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Underachieving Secondary Students' Mathematical Learning Experiences

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Abstract: *Underachievement in mathematics is a major issue in Nepalese secondary education, as national assessments indicate that most students achieve below the proficiency level. This research paper examined the experiences of four eleventh-grade underachieving students to gain insights into the cognitive, emotional, and contextual hindrances influencing their mathematical education. Guided by socio-cultural and motivational theories, a qualitative interpretive design was utilized in this study. Data were collected through several narrative interviews, accompanied by classroom observations and field notes. The findings revealed that students regarded mathematics as abstract and daunting, resulting in decreased self-efficacy, avoidance behaviors, and increased anxiety. Teacher-focused teaching methods with memorization, and restricted personalized assistance diminished student engagement. Socio-economic limitations and a lack of family support exacerbated these difficulties. The results indicated that underachievement in mathematics was associated with a combination of psychological, educational, and socio-cultural elements, emphasizing the importance of learner-focused teaching, contextual methods, and emotional support to promote inclusive math learning environments in Nepal.*

Keywords: *Attitudes, Learning Environment, Math Anxiety, Nepalese Education, Underachievement in Mathematics*

Introduction

Mathematics education remains a significant concern in Nepalese school systems, predominantly due to the persistent underachievement among students (Mathema & Bista, 2006). Despite efforts by the Curriculum Development Center (CDC) to revise and implement the national curriculum frameworks emphasized mathematics as a core subject and suggested various teaching techniques (CDC, 2019), a large percentage of students continue to struggle with understanding and applying mathematical concepts in problem solving. National Assessment of Student Achievement (NASA) 2018 indicated that more than half of the students lie on the underperforming group in Nepal (Education Review Office [ERO], 2019). Further, NASA (2020) specified that the consistently weak performance of students in mathematics. NASA (2018), (2019) and (2020) indicated a low return on the investment in education made by the government. NASA (2020) indicated that only 32.1 percentage of students have passed the

basic proficiency level in mathematics, which is a thoughtful situation. This is an ongoing challenge resulted from low motivation and negative attitudes toward mathematics, and has been a consistent high failure rates in national examinations like the Secondary Education Examination (SEE) (Mathema & Bista, 2006; Ministry of Education [MoE], 2014, NASA, 2020).

Several factors determine poor performance in mathematics. Conventional teaching methods, memorization of mathematical facts without understanding (Ghimire, 2024), and insufficient contextualized instructional approaches are some of the key problems (Bista & Mathema, 2006; Khanal et al., 2021; Rawat, 2018). Additionally, students perceive mathematics as a challenging, abstract, and disconnected subject, which diminishes their interest and self-assurance (Pradhan, 2023; Gadzella & Fournet, 1976). These perceptions are further intensified by psychological elements like math anxiety, which has a negative correlation with achievement (Belbase, 2013, Budhathoki et al., 2022; Paudel, 2019).

In Nepal, mathematics achievement is not satisfactory and the trend persists in both grades 3 and 5 (MoE, 2015). The low performance of students in mathematics can be attributed to insufficient educational support and low socio-economic condition in marginalized communities (Panthi & Belbase, 2017). The literature underscored the students' experiences, attitudes, motivation, and external factors are influential to their mathematical learning (Suan, 2014; Ryan et al., 2001). However, limited research exists focusing on the personal experiences of underachieving secondary students in Nepal, particularly regarding their perception and navigation of learning mathematics within diverse sociocultural and pedagogical contexts (Shrestha et al., 2021).

This research seeks to fill this gap by exploring the narratives of underperforming students in Nepal to assess their experiences, hindrances, and perceptions concerning mathematics learning. The study aims to answer the question: *What are the experiences of underachieving students regarding their mathematics learning*? The study accentuates identifying personal and contextual elements affecting mathematics achievement by concentrating on the narratives, ultimately aiding to more adaptive and effective pedagogical approaches.

Underachievement in mathematics is a global issue as a gap between an individual's potential and actual performance that triggers low academic performance and outcomes, lack of efficacy and negative attitudes towards subject (Gadzella & Fournet, 1976). Several factors underwrite the problem of underachievement like mathematics anxiety (Paudel, 2019). According to Heydari et al., 2013), insufficient support and limited access to resources (Gasper et al., 2012), inappropriate teaching methodology (Khanal et al., 2021) and socio-economic shortcomings (Rawat, 2018) together contribute to low motivation and engagement leading to low performance in mathematics.

A large number of students are at below-grade level (NASA, 2020), and an alarming gap exists between the intended and achieved curriculum. The relationship between students' academic performance and socio-economic status is noteworthy, but its magnitude varies by subjects. The regularity of the teacher and the availability of the resources have positive correlations with learning achievement (Panthi & Belbase, 2017). Examining and addressing the root causes of mathematics underachievement is indispensable for enhancing educational outcomes. It requires a shift toward student-centered teaching practices, fostering positive attitudes, and providing psychological and pedagogical support to the struggling learners in mathematics (Ryan et al., 2001; Suan, 2014). A diagnostic study on the challenges in pedagogical culture is imperative, and the factors for learning achievement should be recognized and disseminated (ERO, 2019).

Theoretical Framework

The study of underachievement in mathematics draws on various educational theories: Vygotsky's (1978) socio-cultural theory, Bandura's achievement motivation theory and Eccles and Wigfield's (2002) expectancy-value theory. Vygotsky's (1978) socio-cultural theory emphasized social

interaction, scaffolding, and cultural tools in cognitive development as he averred that learners achieve higher understanding through guided participation and collaborative learning, stressing the supportive instructional strategies in overcoming learning complications.

Likewise, the achievement motivation theory suggested that students' motivation and self-efficacy significantly influence the learning outcomes (Bandura, 1997). When students believe that they are capable of succeeding in mathematics, they tend to persevere through challenges; conversely, low self-efficacy might lead to avoidance and underachievement (Pajares, 1992; Paudel & Ghimire, 2024). Furthermore, the expectancy-value theory posits that students' engagement and achievement are dictated by their expectations of success and their placement of value on the subject (Eccles & Wigfield, 2002). Negative perceptions of mathematics and low task value reduce efforts leading to underachievement.

Research Method

This study followed interpretive qualitative research method to examine the experiences of low-achieving participants expressed through narratives (Clandinin & Rosiek, 2007). The narratives/stories in the Social Sciences are the discourses possessing a distinct sequential order linking events in a significant manner (Creswell, 2007). This method emphasizes the participants' emotions, feelings, and personal experiences during particular learning instances (Fraser, 2004).

Study Site and Research Participants

The research site was a secondary school in Kathmandu purposively selected based on the researcher's ease of access to the research participants. The research participants were four 11th-grade students (two girls and two boys). Selection of participants was determined by their mathematical performance and enthusiasm for taking part in the study. It is preferable to select a location that is easily accessible to everyone (Maxwell, 1996). The four participants were- Rita, Janu, Akash, and Raj (pseudonyms).

Rita was born to a financially struggling family in Jumla district of Karnali province, Nepal. After completing her grade ten, she moved from Jumla to Kathmandu to pursue her high school education (11^{th} and 12^{th} grades). Her parents back home are employed on their farm. Rita along with her siblings needed to assist their parents with farm chores and rearing cows and goats while at home in Jumla.

The second sample student was Janu, who moved from Rolpa district to Kathmandu. She was raised in impoverished rural area lacking electricity, clean water, and roads. Her father works as a wage laborer in a Gulf country.

The third participant was Akash whose parents arrived in Kathmandu from a distant village in pursuit of employment. Akash was born and brought up in Kathmandu amidst financial struggles of his parents.

Raj was the fourth participant, who, upon completing grade ten, moved to Kathmandu from Sarlahi in the Madesh province in the southern Nepal. His parents work as manual labor having the livelihood below the poverty line.

All the four participants received a failing grade (E grade) in mathematics in the most recent terminal exams. They were recognized as underperforming students in maths owing to their scores in the previous assessments. The learners were considered as cognitively typical in learning mathematics, free from any special needs or challenges related to physical and psychological conditions. The school had not recognized them as having any learning challenges, like dyscalculia or dyslexia. Students' poor outcomes in mathematics was linked to social factors (teachers, schools), curricula, and individual traits (anxiety, interest, and concentration).

Data Collection

Following the schools, students' and their parents' consent, a series of comprehensive interviews were conducted to investigate the participants' experiences with learning mathematics in classroom settings. The interviews occurred in a relaxed setting with open-ended questions to enable participants to share their experiences of learning mathematics. The researcher steered each interview personally to uncover various issues and challenges related to their mathematics learning. The conversations centered on the participants' experiences in mathematics, such as the topics they found easy or difficult and the reasons behind their feelings. Occasionally, the researcher asked them to scribble short notes on the issues they found challenging or simple, and the reasons behind their perspectives. The participants expressed their challenges in studying mathematics for most of the questions whereas in some questions, they could not answer immediately.

The interviews took place four times with each participant. Several interviews were carried out to facilitate the participants in sharing their experiential narratives more openly through further clarifications and details. Each interview lasted from 20-30 minutes. The interviews were recorded and transcribed for the additional analysis. The researcher maintained a field diary by keeping notes of the key concepts addressed during each interview session. The interview records were transcribed verbatim to construct the experience centered narratives by expanding the contexts and materials (Andrews, Squire, & Tamboukou, 2013). Meanwhile the researchers observed the mathematics classes of the sample students to find out the real classroom activities for their mathematics learning as a part of data triangulations.

Data Analysis and Interpretation

The interview transcripts, notes from class observations capturing student activities, and field notes were analyzed. While the field notes and the class observation notes contributed to the analysis and understanding of the data, the interview transcripts were critical in highlighting the key themes, arising from participants' learning experiences (Butina, 2015). These classroom observational notes served as supplementary data analysis to verify that these students participated in the class to perform in a specific manner regarding mathematics. The researcher used these observations and field notes to formulate questions for the interviews. The class observation and field notes served as complementary data to interviews, aimed at identifying any inconsistencies between the observations and the interviews. Consequently, the analysis and interpretation omitted them as the interviews constituted the primary components of the data and analyses. Hence, the primary sources of information were the interviews along with their transcripts. The interview transcripts were reviewed multiple times to locate essential segments to recognize key incidents or experiential high-low moments. These pivotal events were compiled to create accounts of participants, chronologically detailing their experiences of learning mathematics from primary grades to their present grade and explaining how these moments influenced their comprehension or learning of mathematics over the years. Their experiences with mathematics were analyzed through the theoretical lens of socio-cultural, psychological, and pedagogical backgrounds, as per the theoretical framework of the study. The validity and reliability of the study were maintained through iterative process of interviews to represent the participants' narratives in their first point of views, considering the credibility of their voices and verisimilitude of their learning experiences.

Results

The findings of the study have been described through narratives to uncover the participants' experiences at three levels: students' perceptions and attitudes toward mathematics, the learning environment and instructional practices, and the external factors and emotional hindrances. The accounts of participants' lived experiences are grounded on their personal perspectives, instead of the

researchers' interpretative stories. As a result, the participants' narratives are expressed as stories, using either first-person or third-person viewpoints. In the first-person perspective, the participants' statements have been shown through direct quotes, whereas in the third-person perspective, their voices have been conveyed with third-person nouns and pronouns.

Students' Perceptions and Attitudes toward Mathematics

The participants of this study expressed a negative perception of mathematics and depicted the subject as intimidating and difficult resulting to anxiety and frustration. For example, Akash conveyed his low confidence while he stated, "*Math is very hard for me; I get confused and lose interest quickly. I was unable to get good marks in the past, and maybe I won't be able to secure good marks in the future, as well!*" Other respondents also shared their feelings on the same line. Raj said, "*Why is math so difficult for me? I think, it is not my cup of coffee*." These compassions indicated a cycle of avoidance, wherein students preferred to dodge from mathematics and avoid overcoming their difficulties. The negative attitudes were cumulated by the previous underachievement stimulating to a deterioration of self-efficacy and concern in learning math. This perception significantly hampered their motivation to participate actively and persist in challenging tasks.

Similarly, another participant, Rita, expressed "*Mathematics itself is a difficult subject. In the previous grade also, I felt some problems in mathematics; due to mathematics, I am weak in Physics and Chemistry, too. In future, I will select those subjects and career path where there will no or less use of mathematics*." This sentiment is reflective of a learner's demotivation to follow mathematics as a career and developed negative attitude towards mathematics consequently to an avoidance tendency owing to difficulties pertaining to maths.

The interview transcripts and class observation notes indicated that some students grasped the prominence of mathematics and desired to learn it better; however, they struggled with emotional obstacles and lacked to address them. They associated their failure to linguistic challenges and an absence of effective teaching strategies. The perception that mathematics does not have direct applicability to their everyday experiences lessened its significance for them, diminishing their motive to study it. In general, the students' perceptions significantly affected their learning habits and outcomes, culminating to persistent underperformance.

Learning Environment and Teaching Practices

The classroom environment played a critical role in shaping students' learning experiences. The students expressed their classroom to be excessively teacher centered as lecture, memorization and rote learning were heavily practiced that barely engaged the students or excited them to take part in learning activities thereby leading to boredom and disinterest. Most of the students described their classrooms as the places of disconnection and noninvolvement further discouraging their active participation. Rita stated that, "*The teacher just explains everything from the front on the board, and we have to memorize it. There's no time to understand or ask questions.*" Similar statements have also been made by Akash, "*I could not feel comfortable in my mathematics class. Our teacher writes on the board which we copy (on our notebooks); we never get any opportunity to discuss the problem. I never got help from others when I had difficulty to solve a problem in mathematics and numerical problems in other subjects*." These narrations of the underachieving students pointed out the unfavorable learning environment.

Moreover, Janu expressed, "*As a student, I feel that I and my classmates face difficulty in learning because our teachers lack awareness regarding how we truly need to be taught; their teaching style doesn't align with our preferred teaching approach. Some of us struggle in comprehension, and others have issues in concentration in class and, thus, experience anxiety. We need the teachers to add visual tools for complex topics, offer practical examples to make us understand, hands on experience and most importantly time and effort to be invested on us individually according to our learning needs*."

These narratives raise a striking juncture between the mathematical difficulties and the lapses in instructional methods. Janu and other particiapnts primarily locate the teachers' unawareness of the students' needs and level as the factors behind their struggle and lower command and achievement in mathematics; which ultimately triggers their anxiety towards maths.

This context illustrates that students' achievement is significantly affected by the lack of appropriate teaching strategies by the teachers focusing on individual learning needs of the students, particularly those having issues with language and underlying emotional issues with persistent anxiety. The students presented a need for proper visual aids, real life examples and interactive activities along with caring and enthusiastic approach from the teachers.

Teachers' attitudes and pedagogical approaches were sometime alleged as less supportive, that caused students' low confidence and unwillingness to actively participate in mathematics learning activities. Students desired more engaging and supportive learning environment, which could nurture collaboration and inquiry, demonstrating the need of pedagogical approaches accompanying on need of students'.

External Factors and Emotional Barriers

Some external factors, like socioeconomic challenges, and family support, profoundly influenced the learners' mathematics learning experiences. The participants from the marginalized backgrounds undergoing limited access to academic resources and inadequate parental support mentioned that these factors impeded their capability to practice and underpin learning outside the school. Rita stated, "*Owing to the strained financial circumstances of my family, I was unable to contribute abundant time to rehearse mathematics at home and to complete my assignments. Besides, I failed to get extra time to revise the syllabic portions before the exams. Neither could I get additional assistance from my family."* Likewise, other participants also disclosed that their families, too, could not afford the additional tuition charges and lacked the required academic background to support with the home assignments rendering them into helplessness.

Furthermore, psychological hindrances, too, played a pivotal role. All the participants expressed the sense of anxiety and disappointment when given the mathematical tasks that overshadowed their self-confidence and motivation. High-level mathematics anxiety and low self-confidence were common amongst the participants. Many students recounted feeling nervous and terrified during examinations and classroom activities. A student said, "*I feel pretty scared whenever I see maths questions. My mind turns all blank and I forget everything*." Such emotional responses caused further obstruction thereby discouraging the learner to participate and fight the challenges. Such barriers even continued beyond the classroom thereby adversely influencing the motivation and the potential of future learning.

Discussion

The above results on mathematical underachievement unraveled the multidimensional characteristic of the issue, accentuating the mutuality of cognitive, affective, and contextual factors. The findings assert that the traditional pedagogical principles, marked by rote learning and teacher-centric instruction, contributed significantly to the learners' problems and negative perceptions regarding mathematics and (Rawat, 2018; Bista & Mathema, 2006). These instructional methodologies are ineffectual towards engaging the learners proactively by obliterating low motivation and subsequent underachievement (Suan, 2014).

Psychological factors, predominantly mathematics anxiety, are also crucial in hindering students' performance. Ashcraft and Moore (2009) expounded that anxiety spawns cognitive overload thereby damaging the working memory and distracting the problem solving procedures. Such emotional obstruction not only impacts the present achievement but also it discourages the continuity and curiosity in learning mathematics (Heydari et al., 2013).

Moreover, the socioeconomic and environmental aspects significantly influence the outcomes. The students from the marginalized communities have to tackle additional obstructions, like inadequate resources and lack of support thereby limiting the opportunity for conducive engagement into mathematics learning and engagement (Gasper et al., 2012; Panthi & Belbase, 2017). Such circumstances are connected to low engagement with mathematical activities and reduced opportunity for scaffolding and personalized support (Vygotsky, 1978). Such external barriers are created by low self-efficacy and negative perceptions of mathematics- all propagating underachievement (Pajares, 1992; Eccles & Wigfield, 2002).

The above discourse underlines the adaptation of learner-centric teaching strategies, fostering positive attitude, and provision of psychological support to address the underlying causes of the underachievement. Improving classroom practices, incorporating contextualized and inclusive learning experiences, and diagnosing emotional barriers are some of the measures towards enhancing mathematics achievement amongst the underachievers (Gadzella & Fournet, 1976; Ryan et al., 2001).

Conclusion and Implications

This research showed that mathematical underachievement amongst the school children in Nepal is fundamentally influenced by an amalgamation of cognitive, emotional, and environmental factors. The participants' experiences render that mathematics is often taken as difficult and abstract a subject, igniting negative attitudes, lower motivation, and lack of confidence and resulting into learning and assessment anxiety. Factors like language barrier, school transfer, and unsupportive teaching practices exacerbate their struggles, culminating in persistent low performance and less interest in mathematics.

Moreover, efficient interventions need to be implemented for embracing the learner-centric strategies that actively engage learners and associate mathematical principles to lived experiences. Diagnosing emotional challenges like math anxiety and fostering positive attitude are pivotal to uplifting the learners' confidence. Likewise, personalized assistance and continuous assessment might help ascertain misconceptions instantly and facilitate the targeted pedagogical approaches, ultimately improving the achievement level amongst the underachievers. This study has some limitations. First, his study was confined to only four underachieved students of a school, which limits the generalizability of the findings. Second, the participation in the study by low achievers, introducing a potential self-selection bias, as students with introvert characteristics might have been less likely to participate. These limitations should be considered when interpreting the findings and aspects to future research.

The findings carry notable implications for educators, policymakers, and curriculum developers. It is crucial to embrace effective pedagogies, improve teachers' training, and provide resources to foster inclusive and engaging classroom environments, particularly for the underachievers in mathematics. Future research could encompass a larger and diverse sample of research participants and examine intervention strategies to enhance the learning curiosity of underachievers. Overall, an all-inclusive approach that considers social, cultural, and psychological factors is indispensable for improving mathematics results across Nepalese schools. In the long run, it is advisable that addressing underachievement in mathematics requires an all-inclusive approach that allows cognitive, emotional, and sociocultural dimensions to create more inclusive and effective learning environment.

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