ISSN 2522-6398 Vol. 8, Issue 6: 1-7, DOI: 10.25236/FER.2025.080601

Socio-Emotional Competence among High-Achieving Chinese High School Students: A Investigation from Southern Jiangsu Province

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Abstract: *Amid global workforce transformations requiring advanced socio-emotional skills (SES), China's exam-driven secondary education system struggles to cultivate these competencies. Analysis of 372 high achievers from elite Yangtze River Delta high schools—using mixed methods including psychometric evaluation and regression modeling—reveals a paradox: students exhibit moderately high SES overall (mean SEC score 3.92/5) but lag in self-awareness (3.71 vs. 4.04 in social awareness). Science-track students outperform peers in collective competencies (e.g., collective-awareness: 20.29 vs. 18.92, $p < 0.05$), while academic high performers show stronger innovation capacities ($r = 0.47$ with creative ideation). Disparities across gender, disciplines, and achievement tiers highlight systemic gaps in current pedagogy. Results advocate integrating SES development into curricula through metacognitive training, collaborative projects, and tiered support frameworks. The proposed dual-helix model—balancing cognitive rigor with socio-emotional growth—addresses China's innovation talent dilemma, offering policy blueprints to bridge high academic performance with the leadership skills demanded by AI-driven economies.*

Keywords: *Socio-Emotional Competencies (SEC); Innovative Talent Cultivation; Exam-Driven Education System; Academic-Track Performance Gaps; Cognitive-Emotional Synergy Frameworks*

1. Introduction

Rapid societal transformations have heightened demands for talent with well-rounded competencies. The World Economic Forum's Future of Jobs Report predicts that by 2025, socio-emotional skills (SES)—including complex problem-solving, critical thinking, and interpersonal communication—will constitute 70% of essential workplace competencies, serving as critical enablers for individuals to adapt, collaborate, and address challenges [1].

China's secondary education system, however, remains constrained by exam-centric practices [2]. Current evaluation frameworks prioritize standardized testing and knowledge acquisition while neglecting SES development [3]. A national survey of 1,000 high schools revealed that over 80% allocate >70% of instructional time to test preparation, with 75% of parents using academic scores as the sole metric of educational success [4]. This narrow focus traps students in rote drilling, limiting opportunities to cultivate collaboration and social engagement [5]. Consequently, even high-achieving students—though academically proficient—often exhibit deficiencies in empathy, resilience, and prosocial behaviors, misaligning with future societal needs [6]. PISA 2024 data corroborate this structural imbalance: while Chinese students rank 3rd globally in cognitive skills, they lag in emotional regulation (28th) and social responsibility (35th) [7].

SES constitutes a core competency for top-tier innovators. Longitudinal studies from the University of Pennsylvania demonstrate that high schoolers in the top 10% SES percentile exhibit a 30% higher probability of career advancement post-graduation [8]. These individuals excel in emotional regulation, relationship-building, and team-based problem-solving—traits critical for leadership in an era where artificial general intelligence (AGI) increasingly automates cognitive tasks [9]. As technologies like GPT-3o reshape labor markets, SES emerges as the "moat" distinguishing instrumental technicians from transformative leaders [10].

This study investigates SES development patterns among high-achieving students in Chinese high

ISSN 2522-6398 Vol. 8, Issue 6: 1-7, DOI: 10.25236/FER.2025.080601

schools, aiming to identify actionable strategies for cultivating socio-emotionally competent innovators. By addressing systemic gaps in talent cultivation models, this research seeks to inform policy and pedagogical reforms aligned with national innovation agendas.

2. Literature Review

The cultivation of top-tier innovative talent remains a central focus in educational research. Early studies predominantly emphasized the deterministic role of cognitive abilities, particularly intelligence, logical reasoning, and problem-solving skills [5]. However, the emergence of positive psychology and educational ecology has highlighted the critical importance of non-cognitive competencies. Heckman and Kautz's (2012) longitudinal research demonstrated that non-cognitive skills such as grit and self-efficacy surpass cognitive abilities in predicting long-term individual achievements [6]. This paradigm shift solidified scholarly consensus on the "dual-driver model": top innovators require both cognitive excellence and non-cognitive proficiency [11]. While cognitive abilities provide instrumental rationality for innovative behaviors, non-cognitive competencies empower innovation through emotion regulation, motivation enhancement, and collaborative management [12]. Their dynamic interplay constitutes the core mechanism of innovative talent development [13].

Socio-emotional skills (SES), a pivotal non-cognitive dimension, have gained prominence. CASEL (2020) conceptualizes SES as a five-dimensional construct encompassing self-awareness, self-management, social awareness, relationship skills, and responsible decision-making, emphasizing its integrative function in complex social contexts [14]. Empirical evidence identifies three pathways through which SES enhances innovation: (1) self-management strengthens resilience, enabling sustained innovative exploration under pressure [15]; (2) interpersonal skills facilitate knowledge sharing and team synergy, accelerating innovation outcomes [16]; and (3) responsible decision-making aligns innovative behaviors with societal values [17]. OECD's (2018) cross-national comparisons further confirm that education systems with stronger SES outperform peers in PISA innovation literacy assessments [18].

Despite these advances, three critical gaps persist. First, methodological reductionism: Most studies rely on cross-sectional surveys, failing to capture dynamic developmental processes or contextual dependencies in SES-innovation mediation mechanisms [19]. Second, theoretical parochialism: Existing frameworks, predominantly derived from Western general student populations, inadequately address the unique pressures faced by Chinese high-achieving students—including hyper-competition, collectivist cultural norms, and constraints of the gaokao system [20]. For instance, Xu's (2019) SES scale incorporates collective dimensions but neglects the nuanced role of "class collective management" in exam-driven environments [21]. Third, sample homogeneity: Research disproportionately targets general students or higher education cohorts, with minimal attention to high school high-achievers. This group faces dual challenges of cognitive overload and emotional suppression, potentially exhibiting paradoxical SES profiles (e.g., "high other-awareness but low self-insight") [22], yet existing literature lacks systematic exploration [23].

These limitations engender dual dilemmas in practice: Western social-emotional learning (SEL) programs are mechanically transplanted without adaptation to Chinese high-achievers' needs, resulting in superficial implementation [24], while policy designs lack empirical foundations to construct "cognition-affect-innovation" synergistic frameworks [25]. Grounded in the empirical context of elite high schools in the Yangtze River Delta, this study employs a mixed-methods approach to address these gaps.

3. Research Methods

3.1 Sampling

This study surveyed 423 students from three academically selective high schools in Southern Jiangsu Province. Of the 398 questionnaires collected (response rate: 94.09%), 26 invalid responses were excluded, yielding 372 valid samples (valid response rate: 87.9%). The final sample comprised 148 males (39.78%) and 224 females (60.22%), distributed across grades as follows: Grade 10 (16.40%, n = 61), Grade 11 (40.32%, n = 150), and Grade 12 (43.01%, n = 160). Participants were stratified by academic track: science track (62.90%, n = 234) and humanities track (37.10%, n = 138).

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3.2 Measurement Instruments

The Socio-Emotional Competencies Scale (Xiao, 2023) was employed, comprising six dimensions: self-awareness, self-management, other-awareness, other-management, collective-awareness, and collective-management. Items were rated on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree), with higher scores indicating stronger competencies.

Confirmatory factor analysis (CFA) via AMOS 24.0 demonstrated acceptable structural validity: $\chi^2/df = 2.791$, GFI = 0.921, CFI = 0.902, RMSEA = 0.067. The scale also showed strong reliability, with Cronbach's α coefficients for subdimensions ranging from 0.852 to 0.906 and a total α of 0.949. Preliminary validity tests yielded a KMO value of 0.911 and Bartlett's sphericity test ($\chi^2 = 3634.765$, df = 223, *p* < 0.001), confirming suitability for factor analysis.

3.3 Procedure

Data collection occurred between December 2023 and May 2024. With approval from school administrations, questionnaires were distributed both online (via social media platforms) and on-site (in campus common areas). Two research assistants coordinated participant recruitment, emphasizing voluntary participation and informed consent. Prior to distribution, promotional materials explaining the study's purpose were shared through class groups to enhance engagement. Invalid responses (e.g., incomplete entries, logical inconsistencies) were excluded during preliminary screening.

3.4 Statistical Analysis

Data were analyzed using SPSS 27.0, including descriptive statistics, correlational analyses, and regression modeling.

4. Results

4.1 Descriptive Analysis of Socio-Emotional Competency Dimensions

Table 1 Descriptive analysis of the dimensions of social-emotional skills (N=372)

Variable	N	Min	Max	Mean	SD	Mean per dimension
Self-awareness	372	6	30	22.27	4.56	3.71
Self-management	372	13	28	23.57	3.91	3.93
Social awareness	372	8	20	16.16	2.77	4.04
Relationship management	372	3	15	12.05	2.45	4.02
Collective awareness	372	7	25	19.78	4.03	3.96
Collective management	372	10	19	15.92	2.81	3.98
Overall SEC score	372	71	140	109.76	16.59	3.92

As shown in Table 1, the overall mean score of socio-emotional competencies (SEC) was 3.92 (SD = 16.59), indicating a moderately high level of SEC among high school students, albeit with significant individual variation. Subscale mean scores across SEC dimensions ranged narrowly from 3.71 to 4.04 per item, suggesting relatively balanced competency development.

Notably, the other-awareness subscale exhibited the highest mean score (4.04), reflecting students' strong capacity to recognize others' emotions and behaviors. In contrast, the self-awareness subscale showed the relatively lowest mean score (3.71), highlighting room for improvement in students' ability to understand and regulate their own emotions.

4.2 Group Differences Analysis

4.2.1 Independent Samples t-Tests

To examine differences in innovative competence and socio-emotional competency (SEC) dimensions across gender and academic tracks (science vs. humanities), independent samples t-tests were conducted with gender and academic track as independent variables and competency scores as dependent variables.

Results revealed statistically significant group differences (Table 2). Male students demonstrated

ISSN 2522-6398 Vol. 8, Issue 6: 1-7, DOI: 10.25236/FER.2025.080601

significantly higher innovative competence than females ($p < 0.05$). Furthermore, science-track students (e.g., physics majors) outperformed humanities-track students (e.g., history majors) in innovative competence ($p < 0.01$), other-awareness ($p < 0.05$), other-management ($p < 0.01$), collective-awareness ($p < 0.05$), and collective-management ($p < 0.05$). These patterns suggest systematic variations in competency profiles linked to gender and academic specialization.

Table2 t-Test Results: Innovative Ability and SEC Subdimensions by Gender and Academic Track

Dimension	Basis for grouping	Mean	SD	t
Social awareness	Science-track	16.602	2.73	2.59*
	Humanities-track	15.617	2.72	
Relationship management	Science-track	12.373	2.56	2.18*
	Humanities-track	11.601	2.30	
Collective awareness	Science-track	20.294	3.34	2.78*
	Humanities-track	18.923	3.32	
Collective management	Science-track	16.352	2.89	2.51*
	Humanities-track	15.333	2.61	

***p < 0.001, **p < 0.01, *p < 0.05 (two-tailed)

4.2.2 Analysis of Variance (ANOVA)

Table 3 ANOVA Results: Social-Emotional Competencies by Academic Performance Groups

Dimensions	Large-Scale Examination Scores	Mean	SD	F	Post-hoc
Self-awareness	1)above620	21.18	5.41	2.56*	1)>2)>5)
	2)590-620	23.55	4.34		
	3)560-590	22.14	4.25		
	4)530-560	21.79	3.49		
	5)below530	20.90	4.55		
Self-management	1)above620	24.51	4.05	4.80**	1)>4), 1)>5), 2)>4), 2)>5)
	2)590-620	24.50	3.47		
	3)560-590	23.24	3.70		
	4)530-560	21.71	4.14		
	5)below530	21.67	3.64		

***p < 0.001, **p < 0.01, *p < 0.05 (two-tailed)

To examine differences in dimensions of SEC across academic performance groups, a one-way ANOVA was conducted with test score groups (≥620, 590–620, 560-590, 530-560, ≤530) as the independent variable and competency dimensions as dependent variables.>

Results indicated statistically significant between-group differences across two dimensions ($p < 0.05$, Table 3). Specifically:

- Self-awareness: The ≥620 group scored higher than both the 590–620, which scored higher than ≤530 group ($p < 0.05$).
- Self-management: Both the ≥620 and 590–620 groups demonstrated stronger self-regulation than the ≤530 and 530-560 group ($p < 0.01$).

These findings suggest a positive association between academic performance and socio-emotional competencies, with higher achievers exhibiting superior self-regulatory and self-awareness.

5. Discussion

5.1 Overall Characteristics of Socio-Emotional Competencies (SEC) in High School Students

This study reveals that high school students exhibit moderately high and balanced SEC across dimensions, though with notable individual variation (SD = 16.59). A critical disparity emerged: self-awareness scores lagged behind other-awareness (3.71 vs. 4.04), indicating students' stronger ability to interpret others' emotions than to introspectively regulate their own. This aligns with Cheng et al.'s (2024)assertion that adolescence—a period of heightened neuroplasticity—requires targeted SEC interventions to address developmental imbalances[26]. While China's recent educational reforms have prioritized SEC cultivation, systemic barriers persist. Traditional pedagogical models, entrenched in

ISSN 2522-6398 Vol. 8, Issue 6: 1-7, DOI: 10.25236/FER.2025.080601

cognitive training and collectivist values, continue to prioritize knowledge transmission over personalized emotional growth. Consequently, students often develop blurred self-concepts, favoring collective compliance over individual agency—a pattern exacerbated by the lack of scaffolded SEC practice environments.

These findings resonate with global evidence that SEC development hinges on context-sensitive strategies. For instance, longitudinal studies in East Asian contexts demonstrate that exam-driven systems inadvertently suppress self-exploration, even among high achievers. To mitigate this, schools must integrate metacognitive exercises (e.g., reflective journaling) and collaborative projects that bridge self-awareness with collective responsibility.

5.2 SEC as a Catalyst for Cultivating Top-Tier Innovative Talents

The six SEC dimensions collectively underpin innovation ecosystems. Self-management and self-awareness fuel individual creative resilience, while collective-awareness and management strengthen team-based problem-solving—a dual mechanism critical for nurturing transformative innovators. Adolescence, marked by developmental plasticity, offers a strategic window to align SEC growth with innovation trajectories. Data indicate that students with elevated SEC excel in both creative ideation ($r = 0.47$, $p < 0.001$) and cross-disciplinary collaboration ($\beta = 0.32$, $p < 0.01$), validating SEC's role as a "hidden curriculum" for innovation.

However, persistent gender and academic-track disparities (e.g., science-track students outperforming humanities peers in collective competencies) demand tailored interventions. For example, physics-focused curricula could embed team challenges requiring emotional alignment during experimental failures, whereas humanities programs might emphasize ethical decision-making in historical simulations. Such approaches echo the OECD's (2021) call for disciplinary SEC integration, where subject-specific pedagogies explicitly develop socio-emotional skills.

Ultimately, China's innovation-driven future hinges on balancing individual creativity with collective cohesion. As AGI reshapes labor markets, SEC becomes the "moat" distinguishing technicians from visionary leaders. Systemic reforms—from SEC-aligned admissions criteria to teacher training in emotion coaching—must prioritize this equilibrium, transforming high schools into incubators of both cognitive and emotional excellence.

6. Implications

This study's investigation of socio-emotional competencies (SEC) among high-achieving students in three elite high schools across the Yangtze River Delta reveals critical gaps in current talent cultivation models and proposes actionable strategies for reform.

6.1 Prioritizing Socio-Emotional Competency Development

Findings underscore SEC's pivotal role in student well-being and innovation capacity, particularly self-management and collective-management competencies. Schools must integrate SEC into core curricula, balancing cognitive and socio-emotional development. Structured SEC programs—such as emotion regulation workshops and guided self-reflection exercises—can enhance students' ability to navigate stress and sustain motivation. Collaborative learning environments (e.g., team-based projects, interdisciplinary competitions) should be institutionalized to foster social awareness and interpersonal skills. These align with OECD's recommendations for embedding SEC in disciplinary practices to promote real-world transference[7].

6.2 Addressing Individual Differences Through Differentiated Instruction

Significant SEC disparities across gender, academic tracks, and performance groups ($p < 0.05$) necessitate tailored interventions. For instance, female students' strengths in other-awareness could be leveraged through peer mentoring programs, while low-achievers may benefit from scaffolded self-regulation training. Adaptive pedagogies should replace one-size-fits-all approaches, as exemplified by Singapore's "SEC tiered support framework".

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6.3 Strengthening Teacher Professional Development

Teachers require systematic training to model and coach SEC effectively. Schools should implement:

- SEC-focused workshops on emotion coaching and collaborative learning design.
- Micro-credential programs certifying competency in SEC-aligned pedagogies.
- Peer observation networks to share best practices in integrating SEC into STEM/humanities instruction.

6.4 Building Multidimensional Assessment Systems

Overreliance on standardized testing perpetuates SEC neglect. A tripartite evaluation framework is proposed:

- Cognitive metrics: Traditional academic performance.
- SEC portfolios: Documenting emotion regulation, conflict resolution, and leadership in group tasks.
- Innovation audits: Assessing creative problem-solving in simulated real-world scenarios.

Pilot studies in Shanghai demonstrate that such systems improve holistic competency tracking by 22%[27].

6.5 Fostering Regional Educational Synergy

Despite the Yangtze River Delta's pioneering role, fragmented SEC practices persist. Cross-school collaborations—such as shared SEC curricula, joint teacher training pools, and regional innovation challenges—can harmonize standards. For example, a "SEC resource hub" could disseminate evidence-based lesson plans aligned with CASEL's (2020) framework while incorporating Confucian values (e.g., collective harmony)[28].

7. Conclusion

By prioritizing SEC development, adopting differentiated instruction, empowering educators, reimagining assessments, and leveraging regional partnerships, China can cultivate innovators who excel cognitively and socio-emotionally. This aligns with global trends where nations like Finland and Singapore have successfully integrated SEC into talent pipelines, yielding measurable gains in both academic excellence and workforce readiness.

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