not be interpreted as direct evidence of teachers enacted practice quality or of STEM-driven gains in students' SEL outcomes. Given the restricted variance in item means, the

discussion emphasizes plausible pedagogical mechanisms (for example, reflection, collaboration, inquiry, and ethical reasoning) rather than treating high scores as confirmatory proof. The scientific inquiry element of STEM further strengthens self-awareness by encouraging learners to ask questions about their environment [3, 12]. It promotes independent thinking, the planning and conducting of investigative experiments, the drawing of evidence-based conclusions, and the interpretation of results. This process fosters self-awareness, social awareness, and environmental consciousness. Moreover, the open discussions that typically follow inquiry-based activities encourage respect for diverse perspectives, constructive communication, and the appreciation of diverse perspectives [20, 21].

In addition, STEM adopts a problem-solving model rooted in design thinking, which supports and encourages social awareness, with empathy as its foundational pillar. The practices that embody the STEM approach emphasize collaborative work and effective communication at every stage, thereby enhancing social and emotional learning competencies particularly relationship skills grounded in open communication, active listening, trust, and constructive cooperation [22, 23]. Furthermore, the STEM approach promotes responsible decision-making, which involves making thoughtful and constructive choices by considering cause and effect, potential outcomes, and the impact on others. This is especially evident in the engineering and technology design processes within STEM. Here, team members collectively agree on a solution based on exploratory experiments and the application of the design-thinking model. This collaborative process ultimately produces a prototype that addresses the initial problem identified by the group [20, 23].

The consistently high awareness ratings may reflect the expanding professional development agenda in Jordan that has emphasized learner-centered pedagogy, integration of STEM practices, and whole-child competencies. At the same time, ceiling tendencies and social-desirability response are plausible in self-report surveys that ask about valued professional competencies. Accordingly, future research should triangulate teacher awareness with observational evidence (for example, lesson artifacts, classroom observation protocols) and student-level indicators to clarify whether and how perceived awareness translates into implementation and outcomes. In addition, SEL skills are considered essential life skills that should be integrated into teaching and learning practices, as they are closely linked to 21st-century skills [21, 22]. Within the STEM approach, the teacher is viewed as a facilitator and motivator of the learning process. They are responsible for planning and creating opportunities for students to engage with real-life issues drawn from their own contexts and environments. This process enables students to strengthen their SEL competencies.

The significant omnibus difference by teaching experience warrants cautious interpretation. A plausible explanation is that teachers entering the profession more recently may have had greater exposure to contemporary reforms emphasizing integrated STEM and competency-based learning, including explicit attention to SEL, within pre-service preparation and early-career professional development. However, because the study did not conduct post-hoc comparisons and relied on non-probability sampling, this interpretation remains tentative and should be examined in future studies using more rigorous sampling and mixed-method designs. Considering these findings, the study recommends the continued provision of support, resources, and professional development opportunities for teachers, educators, and educational leaders in implementing effective teaching practices that foster SEL competencies. It also highlights the importance of engaging parents in this process, in addition to encouraging further research on the effectiveness and impact of teaching methods that integrate SEL principles and competencies, particularly in strengthening self-confidence, decision-making, problem-solving, and effective communication. There are several limitations of this work:

- Geographical boundaries: The Hashemite Kingdom of Jordan, located in the Middle East.
- Human boundaries: A non-probability sampling of all teachers working in public schools in Jordan.
- Time boundaries: The second semester of the 2024/2025 academic year
- Circumstantial boundaries: The extent to which the instruments employed in the study demonstrate validity and reliability.

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## Author Contributions

Conceptualization, A.K.B. and A.A.-H.; methodology, Y.M.A.; software, S.M.A.-S.; validation, B.S.A. and S.M.A.-S.; formal analysis, A.K.B.; investigation, A.A.-H.; resources, S.M.A.-S.; data curation, Y.M.A.; writing—original draft preparation, A.K.B.; writing—review and editing, S.M.A.-S.; visualization, A.K.B. and Y.M.A.; supervision, A.A.-H.; project administration, B.S.A.; funding acquisition, B.S.A. and A.K.B.

## Conflicts of Interest

The authors declare no conflicts of interest.

## Data Availability Statement

Data is available from the authors upon request.

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