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Dimensions Underlying Student Preferences in Science Education: An Exploratory Factor Analysis

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ABSTRACT

Amid low enrollment rates in science education programs at Rizal Technological University, understanding the motivational drivers behind students' choices became a critical concern. This study aimed to develop and validate a scale to measure students' motivations for selecting Science Education as a career path, particularly within the teacher education programs. Grounded in qualitative thematic analysis of interviews with preservice science education students, an initial item pool was generated, capturing themes such as intrinsic passion, cognitive value, familial influence, and social encouragement. Using Exploratory Factor Analysis (EFA), a three-factor structure emerged, Intrinsic and Familial Motivation for Teaching Science, Cognitive-Value Orientation Toward Science and Teaching, and Social Influences and Teacher-Inspired Motivation, explaining 57.5% of the variance. Reliability analysis yielded high internal consistency (Cronbach's alpha = 0.942; McDonald's omega = 0.946), indicating a robust scale. This validated instrument provides a context-specific tool for understanding student motivation, offering actionable insights for improving recruitment, retention, and targeted support for future science educators.

Keywords: *EFA, motivation, science teacher, science education, teacher education*

INTRODUCTION

Across the globe, science education faces persistent challenges in attracting and retaining students, particularly in teacher education programs (Liu & Li, 2025; See et al., 2020). Despite the increasing demand for science educators to meet the needs of knowledge-based economies, many higher education institutions struggle with low enrollment in science education tracks (Khan et al., 2023; Margot & Kettler, 2019; Rafanan et al., 2020; Ramsurrun et al., 2024). Research consistently shows that students' choices are shaped not only by academic ability but also by social and cultural influences such as family expectations, peer groups, and broader societal perceptions of science as a field of study (Chen et al., 2024; Stefani, 2024). These influences affect students' confidence, perceptions of relevance, and long-term commitment to teaching careers in science.

Motivation plays a central role in these decisions. Students who enter higher education with prior exposure to scientific inquiry, knowledge of fundamental concepts, and clear career goals are more likely to pursue and persist in science-related programs (Hadzigeorgiou & Schulz, 2019; Stuckey et al., 2013; Van Riesen et al., 2018). However, while existing research provides valuable insights into the determinants of STEM participation, there remains a lack of validated instruments that directly measure the motivations underlying students' decisions to enroll in science education programs (Chen et al., 2024; Jafarov, 2023; Thompson-Lee et al., 2024). This gap limits the ability of researchers and policymakers to design evidence-based interventions aimed at increasing interest and retention in science teacher preparation pathways.

The importance of developing valid and reliable measurement tools in this area has been highlighted in recent scholarship. Instruments that capture the multifaceted nature of students' motivations allow for more targeted interventions, support systems, and curricular innovations that enhance educational experiences and outcomes (Gao et al., 2020; Hinduja et al., 2024; Vlachopoulos & Makri, 2024). Moreover, such tools are essential for facilitating cross-national comparisons, enabling researchers to identify both universal and context-specific patterns of motivation in science education.

It is important to acknowledge that the scale developed in this study is situated within the Philippine context, shaped by local cultural, social, and institutional realities. As such, its direct generalizability to other national settings may be limited. Nonetheless, the conceptual and methodological contributions of this work extend beyond its immediate context. By highlighting the key motivational dimensions that underlie students' choices in pursuing science education, this study provides a framework that international researchers can adapt, test, or refine within their own settings. In particular, the emphasis on family and peer influence, prior exposure to scientific practices, and clarity of future goals resonates with

global concerns in science education and teacher preparation. Cross-cultural validation of the scale would not only enrich its applicability but also contribute to a more nuanced understanding of how sociocultural contexts shape science career motivations across diverse educational systems.

Finally, the study underscores the broader significance of scale development in the social sciences. As Morgado et al. (2018) emphasize, validated instruments provide structured and reliable means of capturing human decision-making processes. By employing Exploratory Factor Analysis (EFA), this research uncovers the latent structures underlying student motivations, offering insights that extend beyond a single national case. Ensuring the reliability and validity of the scale strengthens both its local application and its potential contribution to global discourse on science education motivation (Fabrigar & Wegener, 2011; Finch, 2025; Olkin & Sampson, 2001).

METHODS

Research design

We used exploratory sequential mixed method design to develop and validate a scale measuring students' motivations towards choosing science education. Based on the insights gathered from this initial qualitative phase, a quantitative instrument was then developed and validated to assess whether the findings could be generalized to a larger population. This approach, as described by Creswell and Plano Clark (2018), allows for a comprehensive exploration of the topic, followed by the validation of these insights through a more extensive quantitative analysis. This approach was selected to capture rich, in-depth qualitative insights about the student motivations, which then help to the generation of scale items grounded in actual experiences of Pre-service science major teachers. Next is the quantitative validation to statistically examine the factor structure and reliability of the instrument. This design allowed for the integration of student’s perspectives into scale development, while also providing evidence for the tool’s validity and reliability within the context of the motivations of science major students towards choosing science education program.

Participants and Sampling

The respondents of the study were students enrolled in Science Education programs at RTU during the Academic Year 2024-2025. A total of 35 students were selected to participate in interview to generate the qualitative data for the initial development of scale. Following this, 200 science major students answered the initial scale to explore the emerging motivational

factors. This means that we used all the students enrolled in this program for the Academic Year 2024-2025.

Instrument

The research instrument used in this study was the Motivation in Pursuing Science Education Scale (MPSES), a researcher-developed questionnaire designed to assess the motivations of Science Education students and science majors in pursuing Science Education as a career path. The 55-item preliminary instrument was developed from qualitative interview findings and underwent content validation by five experts specializing in Science Education. It utilized a four-point Likert scale ranging from (1) Strongly Disagree to (4) Strongly Agree and was administered through Google Forms to 200 Science Education students and science majors at Rizal Technological University for field testing, exploratory factor analysis, and reliability assessment.

Data collection

The development of the MPSES began with the construction of an initial item pool based on qualitative data. Open ended interviews were conducted with pre-service teacher science major students at Rizal Technological University to explore their motivations and experiences related to choosing science education as a career. They answered the question “What motivates you to pursue science education as a career path”? Themes from these interviews, informed the creation of an initial 96- item instrument.

The initial version of the scale underwent expert review using the Content Validity Index (CVI). It is essential to establish content validity to support the overall validity of an assessment tool, such as questionnaires, particularly for research purposes. Five professionals specializing science education evaluated each item for clarity, relevance, and appropriateness. Based on their feedback and CVI results, items that did not meet content validity standards were revised or removed, resulting in a preliminary version of the scale consisting of 55 items.

The preliminary instrument was designed using a 4-point Likert-type scale with response options: “Strongly disagree” = 1, “Disagree” = 2, “Agree” = 3, and “Strongly agree” = 4, eliminating a neutral option to encourage more decisive responses. The scale was then converted into a Google Form for ease of distribution and accessibility. Field testing was conducted with 200 science major students to collect data for further analysis and refinement of the scale. The validated initial version of the instrument, titled the MPSES: Motivation in Pursuing Science Education Scale consists of 55 items and was administered using a Google Form.

Data analysis

Exploratory Factor Analysis was performed using Jamovi to identify the underlying factor structure of the scale. In this process, Jamovi offers tools for testing assumptions of the analysis, including Bartlett's test and the Kaiser-Meyer-Olkin measure, which assess the factorizability of items (Şahin & Aybek, 2020). Upon confirming that the data met the assumptions for factor analysis, an Exploratory Factor Analysis was carried out to uncover the underlying structure of the scale. Items were examined for their factor loadings, and those with low or cross-loadings were reviewed and removed as necessary. Additionally, a comparative analysis is conducted to ensure conceptual consistency derived from the qualitative interview with factors identified through quantitative analysis. Finally, internal consistency reliability was assessed using Cronbach's alpha and Mcdonald's omega for the overall scale and its subscales. This ensured that the MPSES provided a reliable measure of students' motivation toward pursuing a career in science education.

RESULTS

Qualitative Phase: Thematic Analysis of Student Motivations

Table 1. Thematic Analysis of Interview Data

Theme	Code	Definition
Personal Motivation	Passion for Science	Expressions of deep interest, enjoyment, or love for science as a subject.
	Teaching as a Passion	Mentions of joy in teaching, lifelong learning, or desire to share knowledge.
	Desire to Inspire Students	Desire to motivate students to appreciate and enjoy science.
	Curiosity and Exploration	Descriptions of a desire to understand the world, ask questions, and explore.
Social Influence	Influence of Teachers	References to being inspired or encouraged by former science teachers.
	Family Influence	Mentions of parental or familial encouragement toward teaching or science.
Pragmatic Considerations	Career Practicality	Science seen as in-demand, with broad opportunities and real-world utility.
	No Initial Choice	Statements indicating science was not the first option but became acceptable.

Academic Experience	Science as Challenging but Fun	Recognition of science's difficulty alongside its stimulating nature.
	Relevance and Application	Appreciation for how science explains real-world phenomena or everyday life.
Philosophical Views	Alignment with Faith	Belief that science complements spiritual or religious understanding.

The qualitative coding table reveals that students' motivations to pursue science education are shaped by a complex interplay of personal, social, pragmatic, academic, and philosophical factors. On a personal level, many students are intrinsically driven by a passion for science, a joy in teaching, and a desire to inspire others. These motivations often manifest as a deep curiosity about the world and an eagerness to share knowledge, reflecting how science teaching becomes part of their identity rather than merely a career choice. Social influences also play a critical role, with teachers serving as inspirational role models and families providing encouragement that validates and sustains career decisions. Alongside these idealistic motivations, pragmatic considerations emerge, as some students view science education as a practical pathway with stable career opportunities, while others accept it as a fallback option when initial preferences are unattainable. Academic experiences further shape these choices, as students describe science as both challenging and enjoyable, appreciating its relevance and application in everyday life. Finally, for a subset of students, science teaching holds a philosophical dimension, aligning with their faith and allowing them to reconcile scientific inquiry with spiritual meaning. Together, these themes illustrate that the decision to pursue science education is not singularly defined but rather emerges from a dynamic blend of intrinsic passion, external validation, practical reasoning, formative academic encounters, and personal worldviews.

Quantitative Analysis: Exploratory Factor Analysis

Table 2. Bartlett's Test of Sphericity and Kaiser-Meyer-Olkin Measure of Sampling Adequacy

Statistic	Value
χ^2 (Chi-square)	8875
df (degrees of freedom)	1431
KMO	0.935
p-value	< .001

Bartlett's Test of Sphericity returned a chi-square value of 8875 (df = 1431, $p < .001$), indicating a highly significant result. This test assesses whether the correlation matrix is an

identity matrix, suggesting that variables are uncorrelated and therefore unsuitable for factor analysis. The significant result ($p < .05$) allows us to reject the null hypothesis, supporting the presence of intercorrelations among variables that are sufficient for structure detection. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy for the dataset is 0.935, indicating excellent suitability for factor analysis. The KMO assesses the extent to which correlations among variables reflect underlying common factors. A score near 1.0 suggests tightly clustered correlations, and the current value falls into Kaiser's "marvelous" range, reflecting a high degree of shared variance across items. This result indicates strong partial correlations, suggesting that variables can be meaningfully grouped into underlying constructs. For research on motivation and attitudes toward science education, such a high KMO value supports the coherence of the measured constructs and strengthens the potential reliability and interpretability of the factor solutions. Overall, the high KMO value affirms the dataset's appropriateness for exploratory factor analysis.

Table 3. Factor Loading

Items	Factor			Uniqueness
	1	2	3	
I have always dreamed of becoming a science teacher.	0.718			0.328
I want to share my passion for science with future learners.		0.619		0.310
I feel motivated when I see students learning and improving.		0.589		0.535
I want to become a good source of knowledge and guidance for students.		0.591		0.386
My previous science teachers inspired my career path and influenced my decision to take Science Education.			0.712	0.398
Teaching science helps me fulfill a childhood dream.	0.654			0.417
I am passionate about teaching, which is why I chose to become a science teacher.	0.792			0.280
My family's profession influenced my decision to become a teacher.	0.763			0.489
My personal strengths inspired me to pursue a profession in teaching science.	0.668			0.484
I believe teaching plays a significant role in students' personal and academic growth.		0.665		0.501

Items	Factor			Uniqueness
	1	2	3	
Fostering a passion for Science is my primary teaching goals.		0.460		0.474
My family played an important role in my decision to pursue a career in science education.	0.694			0.548
I pursued science education to make scientific concepts more accessible to students.			0.405	0.437
The support and recognition I received from my science teachers inspired me to continue in this field.			0.806	0.315
My experience with students helped me realize my passion for teaching science.	0.636			0.412
I want to inspire students the same way my teachers inspired me.			0.621	0.408
My high school teachers sparked my curiosity and love for Science.			0.646	0.516
I believe Science offers many career opportunities.		0.796		0.392
I chose Science because of its relevance in today's tech-driven world.		0.551		0.623
Science always offers a logical explanation for what I wonder about.		0.678		0.623
I wanted to become a Science teacher.	0.676			0.380
Teaching Science aligns with my personal goals.	0.700			0.380
I chose teaching because I enjoy sharing ideas and knowledge with others.	0.615			0.380
I find Science fun and intellectually stimulating.		0.776		0.383
I found value and purpose in studying Science.		0.768		0.400

The Exploratory Factor Analysis (EFA) using the minimum residual extraction method with oblimin rotation identified three clear, interrelated dimensions of student motivation in science education. Factor 1 captured intrinsic, personal motivations, characterized by high loadings on items expressing deep-seated aspirations and identity alignment with teaching, such as "I am passionate about teaching" (0.792) and "I have always dreamed..." (0.718). This suggests that for many students, the decision to pursue science education is not merely

functional but tied to long-term goals and personal values. Factor 2 reflected the power of social reinforcement and role modeling, with strong loadings on items like “The support and recognition from my science teachers…” (0.806), emphasizing the significant influence of mentors and affirming experiences during formative years. These findings underscore the vital role of external validation and encouragement in shaping teaching aspirations.

Meanwhile, Factor 3 centered on a cognitive and societal appreciation for science, with items highlighting its intellectual appeal and career potential, such as “Science offers many career opportunities” (0.796) and “Science is intellectually stimulating” (0.776). Although most items loaded strongly, one item—“Science’s relevance in today’s tech-driven world”—showed moderate loading (0.551) and higher uniqueness (0.623), indicating it captures more individualized or context-specific nuances. The absence of cross-loadings and the overall strength of loadings suggest a robust factor structure, while the oblimin rotation appropriately accommodates the correlations between factors, reflecting how intrinsic, social, and societal motivations are intricately linked in influencing students' pathways into science education.

Table 4. Factor Summary

Factor	SS Loadings	% of Variance	Cumulative %
1	5.78	23.1	23.1
2	5.44	21.8	44.9
3	3.16	12.6	57.5

The factor analysis extracted three distinct factors, collectively explaining 57.5% of the total variance. The first factor accounted for 23.1%, the second for 21.8%, and the third for 12.6%, indicating a meaningful distribution of explained variance. Each factor had an eigenvalue above 1 (5.78, 5.44, and 3.16), meeting the Kaiser criterion for retention. The tapering pattern in variance contribution suggests a well-structured model. In the context of social science research, where constructs are often multifaceted, a cumulative variance above 50% is considered acceptable. These results support the adequacy of the three-factor solution. While further review such as scree plot inspection and theoretical alignment of item loadings can offer additional guidance, the current structure appears both statistically sound and conceptually interpretable, providing a strong foundation for subsequent validation.

Table 5. Factor naming

Factor 1: Intrinsic and Familial Motivation for Teaching Science
Item Statements:
I have always dreamed of becoming a science teacher
Teaching science helps me fulfill a childhood dream.
I am passionate about teaching, which is why I chose to become a science teacher.
My family's profession influenced my decision to become a teacher.
My personal strengths inspired me to pursue a profession in teaching science.
My family played an important role in my decision to pursue a career in science education.
My experience with students helped me realize my passion for teaching science.
I wanted to become a science teacher.
Teaching Science aligns with my personal goals.
I chose teaching because I enjoy sharing ideas and knowledge with others.
Factor 2: Cognitive-Value Orientation Toward Science and Teaching
Item Statements:
I want to share my passion for science with future learners.
I feel motivated when I see students learning and improving.
I want to become a good source of knowledge and guidance for students.
I believe teaching plays a significant role in students' personal and academic growth.
Fostering a passion for science is my primary teaching goals.
I believe Science offers many career opportunities.
I chose Science because of its relevance in today's tech-driven world.
Science always offers a logical explanation for what I wonder about.
I find Science fun and intellectually stimulating.
I found value and purpose in studying Science
Factor 3: Social Influences and Teacher-Inspired Motivation
Item Statements:
My previous science teachers inspired my career path and influenced my decision to take science education.
I pursued science education to make scientific concepts more accessible to students.
The support and recognition I received from my science teachers inspired me to continue in this field.
I want to inspire students the same
way my teachers inspired me.
My high school teachers sparked my curiosity and love for science.

The exploratory factor analysis revealed three conceptually coherent motivational dimensions. The first factor, Intrinsic and Familial Motivation for Teaching Science, was

defined by high-loading items that reflected deeply personal aspirations and strong family influence. Students viewed teaching as a long-held dream and a core part of their identity, shaped by familial encouragement and emotional alignment with the teaching profession. The second factor, labeled Cognitive-Value Orientation Toward Science and Teaching, encompassed motivations grounded in the intellectual appeal and perceived societal relevance of science. Respondents expressed interest in science's logic, utility, and career potential. Meanwhile, the third factor, Social Influences and Teacher-Inspired Motivation, captured the impact of role models and interpersonal validation. Students consistently highlighted the encouragement and recognition they received from science teachers, suggesting that mentorship played a pivotal role in their decision to pursue science education.

The finalized scale consists of three factors comprising a total of 25 items: Factor 1 with 10 items, Factor 2 with 10 items, and Factor 3 with 5 items. Overall, the naming process emphasized theoretical alignment, empirical consistency, and conceptual clarity. The resulting factor labels underscore the multifaceted nature of motivation among pre-service science teachers and contribute to a more nuanced understanding of the pathways that lead individuals to pursue a career in science education.

Comparative Analysis Between Qualitative Themes and Quantitative Factor Structure

Comparative analysis was conducted to examine how the qualitative themes identified through thematic analysis align with the quantitative factors extracted through exploratory factor analysis (EFA). This comparison will help assess whether the scale accurately captures the key dimensions of students' motivations for choosing science education. The integration of thematic analysis and exploratory factor analysis (EFA) revealed strong alignment between qualitative themes and the three extracted motivational factors. The first factor, Intrinsic and Familial Motivation for Teaching Science, closely matched the theme of Personal Motivation, with codes such as Passion for Science and Desire to Inspire Students. The inclusion of family influence in this factor further emphasized how deeply internalized motivations are often shaped by supportive familial environments, confirming that many students are guided by intrinsic goals and long-standing aspirations to teach science. The comparison between qualitative themes and EFA results also showed that the second factor, Cognitive-Value Orientation Toward Science and Teaching, reflected themes related to Academic Experience and Pragmatic Considerations, highlighting how students value science for its intellectual stimulation and practical relevance. The third factor, Social Influences and Teacher-Inspired Motivation, aligned with the Social Influence theme, especially the pivotal role of inspirational teachers. This convergence of findings confirms the content validity of the developed scale and demonstrates that students' motivations are

multifaceted, interweaving personal conviction, intellectual interest, and interpersonal encouragement.

Validity and Reliability of the Assessed Scale

The reliability analysis demonstrates excellent internal consistency for the scale, with a Cronbach's alpha of 0.942 and McDonald's omega of 0.946, both well above the accepted threshold of 0.70 and exceeding the 0.90 benchmark for high reliability. While Cronbach's alpha assumes equal item contribution (tau-equivalence), McDonald's omega provides a more flexible estimate that accounts for varying item loadings. The close similarity between the two values suggests minimal violation of tau-equivalence, indicating that items contribute relatively uniformly to the underlying construct. These results affirm the internal coherence of the scale and support the stability and validity of the factor structure derived through exploratory factor analysis. The instrument can therefore be considered psychometrically robust and appropriate for further research or applied use.

DISCUSSION

The discussions in this study stems from the objective of exploring factors that may influence learners to choose a career path in science teaching. With these identified factors, a scale was developed using exploratory factor analysis. The qualitative results conveys that many students' pursuing science education were primarily driven by personal motivation, expressing a deep passion for science and a desire to inspire others through teaching. This intrinsic interest often shaped their identity as both learners and future educators (Cronin-Golomb & Bauer, 2022). At the same time, social influences such as former science teachers and family members in education played a significant role by making the subject engaging and modeling the value of teaching, an example of professional socialization where early exposure to the field influences career paths. ((Kc et al., 2019; Leidy & Parke, 2015; Little & Little, 2014; Vikasconcept & Vikasconcept, 2025). While some students initially chose the program for practical reasons like job prospects or course availability, these instrumental motivations often developed into a deeper, more meaningful commitment over time. (Bradberry & De Maio, 2018). Academic experiences further strengthened this resolve, as many students found satisfaction in the intellectual challenge and real-world relevance of science (Khatri et al., 2024). Interestingly, some students also shared that science aligned with their personal faith, illustrating that science and religion were not in conflict and underscoring the importance of inclusive science education that respects diverse worldviews.

The preliminary analysis confirmed that the dataset was appropriate for factor analysis, with Bartlett's Test of Sphericity yielding a significant result ($\chi^2 = 8875$, $df = 1431$, $p < .001$) and the

Kaiser-Meyer-Olkin Measure of Sampling Adequacy at 0.935. These results indicate a strong pattern of intercorrelations suitable for structure detection, consistent with recent validation practices in psychometric research (Alavi et al., 2020). A KMO above 0.90, categorized as “marvelous,” provides evidence of sampling adequacy and affirms that the data matrix was suitable for uncovering underlying constructs in student motivation related to science education. Using minimum residual extraction and oblimin rotation—an approach suitable when inter-factor correlations are assumed—Exploratory Factor Analysis (EFA) extracted three distinct and conceptually interpretable factors, accounting for 57.5% of total variance. Each factor met the Kaiser criterion (eigenvalues > 1), and the absence of significant cross-loadings indicates a clean and stable factor solution, which is a usual practice in scale development studies. This level of variance explained aligns with the acceptable standards in social sciences, especially for constructs that are theoretically complex and multidimensional, such as career motivation and identity development in science teaching (Knekta et al., 2019; Liu et al., 2023).

The first factor, Intrinsic and Familial Motivation for Teaching Science, captured deeply internalized motivations reinforced by family influence. Items like “I have always dreamed of becoming a science teacher” and “My family’s profession influenced my career decision” are good gauge of this factor and are with the study of Capunitan et al., (2023). This echoes broader observations that personal meaning-making and emotional attachment to the profession are critical motivational drivers in teacher preparation programs (Mgaiwa & Milinga, 2024; Peng et al., 2024; Wang et al., 2024).

The second factor, Cognitive-Value Orientation Toward Science and Teaching, reflected perceptions of science’s intellectual appeal, relevance, and practicality. Items such as “Science is intellectually stimulating” and “Science offers many career opportunities” suggest that participants were influenced by the perceived utility and societal contribution of science, findings echoed in the work of Chen et al., (2024) who emphasized the role of career utility value in motivating STEM career aspirations. Other studies found that students' beliefs about science's real-world application significantly predicted both persistence in science programs and satisfaction in teaching-related roles (Han et al., 2021; Sheldrake et al., 2024). The third factor, Social Influences and Teacher-Inspired Motivation emphasized the role of interpersonal relationships, particularly teachers, as catalysts for motivation. Items highlighting support from former science teachers aligned with recent literature showing that teacher recognition, mentorship, and validation contribute significantly to professional identity development (Chea, 2024; LaTronica-Herb & Noel, 2022; Zhai et al., 2024).

The relationship between the qualitative themes and the factor structure, as recommended in mixed-methods scale development, reinforces the construct validity of the instrument.

Additionally, the scale's reliability, evidenced by Cronbach's alpha of 0.942 and McDonald's omega of 0.946, confirms internal consistency and supports its applicability in broader research and educational settings. Constructs captured by the instrument reflect authentic, lived motivations among students pursuing science education, as emphasized in similar mixed-methods validations (Creswell & Plano Clark, 2017).

Reliability statistics support the scale's psychometric soundness. Cronbach's alpha (.942) and McDonald's omega (.946) indicate excellent internal consistency. The minimal discrepancy between these indices suggests near tau-equivalence across items, affirming the uniform contribution of items to their respective constructs. Collectively, the findings demonstrate that the developed instrument is statistically valid, conceptually meaningful, and reliable for measuring multifaceted student motivations related to science education.

CONCLUSIONS

We concluded that students' motivations to pursue science education are shaped by a combination of intrinsic passion, familial support, social influences, and pragmatic considerations. Thematic analysis identified these as core motivational dimensions, which were further validated through exploratory factor analysis (EFA). The EFA revealed a stable three-factor structure consisting of Intrinsic and Familial Motivation, Cognitive-Value Orientation, and Social Influences with Teacher-Inspired Motivation. The strong alignment between the qualitative themes and quantitative factors underscores the content validity of the developed scale, confirming that it accurately captures the multifaceted nature of students' motivations. These findings imply that science teacher education programs should adopt a holistic approach in both recruitment and support systems emphasizing not only academic appeal and job prospects but also cultivating students' early interest and personal connections to science and teaching.

Furthermore, the developed scale demonstrated high reliability, with consistently strong results in Cronbach's alpha and McDonald's omega, ensuring its robustness for future application. This indicates that the instrument can be confidently used in broader research contexts, institutional diagnostics, and program evaluations. The implications are significant for policy and curriculum developers: by understanding the underlying motivational constructs, targeted interventions and support structures can be designed to enhance student enrollment and retention in science education. For instance, programs can focus on mentoring, career guidance, and early exposure to inspiring science teachers, factors shown to influence students deeply. Overall, this validated instrument serves as a valuable tool for shaping future teacher education strategies and advancing science teaching as a sustainable career path in the context of the college of education, science department of the Rizal Technological University.

LIMITATIONS

Despite the satisfactory in validity and reliability of the result, the study has limitations concerning the generalizability of its findings. This study was conducted exclusively within the context of Sciences Department, College of Education of Rizal Technological University. Consequently, the identified motivational factor structure may reflect the institutional, academic, and contextual characteristics of RTU students and may not necessarily represent the motivation of pre-service science teachers from other higher education institutions. Although the instrument demonstrated strong psychometric properties, its applicability to broader populations remains to be established. Future studies should therefore consider administering the instrument to students from diverse universities and geographical settings to further examine its factor structure, reliability, and validity across different educational contexts. Such cross-institutional validation would strengthen the generalizability of the instrument and support its wider use in science teacher education research.

Ethical Considerations

Ethical considerations were strictly adhered to in order to ensure the integrity of the study and the protection of participants. Formal approval was obtained from the Dean of the College of Education and the Head of the Sciences Department at Rizal Technological University. Prior to data collection, consent forms were provided to all interview respondents, ensuring they were fully informed about the study's purpose and procedures. Additionally, the researchers coordinated with the Data Privacy Office of Rizal Technological University to ensure compliance with data protection protocols.

Conflict of Interest

The authors declare that there's no conflict of interest regarding the conduct, authorship, and publication of this study.

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