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Exploring students' perspectives on mathematics learning barriers in nepalese gurukul schools: An exploratory sequential mixed-methods study

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Abstract

Background: Mathematics learning in Nepalese Gurukul schools presents distinctive challenges associated with traditional instructional practices, linguistic complexities, and sociocultural expectations. However, students' perspectives on these interconnected barriers remain insufficiently explored.
Aims: This study aimed to investigate secondary school students' learning experiences and identify psychological, pedagogical, linguistic, and sociocultural barriers to mathematics learning in Nepalese Gurukul schools.
Method: An exploratory sequential mixed-methods design was employed, involving eight students selected through purposive sampling for qualitative interviews and 207 students selected through stratified random sampling for a quantitative survey. Data were collected using semi-structured interviews and closed-ended Likert-scale questionnaires and analyzed through thematic analysis and descriptive and inferential statistics.
Results: Four major barriers emerged: mathematics anxiety, teacher-centered instructional practices, linguistic and semiotic difficulties, and sociocultural dynamics influencing classroom participation. Quantitative findings highlighted challenges associated with students' perceptions, instructional practices, and mathematical symbolism, while economic support showed no statistically significant association with reported learning difficulties.
Conclusion: Mathematics learning barriers in Gurukul schools reflect interconnected psychological, pedagogical, linguistic, and sociocultural dimensions. Culturally responsive instruction, interactive pedagogical approaches, accessible mathematical language, and supportive classroom environments may help address these challenges.

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INTRODUCTION

Mathematics education plays a fundamental role in developing students' logical reasoning, analytical thinking, problem-solving abilities, and capacity to interpret quantitative information across academic and everyday contexts. Despite its educational significance, mathematics remains a challenging subject for many secondary school students because successful learning requires the integration of conceptual understanding, procedural knowledge, symbolic interpretation, and mathematical communication (Thanheiser, 2023). These interconnected cognitive demands become particularly challenging when learners encounter unfamiliar mathematical representations or struggle to connect abstract concepts with meaningful learning experiences (Montecalvo, 2026; Tasarib et al., 2025). Mathematics learning difficulties are therefore increasingly understood as

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multidimensional phenomena involving interactions among students' cognitive characteristics, psychological dispositions, instructional experiences, and sociocultural environments (Lepore, 2024; Raufelder & Schlesier, n.d.). Purbaningrum et al. (2023) demonstrated that students' beliefs about the inherent difficulty of mathematics can shape their motivation, persistence, and willingness to engage with challenging mathematical tasks. Similarly, Wen and Dubé (2022) highlighted the relationship between students' attitudes toward mathematics and their academic achievement, suggesting that emotional responses constitute an important dimension of mathematical learning experiences. Students who repeatedly experience confusion, frustration, or unsuccessful problem-solving attempts may gradually develop negative perceptions that discourage active participation in mathematics classrooms. Nevertheless, mathematical difficulties should not be attributed exclusively to individual abilities because learning opportunities are also shaped by instructional approaches and classroom interactions. Research on mathematics education increasingly emphasizes the importance of examining how learners interpret mathematical concepts within their particular educational environments rather than treating achievement difficulties as isolated cognitive deficiencies (Chand et al., 2021). Consequently, understanding mathematics learning barriers requires a comprehensive perspective that considers students' experiences alongside the pedagogical and contextual conditions influencing their engagement with mathematical knowledge.

Instructional practices and classroom communication represent essential dimensions of mathematics learning because they influence how students construct, interpret, and apply mathematical knowledge. Teacher-centered instruction that prioritizes procedural demonstrations and repetitive exercises may provide opportunities for practicing established algorithms but can also restrict conceptual exploration when students are given limited opportunities to question, discuss, or justify mathematical ideas. Cardino and Ortega-Dela Cruz (2020) emphasized the importance of aligning mathematics teaching strategies with students' learning needs, highlighting the relevance of varied instructional approaches for improving educational experiences. Similarly, Chand et al. (2021) identified instructional practices and learning conditions among the factors associated with students' perceived difficulties in mathematics. Beyond pedagogical organization, mathematical language introduces additional challenges because learners must interpret specialized terminology, numerical expressions, symbolic conventions, and relationships embedded in mathematical problems (Asenova et al., 2023; Maanu & Asare, 2025; Planas et al., 2025). The transition from everyday language to formal mathematical representations requires students to coordinate linguistic comprehension with conceptual reasoning, particularly when solving algebraic and geometrical problems. Wakhata et al. (2022) demonstrated the importance of students' attitudes toward mathematical word problems, indicating that mathematical tasks involve psychological and interpretative dimensions beyond computational procedures. Furthermore, differences between students' familiar languages and the language of mathematics instruction may complicate their interpretation of mathematical statements and their ability to formulate appropriate representations. Such challenges become especially relevant in educational settings where linguistic diversity intersects with established instructional traditions and expectations regarding classroom participation. Accordingly, investigating pedagogical and linguistic barriers together provides a more comprehensive understanding of how mathematics learning difficulties emerge and persist within specific educational contexts.

In Nepal, mathematics learning challenges have attracted scholarly attention because students' achievement and classroom experiences are influenced by interconnected instructional, psychological, and contextual conditions (Pokhrel, 2023; Tiwari, 2023). Pokhrel (2023) examined difficulties experienced by Nepalese secondary school students, emphasizing the importance of identifying barriers that interfere with effective mathematics learning. Tiwari (2023) similarly investigated factors associated with mathematics achievement, contributing to broader discussions

concerning the conditions shaping students' educational outcomes. More recently, Poudel (2025) highlighted teachers' perspectives on students' low mathematics performance, drawing attention to instructional practices, learning resources, student engagement, and educational support. These concerns are particularly relevant to Gurukul schools, which operate within distinctive educational traditions characterized by Sanskrit-oriented learning, religious and cultural practices, and established expectations concerning teacher–student relationships. Although these traditions provide meaningful cultural and educational foundations, students may experience additional challenges when formal mathematics instruction requires unfamiliar terminology, symbolic interpretation, and different patterns of classroom communication (Batiibwe, 2025; Kabuye Batiibwe, 2024; Umeh, 2025). The coexistence of Sanskrit-based educational practices and mathematics instruction conducted through Nepali or specialized mathematical language creates a context in which linguistic transitions warrant closer examination. Furthermore, students' willingness to ask questions, express uncertainty, and participate in mathematical discussions may be shaped by their perceptions of teacher authority and culturally established expectations of respectful behavior (Amerstorfer & Freiin von Münster-Kistner, 2021; Canonigo, 2024; Gyan & Mensah, 2025; Louie, 2020; Wolf & Brown, 2023). Such circumstances suggest that mathematics learning barriers in Gurukul schools cannot be adequately understood without considering the relationships among students' psychological experiences, instructional practices, mathematical language, and sociocultural environments. Therefore, examining mathematics learning from the perspectives of Gurukul students offers an opportunity to understand how these contextual dimensions are experienced and interpreted within a distinctive secondary education setting.

Existing studies have examined mathematics learning difficulties through psychological, pedagogical, and contextual perspectives, yet important limitations remain concerning their integration within culturally distinctive educational institutions. Research conducted by Chand et al. (2021) and Purbaningrum et al. (2023) has contributed to understanding students' perceived learning difficulties and beliefs about mathematics, although these investigations were not specifically situated within Nepalese Gurukul education. Similarly, Wen and Dubé (2022) synthesized evidence concerning mathematical attitudes and achievement, but their broader perspective does not directly explain how students experience learning barriers within Sanskrit-oriented educational environments. Studies conducted in Nepal have identified challenges associated with mathematics learning and achievement in secondary education (Pokhrel, 2023; Tiwari, 2023). However, the available studies discussed in this article provide limited context-specific evidence concerning the interaction of mathematical symbolism, instructional language, classroom authority, and students' emotional experiences in Gurukul schools. Moreover, research emphasizing teachers' perspectives on mathematics achievement, such as Poudel (2025), does not fully capture how learners themselves interpret instructional difficulties and negotiate culturally embedded classroom expectations. Another limitation concerns the relatively limited integration of qualitative accounts of students' experiences with quantitative evidence describing the distribution of perceived learning barriers within the same educational context. Consequently, the relationships among mathematics anxiety, teacher-centered instructional practices, linguistic and semiotic difficulties, and sociocultural classroom dynamics remain insufficiently explored from Gurukul students' perspectives. Addressing these limitations requires an approach capable of identifying contextually grounded learning experiences and subsequently examining their broader relevance among secondary school students. This study therefore contributes to mathematics education research by employing an exploratory sequential mixed-methods design to investigate perceived learning barriers within the distinctive linguistic, pedagogical, and sociocultural context of Nepalese Gurukul schools.

This study aims to explore secondary school students' perspectives on the barriers encountered during mathematics learning in Nepalese Gurukul schools. Specifically, it seeks to identify the psychological, pedagogical, linguistic, and sociocultural dimensions that students perceive as influencing their mathematical learning experiences. The first objective is to investigate students' experiences of mathematics anxiety, negative perceptions, and difficulties in understanding mathematical concepts and procedures. The second objective is to examine how students perceive teacher-centered instructional practices, classroom communication, and opportunities for active participation in mathematical problem-solving. The third objective is to explore linguistic and semiotic barriers associated with mathematical terminology, symbols, representations, and the transition between familiar instructional languages and formal mathematical expressions. The fourth objective is to understand how culturally embedded teacher–student relationships and classroom expectations shape students' willingness to ask questions, communicate difficulties, and engage in mathematical discussions. To achieve these objectives, the qualitative phase explores students' experiences through semi-structured interviews, while the subsequent quantitative phase examines patterns of perceived learning barriers using structured questionnaire responses. The integration of these two phases is intended to provide a more comprehensive interpretation of students' experiences by connecting context-specific qualitative themes with quantitative patterns. By examining these dimensions within Gurukul education, the study seeks to extend existing discussions of mathematics learning difficulties beyond conventional school settings and contribute context-sensitive evidence to mathematics education research. Ultimately, the findings are expected to inform the development of culturally responsive instructional practices, accessible mathematical communication, and supportive classroom environments that may improve students' engagement with mathematics.

LITERATURE REVIEW

Mathematics learning is embedded within sociocultural environments that shape students' educational experiences, classroom participation, and opportunities to develop mathematical understanding. Sociocultural perspectives emphasize that mathematical knowledge develops through interactions among learners, teachers, instructional practices, and the cultural resources available within educational settings (Lerman, 2024). Students from diverse linguistic and cultural backgrounds may encounter additional challenges when instructional approaches do not adequately accommodate their prior experiences and communication practices. Meeran and Van Wyk (2022) highlighted the importance of recognizing sociocultural diversity in mathematics classrooms, particularly because teachers must respond to students' different educational backgrounds and learning needs. In Nepal, linguistic and cultural diversity creates a complex educational environment in which students may experience differences between their familiar languages and the language used for formal mathematics instruction (Paudel, 2024; Raj Devkota, 2026). These circumstances are particularly relevant to Gurukul schools, where Sanskrit-oriented educational traditions coexist with mathematics instruction that may involve Nepali terminology and specialized mathematical representations. Such linguistic differences may complicate students' interpretation of mathematical concepts, particularly when they must translate familiar expressions into formal mathematical language (Domke et al., 2025; Hankeln & Prediger, 2025; Maanu & Asare, 2025; Ntumi et al., 2026; Planas et al., 2025). Furthermore, culturally established expectations regarding respect for teachers, classroom discipline, and appropriate communication may influence students' willingness to ask questions or express difficulties during mathematics lessons. Although sociocultural traditions provide important foundations for students' educational identities, their relationship with

mathematics learning should be examined through students' experiences rather than assumed to produce uniform educational outcomes. Accordingly, understanding mathematics learning barriers in Nepalese Gurukul schools requires attention to the interaction between linguistic diversity, classroom relationships, cultural expectations, and students' opportunities to participate meaningfully in mathematical activities.

Students' attitudes toward mathematics represent an important psychological dimension of learning because they are associated with motivation, confidence, persistence, and engagement in mathematical activities. Mathematics anxiety may emerge when learners experience fear, nervousness, or uncertainty while interpreting mathematical problems, recalling procedures, or completing classroom assessments (Buckley & Sullivan, 2023; Klee et al., 2022; Montecalvo, 2026; Yarkwah et al., 2024; Zhu et al., 2024). Moussa and Saali (2022) identified several factors associated with students' attitudes toward mathematics, emphasizing the importance of psychological and educational conditions in shaping learning experiences. Similarly, Wen and Dubé (2022) synthesized research on secondary students' mathematical attitudes and achievement, demonstrating that students' perceptions of mathematics are meaningfully related to their academic outcomes. Negative mathematical experiences may reinforce avoidance behaviors, particularly when students repeatedly encounter unfamiliar concepts without sufficient instructional guidance. Purbaningrum et al. (2023) further demonstrated that beliefs portraying mathematics as inherently difficult can influence students' willingness to engage with challenging tasks and develop mathematical competence. Nevertheless, positive attitudes alone do not necessarily guarantee successful mathematical achievement because learning outcomes are also associated with instructional quality, conceptual understanding, and contextual learning conditions (Idris et al., 2021). Shakya and Maharjan (2023) similarly examined the relationship between students' attitudes toward mathematics and mathematical achievement, reinforcing the importance of considering psychological dispositions within mathematics education. In Gurukul schools, students' emotional experiences may also be shaped by their perceptions of classroom authority, opportunities to communicate learning difficulties, and expectations concerning mathematical performance. Consequently, examining mathematics anxiety alongside students' attitudes and classroom experiences provides a more comprehensive understanding of psychological barriers that may influence engagement with mathematical concepts and problem-solving activities.

Instructional approaches play a central role in mathematics education because they determine how mathematical concepts are introduced, explained, practiced, and discussed within classroom environments. Effective mathematics instruction requires opportunities for students to develop conceptual understanding while connecting mathematical procedures with meaningful representations and problem-solving experiences (Chamberlin et al., 2022; Fielding & Makar, 2022; Torres-Peña et al., 2025; Vale & Barbosa, 2023). Cardino and Ortega-Dela Cruz (2020) emphasized the importance of selecting appropriate instructional strategies, suggesting that mathematics teaching should accommodate different learning needs rather than depend exclusively on a single pedagogical approach. Nevertheless, teacher-centered instruction remains a concern when classroom activities emphasize procedural demonstrations, formula memorization, and repetitive exercises without sufficient opportunities for students to explain their reasoning. Chand et al. (2021) identified instructional practices and teacher-related conditions among the perceived factors associated with students' difficulties in mathematics, highlighting the relevance of classroom teaching processes. Similarly, Bah (2022) discussed pedagogical factors contributing to mathematics performance, emphasizing the importance of instructional improvement in addressing persistent learning difficulties. In the Nepalese educational context, Pokhrel (2023) examined challenges experienced by secondary school mathematics learners, while Tiwari (2023) investigated factors associated with students' mathematical achievement. Poudel (2025) further explored teachers'

perspectives on low mathematics performance in Nepal, drawing attention to instructional conditions, students' learning experiences, and educational support. Within Gurukul schools, teacher-centered practices may become particularly consequential when students perceive questioning, disagreement, or requests for clarification as inconsistent with established expectations of classroom behavior. Therefore, examining students' perspectives on instructional practices is essential for understanding how teacher explanations, classroom communication, and opportunities for mathematical participation relate to perceived learning barriers.

Mathematics involves a specialized system of communication in which symbols, numerical expressions, diagrams, technical vocabulary, and formal representations convey mathematical relationships and conceptual meanings. Understanding these representations requires learners to interpret mathematical language and establish meaningful connections between symbolic procedures and underlying mathematical concepts. Difficulties may arise when students recognize mathematical symbols but cannot explain their meanings or apply them appropriately in unfamiliar problem-solving situations (Kenney & Ntow, 2024; Kusmaryono et al., 2024; Moleko & Mosimege, 2020; Shawan et al., 2021). Such challenges become particularly important in algebra and geometry, where mathematical reasoning frequently requires students to translate verbal information into equations, expressions, diagrams, or other symbolic representations. Wakhata et al. (2022) examined secondary school students' attitudes toward mathematical word problems, demonstrating the relevance of learners' perceptions when engaging with mathematically demanding tasks. Furthermore, differences between everyday communication and formal mathematical terminology may create additional interpretative demands, particularly for students learning mathematics through a language that differs from their familiar academic language. In Nepalese Gurukul schools, the coexistence of Sanskrit-oriented learning traditions and mathematics instruction involving Nepali terminology provides a distinctive context for examining these linguistic challenges. Students may experience difficulties when translating mathematical statements into symbolic expressions, interpreting specialized vocabulary, or connecting memorized formulas with conceptual explanations (Castro et al., 2022; Kuske-Janßen & Pospiech, 2026). These experiences should not automatically be interpreted as evidence of limited mathematical ability because difficulties with language and representation may occur independently of students' broader reasoning capabilities. Accordingly, investigating linguistic and semiotic barriers from students' perspectives can provide valuable insights into how mathematical communication, symbolic interpretation, and instructional language shape opportunities for conceptual understanding in Gurukul mathematics classrooms.

Mathematics learning barriers are multidimensional phenomena that cannot be adequately explained through isolated psychological, instructional, linguistic, or sociocultural factors. Existing research has demonstrated that students' attitudes, instructional experiences, and learning environments contribute to the complexity of mathematics education across different educational contexts (Chand et al., 2021; Wen & Dubé, 2022). From a psychological perspective, negative perceptions and mathematics anxiety may influence students' confidence and willingness to participate in challenging mathematical activities (Moussa & Saali, 2022; Purbaningrum et al., 2023). From a pedagogical perspective, limited classroom interaction and insufficient opportunities for conceptual explanation may constrain students' engagement with mathematical reasoning and problem-solving processes (Cardino & Ortega-Dela Cruz, 2020; Bah, 2022). Linguistic and semiotic perspectives further highlight the importance of mathematical communication, particularly when learners must interpret unfamiliar terminology and coordinate verbal explanations with symbolic representations (Wakhata et al., 2022). Meanwhile, sociocultural perspectives emphasize that classroom participation and learning opportunities are embedded within culturally situated relationships, expectations, and educational practices (Meeran & Van Wyk, 2022; Lerman, 2024). Although these perspectives provide complementary explanations of mathematics learning

difficulties, their intersections require further investigation within educational environments characterized by distinctive linguistic traditions and teacher–student relationships. Nepalese Gurukul schools provide a relevant context for examining these intersections because students encounter formal mathematics instruction within an educational setting shaped by Sanskrit-oriented learning practices and established cultural expectations. An exploratory sequential mixed-methods approach offers a suitable framework for investigating these experiences by initially identifying students' perceived barriers through qualitative inquiry and subsequently examining related response patterns through quantitative analysis. By integrating these perspectives, the present study seeks to develop a context-sensitive understanding of mathematics learning barriers and contribute evidence that may inform more responsive instructional practices in culturally distinctive secondary education settings.

METHOD

Research Design

This study employed an exploratory sequential mixed-methods design to investigate secondary school students' perspectives on mathematics learning barriers in Nepalese Gurukul schools. The research integrated qualitative and quantitative approaches to develop a comprehensive understanding of the psychological, pedagogical, linguistic, and sociocultural challenges experienced by students during mathematics learning. The qualitative phase was conducted first to explore students' experiences, perceptions, and interpretations of mathematics learning difficulties within their educational environments. This phase adopted an exploratory approach, allowing participants to describe challenges associated with mathematical understanding, instructional practices, classroom communication, and cultural expectations. The subsequent quantitative phase employed a descriptive survey approach to examine the distribution of perceived mathematics learning barriers among a larger group of students. The integration of these approaches enabled qualitative findings to inform the quantitative investigation while providing complementary evidence concerning students' experiences across different Gurukul school settings. The research was conducted in Gurukul schools located in the Lumbini and Gandaki Provinces of Nepal, representing educational environments with distinctive linguistic and sociocultural characteristics. The sequential organization of the study was intended to connect students' individual experiences with broader patterns of reported learning difficulties. Accordingly, the qualitative component emphasized contextual understanding, whereas the quantitative component focused on describing students' responses to structured questionnaire items. This methodological framework was selected to address the research objectives through an integrated examination of mathematics learning barriers from students' perspectives.

Participants

The study involved two groups of participants recruited during the qualitative and quantitative phases using different sampling techniques. In the qualitative phase, eight secondary school students were selected through purposive sampling to provide detailed information about their experiences of learning mathematics in Gurukul schools. These participants were recruited from four Gurukul schools representing two geographical settings, with four students selected from two schools in the hilly region and four students from two schools in the Terai region of Nepal. Purposive sampling was employed to obtain perspectives from students studying in different geographical and educational contexts. In the quantitative phase, the target population consisted of 445 students enrolled in Grades 9 and 10 at the selected Gurukul schools in the Lumbini and Gandaki Provinces. The sample size was determined using the Raosoft sample size calculator, with a 5%

margin of error, a 95% confidence level, and a 50% response distribution. A total of 207 students participated in the quantitative survey, representing approximately 46.52% of the identified population. The study employed proportional stratified random sampling based on school location, distinguishing between rural and urban educational settings. The quantitative sample comprised 117 students from 12 urban schools and 90 students from eight rural schools, with participants randomly selected from Grades 9 and 10 within the participating schools. All survey respondents were male (100%), aged between 15 and 18 years, with a mean age of 16.5 years, reflecting the composition of the participating Gurukul classes. Consequently, the quantitative findings describe the perspectives of male students in the selected schools and should not be generalized to female students or Gurukul institutions beyond the sampled population without further investigation.

Instruments and Data Collection

Data were collected using semi-structured interviews during the qualitative phase and a structured questionnaire during the quantitative phase. The semi-structured interviews were designed to explore students' experiences and perceptions of mathematics learning, particularly difficulties associated with mathematical concepts, instructional practices, classroom communication, and sociocultural expectations. Open-ended questions provided opportunities for participants to explain their experiences and describe situations that influenced their engagement with mathematics. The interview format also allowed further exploration of issues emerging from participants' responses, supporting the identification of context-specific learning barriers. Qualitative data collection focused on understanding how students interpreted mathematics-related anxiety, teacher-centered instruction, linguistic and symbolic difficulties, and classroom interactions. Following the qualitative phase, a structured questionnaire was used to collect quantitative information from 207 secondary school students. The questionnaire included closed-ended Likert-scale items addressing students' perceptions of mathematics learning barriers, instructional practices, semiotic difficulties, and economic support. These dimensions were consistent with the broader research objective of examining psychological, pedagogical, linguistic, and contextual challenges associated with mathematics learning. Questionnaire responses provided information about students' reported experiences and perceptions across the participating rural and urban Gurukul schools. The use of interviews and questionnaires allowed the study to examine both the contextual characteristics of students' learning experiences and the distribution of perceived barriers within the quantitative sample.

Data Analysis

Qualitative and quantitative data were analyzed separately before their findings were considered together to develop an integrated interpretation of mathematics learning barriers. Qualitative interview data were examined using thematic analysis to identify recurring patterns, meanings, and experiences expressed by participants. The analysis involved familiarization with the interview responses, identification of meaningful information, generation of initial codes, and organization of related codes into broader themes. These themes were subsequently reviewed and interpreted in relation to the research objectives and the educational context of Gurukul schools. The qualitative analysis focused on four principal dimensions: mathematics-related anxiety, teacher-centered instructional practices, linguistic and semiotic difficulties, and sociocultural influences on classroom participation. In the quantitative phase, questionnaire responses were summarized using descriptive statistics, including frequencies and percentages, to describe students' reported mathematics learning barriers. The original analysis also reported chi-square goodness-of-fit tests to examine whether observed response frequencies differed from expected frequencies within the questionnaire categories. Statistical significance was evaluated using a conventional threshold of $p < 0.05$, while the interpretation of the chi-square results was restricted to differences in response

distributions rather than associations between independent variables. Quantitative findings were interpreted alongside the qualitative themes to identify areas of convergence and differences between students' detailed experiences and the broader survey response patterns. This integrated interpretation supported a contextualized understanding of perceived mathematics learning barriers without assuming that the observed statistical patterns established causal relationships.

Research Procedure

The research was implemented sequentially through qualitative exploration, quantitative investigation, and integration of findings. Initially, the study identified Gurukul schools in the Lumbini and Gandaki Provinces as the research setting and established the target population of secondary school students enrolled in Grades 9 and 10. During the first phase, eight students were purposively selected from four Gurukul schools representing hilly and Terai geographical settings. Semi-structured interviews were conducted to explore participants' experiences of mathematics learning and identify perceived difficulties related to psychological, pedagogical, linguistic, and sociocultural conditions. The interview responses were analyzed thematically to organize students' experiences into recurring categories and identify the principal dimensions of mathematics learning barriers. Subsequently, the quantitative phase was conducted using a structured questionnaire addressing students' perceptions, instructional experiences, semiotic difficulties, and economic support. The quantitative sample comprised 207 students selected through proportional stratified random sampling from 20 Gurukul schools, including 12 urban and eight rural institutions. Questionnaire responses were organized and analyzed using descriptive statistics and the reported chi-square goodness-of-fit tests to examine patterns in students' responses. Following the separate analyses, the qualitative themes and quantitative findings were interpreted together to develop a broader understanding of the mathematics learning barriers reported by students in the participating Gurukul schools. Finally, the integrated findings were discussed in relation to the study objectives and relevant mathematics education literature to identify implications for instructional practices and learning environments in Nepalese Gurukul schools.

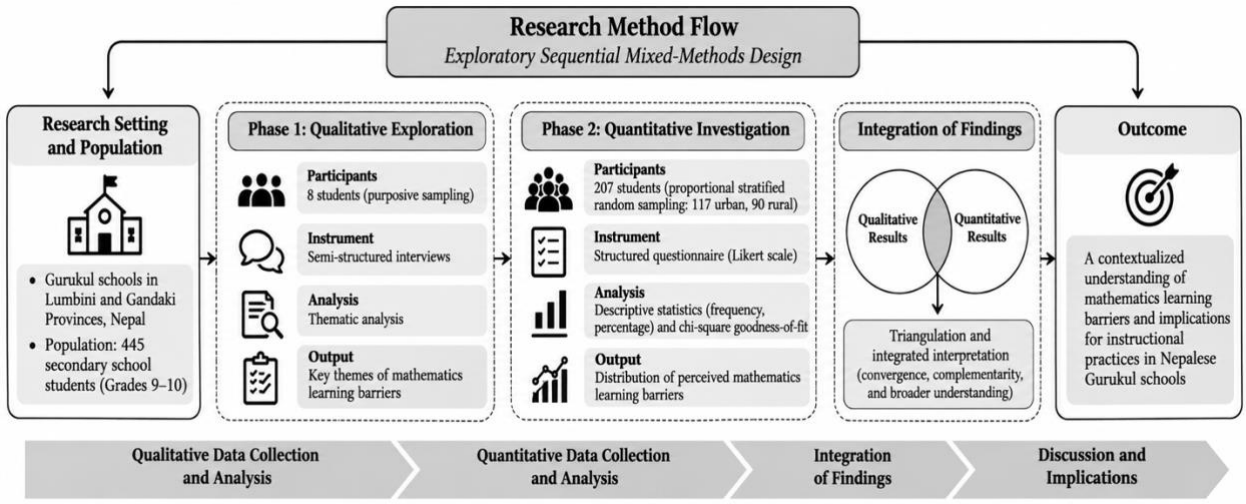


Figure 1. Research Method FLow

RESULTS AND DISCUSSION

Results

For qualitative research, this study adopted thematic analysis that was primarily based on both latent and manifest interpretation. The recorded data of eight participants were transcribed. Before transcription, translation from Nepali language to English was meticulously arranged. The

voice of the students in Nepali language because the medium of communication of all these participants was Nepali; however, their mother tongues were different. After this process, this study coded the data using both descriptive and in vivo coding (Saldaña, 2016). After the completion of coding, these codes were consolidated into the similar categories. After this procedure, themes were thoroughly sought considering research questions and objectives. Finally, themes were named and used for interpretation. Similarly, the quantitative data were analysed using descriptive and inferential statistical techniques. Descriptive statistics, including the mean and standard deviation, were calculated to summarize the participants' responses, determine the average scores, and examine the extent of variation in their responses. Furthermore, inferential statistics were employed to examine the statistical significance of the relationships or differences among the variables under investigation. The p-value was used to determine whether the observed results were statistically significant at the specified significance level. These statistical analyses provided a systematic basis for interpreting the quantitative findings and addressing the research objectives. This study interpreted the data with the help of themes that are the consequences of coding. The statements of the participants are recorded, transcribed and coded. The coding process was manually done using the book (Saldaña, 2016). After this process, the main four themes are revealed in this research.

Scary Experience

This is the first theme that I generated from the coding in this research. One of the participant illustrated: "*I spend my enough time to solve mathematics questions, but some questions are troublesome because they puzzle me a lot.*" This highlighted that learners are worried in solving mathematical questions, and the nature of these questions are not easily comprehensible to them. Similarly, the use of signs and symbols along with the abstract language also influenced learners in conceptualizing the meaning in the questions. Therefore, they are in the process of bewilderment. Likewise, the next participant *expressed (being upset) I memorize formulas as instructed in the classroom, but I could not relate the formula with the questions, so I always face the challenge*. This elicited that students have been instructed to memorize the formulas to sort out the questions of mathematics; however, students' grievances are transparent in relation to their inability to relate formulas with questions. However, these body languages are not adequate enough to determine the emotional states of the participants unless observation is systematically arranged. Further, the evidence from participants activities and classroom activities would essentially be necessary to present the claim that the lacuna between procedural and conceptual knowledge.

Additionally, another participant disclosed *I have heard from the small age that mathematics is complex among all other disciplines. This is the voice of my mathematics teachers whoever taught me mathematics, my parents and even my fellow-friends.* The findings indicate that students are subjected to cultural and academic pressures that portray mathematics as an inherently complex discipline. This perception, formed at an early age, has adversely influenced the process of acquiring mathematical knowledge. Furthermore, both facilitators who have facilitated them mathematics in the institutions, parents at home and their peers have spread unsubstantiated narratives regarding difficulty of mathematics. The next participant also expressed anxious feelings regarding mathematics like *I am really afraid of mathematics as few of my friends passed this subject in different exam. I put efforts to understand it conceptually, and clear all the formuals taught by my teacher, but I couldn't.* This also portrayed that perceived notion about the mathematics subject also creates a fearful and intimidating environment in which students view themselves in a complicated learning settings. On the other hand, mathematics understanding is equivalent to achieving a success in the exam.

Teacher-Centered Instruction

The next theme that I generated from the code of the participants. The perception to observe teacher and teaching is quite different. One of the participants expressed *my teacher solves the questions on the board and tells us to follow the process whatever he does on the board. I follow him and write all the procedures in the rough copy.* This data demonstrated that solution to mathematics questions on the board is viewed as teaching by the teacher where instructions followed is considered as learning. Furthermore, this reflection stressed that there is a gap between preaching and following, and the way it is transferred from preaching to following goes unnoticing. Similarly, this data further portrayed knowledge production and construction process is dependent on tutor where students' participation in answering those questions is limited. ignored. Connecting to the same vein, another participant expressed *I am puzzled in many questions, and I have several queries, but I never ask any questions to my teacher. I have been taught asking questions means a disrespectful manner in academic settings.* This expression reflected students' difficulties with mathematical questions; however, asking questions of the teacher was perceived as disrespectful. From a critical pedagogy perspective, this perception suggests the persistence of traditional classroom power relations in which teacher authority is rarely questioned. Such practices may limit students' opportunities for dialogic engagement and critical participation. From a sociocultural perspective, participants' reluctance to question their teachers may reflect their perceptions of classroom relationships and the authority attributed to teachers in their particular learning contexts. Such perceptions may influence their willingness to participate in classroom interactions, ask questions, and engage in meaning-making processes. However, these accounts represent the experiences of the participants in this study and should not be generalized as characteristics of Gurukul culture as a whole. Similarly, the next participant shared *my teacher enters and starts writing the topic. My teacher continues speaking on what he is going to teach, and never allows us to express our dilemmas, queries and difficulties.* This expression clearly disclosed that teaching is equated to lecturing the topic without any concerns of students' dilemmas and interests. It further disclosed that dialogues between students and teachers are unnoticed and students' participation in learning process is sidelined. According to the culture of Gurukul academic institutions, even asking questions and queries to the teachers sometimes make students feel hesitant and uncomfortable.

Language and Semiotic Barriers to Mathematical Conceptualization

The next theme that I generated is Language as obstacle for conceptualization. Language embedded in the text book of mathematics is different than the language of other subjects that students have. During the interview process, one of the participants expressed, *I get puzzled due to the signs and symbols used in the algebra and geometry. I always face challenge when I solve the questions of algebra and geometry.* This data reflected that the symbols used in the algebra and geometry put pressure to the learners to solve the question. This expression further projected that confusion created by its language hinders students' ability to solve questions and conceptualize the mathematical algorithms. In the same juncture, the next participant also shared *I am not able to make equations after reading the language of questions nor am I able to solve it myself. This is not a single time, but it happens frequently.* This experience clearly stated that forming the concept in the initial stage of reading questions is difficult for the learners in mathematics classroom. This has indicated that participants experience difficulty in incorporating memorized formulas into questions which they are expected to solve. However, it does not suffice to justify that whether the problem in procedural or conceptual knowledge. This also manifested that this inability is not occasional rather frequent in this class. It also demonstrated that language acts as distractor from the concept formation for learners because the way questions are framed is based on different signs and symbols. Connecting to the same vein, the next participant said *I study other subjects in Sanskrit language which*

I feel easy to speak and answer depends upon my language which I often speak, but mathematics language is giving me problems in creating equations and concepts. The participant's response reveals a prominent theme of language-mediated cognitive barriers in learning mathematics within the socio-cultural context of Gurukul education. While the learner feels comfortable studying and expressing understanding in Sanskrit, a language closely connected to daily academic and cultural practices, mathematics is experienced as linguistically alien and cognitively demanding. The specialized symbolic and technical language of mathematics creates difficulty in forming equations and grasping abstract concepts, as it does not align with the learner's commonly spoken instructional language. This linguistic disconnect restricts conceptual translation from familiar verbal understanding to mathematical representation.

Teacher–Student Cultural Dynamics

This is the fourth and last theme under my research. This theme is a reflection of our students' experiences regarding the influence of culture in the society. In this regard, one of my participants shared, *my parents always tell me teachers are the source of knowledge and just like the future makers of students, so respect them and speak very politely whenever necessary.* This expression clearly reflected that students have been culturally guided to respect and offer due honor towards their teachers. In the name of seniority, and knowledgeable person, students feel intimidated to ask any queries to them. This indicated that the gap between teachers and students are still prevalent in academic settings. This culture of respect may discourage students developing the power of reasoning and argument to The next participant also shared his experiences like *my classroom is very silent whenever teacher teaches and nobody asks anything neither to their friends and nor their teachers because noisy classroom means the action of disobedience of students to their teachers.* The participant's statement reflects a strong theme of authoritative classroom culture and silence as obedience**,** which acts as an obstruction to active mathematical learning. The classroom silence may reflect the less participation and engagement of the students in conversing with the teachers, thereby, it broadens the gap between teachers and students. Within this environment, questioning whether directed to the teacher or peers is perceived as disruptive or disobedient, discouraging learners from expressing doubts or engaging in mathematical dialogue. This socio-cultural norm reinforces passive learning, where students prioritize compliance over understanding. As a result, learners suppress curiosity and struggle privately with concepts, leading to gaps in comprehension. The theme highlights how culturally enforced discipline and hierarchical teacher–student relationships limit interaction, critical thinking, and collaborative learning, thereby creating barriers to meaningful engagement with mathematics.

Table 1. *Frequency Distribution* of Student's Perception

Students' perception	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
There is nothing creative in Mathematics, it is just memorizing formula and things	31.4	26.7	10.5	14	15.1
Mathematics is solitary activity, done by individuals in isolation	29.1	30.2	9.3	11.6	19.8
Mathematics is enjoyable and stimulating to me	27.9	30.2	7.0	23.3	11.6
I never liked Mathematics and it is just my most dreaded subject	32.5	29.1	7.0	23.3	8.1
Mathematics is dull, boring and useless	29.1	29.1	4.6	25.	11.6

Notably, 58.1% (31.4% strongly disagree, 26.7% disagree) reject the idea that mathematics is only about memorizing formulas, suggesting some recognition of its creative aspects. However, 59.3% (29.1% strongly disagree, 30.2% disagree) disagree that mathematics is a solitary activity, though 19.8% strongly agree, indicating varied views on collaboration. Engagement is low, with

58.1% (27.9% strongly disagree, 30.2% disagree) finding mathematics unenjoyable, and 61.6% (32.5% strongly disagree, 29.1% disagree) denying it as their most dreaded subject, though 23.3% agree. Similarly, 58.2% (29.1% strongly disagree, 29.1% disagree) reject the notion that mathematics is dull and useless, but 25.6% agree.

Table 3. *Association Between Student's Perception and Challenges*

Students Perception	Frequency	Percent	P value
Challenge	130	62.8	0.0178
Not Challenge	77	37.2	
Total	207	100.0	

Chi square goodness of fitness of data (Difference of proportion)

The table shows 62.8% of students perceive mathematics as significantly challenging, with a p-value of 0.0178. This showed that Challenges on learning mathematics dependent upon Students perception in Gurukul school. Moreover this calculation showed that students' perceptions on mathematics made mathematics learning really challenging and troublesome. Mathematical fear, anxiety, negative thoughts also pose a barrier in mathematics learning among students. Rumours and narratives that are pervasive in the society threatens the children in learning mathematics in gurukul schools. Mathematics is boring, monotonous and solitary subject according to the perceptions of students. This poor perception of students does not prepare them mentally free in learning mathematics questions.

Table 4 *Frequency Distribution of Role of Teacher*

Pedagogy (Role of Teacher)	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Teacher let students discuss and collaborate in the classroom	77.9	8.1	12.8	0	1.2
Teacher teaches content through lecturer throughout the class	39.5	57	2.3	1.2	0
The behaviour of teacher is friendly and cooperative	59.3	37.2	3.5	0	0
Teacher solves questions allowing students for the participation in the solution	32.6	37.2	20.9	2.3	7
Teacher promotes communication in the classroom	46.5	22.2	15.1	6.9	9.3

This above-mentioned table indicated that 77.9% strongly disagree that teachers encourage discussion and collaboration, indicating a lack of interactive learning. Similarly, 96.5% disagree or strongly disagree that teachers rely solely on lectures, suggesting some variety in teaching methods. Teachers are perceived as friendly and cooperative by 96.5% (59.3% strongly disagree, 37.2% disagree about unfriendliness), fostering a positive environment. However, 69.8% disagree or strongly disagree that teachers involve students in problem-solving, and 68.7% report limited promotion of classroom communication, pointing to missed opportunities for engagement.

Table 5. *Association Between Role of Teacher and Challenges*

Role of Teacher	Frequency	Percent	P value
Challenge	137	66.3	0.0026
Not Challenge	70	33.7	
Total	207	100.0	

Chi square goodness of fitness of data (Difference of proportion)

The table indicates that 66.3% of students find the teacher's role had significant challenging, likely due to high expectations or rigorous methods, supported by the significant p-value (0.0026).

This showed that Challenges on learning mathematics dependent upon Role of Teacher in Gurukul school.

Table 6. *Frequency Distribution of semiotic factor*

Semiotic factor	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I understand meaning of signs and symbols	57	23.3	16.3	1.2	2.2
I easily apply signs and symbols in solving questions	39	12.8	27.9	9.7	10.6
My teachers simplifies their meaning	44.2	30.2	10.3	4.8	10.5
I am afraid of using numbers and images	16.9	12.8	15.6	25.6	29.1
I face problem in memorizing the rules and formulas	14.7	13.3	12.6	28.8	30.6

The Likert scale data indicates that the meaning of signs and symbols is not understandable to students. Notably, 80.3 (57% strongly agree, 23.3% disagree) report that it is a problem for students to recognize the meaning of those symbols in the mathematical questions, suggesting very serious issues. However, 3.4 (1.2 agree, 2.2% strongly agree) note that they only understood the concept. This reflected that the conceptualization of signs and symbols are really difficult for the students of Gurukul schools. In regard to the second question, The second perception disclosed that students encounter against the application of these symbols and signs in the domain of solving questions. This revealed that 51.8 percentage students find them in application of those symbols in mathematical questions. However, 20.6 percentage of students perceived that they have an idea of application. Third perception unpacked that teachers don't simplify the meaning of those symbols and signs to the students. Unless students have the meanings of those things purposefully, they cannot solve the questions logically. 74.4 percentage of students disagreed that teachers simplified their meaning. However, only 15.3 percentage students agreed in this case. The fourth perception indicates that they are afraid of using these symbols in mathematical questions. Majority of students agreed that they have the scary feelings in using it. Similarly, the final perception reveals that they dislike memorizing and reciting the formulas of mathematics to apply. Without the clear the concept of those formulas, their inclination towards mathematical formula seems very poor.

Table 7. Association between Semiotic and Challenges

Semiotic	Frequency	Percent	P value
Challenge	137	66.3	0.043
Not Challenge	70	33.7	
Total	207	100.0	

Chi square goodness of fitness of data (Difference of proportion). The p-value of 0.043 indicates that there was significant semiotic challenging on students on learning mathematics. This showed that Challenges on learning mathematics depends upon semiotic factor in Gurukul school.

Table 8. Frequency Distribution of Economic Support

Economic Support	SD	D	N	A	SA
Your parents support you financially to buy learning materials for mathematics instruments	5.8	3.5	4.7	67.4	18.6
Your parents support you to participate in different mathematical programmes conducted outside the classroom	3.5	3.5	16.3	36	40.7
Your parents manage you a coaching class or tuition class for mathematics	2.3	3.5	4.7	68.6	20.9
You take the coaching class of mathematics class regularly	11.6	19.8	17.4	24.4	26.7

The Likert scale data indicates strong parental support. Notably, 86% (67.4% agree, 18.6% strongly agree) confirm parents financially support purchasing mathematics materials, and 76.7% (36% agree, 40.7% strongly agree) report support for extracurricular mathematical programs.

Additionally, 89.5% (68.6% agree, 20.9% strongly agree) note parents arrange coaching or tuition classes, and 51.1% (24.4% agree, 26.7% strongly agree) attend these classes regularly, though 31.4% (11.6% strongly disagree, 19.8% disagree) do not.

Table 8. Association Between Economic Support and Challenges

Economic Support	Frequency	Percent	P value
Challenge	96	46.5	
Not Challenge	111	53.5	0.5164
Total	207	100.0	

The results showed that there was insignificant challenge of occupation of parents in learning mathematics(p=0.5164). This showed that Challenges on learning mathematics doesnot depend upon occupation of parents in Gurukul school.

Discussion

The findings of this study demonstrate that mathematics learning barriers among secondary school students in Nepalese Gurukul schools involve interconnected psychological, pedagogical, linguistic, and sociocultural dimensions rather than a single source of learning difficulty. The qualitative findings revealed that students experienced confusion, fear, and difficulties connecting memorized mathematical formulas with unfamiliar problems, while the quantitative results indicated that 62.8% of respondents were classified as experiencing perception-related mathematics learning challenges. These findings are consistent with Wen and Dubé (2022), whose systematic review identified mathematics attitudes as multidimensional constructs encompassing emotional responses, self-confidence, perceived value, and behavioral intentions associated with mathematical achievement. Similarly, Moussa and Saali (2022) emphasized the importance of psychological and educational conditions in shaping students' attitudes toward mathematics, supporting the interpretation that negative learning experiences may influence students' willingness to engage with mathematical tasks. The findings also correspond with Purbaningrum et al. (2023), who examined students' beliefs about mathematics and highlighted the relevance of perceived mathematical difficulty to learning experiences. However, the present study extends these discussions by illustrating how students' negative perceptions may be reinforced through interactions involving instructional experiences, family expectations, and narratives about mathematics as an inherently difficult subject. Interestingly, although 62.8% of respondents were classified as experiencing perception-related challenges, 61.6% disagreed that mathematics was their most dreaded subject, suggesting that perceived difficulty and emotional rejection of mathematics do not necessarily represent identical experiences. This distinction is consistent with Idris et al. (2021), who indicated that mathematical attitudes should not be interpreted as the sole determinant of students' educational outcomes, and with Shakya and Maharjan (2023), who examined the relationship between attitudes and mathematics achievement. Theoretically, these findings suggest that mathematics-related anxiety should be understood alongside students' conceptual experiences and social learning environments rather than treated exclusively as an individual psychological characteristic. Consequently, instructional responses should prioritize opportunities for conceptual clarification, constructive feedback, and supportive mathematical experiences while recognizing that the present study did not directly measure changes in anxiety or mathematical achievement.

Pedagogical practices emerged as another prominent dimension of mathematics learning barriers, with 66.3% of surveyed students classified as experiencing teacher-related challenges and qualitative participants describing limited opportunities for questioning and mathematical discussion. These findings correspond with Chand et al. (2021), who identified instructional conditions among the factors associated with students' perceived mathematics learning difficulties, suggesting that classroom experiences constitute an important component of educational challenges.

Similarly, Cardino and Ortega-Dela Cruz (2020) emphasized the importance of selecting instructional strategies appropriate to students' learning needs rather than relying on a single pedagogical approach. The participants' descriptions of copying solutions from the board and memorizing procedures without fully understanding their applications suggest a perceived imbalance between procedural demonstrations and opportunities for independent mathematical reasoning. This interpretation is broadly consistent with Bah (2022), who discussed the relevance of pedagogical factors to mathematics performance, although the present study did not directly evaluate the effectiveness of specific instructional methods. Within the Nepalese context, Pokhrel (2023), Tiwari (2023), and Poudel (2025) have examined mathematics learning difficulties and educational conditions, providing a broader basis for understanding the instructional concerns reported by Gurukul students. Nevertheless, an important inconsistency emerged because 96.5% of survey respondents disagreed that their teachers relied primarily on lectures, whereas several interview participants described lessons dominated by teacher explanations and procedural demonstrations. This discrepancy may reflect differences in participants' experiences, interpretations of questionnaire wording, or the distinction between observing mathematical demonstrations and perceiving instruction as lecture-based, but the available evidence cannot determine which explanation is most appropriate. Therefore, the findings should not be interpreted as demonstrating that all participating Gurukul classrooms were uniformly teacher-centered or that instructional practices directly caused students' mathematics learning difficulties. Instead, the results highlight the importance of examining specific dimensions of classroom participation, including opportunities for questioning, collaborative problem-solving, mathematical explanation, and teacher responsiveness, when considering instructional improvements.

Linguistic and semiotic barriers represented one of the most prominent findings, with 66.3% of respondents classified as experiencing semiotic challenges and 80.3% reporting difficulties understanding the meanings of mathematical signs and symbols. The qualitative interviews reinforced this pattern by revealing students' difficulties interpreting algebraic and geometrical representations, translating verbal problems into equations, and connecting familiar language with formal mathematical expressions. These findings suggest that students' mathematical difficulties may involve the interpretation and coordination of representations rather than computational procedures alone, although the study did not directly assess the relative contribution of these processes. Wakhata et al. (2022) examined students' attitudes toward mathematical word problems, providing a relevant comparison because such tasks require learners to engage with mathematical information expressed through language and symbolic representations. Furthermore, Thanheiser (2023) emphasized the importance of mathematical understanding within educational practice, supporting the broader argument that meaningful learning involves more than reproducing mathematical procedures. The present findings extend these discussions by highlighting a distinctive linguistic context in which students reported greater familiarity with Sanskrit-oriented academic communication while encountering difficulties with mathematical terminology and symbolic expressions. This situation may create additional interpretative demands when learners attempt to connect mathematical concepts with familiar linguistic resources, although the study did not independently measure Sanskrit proficiency, Nepali proficiency, or mathematical language competence. The reported difficulties also correspond with the broader educational concerns identified by Chand et al. (2021), particularly the need to consider multiple learning conditions when interpreting students' experiences of mathematical challenges. From an instructional perspective, the findings suggest the potential value of explicitly explaining mathematical terminology, connecting verbal statements with symbolic representations, and providing opportunities for students to articulate mathematical reasoning in accessible language (Abrahamson et al., 2020; Maanu & Asare, 2025; Riccomini et al., 2024; Saiman et al., 2026; Tran & Castro Schepers, 2023)[need

citation]. Nevertheless, these instructional implications remain recommendations derived from students' reported experiences rather than experimentally demonstrated solutions, and further research is needed to determine how specific language-support strategies influence mathematical understanding in Gurukul classrooms.

The sociocultural findings provide an additional perspective by demonstrating how students' interpretations of teacher authority, respectful behavior, and classroom silence may shape their willingness to participate in mathematics learning. Interview participants described situations in which questioning teachers was perceived as potentially disrespectful, suggesting that classroom communication was influenced by expectations extending beyond the immediate mathematical task. These experiences are consistent with the sociocultural perspective discussed by Lerman (2024), which emphasizes the importance of understanding mathematical learning within socially situated practices and interactions. Similarly, Meeran and Van Wyk (2022) highlighted the challenges associated with sociocultural diversity in mathematics classrooms, particularly the need for teachers to recognize learners' backgrounds and respond appropriately to differences in educational experiences. Although their research was situated in a different educational context, the comparison suggests that culturally responsive mathematics instruction requires attention to the meanings students attach to classroom participation and teacher–student relationships. The present study contributes a context-specific perspective by showing that some Gurukul students associated silence with obedience and interpreted requests for clarification through established expectations of respect for teachers. However, these accounts should not be interpreted as evidence that Gurukul educational traditions inherently discourage critical thinking or that respectful teacher–student relationships necessarily restrict mathematical participation. Rather, the findings indicate that particular students experienced tension between their understanding of appropriate classroom behavior and their need to communicate mathematical uncertainty. This interpretation suggests that instructional practices could preserve culturally meaningful expressions of respect while establishing explicit opportunities for questions, peer discussion, and collaborative mathematical reasoning. Importantly, because the quantitative questionnaire did not include a separate measure of teacher–student cultural dynamics, the prevalence of these experiences across the wider sample remains unknown, limiting conclusions about their distribution among Gurukul students.

The integration of qualitative and quantitative findings provides a multidimensional interpretation of mathematics learning barriers while also revealing important differences in the extent to which individual factors were supported by the available evidence. Teacher-related and semiotic challenges were the most frequently reported quantitative categories at 66.3% each, followed by perception-related challenges at 62.8%, whereas economic support-related challenges were reported by 46.5% of respondents. This distribution suggests that instructional, symbolic, and psychological difficulties were more frequently identified than economic support-related barriers within the participating sample, although no statistical comparison between these categories was established. The relatively favorable reports of parental financial assistance also indicate that access to learning materials and supplementary instruction did not necessarily eliminate students' perceived difficulties with mathematical understanding and classroom participation. These findings complement Meeran and Van Wyk (2022) and Wen and Dubé (2022), whose research illustrates the relevance of educational contexts and psychological dimensions to mathematics learning, while the present study adds evidence from a distinctive Gurukul setting. Methodologically, the exploratory sequential mixed-methods design enabled students' interview accounts to provide contextual meaning for several quantitative patterns, particularly those concerning mathematics anxiety, instructional participation, and symbolic interpretation. Nevertheless, the interpretation of the quantitative findings requires caution because the reported chi-square goodness-of-fit tests describe differences in response distributions and do not establish associations between learning barriers and

mathematics achievement. Additional limitations include the small qualitative sample, the exclusively male quantitative sample, the absence of direct classroom observations and achievement measurements, and inconsistencies between selected questionnaire responses and interview accounts. Future investigations should incorporate validated multidimensional instruments, classroom observations, mathematical performance assessments, and appropriate statistical models to examine how psychological, pedagogical, linguistic, and sociocultural factors interact across different Gurukul educational environments. Overall, the study contributes to mathematics education by demonstrating the importance of interpreting students' perceived learning barriers within their specific instructional and cultural contexts and by identifying directions for developing more inclusive, communicative, and conceptually supportive mathematics learning environments.

Implications

The findings of this study have important implications for improving mathematics education in Nepalese Gurukul schools by addressing psychological, pedagogical, linguistic, and sociocultural learning barriers. Mathematics teachers should adopt interactive and student-centered approaches that promote conceptual understanding, collaborative problem-solving, and active classroom participation. Supportive learning environments are also essential for reducing mathematics anxiety, strengthening students' confidence, and encouraging positive attitudes toward mathematical learning. Furthermore, explicit explanations of mathematical symbols, terminology, and representations may help students overcome difficulties in interpreting abstract concepts. Integrating familiar linguistic contexts with formal mathematical language could improve students' conceptual understanding and mathematical communication. Teachers should also encourage respectful dialogue and provide opportunities for students to ask questions without fear of violating cultural expectations. School administrators should prioritize professional development programs focusing on culturally responsive pedagogy, instructional communication, and differentiated learning strategies. Educational policymakers should consider integrating linguistic accessibility and inclusive classroom practices into mathematics education improvement initiatives. Although economic support was less frequently reported as a challenge, equitable access to learning resources and supplementary instruction remains important. Theoretically, this study highlights the interconnected nature of mathematics learning barriers within culturally distinctive educational environments. Methodologically, the findings demonstrate the value of integrating qualitative experiences with quantitative evidence to understand students' learning difficulties. Overall, the study provides practical directions for developing more inclusive and supportive mathematics learning environments, although the effectiveness of these recommendations requires further empirical investigation.

Limitations and Suggestions for Future Research

This study has several limitations that should be considered when interpreting its findings and identifying directions for future research. First, the investigation was limited to selected Gurukul schools in the Lumbini and Gandaki Provinces of Nepal, restricting the generalizability of the findings to other educational settings. Second, the qualitative phase involved only eight participants, potentially limiting the diversity of experiences represented in the thematic analysis. Third, the quantitative sample consisted exclusively of 207 male students, preventing comparisons across gender groups. Fourth, the reliance on self-reported interviews and questionnaires may have introduced response bias and subjective interpretations of mathematics learning barriers. Fifth, the absence of direct classroom observations limited opportunities to examine actual instructional practices and teacher–student interactions. Sixth, the study did not incorporate standardized mathematics achievement assessments, preventing direct examination of relationships between perceived barriers and academic performance. Seventh, the reported chi-square goodness-of-fit

analyses could not establish statistical associations or causal relationships among the investigated factors. Future studies should therefore involve larger and more diverse samples across different geographical regions and educational institutions. Longitudinal and comparative research is recommended to examine how psychological, pedagogical, linguistic, and sociocultural barriers develop and interact over time. Furthermore, future investigations should integrate classroom observations, validated assessment instruments, and appropriate multivariate statistical analyses to strengthen methodological rigor. Finally, intervention-based studies are needed to evaluate the effectiveness of culturally responsive teaching, multilingual instructional strategies, and collaborative learning approaches in improving mathematics learning experiences and achievement among Gurukul students.

CONCLUSION

This study concludes that mathematics learning barriers among secondary school students in Nepalese Gurukul schools are multidimensional, involving interconnected psychological, pedagogical, linguistic, and sociocultural factors. The qualitative findings identified four principal themes: mathematics-related anxiety and negative learning experiences, teacher-centered instructional practices, linguistic and semiotic barriers, and teacher–student cultural dynamics. Students reported difficulties understanding mathematical concepts, applying memorized formulas, interpreting mathematical symbols, and communicating their learning difficulties during classroom activities. The quantitative findings indicated that teacher-related and semiotic challenges were the most frequently reported barriers, each affecting 66.3% of respondents, followed by perception-related challenges at 62.8%. In comparison, economic support-related challenges were reported by 46.5% of students, suggesting that financial support was a less frequently identified concern within the participating sample. The integration of qualitative and quantitative findings demonstrated convergence in students' reported psychological, pedagogical, and semiotic difficulties, while sociocultural dynamics emerged primarily through qualitative accounts of classroom authority, respectful behavior, and reluctance to ask questions. Nevertheless, the reported chi-square goodness-of-fit results do not establish statistical associations or causal relationships between these factors and mathematics learning difficulties. The findings therefore emphasize the importance of interpreting students' perceived barriers within their specific educational and cultural contexts rather than attributing mathematical difficulties to individual abilities or isolated instructional conditions. These results suggest that culturally responsive teaching, interactive classroom communication, explicit explanations of mathematical representations, and supportive learning environments may help address the challenges identified by students. However, the exclusively male quantitative sample, limited qualitative participation, reliance on self-reported data, and absence of direct achievement measurements restrict the generalizability and explanatory scope of the findings. Future research should employ more diverse samples, validated instruments, classroom observations, and appropriate statistical analyses to examine relationships among perceived barriers and mathematical achievement. Overall, this study contributes context-specific evidence to mathematics education research by highlighting the importance of integrating psychological support, pedagogical responsiveness, linguistic accessibility, and culturally sensitive classroom practices in Nepalese Gurukul schools.

AUTHOR CONTRIBUTIONS STATEMENT

Manoj Marasini contributed to the conceptualization of the study, research design, investigation, data collection, and preparation of the original manuscript. Dinesh Panthi contributed to the development of the research methodology, quantitative data analysis, interpretation of findings, and manuscript revision. Krishna Kanta Parajuli contributed to the qualitative data analysis, thematic interpretation, literature review, and critical evaluation of the research findings. Hari Prasad Upadhyay contributed to research supervision, methodological refinement, integration of qualitative and quantitative findings, and critical review of the manuscript. All authors contributed to the intellectual development of the study, reviewed and approved the final manuscript, and agreed to be accountable for the integrity and accuracy of the published work.

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