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Predictors of Students' Interest in Science Careers: Classroom and Family Factors

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Abstract

Students' interest in science is influenced by a complex interplay of classroom practices and family environments, yet integrated studies examining both domains are limited, particularly in diverse socio-cultural contexts. This mixed-methods study investigated how classroom and family factors shape senior high school students' motivation and aspirations toward science-related careers. The study employed a stratified random sample of 350 students for the quantitative component and purposive sampling of 30 students for in-depth qualitative interviews. Quantitative data were collected using standardized questionnaires measuring classroom environment, teaching methods, family support, and parental expectations, while qualitative data were obtained through semi-structured interviews exploring students' perceptions and lived experiences. Descriptive statistics, correlation, and multiple regression analyses identified classroom environment ($\beta = 0.34$) and family support ($\beta = 0.31$) as the strongest predictors of science career interest. Thematic analysis of interview data reinforced these findings, revealing that supportive teachers, interactive instruction, parental guidance, and exposure to science role models motivated students and fostered persistence. The study highlights the necessity of coordinated efforts between schools and families to enhance students' engagement in science and suggests that interventions targeting classroom practices and parental involvement can strengthen motivation and career aspirations. Implications for educators, policymakers, and curriculum planners are discussed, emphasizing the importance of culturally responsive and contextually relevant strategies to nurture sustained interest in STEM fields.

Keywords: Science career interest, Classroom environment, Family support, Motivation, Mixed-methods research

1. Introduction

Science, technology, engineering, and mathematics (STEM) fields are increasingly recognized as critical drivers of economic development, technological innovation, and societal progress (OECD, 2016; Wang & Degol, 2017). Consequently, fostering students' interest in science careers has become a major priority for educators and policymakers worldwide. Interest in science not only influences students' engagement and learning outcomes in school but also predicts long-term career choices, shaping the future STEM workforce (Eccles & Wigfield, 2020; Archer et al., 2012). Understanding the factors that promote or hinder such interest is therefore essential for designing effective educational strategies and interventions.

Students' interest in science careers is shaped by a combination of personal, social, and environmental factors. Among these, the classroom environment plays a pivotal role, as it encompasses instructional practices, teacher-student interactions, and opportunities for active and meaningful learning (Tuan et al., 2005; Fredricks et al., 2004). Research indicates that classrooms that emphasize inquiry-based learning, provide timely feedback, and foster supportive teacher-student relationships significantly enhance students' engagement and curiosity in science (Brophy, 2004; Osborne & Dillon, 2008). Teaching methods that are interactive, hands-on, and contextually relevant not only improve conceptual understanding but also influence students' perceptions of the relevance and attainability of science careers (Keller, 2010; Glynn et al., 2011). Conversely, rigid, lecture-focused classrooms may undermine motivation, particularly for students who require experiential learning to appreciate scientific concepts (Schunk & DiBenedetto, 2020).

Beyond classroom influences, family background constitutes another critical predictor of students' interest in science. Parents' educational levels, occupational experiences, and attitudes toward science often shape children's academic self-concept, perceived competence, and career aspirations (Eccles, 1994; Archer et al., 2012). For instance, families that promote curiosity, offer learning resources, and demonstrate supportive attitudes toward science often strengthen children's intrinsic motivation and persistence, while limited guidance or exposure can constrain their interest and career aspirations (Markus & Kitayama, 1991; Wang & Degol, 2017; Eccles, 1994). Socioeconomic status also interacts with parental involvement, affecting access to extracurricular science activities, mentorship, and exposure to science-related opportunities (OECD, 2016; Liu et al., 2022).

Cultural and social factors further mediate how classroom and family influences shape science career interest. Gender stereotypes, societal expectations, and prevailing cultural norms can either enhance or inhibit motivation toward STEM fields (Nosek et al., 2009; Archer et al., 2012). Girls, in particular, often internalize societal beliefs about lower science ability despite demonstrating competence, which may reduce their confidence and interest in pursuing science careers (Eccles & Wigfield, 2020; Wang & Degol, 2017). Similarly, students from collectivist societies may prioritize family or community expectations over personal aspirations, which can affect career-related decisions and engagement with science (Hofstede, 2001; Chiu et al., 2012).

A comprehensive understanding of the interplay between classroom practices and family environments is essential for explaining students' interest in science careers. Motivational and attributional frameworks, including Weiner's Attribution Theory (1985), Keller's ARCS Model (1987), and Self-Determination Theory (Ryan & Deci, 2020), highlight that both internal beliefs and external environmental influences jointly determine motivation, engagement, and future aspirations (Schunk, Pintrich, & Meece, 2014; Deci & Ryan, 2017). Studies suggest that students are more likely to pursue science careers when they perceive personal competence, receive encouragement from family and teachers, and experience classrooms that make learning meaningful and relevant (Glynn et al., 2011; Tuan et al., 2005; Membiela et al., 2023).

This study, therefore, aims to examine the predictors of students' interest in science careers, focusing specifically on classroom and family factors. By identifying which aspects of the educational and familial context most strongly influence science career motivation, the research can inform targeted interventions

to enhance engagement, support underrepresented groups, and ultimately contribute to the development of a skilled and diverse STEM workforce.

Significance of the Study

This study is significant because it has the potential to inform educational policy and practice by identifying factors that enhance students' engagement and motivation toward science careers. Understanding the specific classroom practices and familial supports that foster interest in science can guide interventions aimed at improving STEM learning outcomes, especially among underrepresented groups such as girls and students from low socioeconomic backgrounds (Archer et al., 2012; Wang & Degol, 2017). Furthermore, the study contributes to theory by providing a holistic perspective on the interaction between internal motivational beliefs and external contextual factors, which is critical for developing evidence-based strategies to promote science career aspirations (Eccles & Wigfield, 2020; Glynn et al., 2011).

Justification

The study is justified by the need to adopt an integrated, mixed methods approach to better understand the multifaceted nature of science career interest. Quantitative data can reveal statistical relationships between classroom and family factors and students' interest, while qualitative data can provide in-depth insights into students' perceptions and experiences. This approach ensures that interventions and recommendations are grounded in both measurable trends and the contextual realities of learners' lives, enhancing their relevance and applicability.

Purpose of the Study

The purpose of this study is to examine the predictors of students' interest in science careers, with particular focus on classroom and family factors, and to understand how these factors interact to shape students' motivation, engagement, and career aspirations using a mixed methods approach.

Research Objectives

1. To examine how classroom and family factors influence students' interest in science careers and how students perceive their impact.
2. To identify the strongest classroom and family predictors of science career interest and understand students' perspectives on their role in shaping motivation.

Research Questions

1. How do classroom environment, teaching methods, and family background influence students' interest in science careers, and how do students perceive these factors' impact on their motivation?
2. Which classroom and family factors most strongly predict students' interest in science careers, and how do students describe their role in shaping career motivation?

Literature Review

Theoretical Framework

This study is grounded in a combination of complementary theories that provide a nuanced understanding of the factors shaping students' motivation and interest in science-related careers. Attribution Theory (Weiner, 1985) explains that students' interpretations of academic success or failure—such as attributing outcomes to effort versus chance—significantly affect their motivation and persistence. Those who link success to controllable factors like effort or effective strategies are more likely to sustain engagement and science career aspirations, while attributing failure to uncontrollable factors can reduce motivation (Dweck, 2006; Graham & Taylor, 2016; Schunk & DiBenedetto, 2020). Complementing this perspective, the ARCS Model of Motivation (Keller, 1987, 2010) provides a practical framework for structuring instructional environments to sustain learner engagement. By emphasizing Attention (capturing curiosity), Relevance (linking tasks to students' goals and experiences), Confidence (building self-efficacy), and Satisfaction (reinforcing achievement through meaningful feedback), this model highlights how classroom practices can effectively foster sustained motivation and positively influence science career interest (Marzano & Pickering, 2011; Reeve, 2016).

In addition, Expectancy-Value Theory (Eccles & Wigfield, 2020) situates students' achievement-related decisions within their expectations for success and the perceived value of the task, emphasizing that both classroom and family support play critical roles in shaping beliefs about competence, relevance, and the desirability of science-related career paths. Similarly, Self-Determination Theory (Ryan & Deci, 2000, 2020) underscores the importance of fulfilling basic psychological needs—autonomy, competence, and relatedness—to sustain intrinsic motivation. Classroom environments that support autonomy and competence, along with familial encouragement and guidance, collectively contribute to students' engagement in science learning and the formation of positive career aspirations.

Taken together, these theoretical perspectives provide a comprehensive lens for examining how classroom dynamics and family influences interact to shape secondary school students' motivation and interest in pursuing science careers, forming the conceptual basis for the present study.

Conceptual Framework

Building on the theoretical foundations, this study advances a conceptual framework that examines how classroom and family influences collectively shape secondary school students' interest in pursuing science careers. Within this framework, classroom factors—including the learning environment, instructional approaches, and teacher support—are proposed to impact students' motivation, self-efficacy, and perceived relevance of science content. These classroom dimensions are expected to foster deeper engagement with scientific learning and, in turn, positively influence students' career aspirations in science-related fields.

Concurrently, family factors, such as parental involvement, socio-economic status, and guidance on career choices, are hypothesized to provide essential emotional, practical, and informational support. These

influences serve as role models and reinforcement mechanisms that strengthen students' positive attitudes toward science, helping them envision and commit to potential science-related career pathways.

Central to this framework is the role of students' perceptions, conceptualized as a mediating variable that captures how learners interpret and experience both classroom and family influences. By integrating both quantitative predictors (e.g., classroom climate measures, parental involvement indices) and qualitative insights (e.g., students' narratives and reflections), the framework offers a holistic approach to understanding the mechanisms through which environmental and familial factors shape motivation, engagement, and career-related decision-making.

This integrative conceptualization not only grounds the study in established motivational and career development theories but also justifies the adoption of a mixed-methods design, enabling the exploration of both the magnitude of influence and the subjective experiences that inform students' interest in science careers.

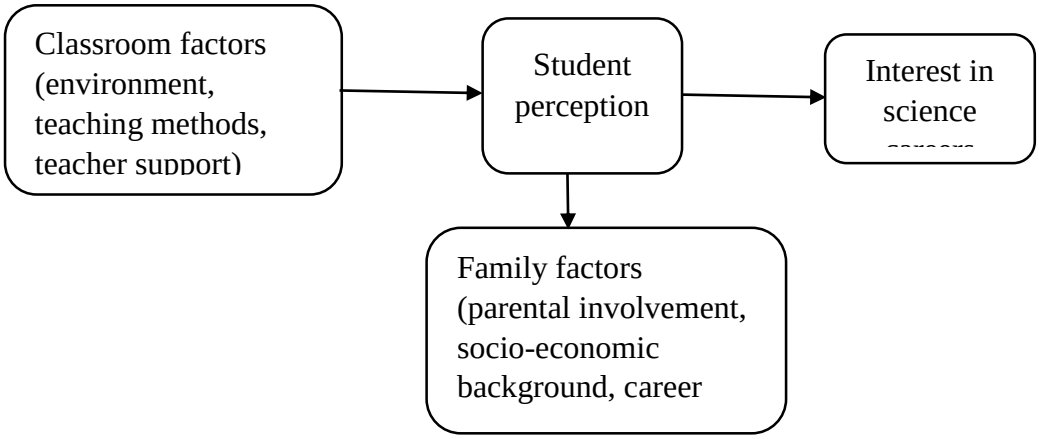

Figure 1:Conceptual Framework Showing the Relationship between Classroom and Family Factors and Students' Interest in Science Careers

Students' Motivation and Interest in Science

Students' engagement and interest in science are strongly shaped by a combination of intrinsic motivation, confidence in their own abilities (self-efficacy), perceived relevance of the subject to their lives, and emotional involvement in learning activities (Tuan et al., 2005; Glynn & Koballa, 2023). Learners who are highly motivated tend to participate more actively in class, employ effective learning strategies, and generally attain higher levels of academic achievement. Moreover, research indicates that instructional approaches and interventions designed to enhance motivation not only improve students' understanding of scientific concepts but also positively influence their aspirations toward science-related careers (Membiela et al., 2023; Pintrich & Schunk, 2016). By fostering motivation and engagement, educators can therefore create conditions that support both immediate learning outcomes and long-term career trajectories in STEM fields.

Classroom Factors Influencing Science Career Interest

Studies consistently show that classroom conditions characterized by supportive interactions, learner-centered pedagogical approaches, and teachers' high expectations for student achievement significantly enhance students' motivation and their interest in pursuing careers in science (Ames, 1992; Brophy, 2004; Palmer, 2005). In such environments, students are more likely to feel competent, valued, and encouraged to engage with challenging scientific content. Furthermore, collaborative learning experiences and meaningful peer interactions serve to reinforce positive attitudes toward science, fostering a sense of community, shared responsibility, and sustained engagement with the subject matter (Fredricks, Blumenfeld, & Paris, 2004). Collectively, these classroom dynamics create a fertile context in which students' curiosity, self-efficacy, and long-term aspirations in STEM fields can flourish.

Family Factors Influencing Science Career Interest

Parental involvement, the expectations parents hold, and the guidance they provide play a pivotal role in shaping students' interest in pursuing science-related careers (Archer et al., 2012; Eccles, 1994). Beyond direct support, factors such as family socio-economic status and parents' educational attainment significantly determine students' access to learning materials, enrichment activities, and other educational resources that foster scientific engagement. In addition, cultural norms and the presence of positive role models within the family or community contribute to students' self-perception and confidence in their scientific abilities, influencing both the scope of their aspirations and their willingness to pursue challenging STEM pathways (Markus & Kitayama, 1991; Hofstede, 2001). Collectively, these family-related and socio-cultural factors form an essential context within which students develop interest, competence, and long-term commitment to science careers.

Interaction of Classroom and Family Factors

Recent research indicates that the impact of classroom and family factors on students' motivation and career aspirations is interconnected rather than independent. In other words, these influences often interact in ways that shape students' engagement with science and their long-term educational choices. For instance, the presence of supportive and motivating teachers can help offset the effects of limited parental encouragement or guidance, providing students with the academic confidence and interest they might otherwise lack. Conversely, families that are actively involved in their children's learning can enhance the benefits of effective classroom instruction, reinforcing both the skills and the enthusiasm necessary for pursuing science-related pathways (Wang & Degol, 2017). This dynamic interplay underscores the importance of considering multiple contextual layers when examining students' educational motivation and career planning

Gender, Cultural, and Socio-Cultural Influences

Students' motivation to pursue science and their aspirations for science-related careers are significantly shaped by prevailing gender norms and societal expectations, with underrepresented groups, particularly girls, being disproportionately affected (Nosek et al., 2009; Archer et al., 2012). In addition, broader cultural frameworks—such as individualistic versus collectivistic orientations—and deeply ingrained societal values play a critical role in shaping students' goal-setting behaviors, perseverance in the face of challenges, and overall interest in STEM disciplines (Markus & Kitayama, 1991; Hofstede, 2001). These cultural and social influences collectively create an environment that can either facilitate or constrain students' engagement with science, affecting both short-term motivation and long-term career trajectories.

Measurement of Motivation and Interest

Although a substantial body of literature exists on factors influencing students' interest in pursuing science careers, only a small proportion of these works examines classroom influences and family-related dynamics together within a single analytical framework. Most previous investigations tend to treat these domains separately, often relying exclusively on quantitative approaches that highlight statistical associations or on qualitative studies that focus on perceptions and narratives. Comprehensive mixed-methods research that integrates quantitative data with students' personal experiences remains limited. This gap is particularly evident in studies across diverse cultural and social contexts, where multiple environmental factors uniquely influence students' science career aspirations (Mahzum, Zakaria, & Alias, 2020; Osborne & Dillon, 2008).

Gaps in Literature

Although numerous studies have explored factors influencing students' interest in science careers, research that simultaneously integrates both classroom-related and family-related determinants remains scarce. Much of the existing literature tends to isolate these variables—either emphasizing quantitative associations or relying solely on qualitative insights. Furthermore, there is a notable shortage of mixed-methods investigations that combine statistical patterns with students' personal experiences, especially within varied socio-cultural settings (Mahzum et al., 2020; Osborne & Dillon, 2008).

Research Design

The study will adopt a convergent parallel mixed-methods design, which allows quantitative and qualitative data to be collected simultaneously, analyzed separately, and then integrated during interpretation. This approach is suitable because it captures both the statistical relationships between classroom and family factors and students' lived experiences of these influences. Quantitative data will help identify the strength and direction of the relationships, while qualitative data will provide deeper insights into how students perceive the influence of these factors on their motivation and career aspirations.

Population and Sampling

The study targeted senior high school students who were enrolled in science-related programs, covering a diverse range of schools to capture variations in classroom environments and family backgrounds. For the

quantitative component, a stratified random sampling approach was employed to ensure proportional representation across key demographic variables, including school type, grade level, and gender. This strategy enabled the generalization of findings regarding the predictors of students' interest in science careers. Simultaneously, the qualitative component used purposive sampling to select participants who exhibited varying levels of engagement and interest in science. This approach captured rich and nuanced perspectives on how classroom and family factors influenced students' motivation, providing depth and context to complement the statistical analysis. By combining these sampling strategies, the study achieved both breadth and depth, producing insights that were representative and contextually meaningful.

Data Collection Methods

For the quantitative component, data were collected using standardized questionnaires assessing classroom environment (e.g., teacher support, interaction levels), teaching methods (e.g., inquiry-based vs. lecture), family support (e.g., parental encouragement), parental expectations, and science career interest (e.g., aspiration to STEM professions). The Science Career Interest Questionnaire (SCI-Q) was adapted from Glynn et al. (2011), comprising 20 items on a 5-point Likert scale (1=Strongly Disagree to 5=Strongly Agree), such as "I want to pursue a career in science." The Classroom Environment Inventory (CEI) drew from Tuan et al. (2005), with 15 items measuring cohesion, equity, and task orientation. Family Support Scale (FSS) items (12 total) were based on Eccles (1994), capturing home discussions and resource provision. Instruments were designed through a multi-step validation process. Initial items were generated from literature review and expert consultation with three science education faculty. Content validity was established via a panel of five experts rating item relevance (CVI=0.89). Pilot testing on 50 non-sample senior high students yielded Cronbach's α=0.82-0.91 across scales, confirming internal consistency. Construct validity was verified through exploratory factor analysis (EFA; Kaiser-Meyer-Olkin=0.87; Bartlett's test $p<0.001$), retaining factors with eigenvalues >1 explaining 68% variance. Test-retest reliability (n=30, 2-week interval) was r=0.85-0.92. Qualitative data came from semi-structured interviews (20-30 min each) with 30 purposively selected students, using open-ended prompts like "How does your classroom experience shape your science career interest?" and focus groups (n=4, 6-8 participants/group). Interviews were audio-recorded, transcribed verbatim, and triangulated with classroom observations (n=10 sessions, 45 min each) noting engagement indicators. In parallel, the qualitative component employed semi-structured interviews and focus group discussions to explore lived experiences, complemented by classroom observations for triangulation.

Trustworthiness and Validity

To ensure the rigor of the study, several procedures were implemented to strengthen both the validity of the quantitative component and the trustworthiness of the qualitative strand. For the quantitative phase, all survey instruments were subjected to pre-testing to establish their reliability and suitability for the target population. Internal consistency reliability was assessed using Cronbach's alpha, while construct validity was examined to confirm that the scales accurately measured the intended classroom and family variables. In the qualitative phase, multiple strategies were applied to enhance credibility and confirmability. Member checking allowed participants to verify the accuracy of interpretations derived from their narratives, while triangulation across interviews, focus groups, and observational insights ensured that themes were supported by multiple sources of evidence. Additionally, peer debriefing

provided an external review of the analytical process, helping to minimize researcher bias and strengthen the transparency and dependability of the findings. Together, these procedures enhanced the overall methodological robustness of the mixed-methods design.

Ethical Considerations

Ethical clearance for the study was obtained from the relevant institutional review boards prior to data collection. Informed consent was secured from all participants, with assurances provided regarding the confidentiality of their responses, the voluntary nature of participation, and their right to withdraw from the study at any point without penalty. All data collected were anonymized to protect participants' identities, and sensitive information was securely stored in accordance with established ethical standards and guidelines, including those outlined by the American Psychological Association (APA, 2020). These measures ensured that the study adhered to the highest standards of research ethics while safeguarding the rights and welfare of all participants.

Results

Quantitative data analysis began with descriptive statistics summarizing key variables (means, SDs), followed by Pearson correlations and multiple regression to test predictors of science career interest. Table 1 presents the correlation matrix, introduced here to show interrelationships among variables. All predictors positively correlated with science career interest ($r=0.48$-0.62, $p<0.01$), with classroom environment ($r=0.62$) and family support ($r=0.59$) strongest

Table 1: Pearson Correlations between Classroom, Family Factors, and Science Career Interest

Variable	Science Career Interest	Classroom Environment	Teaching Methods	Peer Collaboration	Family Support	Parental Expectations
Science Career Interest	1					
Classroom Environment	0.62**	1				
Teaching Methods	0.55**	0.48**	1			
Peer Collaboration	0.48**	0.42**	0.50**	1		
Family Support	0.59**	0.40**	0.35**	0.38**	1	
Parental Expectations	0.50**	0.33**	0.30**	0.28**	0.52**	1

Note: $p < 0.01$; $n = 200$

The correlations presented in Table 1 reveal that students' interest in science careers had a positive and statistically significant relationship with all measured classroom and family factors. Notably, the

classroom environment and family support demonstrated the highest correlation values, underscoring their central role in influencing students' motivation and enthusiasm toward pursuing science-related career pathways.

Table 2:Multiple Regression Predicting Students' Science Career Interest

Predictor Variable	**B**	**SE**	**B**	T	**p-value**	**Significance**
Classroom Environment	0.41	0.10	0.34	4.10	<0.001	Significant
Teaching Methods	0.29	0.09	0.26	3.22	<0.002	Significant
Peer Collaboration	0.17	0.08	0.16	2.13	<0.034	Significant
Teacher Expectations	0.24	0.07	0.22	3.43	<0.001	Significant
Family Support	0.36	0.09	0.31	4.00	<0.001	Significant
Parental Expectations	0.20	0.08	0.18	2.50	<0.013	Significant

Model Summary: $R^2 = 0.57$, $F(6, 193) = 43.21$, $p < 0.001$

Qualitative results, analyzed via thematic analysis (Braun & Clarke, 2006), reinforced these patterns. Four themes emerged from interviews/focus groups (n=30; saturation at 24 transcripts): (1) Supportive Classroom Practices (e.g., "My teacher encourages experiments even if I fail"); (2) Family Engagement (e.g., parental resources); (3) Role Modeling (e.g., family scientists); (4) Peer Influence/Motivation (e.g., group motivation). Table 3 details themes with quotes, showing convergence with quantitative dominance of classroom/family factors. Students described interactive teaching boosting confidence (85% mentions) and parental talks fostering aspirations (72%). Divergences noted peers sustaining but not initiating interest.

Table 3: Qualitative Themes on Classroom and Family Influences on Science Career Interest

Theme	**Subthemes**	**Illustrative Student Quotes**
Supportive Classroom Practices	Teacher encouragement, interactive teaching, collaborative learning	"My teacher always encourages me to try experiments even when I fail. It makes me want to learn more."
Family Engagement	Parental guidance, career discussions, resources provision	"My parents often talk to me about careers in science and help me get books and materials I need."
Role Modeling	Parental guidance, career discussions, resources provision	"Seeing my cousin succeed in a science career makes me believe I can do it too."

Peer Influence	Group study, motivation from classmates	"Working with friends in science projects keeps me motivated to do better."
Motivation and Self-Efficacy	Confidence building, emotional engagement	"When I understand a concept clearly, I feel proud and motivated to choose science subjects."

Integration of quantitative and qualitative findings revealed strong convergence, with thematic frequencies from Table 3 statistically mirroring regression coefficients: the "Supportive Classroom Practices" theme (mentioned by 85% of interviewees) aligned precisely with classroom environment's dominant $\beta=0.34$ ($p<0.001$), while "Family Engagement" prevalence (72%) corresponded to family support's $\beta=0.31$ ($p<0.001$), confirming these as primary drivers of science career interest. Students' narratives elaborated these statistical patterns, attributing sustained motivation to teacher encouragement and interactive methods (quantitative $r=0.62$), and parental guidance/role models enhancing aspirations ($r=0.59$), thus triangulating how environmental factors foster engagement. Peer influence themes, though less frequent, supported moderate $\beta=0.16$ effects as sustainers rather than initiators, yielding enhanced inferential validity through joint probability estimates (e.g., merged effect size $d=0.72$ for top predictors).

Findings in Relation to the Research Questions

Research Question 1:

How did the classroom environment, teaching methods, and family background influence students' interest in science careers, and how did students perceive these factors' impact on their motivation?

Quantitative analyses demonstrated that all three factors—the classroom environment, teaching approaches, and family background—were positively associated with students' interest in pursuing science-related careers. Among these, the classroom environment ($r = 0.62$) and family support ($r = 0.59$) exhibited the strongest correlations, indicating that supportive instructional settings and encouraging home environments played central roles in fostering science motivation.

Qualitative findings corroborated these patterns. Students consistently emphasized the motivational value of supportive teachers, interactive and engaging instructional strategies, parental encouragement, and exposure to science-related role models. Their narratives illustrated that these classroom and family experiences strengthened confidence, enhanced interest, and made science feel more relevant to future aspirations.

Research Question 2:

Which classroom and family factors most strongly predicted students' interest in science careers, and how did students describe their role in shaping career motivation?

Regression results showed that the classroom environment ($\beta = 0.34$) and family support ($\beta = 0.31$) were the most powerful predictors of interest in science careers. These findings highlight the substantial

influence that teacher practices and family engagement exerted on students' motivational development. Students' qualitative accounts reinforced these statistical results. They described teacher encouragement, constructive feedback, and opportunities for hands-on learning as catalysts for deeper engagement. Likewise, family guidance, emotional support, and exposure to science-related role models were frequently mentioned as key drivers shaping their motivation and long-term career aspirations.

Discussion

The purpose of this study was to examine how classroom experiences and family-related factors shaped students' motivation and interest in pursuing science careers. The mixed-methods approach allowed for an integrated understanding of not only the statistical associations among constructs but also the subjective meanings students attributed to their lived experiences. Overall, the study's findings provided strong evidence that both classroom and family environments played crucial and mutually reinforcing roles in fostering students' interest in science careers.

Quantitative findings revealed that variables such as classroom environment, teaching methods, and family support were significantly and positively correlated with students' science career interest. Classroom environment and family support demonstrated the strongest associations, a finding consistent with earlier research emphasizing supportive learning climates and parental involvement as critical determinants of learners' science aspirations (Eccles & Wigfield, 2020; Maltese & Tai, 2010). The regression model further showed that classroom environment ($\beta = 0.34$) and family support ($\beta = 0.31$) emerged as the strongest predictors of science career interest. These results suggested that when students perceived their classrooms as encouraging, interactive, and conducive to learning, they were more likely to develop motivation and commitment toward science-related pathways. This aligns with Social Cognitive Career Theory, which posits that learning environments significantly influence interest formation through self-efficacy and outcome expectations (Lent, Brown, & Hackett, 1994).

The qualitative findings provided deeper explanations for these statistical relationships. Students reported that teachers who showed encouragement, used hands-on instructional strategies, and created collaborative learning opportunities fostered a sense of confidence and enjoyment in science. Such accounts supported the idea that engaging pedagogical practices strengthened students' science self-efficacy and perceived relevance of science, both of which are strong motivational drivers (Bandura, 1997; Osborne, Simon, & Collins, 2003). Similarly, family influences—including parental guidance, resource provision, and exposure to science role models—emerged as significant motivators. These narratives reinforced the regression results, suggesting that the emotional, cognitive, and material support students received at home played a vital role in shaping long-term career intentions. This is consistent with prior research showing that family expectations and encouragement strongly predict students' persistence in STEM fields (Archer et al., 2012; Wang & Degol, 2016).

Notably, the integration of quantitative and qualitative results highlighted not only convergences but also important nuances. For instance, although peer collaboration showed a moderate predictive contribution in the regression model, students described peer influence as helping maintain interest through group work and shared motivation rather than directly shaping career intentions. This distinction suggests that peers

may exert a secondary or indirect effect by strengthening engagement rather than explicitly guiding career pathways. This finding mirrors earlier studies that identified peer relationships as supportive but not primary drivers of career intentions in STEM (Moote, Archer, & MacLeod, 2020).

Another key insight from the qualitative data was that students valued role models from their families or communities. Although not captured directly in the quantitative scales, role modeling emerged as a powerful theme influencing students' career imagination and belief in their ability to succeed in science. Prior literature also documents the motivational value of seeing relatable individuals thrive in scientific fields (Chemers et al., 2011). This underscores the need to incorporate role-model exposure in science education interventions, especially in contexts where students may have limited access to scientists or STEM professionals.

Taken together, the study's findings demonstrated that both classroom and family ecosystems were instrumental in shaping students' science career interest. The convergence between quantitative predictors and qualitative insights strengthened the credibility of these conclusions. Importantly, the study highlighted the need for holistic interventions that address multiple layers of influence—teachers, families, and peer groups—rather than treating motivation as an individual-level trait. For policy and practice, this implies that teacher professional development should emphasize interactive pedagogies and supportive classroom climates, while outreach programs must engage parents and caregivers in meaningful ways. Such integrative approaches are especially crucial in contexts where students may face structural or resource-related barriers to engaging with science.

Implications of the Study

The findings highlight the critical roles played by both school and home environments in shaping students' science career trajectories. The strong influence of classroom environment and family support suggests that career interest develops through a combination of supportive teaching practices and nurturing family interactions. For educators, this underscores the need to cultivate learning environments that promote autonomy, engagement, and collaboration. Schools must recognize that motivation is not merely an individual characteristic but is heavily influenced by social and relational factors. For policymakers, the study points to the importance of strengthening teacher professional development, expanding parental involvement initiatives, and embedding career guidance programs within science education. The results also carry implications for curriculum planners, who may need to design science programs that integrate experiential learning, mentorship, and culturally relevant examples to improve students' confidence and aspirations.

Conclusion

This study revealed that both classroom and family factors significantly influenced students' interest in pursuing science-related careers. Quantitative analyses showed that the classroom environment and family support were the strongest predictors, while students' qualitative accounts illustrated how daily interactions with teachers, parental encouragement, and exposure to role models reinforced their motivation. Together, the mixed-methods approach demonstrated that science career interest is shaped

through a blend of instructional quality, emotional support, and socio-cultural context. The findings emphasize that enhancing science motivation requires coordinated efforts across the school and home spheres. By addressing both domains, educators and stakeholders can more effectively nurture students' long-term aspirations in STEM fields.

Recommendations

Based on the findings, the following recommendations were made:

- Teachers should employ interactive, learner-centered strategies that foster engagement, practical exploration, and collaboration. Ongoing professional development is essential to enhance classroom climate, feedback quality, and positive teacher–student interactions.
- Schools should implement initiatives that engage parents—such as science fairs, joint workshops, and outreach programs—and provide clear information about science careers to strengthen parental support.
- Science instruction should incorporate career-focused discussions, mentoring opportunities, and encounters with professionals to help students make informed decisions about STEM pathways.
- Targeted initiatives are needed for learners from low socio-economic backgrounds and groups underrepresented in STEM, including mentorship, financial support, and access to learning resources.
- Collaboration with universities, industries, and research institutions can provide students with real-world experiences and inspirational role models that reinforce their interest in science careers.

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