STEM EDUCATION AWARENESS AMONG SCHOOL TEACHERS: DEMOGRAPHIC VARIATIONS AND DIMENSIONAL CORRELATES

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Abstract

STEM (Science, Technology, Engineering, and Mathematics) education has emerged as a critical educational approach for promoting interdisciplinary learning, innovation, and problem-solving skills among students. Despite increasing emphasis on STEM-oriented teaching under India's educational reforms, empirical evidence regarding STEM education awareness of school teachers across demographic variables. The present study examined the level of STEM education awareness among 127 school teachers in Coimbatore district and investigated differences with respect to gender, age, educational qualification, and teaching stream. A descriptive survey research design was adopted, and data were collected using the STEM Education Awareness Scale (SEAS), a 30-item instrument demonstrating satisfactory reliability (Cronbach's α = .82). Statistical analyses included descriptive statistics, independent samples t-tests, one-way ANOVA with Tukey HSD post hoc comparisons, and Pearson correlation analysis. Findings revealed a high level of STEM education awareness among teachers. Significant differences emerged with respect to age and teaching stream, with younger teachers and science-stream teachers demonstrating comparatively higher STEM awareness, whereas gender and educational qualification did not significantly influence awareness levels. All four dimensions of STEM awareness—STEM Conceptual Knowledge & Sustainability, Inclusive Pedagogical Practices in STEM, Technology & Innovative Integration, and Critical Thinking & Collaborative Problem Solving—showed strong positive correlations with overall STEM awareness, with technology integration emerging as the strongest correlate. The findings underscore the need for targeted professional development programmes, particularly for humanities teachers and senior educators, to strengthen STEM readiness and support effective implementation of interdisciplinary and technology-integrated learning environments.

***Keywords:** STEM Education Awareness, School Teachers, STEM Pedagogy, Technology Integration, Demographic Variables, Interdisciplinary Learning*

Introduction

The twenty-first century educational landscape increasingly emphasises interdisciplinary knowledge, technological competence, and problem-solving skills to prepare learners for a rapidly changing society. In this context, Science, Technology, Engineering, and Mathematics (STEM) education has emerged as a transformative approach aimed at fostering critical thinking, creativity, and innovation (Stohlmann et al., 2012). STEM education equips learners with scientific and technological knowledge while enabling them to address authentic real-world problems.

In India, STEM education has gained considerable attention following the National Education Policy (NEP) 2020, which advocates multidisciplinary, experiential, and inquiry-based learning, emphasising scientific temper, digital literacy, and skill development (National Education Policy, 2020). The successful implementation of STEM education largely depends on teacher preparedness. Teachers serve as primary agents responsible for translating STEM principles into classroom practice, and their preparedness significantly influences successful STEM implementation (Margot & Kettler, 2019; Shernoff et al., 2017). Research suggests that teachers with stronger STEM awareness demonstrate greater readiness and confidence in implementing inquiry-based pedagogies (Saadati & Celis, 2021; Liaw & Gao, 2022). Conversely, limited STEM awareness may restrict students' opportunities to develop higher-order thinking skills (Fernández-Batanero et al., 2023).

In the present study, STEM awareness is conceptualised through four dimensions: STEM Conceptual Knowledge & Sustainability (SCKS), Inclusive Pedagogical Practices in STEM (IPPS), Technology & Innovative Integration (TII), and Critical Thinking & Collaborative Problem Solving (CTCPS). Despite growing emphasis on STEM in India, empirical investigations examining teacher STEM awareness with respect to demographic variables remain limited, particularly in Coimbatore district. Prior studies indicate that gender, qualification, and teaching stream may influence STEM readiness (Singh & Kaur, 2023; Kumar & Mishra, 2024).

Significance of the Study

The present study possesses considerable academic and practical significance in the context of ongoing educational reforms emphasising STEM-based teaching and learning. As schools increasingly adopt interdisciplinary and technology-integrated pedagogies, understanding teachers’ awareness of STEM education becomes essential for improving instructional quality and student learning outcomes (Rojas & Bhaskaran, 2023).The study contributes to the literature by examining STEM awareness in relation to demographic variables, thereby assisting educational institutions in developing targeted professional development programmes suited to teachers’ diverse needs (Kumar & Mishra, 2024). Understanding teachers’ STEM awareness is essential because teachers’ beliefs, attitudes, and readiness toward STEM significantly influence classroom implementation and instructional effectiveness. Prior research indicates that professional development and positive teacher perceptions contribute substantially to successful STEM integration (Abd Ghani et al., 2025).

Theoretical Framework

The present study is grounded in Bandura's (1997) Social Cognitive Theory, particularly the construct of self-efficacy—an individual's belief in their own capabilities to perform specific tasks. In the context of STEM education, teachers' self-efficacy shapes their willingness to adopt innovative pedagogical strategies, integrate technology, and facilitate interdisciplinary learning. Teachers who possess strong conceptual STEM knowledge and awareness of inclusive instructional practices are more likely to develop higher instructional self-efficacy, which in turn translates into more effective classroom implementation. The four STEM dimensions measured in this study—SCKS, IPPS, TII, and CTCPS—collectively represent the cognitive and pedagogical competencies that underpin teachers' STEM self-efficacy. The findings are interpreted through this lens, with differences in STEM awareness across demographic groups understood as variations in opportunity, exposure, and confidence grounded in social cognitive processes.

STEM Education Awareness

STEM education awareness refers to teachers' familiarity with and understanding of integrated Science, Technology, Engineering, and Mathematics education, including the pedagogical principles, interdisciplinary strategies, technological applications, and problem-solving approaches associated with STEM learning (Stohlmann et al., 2012). Teachers with strong STEM awareness are more likely to create innovative, collaborative, and inquiry-oriented learning environments that foster student engagement and higher-order thinking (Singh & Kaur, 2023).

In the present study, STEM education awareness is operationalised through four dimensions:

- STEM Conceptual Knowledge & Sustainability (SCKS): This dimension reflects teachers' understanding of core STEM concepts, interdisciplinary integration, and the application of STEM principles to real-world sustainability challenges.
- Inclusive Pedagogical Practices in STEM (IPPS): This dimension captures teachers' readiness to employ diverse, student-centred instructional strategies that accommodate varied learning needs.
- Technology & Innovative Integration (TII): This dimension measures teachers' awareness and confidence in incorporating digital tools, educational technologies, and innovative instructional resources into STEM teaching
- Critical Thinking & Collaborative Problem Solving (CTCPS): This dimension assesses teachers' capacity to facilitate higher-order thinking and cooperative learning in STEM contexts.

Review of Related Literature

The reviewed literature on STEM education awareness among teachers can be organised thematically around four key areas: the role of disciplinary background and teaching stream, age-related differences in STEM readiness, gender and qualification effects, and the relationship between STEM awareness and instructional effectiveness.

Disciplinary Background and Teaching Stream

A consistent finding across studies is that science-stream teachers demonstrate stronger STEM awareness and instructional confidence than their humanities counterparts. Cvencek, Kapur, and Meltzoff (2022) found that science teachers in Singapore exhibited stronger STEM identity and orientation, attributing this to sustained disciplinary exposure. Similarly, Yıldız and Akın (2024) reported significant stream-based differences in STEM readiness among Turkish middle school teachers, with science teachers outperforming humanities teachers in nearly all STEM competency domains. Singh and Kaur (2023) corroborated these findings in the Indian context, noting that science teachers in Punjab demonstrated markedly stronger STEM awareness. Stohlmann, Moore, and Roehrig (2012) theorised that effective STEM teaching requires awareness of cross-disciplinary integration—a competency more naturally developed through science education pathways.

Age and Professional Experience

Several studies have examined how age and experience influence STEM readiness. Hu, Zhang, and Chen (2023) reported that younger teachers in China demonstrated greater openness to technology integration and innovative STEM pedagogies, while experienced teachers showed stronger pedagogical maturity but comparatively lower digital fluency. Liaw and Gao (2022) similarly found that teachers with more recent professional training demonstrated higher STEM instructional readiness, reflecting the growing emphasis on digital pedagogy in contemporary teacher education. Saadati and Celis (2021) demonstrated that structured professional development significantly improved STEM instructional confidence regardless of experience level, suggesting that age-related gaps can be addressed through targeted training.

Gender and Qualification Effects

The influence of gender on STEM awareness has produced mixed results. Tahir, Kamarudin, and Hassan (2021) observed gender-based differences in science teaching self-efficacy among Malaysian secondary teachers, with female teachers showing stronger engagement competencies. However, Gómez-Trigueros and Yáñez-de-Aldecoa (2022) found no significant gender differences in STEM competencies among Spanish in-service teachers. Regarding qualification, Kumar and Mishra (2024) reported that postgraduate-qualified teachers in Tamil Nadu demonstrated stronger STEM readiness, whereas Supena, Darmuki, and Hariyadi (2021) found that pedagogical competency was a stronger predictor of STEM effectiveness than formal qualification level alone.

STEM Awareness and Instructional Effectiveness

Research consistently establishes positive relationships between STEM awareness and classroom effectiveness. Fernández-Batanero, Serrano-Rodríguez, and Reyes-Rebollo (2023) reported significant associations between digital competence and STEM instructional readiness among Spanish in-service teachers. Yıldız and Akın (2024) found that technology integration emerged as the dimension most strongly associated with overall STEM awareness and classroom confidence. Bandura's (1997) self-efficacy framework provides the theoretical underpinning for these relationships, as teachers' beliefs about their STEM capabilities mediate their instructional behaviours. Mutseekwa *et al*. (2024) highlighted that STEM education implementation depends heavily on teachers' knowledge of interdisciplinary integration approaches, technological adoption, and pedagogical preparedness. The authors further emphasized that inadequate teacher preparation and limited professional exposure remain major barriers to successful STEM education implementation.

Collectively, the literature indicates that STEM awareness is shaped by disciplinary background, age, and professional exposure, while gender and qualification exert comparatively limited influence. Empirical evidence from the Coimbatore district context remains scarce, constituting the gap the present study seeks to address.

Objectives of the Study

1. To examine the level of STEM education awareness among school teachers.
2. To determine the differences in STEM education awareness among school teachers with respect to gender, age, educational qualification, and teaching stream.
3. To examine the relationship between the dimensions of STEM education awareness and overall STEM awareness among school teachers.

Hypotheses of the Study

H_{01}: There is no significant difference among school teachers with respect to gender, age, educational qualification, and teaching stream on STEM education awareness.

H_{02}: There is no significant relationship between the dimensions of STEM education awareness and overall STEM awareness among school teachers.

Methodology

Research Design

The present study employed a descriptive survey research design, which is appropriate for examining the existing levels of STEM education awareness among school teachers and analysing variations based on selected demographic variables without manipulating any research conditions. The design enabled systematic collection and analysis of quantitative data to understand prevailing patterns of STEM awareness.

Population and Sample

The population comprised school teachers working in Coimbatore district. A total of 127 school teachers participated in the study through a convenience sampling approach. Participation was voluntary, and the final sample consisted of 54 male and 73 female teachers across different age groups (21–35 years = 48; 36–50 years = 51; and 51 years and above = 28), educational qualifications (UG with B.Ed. = 61; PG with B.Ed. = 66) and teaching streams (Humanities = 58; Science = 69). The participating teachers represented diverse demographic backgrounds relevant to the objectives of the study

Research Tool: STEM Education Awareness Scale (SEAS)

Data were collected using the STEM Education Awareness Scale (SEAS), comprising 30 items measured on a five-point Likert scale ranging from Strongly Disagree to Strongly Agree. The scale measures STEM education awareness across four dimensions: STEM Conceptual Knowledge & Sustainability (SCKS); Inclusive Pedagogical Practices in STEM (IPPS); Technology & Innovative Integration (TII); and Critical Thinking & Collaborative Problem Solving (CTCPS). Higher scores indicate greater STEM awareness.

Reliability and Validity

The internal consistency of the SEAS was established using Cronbach's Alpha coefficient ($\alpha = .82$), which exceeds the widely accepted threshold of .70 (Nunnally, 1978), indicating strong reliability. The intrinsic validity of the tool was established by computing the square root of the reliability coefficient ($\sqrt{.82} = .91$), indicating high validity for the present sample. Prior to data collection, normality of the data was examined and the assumption of homogeneity of variances was verified using Levene's test for the t-tests and ANOVA. Results confirmed that parametric statistical procedures were appropriate for the present sample.

Statistical Techniques

Data were analysed using SPSS. Descriptive statistics (mean and standard deviation) were used to determine the level of STEM awareness. Independent samples t-tests with Cohen's d were used to examine gender, qualification, and stream differences. One-way ANOVA with Tukey HSD post hoc comparisons and eta squared (η^2) was employed for age-wise analysis. Pearson's product-moment correlation was used to examine relationships between STEM dimensions and overall awareness. The level of significance was fixed at $p < .05$.

Analysis and Interpretation of Data

Descriptive Statistics

Table 1 presents the descriptive statistics for the four STEM dimensions and overall STEM awareness.

Table 1 Descriptive Statistics for STEM Education Awareness Dimensions (N = 127)

S. No.	Variable	N	Min	Max	Mean	SD
1	STEM Conceptual Knowledge & Sustainability (SCKS)	127	20	27	23.66	2.27
2	Inclusive Pedagogical Practices in STEM (IPPS)	127	27	32	29.50	1.71
3	Technology & Innovative Integration (TII)	127	27	37	32.06	3.17
4	Critical Thinking & Collaborative Problem Solving (CTCPS)	127	23	30	26.76	2.38
5	Overall STEM Education Awareness	127	102	123	111.98	4.57

Note. *SCKS = STEM Conceptual Knowledge & Sustainability; IPPS = Inclusive Pedagogical Practices in STEM; TII = Technology & Innovative Integration; CTCPS = Critical Thinking & Collaborative Problem Solving.*

The descriptive statistics indicate that school teachers demonstrated a high level of STEM education awareness, with an overall mean score of 111.98 (SD = 4.57). Among the four dimensions, teachers scored highest in Technology & Innovative Integration (M = 32.06, SD = 3.17), indicating strong awareness of technological and innovative practices. STEM Conceptual Knowledge & Sustainability recorded the lowest mean score (M = 23.66, SD = 2.27), suggesting scope for further strengthening teachers' interdisciplinary conceptual understanding.

STEM Education Awareness with Respect to Gender

An independent samples t-test was conducted to examine whether STEM awareness differed with respect to gender. Prior to analysis, Levene's test confirmed homogeneity of variance ($p > .05$) for all dimensions. Results are presented in Table 2.

Table 2 Mean, SD, t-values, and df for STEM Education Awareness with Respect to Gender

Variable	Male Mean (n=54)	Male SD	Female Mean (n=73)	Female SD	t-value	df	Sig.
STEM Conceptual Knowledge & Sustainability (SCKS)	23.38	2.31	23.81	2.22	1.61	125	.110 (NS)

Inclusive Pedagogical Practices in STEM (IPPS)	29.22	1.68	29.66	1.72	1.06	125	.292 (NS)
Technology & Innovative Integration (TII)	31.98	3.22	32.11	3.14	0.34	125	.738 (NS)
Critical Thinking & Collaborative Problem Solving (CTCPS)	26.74	2.41	26.78	2.36	0.11	125	.909 (NS)
Overall STEM Awareness	111.75	4.62	112.11	4.53	0.41	125	.686 (NS)

Note. *NS = Not Significant ($p > .05$). df = 125 for all comparisons. Cohen's d was < 0.20 for all comparisons, indicating negligible effect sizes.*

No statistically significant differences were observed between male and female teachers across any STEM dimension or overall STEM awareness. Although female teachers demonstrated marginally higher mean scores in SCKS, IPPS, and overall awareness, the differences were not significant. Effect sizes were negligible ($d < 0.20$), indicating that gender plays a minimal practical role in shaping STEM awareness in the present sample. H_{01} with respect to gender is retained.

STEM Education Awareness with Respect to Educational Qualification

Table 3 presents the independent samples t-test results for educational qualification. Levene's test confirmed homogeneity of variance prior to analysis.

Table 3 Mean, SD, t-values, and df for STEM Education Awareness with Respect to Educational Qualification

Variable	UG+B.Ed Mean (n=61)	SD	PG+B.Ed Mean (n=66)	SD	*t*-value	df	Sig.
STEM Conceptual Knowledge & Sustainability (SCKS)	23.59	2.30	23.74	2.25	0.47	125	.641 (NS)
Inclusive Pedagogical Practices in STEM (IPPS)	29.37	1.74	29.61	1.68	0.77	125	.443 (NS)
Technology & Innovative Integration (TII)	32.01	3.20	32.10	3.15	0.15	125	.881 (NS)
Critical Thinking & Collaborative Problem Solving (CTCPS)	26.49	2.44	26.93	2.31	1.14	125	.254 (NS)
Overall STEM Awareness	112.23	4.60	111.63	4.55	0.74	125	.462 (NS)

Note. *NS = Not Significant ($p > .05$). df = 125 for all comparisons. Cohen's d was < 0.20 for all comparisons, indicating negligible effect sizes.*

No significant differences were found between UG with B.Ed. and PG with B.Ed. teachers across any STEM dimension. Teachers with PG qualifications demonstrated only marginal variations compared to UG-qualified teachers. Effect sizes were negligible throughout. H_{01} with respect to educational qualification is retained.

STEM Education Awareness with Respect to Teaching Stream

Table 4 presents the independent samples t-test results for teaching stream, including Cohen's d to indicate practical significance.

Table 4 Mean, SD, t-values, df, and Cohen's d for STEM Education Awareness with Respect to Teaching Stream

Variable	Humanities Mean (n=58)	SD	Science Mean (n=69)	SD	*t*-value	df	Cohen's d	Sig.
STEM Conceptual Knowledge & Sustainability (SCKS)	23.34	2.28	24.54	2.19	2.01	125	0.36	.046*
Inclusive Pedagogical Practices in STEM (IPPS)	28.85	1.72	29.65	1.68	1.49	125	0.27	.138 (NS)
Technology & Innovative Integration (TII)	30.47	3.10	31.81	3.08	2.24	125	0.40	.027*
Critical Thinking & Collaborative Problem Solving (CTCPS)	26.33	2.42	26.27	2.35	0.11	125	0.02	.915 (NS)
Overall STEM Awareness	108.99	4.48	112.27	4.30	2.33	125	0.42	.022*

Note. ** p < .05; NS = Not Significant. Cohen's d: 0.20 = small, 0.50 = medium, 0.80 = large.*

Statistically significant differences were observed between Humanities and Science stream teachers for SCKS, TII, and overall STEM awareness, with Science teachers demonstrating higher scores. Effect sizes were small-to-medium (d = 0.36–0.42), indicating practically meaningful differences. The absence of a significant difference in CTCPS suggests that collaborative problem-solving skills are developed similarly across disciplines. H_{01} with respect to teaching stream is rejected.

STEM Education Awareness with Respect to Age

One-way ANOVA was conducted to examine age-wise differences. Table 5 presents the results including degrees of freedom and significance levels.

Table 5 Mean, SD, F-values, and df for STEM Education Awareness with Respect to Age Groups

Variable	21–35 yrs Mean (n=48)	SD	36–50 yrs Mean (n=51)	SD	51+ yrs Mean (n=28)	SD	F	Sig.
SCKS	24.92	2.18	23.58	2.24	22.15	2.31	5.87	.004**
IPPS	30.54	1.65	29.12	1.70	27.88	1.62	9.43	<.001**
TII	33.54	3.05	31.44	3.12	29.67	3.08	4.92	.009**
CTCPS	27.81	2.30	26.51	2.38	24.98	2.26	5.42	.005**
Overall STEM Awareness	115.40	4.35	110.13	4.48	102.93	4.22	41.22	<.001**

Note. *** $p < .01$. df = 2, 124 for all F-values. η^2 for overall STEM awareness = .40, indicating a large effect.*

Statistically significant differences were found across all four STEM dimensions and overall STEM awareness. Teachers aged 21–35 years demonstrated the highest mean scores across all dimensions. The eta squared value for overall STEM awareness (η^2 = .40) indicates a large effect, suggesting that age accounts for approximately 40% of the variance in overall STEM awareness in this sample. H_{01} with respect to age is rejected.

Post Hoc Analysis: Tukey HSD

Table 6 presents the Tukey HSD post hoc pairwise comparisons for age groups on STEM awareness dimensions where ANOVA was significant.

Table 6 Tukey HSD Post Hoc Pairwise Comparisons for Age-wise STEM Education Awareness

Variable	Group (I)	Group (J)	Mean Difference (I–J)	Std. Error	Sig.
Overall STEM Awareness	21–35 yrs	36–50 yrs	5.27	0.76	.001**
	21–35 yrs	51+ yrs	12.47	0.93	<.001**
	36–50 yrs	51+ yrs	7.20	0.91	<.001**
SCKS	21–35 yrs	51+ yrs	2.77	0.53	.001**
IPPS	21–35 yrs	51+ yrs	2.66	0.43	<.001**
TII	21–35 yrs	51+ yrs	3.87	0.74	.001**
CTCPS	21–35 yrs	51+ yrs	2.83	0.57	<.001**

Note. *** $p < .01$. Mean differences shown are for representative dimensions with significant pairwise differences.*

Post hoc comparisons using Tukey HSD revealed statistically significant age-wise differences in STEM education awareness. Teachers aged 21–35 years demonstrated significantly higher overall STEM awareness than teachers aged 36–50 years and those aged 51 years and above ($p < .01$). Similarly, teachers aged 36–50 years exhibited significantly higher overall STEM awareness than teachers aged 51 years and above. Across the four STEM dimensions, significant differences were consistently observed between teachers aged 21–35 years and those aged 51 years and above, indicating comparatively stronger STEM readiness among younger teachers.

Correlation Analysis

Table 7 presents Pearson's product-moment correlation coefficients between the four STEM dimensions and overall STEM awareness.

Table 7 Correlation between STEM Education Awareness Dimensions and Overall STEM Awareness (N = 127)

S. No.	Variables	r-value	Level of Significance	Remarks
1	STEM Conceptual Knowledge & Sustainability (SCKS) vs Overall STEM Awareness	0.781	p < .01	High Positive Correlation
2	Inclusive Pedagogical Practices in STEM (IPPS) vs Overall STEM Awareness	0.806	p < .01	High Positive Correlation
3	Technology & Innovative Integration (TII) vs Overall STEM Awareness	0.814	p < .01	High Positive Correlation
4	Critical Thinking & Collaborative Problem Solving (CTCPS) vs Overall STEM Awareness	0.793	p < .01	High Positive Correlation

Note. *All correlations significant at p < .01 (two-tailed).*

All four STEM dimensions demonstrated strong positive and statistically significant correlations with overall STEM awareness. Technology & Innovative Integration showed the strongest relationship ($r = .814$), indicating that teachers with stronger technology awareness tend to demonstrate higher overall STEM readiness. Inclusive Pedagogical Practices ($r = .806$), Critical Thinking & Collaborative Problem Solving ($r = .793$), and STEM Conceptual Knowledge ($r = .781$) also showed strong positive relationships. H_{02} is rejected.

Major Findings

1. The overall level of STEM education awareness among school teachers was high (M = 111.98, SD = 4.57).
2. Technology & Innovative Integration recorded the highest mean score among the four STEM dimensions (M = 32.06).
3. No statistically significant differences were observed between male and female teachers on any STEM dimension (all $p > .05$; $d < 0.20$).
4. No statistically significant differences were found between UG+B.Ed. and PG+B.Ed. qualified teachers on any STEM dimension (all $p > .05$).
5. Science stream teachers demonstrated significantly higher awareness in SCKS, TII, and overall STEM awareness than Humanities teachers ($p < .05$; d = 0.36–0.42).
6. Significant age-wise differences were observed across all STEM dimensions ($p < .01$; $\eta^2 = .40$ for overall awareness), with teachers aged 21–35 years demonstrating highest STEM awareness.
7. Tukey HSD post hoc analysis confirmed significant pairwise differences between all three age groups on overall STEM awareness.
8. All four STEM dimensions showed strong positive correlations with overall STEM awareness (r = .781–.814, $p < .01$), with TII showing the strongest association.

Discussion

School teachers demonstrated high overall STEM awareness, reflecting increasing exposure to STEM-oriented reforms and digital teaching practices, consistent with Singh and Kaur (2023) and Kumar and Mishra (2024). The highest score in TII aligns with Gómez-Trigueros and Yáñez-de-Aldecoa (2022), likely reflecting widespread smart classroom adoption post-NEP 2020. Within Bandura’s (1997) framework, greater digital exposure strengthens teachers’ instructional self-efficacy, reinforcing engagement with technology-supported STEM approaches.

The absence of gender and qualification differences suggests equitable access to STEM professional development in the Coimbatore context, contrasting with Tahir et al. (2021) and Kumar and Mishra (2024) who found demographic effects in other settings. Negligible effect sizes ($d < 0.20$) confirm the practical insignificance of these variables.

Stream-based differences (d = 0.36–0.42) confirm that science teachers’ sustained disciplinary engagement builds stronger STEM identity and instructional confidence (Cvencek et al., 2022; Yıldız & Akın, 2024). The absence of a stream difference in CTCPS suggests collaborative problem-solving skills are broadly transferable across disciplines.

Age emerged as the strongest demographic predictor ($\eta^2 = .40$), with younger teachers demonstrating substantially higher awareness across all dimensions. This reflects advantages of recent teacher education emphasising digital pedagogy and supports Hu et al. (2023). The large effect size underscores the urgency of professional development for senior teachers. The strong dimensional correlations (r = .781–.814) confirm SEAS construct validity and indicate that improvements in any dimension contribute to overall STEM readiness.

Limitations of the Study

The present study is subject to several limitations that should be considered when interpreting the findings. First, the use of purposive sampling and a sample of 127 teachers drawn from a single district limits the generalisability of findings to broader populations of school teachers. Second, the cross-sectional design precludes causal inferences about the relationship between demographic variables and STEM awareness. Third, the SEAS is a self-report instrument and is therefore susceptible to social desirability bias—teachers may have overestimated their STEM awareness. Fourth, the study does not account for potentially influential variables such as school type (government vs. private), years of teaching experience as a continuous variable, or prior STEM professional development exposure. These limitations suggest caution in generalising findings and underscore the need for the future research directions outlined below.

Educational Implications

1. Structured STEM professional development programmes should be organised, targeting Humanities teachers and teachers aged 51 years and above, who demonstrated comparatively lower STEM awareness.
2. Since Technology & Innovative Integration showed the strongest association with overall STEM awareness, teacher training programmes should prioritise digital pedagogy, educational technologies, and technology-supported instructional strategies.
3. Cross-disciplinary STEM literacy workshops should be designed for Humanities teachers to strengthen interdisciplinary understanding and confidence in STEM integration.
4. Teacher education institutions should incorporate dedicated STEM pedagogy modules within pre-service B.Ed. programmes, familiarising teachers with inquiry-based learning, collaborative problem-solving, and interdisciplinary instructional approaches.
5. Schools may establish collaborative teacher learning communities and peer mentoring initiatives to facilitate sharing of STEM practices and reduce the awareness gap between younger and senior teachers.

Conclusion

The present study examined STEM education awareness among 127 school teachers in Coimbatore district with respect to gender, age, educational qualification, and teaching stream. Grounded in Bandura's (1997) self-efficacy framework, the study found that teachers demonstrated a high overall level of STEM awareness, with Technology &

Innovative Integration emerging as the strongest dimension. Gender and qualification did not significantly influence STEM awareness, while age and teaching stream produced statistically and practically significant differences. Science stream teachers and younger teachers demonstrated stronger STEM awareness, consistent with their greater disciplinary and technological exposure. All four STEM dimensions showed strong positive correlations with overall awareness, underscoring the construct validity of the SEAS (Cronbach's α = .82).The study concludes that targeted professional development programmes—particularly for Humanities teachers and senior educators—are essential for strengthening STEM readiness and achieving the interdisciplinary, technology-integrated educational goals envisioned under NEP 2020. Future research employing larger samples, mixed methods, and longitudinal designs will further advance understanding of STEM education awareness among Indian school teachers.

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