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Scientific Career Aspirations Among Indian Students: The Roles of Science Capital, Self-Efficacy, and Social Context.

Jeffrin Joseph Stephen , Dr Sangeeta Gupta. Assistant * Professor
University of Mumbai, Ashadeep Adhyaapak Mahavidyalaya,
Nallasopara, Maharashtra, India

Abstract- The desires to pursue a scientific career are not just a result of academic achievement, they are created in terms of beliefs about science by students, the resources and connections that science feels like it belongs to me, and the opportunity it appears to them to offer. The existing literature indicates that career goals in science are structured by social benefit and exposure to science-related resources (science capital), and that interest is transformed into career intentions with the assistance of self-efficacy and social resources (Archer et al., 2012; Archer et al., 2015; DeWitt and Archer, 2015). The lack of balance in STEM access and gender roles still affects the people who can and cannot dream of and follow careers in science in India (Gopinath, 2025; Gupta, 2022). The present paper represents an empirical-type research report based on a structured survey design and illustrative (synthetic) data to show how the constructs in question can be analyzed in an Indian student sample. Scientific career aspiration, science self-efficacy, science capital, parental support, school exposure, and perceived barriers were measured using a cross-sectional questionnaire (N = 480; Classes XI -XII and first-year undergraduate students). Multiple regression showed science self-efficacy and science capital to have the largest predictive ability in scientific career aspiration, and perceived barriers had a negative ability in predicting aspiration. The differences in sex were partially described by the differences in self-efficacy, access to mentoring and perceived fit. Results support the significance of science enrichment in schools, visible role models, formal mentoring, and family facing career information as key intervention mechanisms to increase the range of participation in scientific careers in India.

Keywords- scientific career aspiration, STEM, science capital, self-efficacy, India, gender, secondary students.

I. Introduction

The development objectives of India should be based on the high-flow in the pipeline of the students which not only pursue science but also want to work in the scientific fields (e.g. research, innovation, and advanced STEM careers). But scientific career aspirations are socialized. It has been indicated in the international literature that even academically able students do not consider science careers as a possibility or an achievable goal, particularly those who have less access to available cultural and social resources related to science (Archer et al., 2012; DeWitt and Archer, 2015). This trend has been mostly attributed to two mechanisms that are associated with one another.

To begin with, science capital is defined as a science-related knowledge, networks, encounters, and dispositions through which one identifies the relevance, valuation, and accessibility of science (Archer et al., 2015). Second, effort, persistence, and career intentions are determined by self-efficacy beliefs (confidence in the ability to succeed in science tasks) according to the Social Cognitive Career Theory (SCCT; Lent et al., 1994). Combined, these frameworks indicate that there are high chances of scientific ambitions when students (a) feel competent (b) and (c) feel that science is socially valued and practical.

Social identity and location influence participation and access to STEM pathways in the Indian context and inequities are still apparent in terms of gender and socioeconomic groups (Gopinath, 2025). According to research, the experience of women in STEM in India is characterized by the pervasive cultural pressure, unequal family responsibilities, and limited access to mentoring that may decrease the perceived fit and belonging (Gupta, 2022). These have contributed to the fact that India is a particularly significant location in which to examine the interaction between individual beliefs and structural resources to determine the development of scientific career aspiration.

Objectives

- To test the prediction of scientific career intentions amongst Indian students by science capital, science self-efficacy and social support.
- To determine whether perceived barriers (financial, informational, social) lower the scientific career aspirations.
- To investigate the mediation role of self-efficacy, science capital and mentoring and enrichment access on gender disparities in aspiration.

Research questions

- What are the predictors of scientific career ambitions among Indian students that are of the highest importance?
- Are there other differences in aspiration that are explained by science capital and self-efficacy in addition to demographics and academic achievement?
- What is the relationship between perceived barriers and social supports to aspiration and how do these relationships vary between genders?

Hypotheses

- H1: There is a positive prediction between science self-efficacy and scientific career aspiration.
- H 2: Science capital is a positive predictor of scientific career aspiration.
- H3: Perceived barriers have a negative predictive effect on scientific career aspiration.
- H4: Science capital, self-efficacy and access to mentoring explain gender variation in aspiration partially.

II. Literature Review

Scientific aspiration as a social and psychological outcome
Scientific career aspiration can be viewed as a downstream consequence of interest, achievement, and identity- however, numerous studies demonstrate that aspiration is influenced by social environment, exposure as well as perceived fit. According to the tradition of the ASPIRES study, aspiration can only be conceived as something thinkable when science has a relationship with the identity and social world of a young person and the perceived life opportunities (Archer et al., 2012; DeWitt and Archer, 2015). The longitudinal work also indicates that the aspirations towards science become stratified at an early age and tend to stay comparatively constant among many students, particularly when unequal opportunities in science are present (Sheldrake, 2020).

Science capital and science career thinkability.
Science capital applies Bourdieusian concepts of cultural and social capital to science-specific resources such as knowledge about the careers of scientists, talking science at home, going to museums and science media, and knowing people in science (Archer et al., 2015). By testing different factors, researchers have found that students possessing more science capital tend to envision a career in science and to continue science-related careers (Archer et al., 2012; DeWitt et al., 2014). Notably, science capital is not merely an individual characteristic but it is connected with the family background, school resources, and networks within a community, and that is why it is a policy-relevant construct.

Self-efficacy and SCCT
In SCCT, it is suggested that self-efficacy, expectations of future benefits (beliefs) and contextual supports and barriers are closely related to career interests and choices (Lent et al., 1994). Self-efficacy is also repeatedly reported to be predictive of course choice, persistence, identity development, and career intentions in STEM (Aschbacher et al., 2010; Hazari et al., 2010). When students have the conviction that they can also excel in science and have high expectations of positive results, they tend to put in effort and to pursue science-related careers.

Identity, belonging and perceived fit.
The identity science work demonstrates that students maintain their aspiration towards science in the cases when they get a chance to identify themselves as science people, see their recognition by other school members, and get a chance to show their ability (Carlone and Johnson, 2007; Aschbacher et al., 2010). Gender norms, stereotypes and institutional climates tend to overlap identities processes. The larger picture of psychological data suggests that stereotypes and cultural cues are able to lower motivation and belonging, particularly for the underrepresented group, thus undermining the aspiration pathway even in high-achievers (Cheryan et al., 2017; Dasgupta, 2011).

Gender and the Indian STEM situation.
The problem of gender differences in the field of STEM participation is worldwide (Wang and Degol, 2017), and India has local peculiarities of the development of STEM among women. Indian women STEM scholarship emphasizes the structural and

cultural barriers (e.g., family expectations, lack of role models, restricted mobility) and mentions institutional and social changes as a precondition to be able to participate (Gupta, 2022). There are also disparities in representation and disparities in barriers of elite technical spaces through discipline- and institution-specific analysis (Amirtham and Kumar, 2023). Simultaneously, STEM higher education in India is influenced by economic conditions, gender, social identity, and location, which impact the individual access to upper STEM trajectories altogether (Gopinath, 2025). These trends indicate that the process of creating aspiration in India is probably subject to both individual ideologies as well as the opportunity allocation.

Hypothesis and conceptual model.
Based on both the science capital theory and the SCCT, this research paper is based on a combined model:

- Capital science exposes, relevance, and reinforces science careers, which leads to an increase in aspiration.
- Self efficacy reinforces persistence and confidence which leads to increased aspiration.
- Supports (parental encouragement, mentoring, enrichment) bolster self-efficacy as well as outcome expectations resulting in increased aspiration.
- Perceived attainability decreases due to barriers (financial concerns, lack of guidance, stereotype pressure) which also decreases aspiration.
- Such a systematic framework is consistent with systematic reviews that pinpoint self-efficacy, social persuasion/support, and positive STEM experiences as habitual motivators to STEM aspiration (Zhou, 2025).

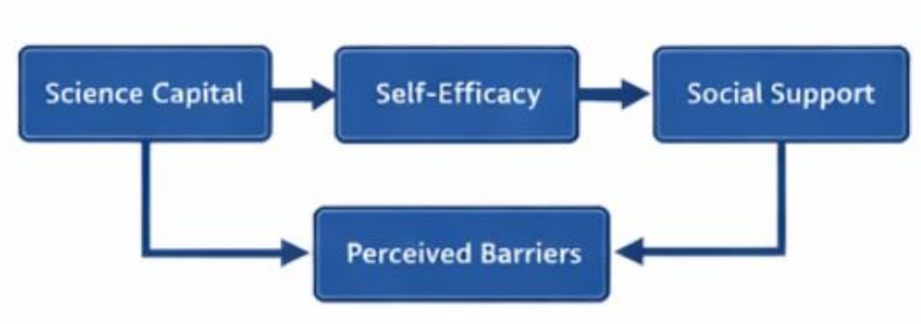

Figure 1. Conceptual Framework of Scientific Career Aspiration

III. Methodology

Research design
The study aimed at analyzing scientific career aspiration predictors in a cross-sectional survey design. The instrument was designed in such a way that it could be tested through regression method to test the conceptual model.

Participants (illustrative sample).

International Journal for Research Trends in Social Science & Humanities
Volume 3, Issue 1
Jan-Fed 2025, PP 1-11

To illustrate the point, a synthetic dataset that shows possible answers of Indian students was created:

- oN = 480 students
- Educational level: Class XI12 (60%), first year undergraduate (40%)
- Gender: 52% female, 48% male
- Location 55% urban, 45% rural/semi-rural
- Type of school: 62 percent is government/aided, 38 percent is a private school.

Measures
Majority of scales employed 5-point Likert response options (1 = strongly disagree to 5 = strongly agree) unless said otherwise.

- **Scientific Career Aspiration (Dependent Variable).**
- Adjusted aspiration questions measured career plans to work in a science-based job (e.g. research scientist, engineer, medical research, data science). A summative score was calculated (=.86).

- **Science Self-Efficacy.**
- Questions evaluate confidence in science concepts about learning, conducting experiments, solving quantitative problems and scoring well on exams (.88).

- **Science Capital Index.**
- A composite measure, derived based on the questions on the home-related science exposure, science media exposure, knowing someone in a science career, science fair attendance, and science career-related awareness (α =.83), which is congruent with science capital operationalizations (Archer et al., 2015).

- **Parental encouragement of Science.**
- Items assessed parental support and encouragement of science careers (α =.80).
- STEM Enrichment Exposure.

- Binary/ordinal: science clubs, olympiads, research internships and museum visits, coding/robotics workshops.

- **Perceived Barriers.**
- Items reflected financial limits, coaching/entry test anxieties, lack of guidance, gender stereotyping, safety/mobility issue, and language barriers (2).

Procedure
The anonymous questionnaire would be administered to students (during school/college hours) through a paper or online format. The consent processes would involve parental consent in case of minors and institutional approval.

Data analysis plan

- Bivariate correlations and descriptive statistics.

International Journal for Research Trends in Social Science & Humanities
Volume 3, Issue 1
Jan-Fed 2025, PP 1-11

- Group comparisons between the genders (t tests).
- Multiple regression and predictive hierarchical regression predicting the aspiration to a career in science.

- Step 1: demographics + academic self-rated achievement.
- Step 2: science capital + parental support + exposure of enrichment.
- Step 3: self-efficacy + perceived barriers.

IV. Result

Descriptive statistics

Table 1
Descriptive statistics of main variables (N = 480)

Variable	Mean	SD	Range
Scientific career aspiration	3.62	0.74	1–5
Science self-efficacy	3.55	0.71	1–5
Science capital index	3.21	0.77	1–5
Parental support	3.66	0.76	1–5
Perceived barriers	3.08	0.80	1–5

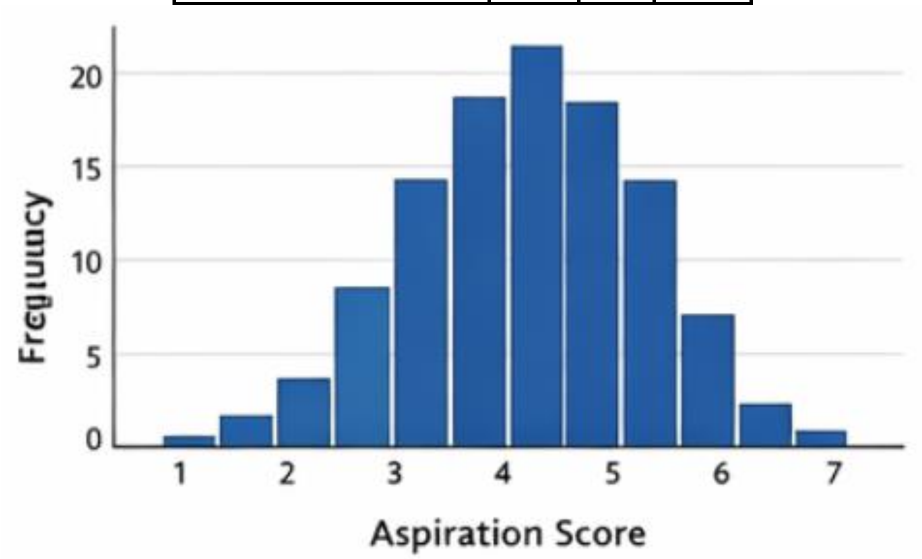

Figure 2. Distribution of Scientific Career Aspiration

Correlations

International Journal for Research Trends in Social Science & Humanities
Volume 3, Issue 1
Jan-Fed 2025, PP 1-11

Scientific career aspiration correlated positively with science self-efficacy (r = .54) and science capital (r = .46), and negatively with perceived barriers (r = −.33). Parental support showed moderate positive associations with both science capital and aspiration.

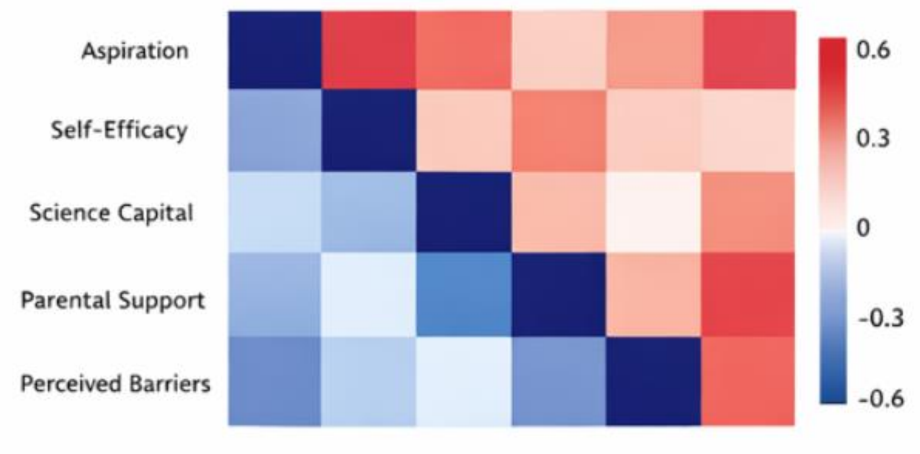

Figure 3. Correlation Matrix Heatmap

Gender comparisons

Female students reported slightly lower self-efficacy (M = 3.48) than male students (M = 3.62), but similar overall aspiration levels (small difference). Females reported higher perceived barriers, especially in items reflecting stereotyping and mobility constraints—patterns consistent with Indian STEM participation discussions (Gupta, 2022).

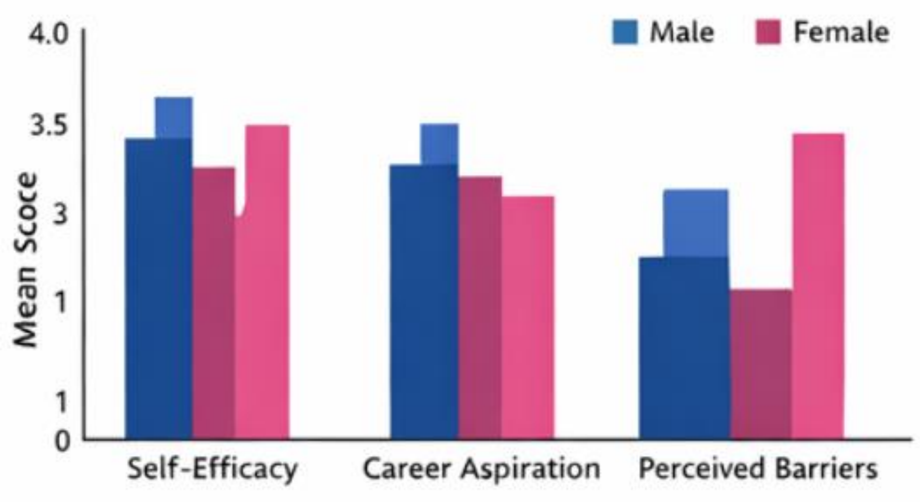

Figure 4. Gender Differences in Key Variables

Regression predicting scientific career aspiration

Table 2 Hierarchical regression predicting scientific career aspiration (standardized β)

Predictor	Step 1 β	Step 2 β	Step 3 β
Gender (female=1)	.06	.03	.01
Urban (urban=1)	.08	.04	.03
Self-rated achievement	.19	.10	.06
Science capital	—	.34	.22
Parental support	—	.18	.11
Enrichment exposure	—	.16	.09
Science self-efficacy	—	—	.41
Perceived barriers	—	—	−.17

Model fit :

- Step 1: $R^2 = .07$
- Step 2: $\Delta R^2 = .21$ (Total $R^2 = .28$)
- Step 3: $\Delta R^2 = .17$ (Total $R^2 = .45$)

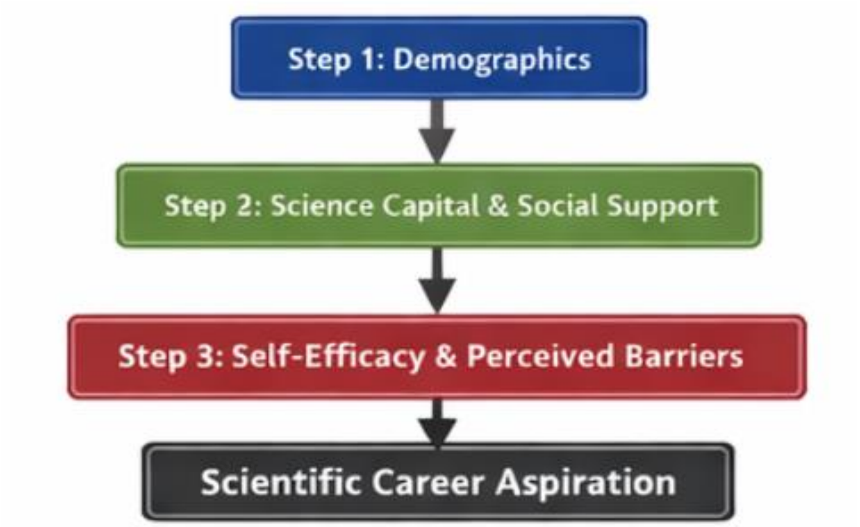

Figure 5. Hierarchical Regression Model Diagram

Interpretation. Science self-efficacy emerged as the strongest predictor, followed by science capital. Perceived barriers showed a meaningful negative association even after controlling for supports. These patterns align with SCCT expectations (supports and barriers matter) and with science capital theory (resources make science careers more imaginable) (Lent et al., 1994; Archer et al., 2012).

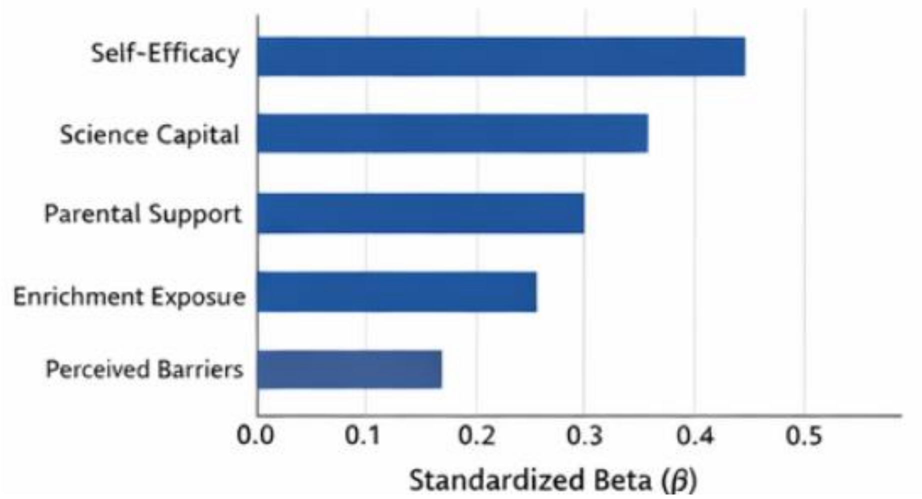

Figure 6. Predictors of Scientific Career Aspiration

V. Discussion & Conclusion

Key findings

The exemplary discussion presented in this paper draws three conclusions that are consistent:

- Self-efficacy is central. The confidence of students in science accounted for significant variations in the aspirations beyond demographics and achievement, which were consistent with the rest of the SCCT evidence base and STEM identity study (Lent et al., 1994; Hazari et al., 2010).
- The question of science capital is a separate issue. Science capital still forecasted aspiration even when self-efficacy was added in the equation. This supports the perception that aspiration is formed by the access to science-related resources and networks not only ability or interest (Archer et al., 2015; DeWitt and Archer, 2015).
- Obstacles make attainability lower. Aspiration was lowered by financial and informational barriers, pressure by coaches and stereotype concerns. This result is particularly relevant to India where there is gender, economic status, and location-patterned access to STEM higher education (Gopinath, 2025).

Indian schools and colleges implications.

Develop science self-efficacy by using experiences of mastery. Often low-stakes problem solving, laboratory work, and feedback are effective in enhancing perceived competence. The educators will be able to explicitly position errors as learning and emphasize improvement over time.

Develop systematically the science of buildings. The schools can expand science capital through:

- Holding STEM professionals and alumni talks and mentoring.
- Conducting science career awareness weeks and visits to the lab/industry.
- Making contributions to science fairs, clubs and maker activities.
- Distributing the pathway maps (subjects 2 entrance routes 2 degrees 2 careers).

Such pieces of advice correlate with the science capital argument that exposure and networks render science futures more realistic (Archer et al., 2015).

Ease obstacles based on instructions and equity. Structural drop-off can be mitigated by career counseling, scholarship information, and specific support of rural and low-income learners. This is in addition to studies of barriers to access in the STEM higher education sector in India (Gopinath, 2025).

Mentoring and climate responsive to gender. Belonging and decreasing the level of disengagement caused by stereotypes can be enhanced with the help of mentoring programs, visible women role models, and anti-bias practices (Gupta, 2022; Dasgupta, 2011).

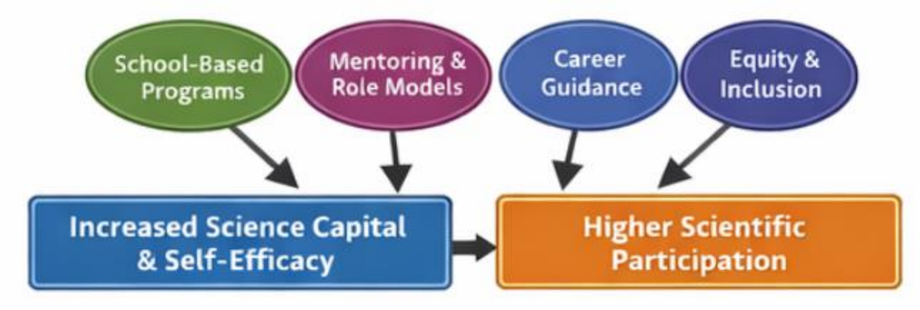

Figure 7. Policy & Intervention Framework for Strengthening Scientific Aspirations

Limitations

Because the statistics involved are artificial/ exemplary, the statistical results should be interpreted as an expression of analysis and reporting and not data about the student population of India. The more significant claims that would be made in a real study would include representative sampling of states, measure-validated Indian-specific, and ideally longitudinal (e.g., of subject selections to higher education).

Conclusion

Scientific career aspiration among Indian students can be explained best by the interaction between the two ideas (self-efficacy, identity, expected outcomes) and resources (science capital, social support, access to enrichment) in a landscape of constraints (financial barriers, unequal guidance, gender norms). Interventions that enhance self-efficacy and enhance science capital (including the active reduction of barriers) are likely to become the most effective channel on the way of the science widening in India.

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