

Fostering technopedagogical and social-emotional competencies in teachers of gifted primary students

Deniz Görgülü ^{1*} 

¹ Selçuklu Science and Art Centre, TÜRKİYE

*Corresponding Author: drdenizgorgulu@gmail.com

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ABSTRACT

This study examined the effects of a technopedagogical professional development programme, implemented within a nationally funded project in Türkiye, on teachers supporting gifted primary students' social-emotional development. Using an embedded mixed-methods design with quantitative predominance, 30 classroom teachers selected via purposive sampling completed the Educational Technology Standards Self-Efficacy Scale (ETSSE) and the Social-Emotional Competence Teacher Rating Scale (SECTRS) pre- and post-programme, alongside thematically analysed End-of-Day Evaluation Forms. Paired-samples t-test and Wilcoxon signed-rank tests showed significant improvements across all ETSSE dimensions with large effect sizes, and across all SECTRS subscales with moderate-to-large effect sizes, except Student-Teacher Relationship. Thematic analysis identified five themes: heightened social-emotional awareness, technopedagogical tool experience, instructional design competence, enhanced professional self-efficacy, and collegial collaboration. These preliminary findings suggest that integrating technopedagogy with social-emotional learning in professional development can strengthen teacher competencies and pedagogical sensitivity in gifted education, though longitudinal, controlled studies are needed to confirm sustainability and generalisability.

Keywords: giftedness, mixed methods, social-emotional development, professional development, technopedagogy

INTRODUCTION

Gifted students consistently demonstrate superior performance relative to their peers within specific domains, reflecting a capacity that is increasingly recognized as transcending conventional intelligence quotient (IQ) metrics (Hamza et al., 2020; Worrell et al., 2019). Differentiating giftedness from high achievement, Gagné (1985) posited that exceptional natural abilities do not automatically translate into eminent accomplishments (Gagné, 2005; Jung et al., 2022). In contrast to static views of ability, contemporary paradigms conceptualize talent as a dynamic, evolving form of expertise cultivated through sustained interactions with environmental affordances (Kuo, 2022; Maker, 2021; Nolte, 2012; Subotnik & Jarvin, 2005).

Despite their strong academic profiles, gifted learners often exhibit unique and multifaceted social-emotional developmental trajectories. These patterns frequently manifest as heightened emotional intensity, psychological vulnerabilities, peer-relation challenges, and maladaptive perfectionism (Goksu et al., 2024; Noor, 2023; Rinn, 2021; Tasca et al., 2024). Silverman (1993) conceptualized these

socio-affective tensions through the lens of 'asynchronous development,' wherein intellectual maturation significantly outpaces emotional and social growth.

Targeted interventions—such as emotional education, specialized counseling, and structured opportunities for peer-level socialization—have been shown to enhance gifted students' social adjustment, self-worth, and leadership capabilities while mitigating the risks of social isolation and stigmatization (Casino-García et al., 2021a; Helali & Alwaely, 2025; Papadopoulos, 2020). Consequently, structured educational initiatives provide a crucial framework for systematic psychosocial support. In parallel, the integration of educational technology within such frameworks has garnered growing empirical interest for its capacity to concurrently support cognitive enrichment and social-emotional growth (Goldsworthy, 2002; Iaosanurak et al., 2016; Low & Van Ryzin, 2024; Sethi & Jain, 2024; Zagni et al., 2025).

Technopedagogical approaches, which synthesize pedagogically sound strategies with targeted digital tools, have demonstrated substantial efficacy in scaffolding students' social-emotional competencies (Wang, 2019; Zagni et al., 2025). In primary education, these approaches enable learners to conceptualize abstract socio-affective constructs

through interactive, experiential learning modalities (Khan et al., 2025). Nevertheless, the successful implementation of such frameworks fundamentally hinges on teacher professional competence; refining educators' technological and pedagogical repertoires equips them to respond more holistically to the cognitive, affective, and interpersonal needs of gifted learners (Brown, 2021; Topcu & Aktan, 2025). For instance, Cheung et al. (2022) found that specialized professional development for teachers of gifted students in Hong Kong yielded marked improvements in pedagogical knowledge, attitudes, and instructional strategies. Nonetheless, empirical inquiries that systematically integrate technopedagogy with social-emotional learning (SEL) within gifted education professional development remain scarce, particularly regarding their combined effects on multifaceted teacher competencies (Ayik & Gul, 2025).

To address this empirical gap, the present study introduces and evaluates a theoretically grounded professional development programme that merges a technopedagogical framework with a structured SEL curriculum for teachers of gifted students. The novelty of this study lies in its simultaneous intervention design, assessing the dual impact of technopedagogical and socio-emotional components on teacher competence within an integrated framework. While prior work by Ayik and Gul (2025) formulated and validated a technopedagogical framework (GTPACK) using augmented reality enrichment, their intervention focused exclusively on technopedagogical competencies, leaving teachers' social-emotional competencies and interpersonal classroom dynamics unaddressed. Similarly, while Cheung et al. (2022) reported favorable outcomes from gifted-education teacher training, their model lacked both an overarching technopedagogical foundation and validated instruments to assess social-emotional dimensions.

The present investigation bridges these gaps by concurrently fostering teachers' technopedagogical self-efficacy and social-emotional competence within a singular intervention, evaluated through an embedded mixed-methods design that pairs validated psychometric instruments with qualitative depth. To the best of the author's knowledge, this is among the first empirical studies in the gifted education literature to investigate such an integrated intervention. Beyond its theoretical contributions, this research provides an evidence-based model capable of informing policy formulations, curriculum design, and in-service teacher training initiatives in gifted education, particularly within the educational landscape of Türkiye.

LITERATURE REVIEW

Social-Emotional Learning in Gifted Education

Social-emotional learning (SEL) provides a foundational framework for fostering students' holistic development by cultivating the knowledge, skills, and attitudes essential for emotion regulation, constructive interpersonal relationships, and responsible decision-making (Green et al., 2021). Grounded in the Collaborative for Academic, Social, and Emotional Learning (CASEL) model, SEL encompasses five core interrelated competencies: self-awareness, self-

management, social awareness, relationship skills, and responsible decision-making (Cipriano et al., 2023; Corcoran et al., 2018; Zhao & Sang, 2025). Empirical evidence consistently demonstrates that CASEL-aligned interventions enhance students' socio-emotional skills, mitigate behavioural difficulties, and confer meaningful gains in academic performance (Durlak et al., 2011; Ha et al., 2025; Yang et al., 2019). While these positive outcomes are documented across general student populations, intentional SEL support is particularly critical for gifted learners, whose precocious cognitive capacities often diverge from their social-emotional maturation.

Research addressing the affective profiles of gifted students reveals a frequent paradox: heightened emotional sensitivity and self-awareness coexisting with distinct vulnerabilities in emotion regulation (Casino-García et al., 2021b; Goksu et al., 2024; Yudha et al., 2019). When left unaddressed, these socio-affective discrepancies can exacerbate risks of social alienation, internalising problems such as anxiety and depression, maladaptive perfectionism, and academic disengagement (Blaas, 2014; Helali & Alwaely, 2025). Accordingly, contemporary literature underscores the necessity of embedding structured SEL interventions within gifted education curricula to safeguard psychosocial well-being and foster balanced talent development (Elias et al., 2025; Szymanski, 2021; Zeidner & Matthews, 2017).

Crucially, the efficacy of school-based SEL initiatives relies on teachers' own socio-emotional competence, which directly shapes classroom climate, instructional quality, and student engagement (Jennings & Greenberg, 2009; Odak et al., 2023; Schonert-Reichl, 2017). In support of this link, empirical work with Turkish pre-service teachers has demonstrated a strong positive association between educators' socio-emotional competence and their emotional literacy (Esen Aygun & Alemdar, 2022). Consequently, advancing teachers' socio-emotional development is widely regarded as a fundamental prerequisite for the successful translation of SEL principles into classroom practice (Blewitt et al., 2020; Lozano-Peña et al., 2021). This imperative is especially pronounced in Türkiye, where SEL concepts have only recently been incorporated into the national curriculum without comprehensive, teacher-informed needs analyses (Alemdar & Asikcan, 2026)—highlighting an urgent need for targeted professional development initiatives tailored to gifted education contexts.

Technopedagogy and digital transformation

The rapid digital transformation of education has intensified the demand for educators to integrate digital tools into instructional practice in pedagogically grounded ways (Tondeur et al., 2017). This integrative capacity is widely conceptualized through the Technological Pedagogical Content Knowledge (TPACK) framework, which articulates the dynamic interplay among technological, pedagogical, and content-specific domains of knowledge (Koehler et al., 2013; Mishra & Koehler, 2006). Rather than framing digital tools as self-contained solutions, the framework underscores their deliberate alignment with curricular objectives, pedagogical strategies, and learner characteristics (Harris et al., 2009; Joshi, 2023; Yang et al., 2025).

Technology-enriched learning environments offer considerable potential for fostering both cognitive growth and social-emotional competencies. For instance, digital storytelling modalities have been shown to cultivate empathy, self-reflection, affective expression, communication, and peer collaboration (Khan et al., 2025; Sarica, 2023). Similarly, immersive technologies like augmented reality have demonstrated efficacy in stimulating learner curiosity, intrinsic motivation, and collaborative inquiry (Gómez-Ríos et al., 2023; Paredes-Velasco et al., 2023). Recent systematic reviews corroborate these findings, indicating that purposefully designed digital interventions can systematically support self-awareness, emotion regulation, social awareness, and relationship-building skills (Mukhemar et al., 2025; Sáez-Delgado et al., 2025).

Nevertheless, the pedagogical value of instructional technology depends heavily on the educator's capacity to orchestrate meaningful relational interactions. Digital tools cannot substitute for the interpersonal, human-centered foundations of social-emotional development; rather, optimal outcomes emerge when digital media are coupled with direct, relationship-focused pedagogy (Slovák & Fitzpatrick, 2015; Walker & Venker Weidenbenner, 2019). Technopedagogy, therefore, transcends procedural tool literacy, encompassing a synthesis of technological knowledge, pedagogical judgment, and responsiveness to learners' affective and social dimensions (McLay & Reyes Jr, 2024; Wang, 2019).

This synergistic approach holds particular significance for gifted education. Technology-mediated learning environments that deliberately incorporate SEL frameworks support gifted students in developing emotion regulation, empathy, and interpersonal skills while simultaneously stimulating higher-order cognition and creativity (Elias et al., 2025; González-Carrasco et al., 2018; Sidqia et al., 2024; Sternberg, 2024). Because realizing these dual benefits relies on teachers' capacity to synthesize technological, pedagogical, and socio-emotional competencies within their instructional practice, there is a clear imperative for professional development programmes that systematically target these domains in tandem (Tang & Pentón Herrera, 2025).

Research Purpose and Questions

Employing a mixed-methods design, this study investigated the effects of a professional development programme grounded in technopedagogical approaches on classroom teachers. Implemented under the TŪBİTAK 4005 Innovative Educational Practices Support Programme, the intervention was designed to equip teachers with competencies to support the social-emotional development of gifted primary school students. To guide this inquiry, the following research questions were formulated:

1. Is there a statistically significant difference in classroom teachers' technopedagogical self-efficacy levels between the pre-test and post-test assessments?
2. Is there a statistically significant difference in classroom teachers' competencies concerning the social-emotional development of gifted students before and after participating in the programme?
3. What are the participating teachers' qualitative experiences and perceptions regarding the integration of technopedagogy to support gifted students' social-emotional development?

METHOD

Research Design

This study adopted an embedded mixed-methods design in which the quantitative strand served as the primary framework, underpinned by a single-group pre-test–post-test quasi-experimental approach. Qualitative data—consisting of participants' reflective feedback gathered via End-of-Day Evaluation Forms—were embedded throughout the intervention to contextualize and enrich the quantitative results (Creswell & Plano Clark, 2024). This methodological integration facilitated a rigorous assessment of the programme's efficacy through validated outcome metrics while capturing nuanced contextual insights into teachers' lived experiences during the intervention.

Participants

The study sample comprised 30 classroom teachers selected through purposive sampling who participated on a voluntary basis, including 17 females (56.7%) and 13 males (43.3%). The majority of the participants ($n = 22$, 73.3%) served as classroom teachers in Science and Art Centres (BİLSEM/SACs), while the remaining participants ($n = 8$, 26.7%) were employed in mainstream primary schools. Total professional teaching experience ranged from 5 to 28 years ($M = 17.6$, $SD = 4.7$), with 43.3% ($n = 13$) reporting 16–20 years, 30.0% ($n = 9$) reporting 21 or more years, 23.3% ($n = 7$) reporting 11–15 years, and 3.3% ($n = 1$) reporting 6–10 years of service.

Programme Activities

Ethical approval for the study was granted by the Social and Humanities Scientific Research Ethics Committee of Necmettin Erbakan University (Decision No. 2024/909, Meeting No. 23, dated 13 December 2024), and official research permission was issued by the Ministry of National Education (Application No. MEB.TT.2025.022341.01, dated 28 March 2025). Following institutional approvals, the intervention was carried out between 30 June and 4 July 2025.

The professional development programme comprised 18 interactive workshops structured around five thematic modules. The curricular framework was grounded in the Technological Pedagogical Content Knowledge (TPACK) model, the core competencies of Social-Emotional Learning (SEL), and contemporary evidence-based practices in gifted education. The TPACK framework guided the synergistic integration of technological, pedagogical, and content knowledge, ensuring that digital tools were purposefully aligned with instructional objectives and the unique affective needs of gifted learners (Mishra & Koehler, 2006; Wang, 2019). **Table 1** outlines the thematic modules, corresponding sub-objectives, and workshop titles.

Table 1. Programme activities

Theme Group	Sub-objective	Workshop Titles
Core Social-Emotional Skills	To enable teachers to identify the core social-emotional characteristics of gifted students	Social-Emotional Skills Workshop; Socio-Emotional Characteristics of Gifted Students; Identifying Social-Emotional Characteristics of Gifted Students; Empathy Mapping
Family Engagement and Support Systems	To strengthen family-teacher collaboration and build social support systems	The Role of the Family in Supporting the Social-Emotional Development of Gifted Students; Strengthening Social, Affective, and Family Relationships Through Neighbourhood Collage
Technology and Digital Skills	To introduce digital tools that support social-emotional development through technopedagogical approaches	Digital Storytelling Workshop; Innovative and Interactive Learning Experiences with CoSpaces Edu; From Theory to Practice: Artificial Intelligence and Educational Applications; Gamifying Lesson Content with AI; The Role of Augmented Reality (AR) Technology; Telling Animation Through Animation
Creative Arts and Expression Methods	To support social-emotional development through art and creative expression	Comic Strip and Cartoon Making; Lives from Stories; STEAM Activities with Micro-Drama
Awareness and Personal Development	To enhance teachers' personal and professional awareness	Mindful Awareness in Managing the Learning Environment; I Am Moving: Strengthening My Socio-Emotional Side; Gamification Strategies for Teachers of Gifted Students

Each workshop was systematically designed using a standardized activity-planning template completed in advance by the respective workshop facilitator. This template detailed the instructional objectives, targeted competencies, required materials, pedagogical methods, and step-by-step implementation procedures, thereby ensuring structural consistency across the five thematic modules while affording facilitators pedagogical flexibility aligned with their domain expertise.

The intervention was delivered to the cohort of 30 teachers across five consecutive days (30 June–4 July 2025), structured into multiple 110-minute sessions per day. Although instructional foci varied, each workshop followed a consistent pedagogical trajectory: (a) an introductory phase establishing the theoretical and conceptual framing, (b) hands-on, application-oriented tasks utilizing designated digital platforms or pedagogical techniques, and (c) a closing reflection, debriefing, and collaborative sharing phase. For instance, during the CoSpaces EDU module, participants constructed interactive three-dimensional virtual environments via block-based coding and evaluated strategies for adapting these tasks to gifted learners. Similarly, in the digital storytelling module, teachers translated socio-affective case scenarios into digital narratives using platforms such as Toontastic 3D and StoryJumper.

A diverse repertoire of digital and embodied pedagogical modalities was integrated according to the learning goals of each session. These included gamification platforms (e.g., Kahoot, Quizizz), generative artificial intelligence tools (e.g., ChatGPT), digital storytelling and animation software (e.g., Toontastic 3D, StoryJumper, Canva, Adobe Character Animator), augmented and virtual reality environments (e.g., CoSpaces EDU, mobile AR applications), and digital comic-authoring tools (e.g., Pixton). These digital tools were paired with interactive, face-to-face instructional strategies, including case-based discussions, role-playing, creative drama, mindfulness exercises, and station-based learning rotations.

To maintain high intervention fidelity, all session plans underwent preliminary review by the project coordination team to ensure alignment with stated competencies and standardized procedural guidelines. In addition, participants completed an End-of-Day Evaluation Form following each day's sessions, enabling the research team to monitor instructional pacing, clarity, and task difficulty dynamically

and make necessary formative adjustments throughout the intervention.

Data Collection Instruments

Quantitative data were collected using two standardised self-report instruments. The Educational Technology Standards Self-Efficacy Scale (ETSSE; Simsek & Yazar, 2016), based on the ISTE educational technology standards, comprises 40 items across five dimensions—supporting student learning and creativity, designing digital-age learning experiences and assessments, modelling digital-age work and learning, promoting digital citizenship and responsibility, and professional growth and leadership—rated on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The original validation study demonstrated acceptable construct validity via confirmatory factor analysis and high internal consistency ($\alpha = .77-.87$ for subscales, .95 total) (Simsek & Yazar, 2016).

Although the ETSSE is grounded in the ISTE standards rather than the TPACK framework, its dimensions assess teachers' self-efficacy in applying technology within pedagogical and professional contexts, aligning well with the intervention's objectives (Joshi, 2023; Simsek & Yazar, 2016). Unlike traditional TPACK self-report instruments (e.g., Schmidt et al., 2009), which primarily measure perceived TPACK knowledge, the ETSSE evaluates standards-based professional practices—supporting student learning, digital citizenship, and professional leadership—all explicitly targeted in the training programme, and it has demonstrated strong psychometric properties among Turkish teachers.

The Social-Emotional Competence Teacher Rating Scale (SECTRS) is the Turkish adaptation by Sarisoy et al. (2021) of an instrument originally developed by Tom (2012), consisting of 25 items across four dimensions—student-teacher relationship, emotional regulation, interpersonal relationships, and social awareness—rated on a six-point Likert scale. The Turkish validation study confirmed the original four-factor structure via exploratory and confirmatory factor analyses, reporting acceptable model fit and satisfactory internal consistency ($\alpha = .889$ total; .703–.805 subscales) (Sarisoy et al., 2021).

For the qualitative component, an End-of-Day Evaluation Form was developed based on the professional development evaluation frameworks of Guskey (2000) and Desimone (2009), reviewed by experts in educational measurement, curriculum

Table 2. Wilcoxon signed-rank test results for ETSSE subscales and total score (N = 30)

Subscale / Scale	Pre M	Post M	Pre SD	Post SD	W	p	r
Supporting Student Learning and Creativity	39.3	43.5	6.09	2.19	41.5	< .001	-0.764
Designing Digital Age Learning Experiences and Assessments	41.0	48.4	7.46	2.92	24.5	< .001	-0.860
Modeling Digital Age Work and Learning	19.9	23.7	3.81	2.00	14.5	< .001	-0.911
Promoting Digital Citizenship and Responsibility	29.5	33.7	4.86	2.45	36.0	< .001	-0.795
Professional Growth and Leadership	38.0	43.7	6.63	2.72	38.0	< .001	-0.813
ETSSE Total	168.0	193.0	26.0	10.3	32.0	< .001	-0.853

Note. M = Mean; SD = Standard Deviation; W = Wilcoxon Statistic; r = Rank-Biserial Correlation.

Table 3. Comparison test results for SECTRS subscales and total score (N = 30)

Subscale / Scale	Pre M	Post M	Pre SD	Post SD	Test Stat.	p	Effect Size
Student-Teacher Relationship*	37.3	39.1	5.58	2.18	W = 126.0	.078	r = -0.382
Emotional Regulation**	26.5	28.9	4.65	2.58	t(29) = -2.95	.006	d = -0.538
Interpersonal Relationships*	31.2	33.4	5.24	2.44	W = 126.0	.048	r = -0.421
Social Awareness*	31.8	34.7	5.58	1.88	W = 62.0	.004	r = -0.647
SECTRS Total*	127.0	136.0	19.2	6.88	W = 106.0	.009	r = -0.546

Note. M = Mean; SD = Standard Deviation; W = Wilcoxon Statistic; t = Student's t Statistic; r = Rank-Biserial Correlation; d = Cohen's d.

* Wilcoxon Signed-Rank Test was applied. ** Paired samples t-test was applied. Effect size interpretation: |r| and |d| ≥ .10/.20 small; ≥ .30/.50 moderate; ≥ .50/.80 large (Cohen, 1988).

and instruction, classroom education, and gifted education, and piloted with one SAC teacher and one classroom teacher providing gifted education in a resource room; the wording was judged clear and required no revision. The final form comprised seven open-ended questions across three dimensions—instructional content, instructional methods and approaches, and applicability—exploring participants' evaluations of programme content, instructional practices, perceived professional learning, classroom applicability, and suggestions for improvement.

Data Analysis

For the quantitative analyses, normality was assessed using the Shapiro-Wilk test. ETSSE scores did not satisfy normality for the total scale or any subscale (all $p < .05$); pre-test–post-test differences were therefore examined using the Wilcoxon signed-rank test. ETSSE internal consistency was excellent at both administrations (pre-test: $\alpha = .981$, $\omega = .982$; post-test: $\alpha = .958$, $\omega = .967$) (Kline, 2015).

For the SECTRS, only the Emotional Regulation subscale met the normality assumption ($p > .05$) and was analysed with a paired-samples t-test; the remaining subscales and the total score violated normality (all $p < .05$) and were analysed with the Wilcoxon signed-rank test. The SECTRS also showed satisfactory internal consistency ($\alpha = .957$, $\omega = .971$ pre-test; $\alpha = .826$, $\omega = .880$ post-test) (Kline, 2015).

Pre-test–post-test comparisons were conducted for the five ETSSE and four SECTRS subscales plus their totals (11 significance tests in total). No adjustment for multiple comparisons was applied, as each outcome represented a theoretically defined construct rather than an exploratory comparison; nonetheless, the increased risk of Type I error should be acknowledged, and greater emphasis was placed on the overall pattern of results than on isolated subscale-level findings.

The qualitative data were analysed using thematic analysis following Braun and Clarke (2006). A codebook developed prior to coding guided the systematic analysis (Appendix 1), enhancing consistency and transparency; to preserve anonymity, direct quotations are presented using participant codes (P1–P30).

FINDINGS

Findings from the Educational Technology Standards Self-Efficacy Scale

The first research question addressed whether classroom teachers' technopedagogical self-efficacy differed significantly before and after the programme. Table 2 presents pre-test and post-test means, standard deviations, Wilcoxon W statistics, significance levels, and effect sizes (rank-biserial correlation) for all subscales and the total scale.

As shown in Table 2, statistically significant pre-to-post improvements were observed across all five ETSSE subscales and the total score (all $p < .001$), with post-test standard deviations decreasing consistently, suggesting greater homogeneity in self-efficacy following the programme. Effect sizes were uniformly large, ranging from $r = -.764$ (Supporting Student Learning and Creativity) to $r = -.911$ (Modelling Digital Age Work and Learning, the strongest effect), and the largest absolute mean gain was observed for Designing Digital Age Learning Experiences and Assessments (7.4 points). Overall, the programme was associated with substantial, consistent improvements across all ETSSE dimensions, with particularly strong gains in teachers' confidence to model digital-age teaching practices.

Findings from the Social-Emotional Competence Teacher Rating Scale

The second research question addressed whether classroom teachers' social-emotional competencies for gifted education differed significantly before and after the programme, assessed via the SECTRS pre-test and post-test. As normality was satisfied for the Emotional Regulation subscale (pre-test $p = .087$; post-test $p = .142$), a paired-samples t-test was used for this subscale; the Wilcoxon Signed-Rank Test was used for the remaining subscales and the total, where normality was not met. Table 3 presents the descriptive statistics and comparison results.

As shown in Table 3, standard deviations decreased across all SECTRS subscales at post-test, indicating greater homogeneity in teachers' responses. Statistically significant improvements were observed in Emotional Regulation ($t(29) =$

Table 4. Thematic analysis framework: Themes, sub-themes, and participant codes

Theme	Sub-themes	Participants
T1. Social-Emotional Development Awareness and Competency Acquisition	Emotional awareness, student observation, parental relationships, empathy-responsive teaching	P1, P4, P5, P16, P20, P25, P27
T2. Technopedagogical Tool and Application Experience	Digital tool exploration, Web 2.0, AI, design tools, novel software	P2, P6, P8, P10, P11, P14, P17, P18, P21, P26, P29, P30
T3. Instructional Design and Classroom Integration	Digital activity design, lesson scenarios, interactive environments, instructional methods	P3, P13, P19, P22, P24, P27, P28
T4. Professional Development and Self-Efficacy Perception	Sense of professional competence, perspective change, skill development, leadership	P2, P5, P7, P9, P11, P12, P15, P23, P25, P30
T5. Collaboration and Experience Sharing	Experience sharing with teachers from different regions, group work, collegial solidarity	P7, P15

−2.95, $p = .006$, $d = -0.538$), Interpersonal Relationships ($W = 126.0$, $p = .048$, $r = -0.421$), Social Awareness ($W = 62.0$, $p = .004$, $r = -0.647$, the largest effect size), and the SECTRS total ($W = 106.0$, $p = .009$, $r = -0.546$). In contrast, the Student–Teacher Relationship subscale showed no significant change ($W = 126.0$, $p = .078$, $r = -0.382$), a finding discussed further below. Overall, the programme was associated with significant improvements in three of the four SECTRS subscales and the overall score, but not in the Student–Teacher Relationship dimension.

Findings Regarding Teachers' Experiences and Perceptions in the Domains of Social-Emotional Development Support and Technopedagogy

The third research question explored participating teachers' experiences and perceptions regarding social-emotional development support and technopedagogy. Five main themes were identified and are presented in **Table 4**.

Considered as a whole, the qualitative findings indicate that teachers derived meaning from the programme across five dimensions: (1) awareness and sensitivity regarding students' social-emotional development, (2) encounters with new technopedagogical tools and deepened existing knowledge, (3) concrete design competencies for classroom transfer, (4) strengthened professional self-efficacy and pedagogical identity, and (5) learning through experience sharing with colleagues, addressed below.

T1. Social-emotional development awareness and competency acquisition

This theme encompasses changes in participants' awareness and competencies regarding students' social-emotional development, expressed by P1, P4, P5, P16, P20, P25, and P27. P1 stated: "I realised that beyond observation, there are ways to explore students' social-emotional dimensions—such as working with them through digital applications like story writing, animation production, and engineering design, as well as implementing problem-solving and emotional awareness activities."

This view suggests that digital tools serve not only for knowledge transfer but also as instruments for emotional exploration, illustrating that technology and SEL are mutually reinforcing. Similarly, P4 stated: "I am a teacher who can observe my students' emotions. I will integrate the technological knowledge I acquired in the project into my in-class methods and techniques."

P5 noted that this knowledge would extend beyond the classroom into relationships with parents: "I acquired knowledge that supports social-emotional development. I will

use what I have learned in my relationships with both my students and their parents. My perspective on technological tools has changed in a positive direction."

P16 expressed that this awareness led to a more informed pedagogical stance: "I understood that I need to approach students who are receptive to innovation more consciously. I realised that the social-emotional dimensions of students who use technology are also important."

P20 and P25 articulated a sensitivity-oriented teaching approach; P25 stated: "The project was very decisive for my technopedagogical development. I gained awareness about developing a teaching approach that is sensitive to the emotional needs of students."

P27 directly linked technology to social-emotional skill development: "I learned to write lesson scenarios targeting social-emotional skills such as empathy, self-awareness, and emotion management using technology."

T2. Technopedagogical tool and application experience

This theme—encompassing experiences with new digital tools, Web 2.0 applications, AI-based platforms, and design tools—attracted the largest number of participants (P2, P6, P8, P10, P11, P14, P17, P18, P21, P26, P29, P30):

"Thanks to the project, I learned much new information; my perspective on technology has changed. I will make an effort to put this knowledge into practice." (P2)

"It was a productive process in terms of using digital content and applications more extensively in classroom settings." (P8)

P10 also articulated a critical, philosophical awareness of AI technologies: "I gained a philosophical perspective on technopedagogical approaches. I developed an understanding of the features that AI-powered tools should possess."

P11 and P30 emphasised both instrumental and conceptual deepening together:

"The project made a significant contribution to my technopedagogical development. My ability to use digital design tools has improved. It has also strengthened my problem-solving approach." (P11)

"My awareness increased and my superficial knowledge deepened. The educational content was very well designed. It enabled me to learn new tools and

techniques. I learned many software programmes I had not known before.” (P30)

P14 and P17 described discovering tools previously unknown or only superficially known:

“I learned how to integrate programmes I had never heard of or used into education more effectively. My perspective on education has changed.” (P14)

“Although I had used similar programmes before, I realised that what I learned here was more effective.” (P17)

P21 and P29 articulated their intention to directly integrate AI and Web 2.0 tools into their lessons:

“I learned different methods and activities for social-emotional development. I discovered more engaging approaches using AI and digital tools.” (P21)

“I learned to use AI and Web 2.0 tools more effectively and to integrate them into my lessons.” (P29)

T3. Instructional design and classroom integration

This theme encompasses participants’ views on transferring learning to classroom settings, designing lesson activities, and enriching instructional processes (P3, P13, P19, P22, P24, P27, P28):

“I learned activity suggestions regarding how innovative applications can be used in line with students’ social-emotional development.” (P3)

“I gained many experiences that will contribute to the child’s development while integrating technology in classroom settings.” (P13)

P19 articulated responsiveness to student needs as foundational to technopedagogical design: “It developed my technology-supported pedagogical skills. I experienced the importance of designing instruction suited to students’ needs.” P22 and P24 likewise described a concrete transformation in classroom quality:

“I learned to integrate education with technology. It guided me in creating a more interactive classroom environment.” (P22)

“It was an extremely positive and innovative project. I can now prepare richer, more multidimensional in-class activities.” (P24)

P28 integrated technology’s instrumental, pedagogical, and emotional dimensions: “It was a project that combined technology with emotion and pedagogy. I learned about the possibilities that technology offers within pedagogical approaches.”

T4. Professional development and self-efficacy perception

This theme encompasses participants’ perceptions of themselves as more competent, skilled, and growth-oriented teachers, including changes in self-efficacy, technological

perspective, and professional identity (P2, P5, P7, P9, P11, P12, P15, P23, P25, P30):

“I learned many new approaches and programmes. I acquired knowledge that will develop my teaching skills. I gained collaborative experience through group work.” (P7)

“This project will serve as a guide and facilitator for me.” (P12)

“The project provided me with new experiences. I see myself as a more competent teacher.” (P23)

P9 described the experience simply as “very positive,” whereas P25 explicitly characterised the programme as decisive for their technopedagogical development.

T5. Collaboration and experience sharing

This theme encompasses participants’ experiences of interaction and solidarity with colleagues from different regions. Although only P7 and P15 directly referenced it, their views indicate this emerged as a distinctive experience:

“I shared experiences with teachers from different regions. I learned a great deal about the integration of technology into education.” (P15)

“I gained collaborative experience through group work.” (P7)

DISCUSSION

This study examined the effects of a technopedagogical programme supporting gifted primary students’ social-emotional development on classroom teachers. In response to the first research question, the programme significantly improved teachers’ technopedagogical competencies across all ETSSE subscales with large effect sizes, consistent with prior evidence that well-designed professional development can meaningfully enhance such competencies (Diamah et al., 2022; Lachner et al., 2021; Malusay et al., 2025) and with the TPACK framework’s premise that technology–pedagogy–content integration can be strengthened through systematic professional development (Mishra & Koehler, 2006).

The largest mean gain was observed for Designing Digital Age Learning Experiences and Assessments, suggesting teachers had comparatively greater room for improvement in this domain, consistent with Harris et al.’s (2009) argument that teachers need structured learning experiences to integrate technology with pedagogical goals, and with more recent evidence that technopedagogical competencies develop through structured, iterative, sustained professional learning (Amemasor et al., 2025; Köstler & Wolff, 2025; Ning et al., 2022; Oktaviani & Utami, 2024). The Modelling Digital Age Work and Learning subscale yielded the largest effect size, suggesting the programme influenced not only instructional practices but also teachers’ professional identities as digital-age role models, consistent with the identity-transformation process described by Joshi (2023).

A note of caution is warranted: as shown in **Table 2**, Modelling Digital Age Work and Learning had both the largest effect size and the lowest pre-test mean, while Supporting Student Learning and Creativity had the smallest (still large) effect size and one of the highest pre-test means. Because ETSSE subscales differ in item number and score range, this pattern may partly reflect differences in the distance between baseline scores and each subscale's ceiling rather than true differences in responsiveness—consistent with the restriction-of-range concern noted in the Limitations section. The relative ranking of effect sizes should therefore be read as a descriptive pattern that generates, rather than confirms, hypotheses about which competencies are most responsive to short, intensive professional development.

Regarding the second research question, the programme significantly improved teachers' social-emotional competencies across all SECTRS subscales and the total score except Student-Teacher Relationship, consistent with prior evidence that SEL programmes enhance teachers' social-emotional competence (Ciucci et al., 2024; Oliveira et al., 2021; Ulker et al., 2023). The largest effect size was observed for Social Awareness, suggesting the programme broadened teachers' awareness of gifted students' social and environmental needs, consistent with studies highlighting social awareness as key to supporting gifted students' social-emotional development (Neihart et al., 2016; Szymanski, 2021).

The absence of a statistically significant change in the Student-Teacher Relationship subscale is noteworthy. Two explanations may account for this: the relatively small sample may have reduced statistical power, and student-teacher relationships develop through sustained, cumulative interactions shaped by consistent, long-term experience within specific contexts (Ansari et al., 2025; Hajovsky et al., 2023; Jowett et al., 2023)—so the programme's five-day duration may not have sufficed for measurable change in this dimension.

A third, measurement-related explanation is that Student-Teacher Relationship had the highest pre-test mean of the four SECTRS subscales, so the limited distance to the scale's ceiling may have constrained observable change even if underlying relational practices improved comparably to other dimensions. This explanation cannot be disentangled from the substantive ones above given the single-group design, and is consistent with the restriction-of-range concern noted in the Limitations section.

Taken together, the five-day programme may have been more effective for competencies developed through direct instruction and immediate application—such as digital-age learning design and social awareness—than for relational competencies like student-teacher relationships, which develop gradually through repeated classroom interaction. Intensive short-term formats thus appear well suited to strengthening instructional and awareness-related competencies but may need complementary follow-up coaching, mentoring, or classroom-based support to improve relational quality, highlighting the potential value of combining intensive workshops with sustained, classroom-embedded support in gifted education.

The qualitative findings complement the quantitative results, providing a deeper understanding of how teachers experienced the programme across five interrelated themes—increased social-emotional development awareness, exposure to new technopedagogical tools, classroom-oriented design competencies, strengthened professional self-efficacy, and collegial experience sharing—consistent with research showing that professional development promotes multidimensional changes in teachers' knowledge, beliefs, and practices (Desimone, 2009; Guskey, 2000). The Professional Development and Self-Efficacy Perception theme, in which teachers described feeling more competent and better equipped, aligns with Bandura's (1997) theory of self-efficacy and with evidence that experiential, structured professional development strengthens self-efficacy beliefs (Boeve-de Pauw et al., 2022; Täschner et al., 2025). Teachers' descriptions of technology and SEL as mutually reinforcing further suggest that technopedagogical approaches may support internal processes such as emotional awareness and empathy alongside instructional practice, consistent with studies emphasising digital tools' role in supporting social-emotional skills alongside the indispensable role of human interaction (Low & Van Ryzin, 2024; Slovák & Fitzpatrick, 2015).

Beyond corroborating the quantitative findings, the qualitative data help explain the underlying mechanisms: teachers' reflections within the Social-Emotional Development Awareness theme frequently described technology as a means of recognising and addressing students' emotions rather than merely delivering instruction, consistent with the large Social Awareness effect size and suggesting teachers increasingly viewed digital activities as opportunities to support gifted students' social-emotional needs. By contrast, participants rarely referred to changes in day-to-day relationships with individual students, mirroring the absence of significant change in the Student-Teacher Relationship subscale and supporting the interpretation that this dimension requires sustained classroom interaction beyond a short, intensive programme. The qualitative findings thus help distinguish competencies that shifted through changes in professional perspective from those requiring longer-term reinforcement through practice.

The distribution of participants across themes further converges with the quantitative findings: the Technopedagogical Tool and Application Experience theme included the largest number of participants (12 of 30), consistent with the uniformly large ETSSE improvements, whereas only two participants referred to Collaboration and Experience Sharing, suggesting peer interaction was not a primary mechanism of change—an issue discussed further in the Suggestions section.

Overall, the findings suggest that professional development integrating technopedagogy and SEL can foster multidimensional improvements in teachers' professional competencies, consistent with research emphasising support across both domains (Masry-Herzallah, 2025; Mukhemar et al., 2025; Zagni et al., 2025). Nevertheless, the large effect sizes observed after a five-day intensive programme warrant caution regarding sustainability: Durlak et al. (2011) similarly emphasised that SEL interventions' long-term effectiveness depends on sustained, contextually embedded, well-supported

implementation, so longitudinal research is needed to determine whether these improvements are maintained over time.

CONCLUSION

The findings indicate that the technopedagogical programme significantly improved classroom teachers' technopedagogical self-efficacy, with large effect sizes across all ETSSE dimensions, and their social-emotional competencies, with moderate-to-large effect sizes across all SECTRS subscales except Student-Teacher Relationship. The qualitative findings complemented these results by revealing changes across five thematic dimensions, offering further insight into how teachers experienced and interpreted the programme. Taken together, the programme was associated with improvements in teachers' technopedagogical and social-emotional competencies, professional self-efficacy, and intentions to transfer these gains into practice. Within the limitations of a single-group pre-test-post-test design, these findings provide preliminary evidence that programmes integrating technopedagogy and SEL may strengthen teacher competencies and pedagogical responsiveness to gifted students' needs; future longitudinal, controlled studies are needed to determine the durability, transferability, and generalisability of these outcomes.

LIMITATIONS

Several limitations should be acknowledged. The absence of a control group limits causal inference, since observed changes cannot be fully disentangled from threats to internal validity such as maturation, historical events, or testing effects. The relatively small sample ($n = 30$) and purposive sampling limit generalisability, and the intensive five-day format raises questions about the durability of the observed improvements. The instruments assessed teachers' self-reported competencies and self-efficacy rather than actual instructional practices or student outcomes. Although the first research question focused on technopedagogical self-efficacy, the ETSSE operationalises this construct through the ISTE standards rather than the TPACK framework directly; despite substantial conceptual overlap, future studies should employ TPACK-specific instruments. Finally, the study was conducted within the Turkish educational context, where SEL has only recently entered the national curriculum without a systematic teacher-informed needs assessment (Alemdar & Asikcan, 2026); the findings should therefore be interpreted as evidence from one professional development model within this evolving policy context rather than as directly transferable to other educational systems.

Three further methodological limitations warrant note. The 11 significance tests across the ETSSE and SECTRS subscales and totals were not adjusted for multiple comparisons, and the consistent reduction in post-test standard deviations suggests a possible restriction of range that may have inflated rank-based effect sizes and contributed to lower post-test SECTRS reliability; this is consistent with,

but not conclusive evidence of, a ceiling effect, so effect sizes should be interpreted cautiously. Both the quantitative and qualitative data relied exclusively on teachers' self-reports collected immediately after a programme delivered by the research team, so the influence of social desirability and demand characteristics cannot be ruled out, reinforcing the need for independent outcome measures and controlled designs in future research. Finally, implementation consistency across the 17 specialist-led workshops relied on a shared planning template and end-of-day feedback rather than independent fidelity monitoring, so it was not possible to verify independently whether each workshop was implemented exactly as planned.

SUGGESTIONS

Based on the findings, several recommendations can be made for future research, practice, and policy. For research, quasi-experimental or true experimental designs with control groups are recommended to strengthen causal inference, alongside longitudinal follow-up to examine sustainability, direct assessment of student outcomes through classroom observations and student-based measures, and qualitative or mixed-methods longitudinal studies incorporating classroom observations and professional portfolios to better understand how teachers transfer acquired competencies into practice.

For practitioners and policy-makers, the findings suggest that professional development integrating technopedagogical and social-emotional competencies may offer advantages over addressing these domains separately, as supported by the positive outcomes observed here. Extending the programme beyond an intensive five-day format—with sustained learning opportunities throughout the school year and periodic follow-up—may help consolidate these gains, and similar technopedagogy-SEL programmes could be adapted for broader implementation in Science and Art Centres and resource rooms under the Ministry of National Education, accounting for local institutional conditions. The programme may also serve as a practical model for comparable initiatives; since peer collaboration was mentioned by only a small number of participants, future implementations could deliberately incorporate structured peer-learning opportunities—mentoring pairs, professional learning communities, or shared online platforms—to transform collegial learning into a more intentional, sustainable component of professional development.

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APPENDIX 1

Table A1. Qualitative research codebook

Code No.	Code Name	Definition	Example Statement	Theme
C-01	Emotional Awareness	Recognising students' emotional states	"I am a teacher who can observe my students' emotions." (P4)	T1
C-02	SEL Skill Acquisition	Knowledge/skills in social-emotional learning	"I learned different methods and activities for social-emotional development." (P21)	T1
C-03	Empathy Development	Empathic, emotionally responsive stance towards students	"I learned to write lesson scenarios targeting social-emotional skills such as empathy, self-awareness, and emotion management." (P27)	T1
C-04	Student Needs Awareness	Understanding the social-emotional needs of gifted students	"I realised that the social-emotional dimensions of students who use technology are also important." (P16)	T1
C-05	Family Relationships	Sensitivity in parent–teacher communication	"I will use what I have learned in my relationships with both my students and their parents." (P5)	T1
C-06	Digital Tool Use	Identifying new digital tools and software	"I learned how to integrate programmes I had never heard of or used into education more effectively." (P14)	T2
C-07	AI and Web 2.0 Awareness	Ability to use AI-based and Web 2.0 tools in education	"I learned to use AI and Web 2.0 tools more effectively and to integrate them into my lessons." (P29)	T2
C-08	Technopedagogical Perspective	Holistic understanding that connects technology with pedagogy	"I gained a philosophical perspective on technopedagogical approaches." (P10)	T2
C-09	Technology Integration	Aligning technology with instructional objectives and student needs	"I experienced the importance of designing instruction suited to students' needs." (P19)	T3
C-10	Material and Activity Development	Designing technology-supported activities and materials	"I learned activity suggestions regarding how innovative applications can be used in line with students' social-emotional development." (P3)	T3
C-11	Interactive Environment	Making the classroom more active and participatory	"It guided me in creating a more interactive classroom environment." (P22)	T3
C-12	Creative Thinking	Problem-solving and production-oriented processes	"It has also strengthened my problem-solving approach." (P11)	T3
C-13	Enriched Learning	Diversification of in-class experiences	"I can now prepare richer, more multidimensional in-class activities." (P24)	T3
C-14	In-class Technology	Integration of technology into classroom practice	"I gained many experiences that will contribute to the child's development while integrating technology in classroom settings." (P13)	T3
C-15	Professional Confidence	Increased confidence in professional identity	"I see myself as a more competent teacher." (P23)	T4
C-16	Motivational Increase	Openness to new developments and willingness to apply them	"I will make an effort to put this knowledge into practice." (P2)	T4
C-17	Attitudinal Shift	Positive transformation of views about technology	"My perspective on technological tools has changed in a positive direction." (P5)	T4
C-18	Professional Identity Reinforcement	Sense of contribution to the teaching profession	"This project will serve as a guide and facilitator for me." (P12)	T4
C-19	Perceived Programme Value	Positive overall evaluation of the programme	"It was a very positive experience." (P9)	T4
C-20	Collaborative Experience	Interaction and experience sharing with colleagues	"I shared experiences with teachers from different regions." (P15)	T5

Note. T1 = Social-Emotional Development Awareness and Competency Acquisition; T2 = Technopedagogical Tool and Application Experience; T3 = Instructional Design and Classroom Integration; T4 = Professional Development and Self-Efficacy Perception; T5 = Collaboration and Experience Sharing.