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Student Cognitive Engagement in High School Mathematics Classrooms of Nepal

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Abstract

In examination-driven education systems, student engagement often reflects strategic responses to assessment demands. Using a quantitative survey, this study examines the cognitive engagement strategies of 273 students of Grade 11 at an academically selective high school in Nepal, focusing on surface, deep, and teacher-reliant learning. Results show that students ideologically reject rote memorization as a superior approach, yet pragmatically employ memorization and repeated practice for academic success. Students report engagement in deep strategies, including self-questioning and seeking real-life applications, but show polarized responses in connecting new learning to prior knowledge. Strong reliance on teachers for content and problem-solving methods is evident. Gender differences were minimal, except that female students reported greater use of spare time for study. These findings demonstrate the influence of a high-stakes assessment culture on cognitive engagement in mathematics, underscoring the need for systemic reform in assessment and pedagogy.

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Introduction

The quality of a student's engagement is a key determinant of educational success. Engagement has multiple facets, including behavioral and emotional components (Fredricks et al., 2004), but cognitive engagement lies at the heart of meaningful learning. Cognitive engagement, defined as the psychological investment and mental effort a student exerts to understand complex ideas (Newmann, 1992), distinguishes superficial memorization from deep conceptual understanding. To foster an education system that promotes effective cognitive engagement, it is important to understand how different learning environments shape students’ cognitive strategies, particularly their use of surface approaches (e.g., rote learning) and deep approaches (e.g., seeking meaning and connections of the subject matter) (Entwistle & Ramsden, 1983).

This issue is particularly important in Nepal, where the National Assessment of Student Achievement (NASA) 2020 report shows lower student proficiency in mathematics than in other subjects, especially among female students (Khanal et al., 2022). Nepal's education system is dominated by high-stakes examinations, which carry substantial consequences for students' academic advancement. This system creates a washback effect (Alderson & Wall, 1993), where exams dictate teaching and learning practices. It has encouraged a "teach-to-the-test" culture (Phelps, 2011) in Nepalese mathematics classrooms that rewards rote memorization and limits students' deep mathematical understanding (Panthi & Belbase, 2017).

This study examines the cognitive engagement of two consecutive cohorts of Grade 11 students in an academically selective school in Nepal. Having been conditioned by an examination culture that rewards procedural fluency, these students provide a critical case for examining how such an environment shapes their cognitive learning strategies. This study is guided by two research questions:

1. What is the nature of cognitive engagement strategies in mathematics classrooms among students at an academically selective school?
2. Are there statistically significant differences between male and female students in their reported cognitive engagement strategies?

By addressing these questions, the paper provides empirical insight into how high-achieving students adapt their cognitive learning strategies in an exam-focused education system and whether gender shapes these adaptations.

Literature Review

Cognitive Engagement

Student engagement refers to "the students' psychological investment in and effort directed toward learning, understanding, or mastering the knowledge, skills, or crafts that academic work is intended to promote" (Newmann, 1992, p. 12). Engagement is a multifaceted construct with interrelated behavioral, emotional, and cognitive dimensions (Fredricks et al., 2004). These dimensions interact with learners' characteristics and the learning environment to shape their strategies and outcomes (Helme & Clarke, 2001).

Behavioral engagement involves students' effort and participation in academic, social, and extracurricular activities (Cevikbas & Kaiser, 2021). Emotional engagement refers to students' positive and negative reactions to learning, peers, teachers, and the school environment (Cevikbas & Kaiser, 2021). The focus of this study, cognitive engagement, involves students' willingness to invest mental effort to understand complex ideas and master difficult skills (Fredricks et al., 2004). Cognitive engagement is characterized by thoughtful learning strategies, self-regulation, and a preference for challenge (Skilling et al., 2016).

In mathematics classrooms, cognitive engagement is closely linked to students' approaches to learning (Entwistle & Ramsden, 1983; Kong et al., 2003). Deep approaches to learning (e.g., linking new information with prior knowledge, understanding principles, connecting concepts to real life, and self-questioning) are associated with higher levels of cognitive engagement and better learning outcomes. These strategies are driven by intrinsic motivation and a focus on meaning-making. Surface approaches (e.g., memorizing facts, formulas, and procedures) are characterized by an intention to reproduce information. Surface strategies are driven by extrinsic goals, such as passing an examination or avoiding failure. Reliance on teachers' instructions is another strategy identified by Kong and colleagues (2003), in which students closely follow directions to achieve desirable outcomes.

Deep strategies tend to develop robust, applicable knowledge, whereas surface strategies often yield fragmented knowledge that is not easily transferred to new contexts. However, a simple "surface is bad, deep is good" dichotomy is unproductive. The two approaches are not opposites but two phases of a learning continuum (Hattie et al., 2016). In mathematics, students typically acquire surface-level knowledge (vocabulary, formulae, procedures) before making connections and developing deep conceptual understanding. The critical failure in many systems is not surface learning itself, but the lack of curriculum, instruction, and assessment that explicitly support a transition from surface to deep learning.

Student engagement is a multidimensional construct rooted in internal psychological processes. This complexity makes precise measurement of engagement difficult (Cevikbas & Kaiser, 2021). Cognitive engagement, in particular, involves intrinsic motivation, self-regulation, and higher-order thinking, which makes both quantitative measurement and observation challenging. Despite these challenges, engagement has been studied using self-report questionnaires, checklists, observations, interviews, and case studies (Chapman, 2003). The Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1993) is a widely used instrument that assesses students' learning motivation and cognitive engagement in classroom tasks. Similarly, Kong et al. (2003) developed a survey to measure affective, behavioral, and cognitive engagement in mathematics in Chinese regions. Because specialized cognitive engagement scales are limited, researchers often draw on subscales from existing instruments, such as self-regulatory learning scales from the MSLQ (Rotgans & Schmidt, 2011).

The engagement measurement instrument developed by Kong and colleagues (2003) was customized for the Chinese context, where the curriculum is often examination-driven and "undue emphasis is put on lecturing, memorisation, and preparation for in-school and public examinations" (Kong et al., 2003, p. 4). The Nepalese educational context, particularly in mathematics, exhibits similar features. Nepalese mathematics classrooms are typically teacher-centered, emphasize rote memorization, and rely on assessments with limited real-life connection (Panthi & Belbase, 2017). These parallels make Kong et al.'s instrument a suitable tool for investigating student engagement in mathematics in Nepal.

This instrument conceptualizes cognitive engagement as comprising three dimensions: surface strategy, deep strategy, and reliance. Findings from Kong et al. (2003) indicate that surface strategies and reliance predict success on routine problems, whereas deep strategies are needed for success on non-routine, open-ended problems requiring flexible thinking (Kong et al., 2003). This distinction offers a useful lens for analyzing how students align their strategies with the perceived demands of curriculum and assessment.

Paudel et al. (2023) investigated the cognitive development of fifth-grade students across six schools in Nepal, focusing on how educational provisions and classroom practices facilitate learning. The findings revealed that students generally performed well in "remembering", i.e., memorization, but struggled significantly with "creating", indicating a weakness in higher-order thinking skills. Classroom observations highlighted a predominance of lecture-based teaching focused on rote memorization from textbooks, with limited engagement in activities that promote critical thinking or creative problem-solving. Joshi et al. (2022) investigated behavioral, cognitive, emotional, and social engagement in secondary-level mathematics teachers during the COVID-19 shift to online learning in Nepal. The authors reported high cognitive, emotional, and social engagement, but only moderate behavioral engagement. Cognitive engagement was found to have the most significant impact on other forms of engagement, suggesting its central role in effective learning.

Influence of the Education System on Student Learning

Students' learning approaches are strongly shaped by assessment, particularly in high-stakes contexts. High-stakes refers to standardized assessments that carry substantial repercussions for students, including decisions about academic or career advancement, as well as implications for educators and educational institutions (Amrein & Berliner, 2002). Such tests influence what is taught and how it is learned, a dynamic known as washback (Alderson & Wall, 1993). The washback phenomenon might negatively affect students if the test format rewards narrow, superficial knowledge. It can narrow the curriculum to tested material, marginalizing skills such as open-ended problem-solving, creativity, and critical thinking. It can also shift pedagogy toward teacher-centered, drill-and-practice methods aimed at maximizing test scores.

Pedagogy in Nepalese mathematics classrooms reflects the washback effect, relying on traditional chalk-and-talk methods. These teacher-centered practices limit student interaction, negatively affecting student agency and engagement (Nakawa, 2013; Panthi & Belbase, 2017). This instructional environment consequently signals to students that surface-level strategies, such as rote memorization and procedural imitation, are the most effective and rational ways to succeed. Scouller (1998) shows that students' perceptions of assessment formats (e.g., multiple-choice versus essay) are a key determinant of whether they adopt surface or deep learning approaches. In a system like Nepal's, which primarily assesses procedural fluency, students learn that academic success depends on these skills. Consequently, high-achieving students receive sustained reinforcement for developing sophisticated, efficient surface-learning habits. While these habits support success in the current system, they may leave these masters of exam-taking underdeveloped in the creative and analytical skills needed for deep understanding in higher education and the modern workforce.

Gender Differences in Mathematics Classrooms of Nepal

In Nepal, significant gender differences are reported in mathematical engagement, achievement, and interest (Panthi & Belbase, 2017). The NASA 2020 report (Khanal et al., 2022) shows that, on average, female students perform worse in mathematics than male students. Studies also indicate that female students in Nepal report higher mathematics anxiety and lower self-confidence than males. For example, Paudel (2025) found a significant gender difference in mathematics anxiety across multiple ethnic groups, with females reporting higher anxiety. This aligns with broader findings that sociocultural factors, gendered stereotypes, and familial pressures undermine girls' confidence in mathematics (Mathema & Bist, 2006; Paudel et al., 2025).

While existing research offers valuable insights into Nepalese classrooms (Nakawa, 2013; Paudel et al., 2023; Panthi & Belbase, 2017), studies focused specifically on students' cognition for learning are scarce. In particular, there are no studies on the cognitive engagement strategies of academically successful students within Nepal's high-stakes, examination-driven system. It remains unclear whether these high-achievers succeed mainly by mastering rewarded surface-level strategies or by cultivating a more complex blend of deep and surface approaches. Furthermore, although gender differences in mathematics achievement (Khanal et al., 2022) and affect, such as anxiety (Paudel, 2025), are well established, little is known about whether they correspond to distinct cognitive engagement strategies. This study addresses these gaps by analyzing the cognitive engagement strategies of high-achieving students in an academically selective school and examining whether these strategies differ by gender.

Methods

Context and Participants

This study comprises a quantitative repeated cross-sectional case study at an academically selective, co-educational school located in a major urban city of Nepal. Students at this school are admitted at different levels through rigorous entrance examinations. The participants of this study were drawn from two cohorts of Grade 11 students in this school studying the +2 science curriculum (which includes Grades 11 and 12). Students in this program are admitted after passing a competitive entrance examination, which is required of everyone, regardless of whether they were formerly enrolled at the same school.

Table 1

Highest Level of Education Attained by Participating Students' Parents

Education Level	Father		Mother	
	Count	Percentage	Count	Percentage
Master's Degree or Ph.D.	84	30.77%	40	14.65%
Bachelor's Degree	50	18.32%	63	23.08%
10+2 / PCL	64	23.44%	74	27.11%
SLC / SEE	26	9.52%	42	15.38%
Don't Know / Other	49	17.95%	54	19.78%
Total	273	100%	273	100%

A cross-sectional survey of the Grade 11 class was first conducted in 2022 and then repeated with a new, independent cohort in 2023. A total of 273 students volunteered to participate in the study (129 from 2022 and 144 from 2023). The sample consisted of 157 male (57.71%) and 116 female (42.49%) students. As illustrated in Table 1, a significant proportion of students came from families with high educational capital. Nearly half (49.08%) of fathers and 37.73% of mothers have higher education degrees (Bachelor's, Master's, or PhD). This profile suggests a student body originating from households with high academic expectations. The academic caliber of the participants is further evidenced by their Grade 11 mathematics scores. Nearly three-quarters (74.91%) of the student body achieved a B or higher grade: 27.39% earned an A or A+, and 47.52% secured a B or B+. This level of performance confirms the high-achieving nature of the sample.

Data Collection

Data were collected via self-administered paper questionnaires during regular class time. Students received an explanation of the study purpose and confirmed voluntary participation. The first section of the questionnaire collected demographic information, including the students' gender and their parents' educational background. The second section measured cognitive engagement in mathematics using 15 items adapted from Kong et al.'s (2003) instrument. The instrument assessed three dimensions:

- **Surface Strategy:** This dimension measured a learning approach focused on rote memorization. It includes strategies like memorizing formulas and problem-solving methods rather than understanding the principles behind them.
- **Deep Strategy:** This dimension assessed a student's effort to find meaning and make connections. It involves thinking about the real-life applications of mathematics, connecting new concepts to prior knowledge, and posing questions to deepen understanding.
- **Reliance:** This dimension measured the tendency to depend on the teacher for learning. It is characterized by closely following the teacher's instructions and solving problems exactly as taught, without independent deviation.

Table 2

Cognitive Engagement Items (adapted from Kong et al., 2003)

Engagement Categories	Survey Item
Surface Strategy	S_1: Memorizing formulas is the best way to learn.
	S_2: I prefer memorizing formulas over understanding principles.
	S_3: Memorizing is more effective than understanding.
	S_4: Best way is to memorize facts by repeated work.
	S_5: Useful to memorize methods for solving word problems.
Deep Strategy	D_1: I wonder how math can be applied to real life.
	D_2: I try to pick out things to be thoroughly understood.
	D_3: I try to connect new learning to what I already know.
	D_4: I pose questions to myself to understand the core of math.
	D_5: I use spare time to study topics discussed in class.
Reliance	R_1: Best way to learn is to follow teacher's instructions.
	R_2: I would learn what the teacher teaches.
	R_3: I would learn in the way the teacher instructs me.
	R_4: I would solve problems the same way the teacher does.
	R_5: No matter what the teacher says, I will follow accordingly.

For each of the 15 items, as shown in Table 2, students indicated their level of agreement on a 5-point Likert-type scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

Data Analysis

All quantitative data from the questionnaires were analyzed using Python (version 3.12). The *pandas* library was employed for data organization, cleaning, and manipulation, while the *scipy.stats* module was used to conduct all inferential statistical tests.

First, descriptive statistics, specifically the mean (M) and standard deviation (SD), were calculated for each of the 15 questionnaire items. Second, two types of inferential statistical tests were conducted. One-sample t-tests ($\mu = 3.0$; $\alpha = 0.05$) were employed to test deviation from neutral responses. This analysis is critical for making statistically supported claims about whether the student population genuinely tends to agree or disagree with a specific statement regarding their learning strategies. Welch's t-test was used to investigate potential differences in survey responses based on gender. This version of the independent-samples t-test was specifically chosen because it does not assume equal variances between the two groups (male and female), making it a more reliable test for comparing the means. The test compared the mean scores of male (M_m) and female (M_f) students on each of the 15 items to determine whether any observed differences in their reported cognitive engagement strategies were statistically significant.

Findings and Discussion

Surface Strategy

Students clearly rejected rote learning as preferable to understanding, as presented in Table 3 (S_1: $M = 2.32, t = -8.45$; S_2: $M = 2.76, t = -2.95$; S_3: $M = 2.24, t = -10.23$). However, they agreed that memorizing through repeated practice is an effective method (S_4: $M = 3.81, t = 10.26$) and that memorizing specific methods for solving math word problems is useful (S_5: $M = 3.34, t = 4.89$). This reveals strategic pragmatism (Entwistle & Ramsden, 1983), in which students distinguish between ideological beliefs and the practical use of memorization as a tool for achieving academic performance.

Table 3

One-sample t-test Results for Surface Strategy

Survey Item	M	SD	t	p	Significance ($p < 0.05$)
S_1: Memorizing formulas is the best way to learn.	2.32	1.33	-8.45	0.0000	TRUE
S_2: I prefer memorizing formulas over understanding principles.	2.76	1.35	-2.95	0.0034	TRUE
S_3: Memorizing is more effective than understanding.	2.24	1.23	-10.23	0.0000	TRUE
S_4: Best way is to memorize facts by repeated work.	3.81	1.30	10.26	0.0000	TRUE
S_5: Useful to memorize methods for solving word problems.	3.34	1.16	4.89	0.0000	TRUE

This strategic approach is a rational adaptation to the Nepalese education system, which endorses a powerful negative washback phenomenon (Alderson & Wall, 1993). From the public high-stakes Secondary Education Examination (SEE) and Grade 12 final examinations administered by the National Examination Board (NEB) to competitive entrance examinations for admission to good schools, the system continuously teaches and rewards rote-learning-based reproduction of knowledge. In such a context, students learn that mastering past exam papers and textbook exercises is the most efficient path to success. High-achieving students thus use surface strategies as highly effective tools for maximizing grades within system constraints. They use memorization not as a replacement for understanding, but as a pragmatic tactic to secure academic success.

Table 4

Welch's t-test Results for Surface Strategy

Survey Item	M_m	M_f	Mean Difference (d)	t	p	Significance ($p <= 0.05$)
S_1	2.25	2.41	-0.15	-0.91	0.365	FALSE
S_2	2.64	2.91	-0.27	-1.63	0.1045	FALSE
S_3	2.15	2.35	-0.20	-1.32	0.1865	FALSE
S_4	3.84	3.77	0.07	0.45	0.6538	FALSE
S_5	3.29	3.41	-0.11	-0.74	0.4622	FALSE

As demonstrated in Table 4, Gender differences were not significant across all items, indicating that students, regardless of gender, shared strategic adaptations in cognitive learning habits.

Deep Strategy

Students actively use several deep strategies, but are sharply divided in their agency to connect new learning to prior knowledge, with minimal gender differences, except for study time. As demonstrated in Table 5, students reported consistent use of multiple deep-processing strategies.

Table 5

One-sample t-test Results for Deep Strategy

Survey Item	M	SD	t	p	Significance ($p < 0.05$)
D_1: I wonder how math can be applied to real life.	3.82	1.07	12.63	0.0000	TRUE
D_2: I try to pick out things to be thoroughly understood.	3.18	1.23	2.45	0.0149	TRUE
D_3: I try to connect new learning to what I already know.	2.97	1.49	-0.28	0.7762	FALSE
D_4: I pose questions to myself to understand the core of math.	3.83	0.91	15.11	0.0000	TRUE
D_5: I use spare time to study topics discussed in class.	3.44	0.93	7.78	0.0000	TRUE

Students agreed that they question themselves to understand the core of the material (D_4:$M = 3.83, t = 15.11$) and wonder how math concepts can be applied to real life (D_1:$M = 3.82, t = 12.63$). They also indicated that they use spare time to review topics discussed in class (D_5: $M = 3.44, t = 7.78$) and, to a lesser extent, that they deliberately identify material to understand thoroughly (D_2: $M = 3.18, t = 2.45$). Together, these patterns portray students as cognitively active learners who seek meaning, relevance, and mastery beyond minimal task completion.

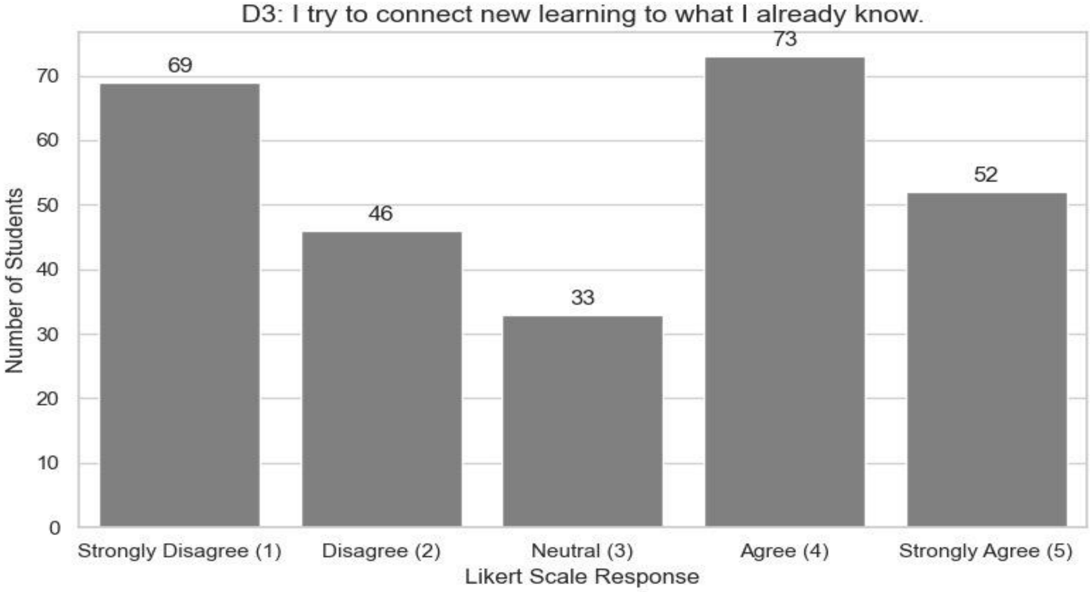
A notable exception was observed for the item D_3, where the mean does not differ from neutrality ($M = 2.97, t = -0.28, p = 0.7762$). However, a deeper analysis of the responses to this item reveals that this neutrality is a statistical artifact of a deeply polarized student body. The mean score hides a sharp division of opinion, as illustrated in Figure 1. The data shows:

- A large "Agreeing Camp": 125 students (46%) reported that they do try to connect new learning to prior knowledge.
- An almost equal "Disagreeing Camp": 115 students (42%) reported that they do not.
- A very small "Neutral Camp": Only 33 students (12%) were actually neutral.

The real story for D3 is not that students are ambivalent; rather, there is no consensus. The student body is fractured into two distinct subgroups regarding this foundational deep-learning strategy. In an exam-focused, procedural curriculum, where lessons and tests rarely require explicit prior-knowledge activation (Nakawa, 2013; Panthi & Belbase, 2017), such a split is consistent with an environment that does little to scaffold systematic conceptual linking.

Figure 1

Distribution of Student Responses for Item D_3



The Welch's t-test results (see Table 6) indicate that for most deep strategies, there are no statistically significant differences between the male and female groups. Mean scores for applying math to real life (D_1), identifying key ideas (D_2), connecting to prior knowledge (D_3), and self-questioning (D_4) did not differ significantly by gender (all $p > 0.05$). This indicates that male and female students engage in conceptually oriented strategies in comparable ways. The only significant difference was observed for D_5, where female students reported higher levels of spare-time study ($M_f = 3.59, M_m = 3.32, t = -2.28, p = 0.0236$). This finding resonates with a large body of literature suggesting that the primary gender disparities in mathematics are not cognitive but affective (Goetz et al., 2013; Meece et al., 2006). Research in Nepal confirms that female students report higher math anxiety and lower self-confidence (Paudel, 2025). It is plausible that to compensate for this lower confidence or higher anxiety, female students are more likely than their male peers to feel the need to invest time and effort to achieve academic success.

Table 6

Welch's t-test Results for Deep Strategy

Survey Item	M_m	M_f	d	t	p	Significance ($p <= 0.05$)
D_1	3.87	3.75	0.12	0.91	0.3649	Not Significant ($p >= 0.05$)
D_2	3.25	3.09	0.15	1.02	0.3102	Not Significant ($p >= 0.05$)
D_3	2.92	3.05	-0.13	-0.74	0.463	Not Significant ($p >= 0.05$)
D_4	3.79	3.88	-0.09	-0.8	0.4243	Not Significant ($p >= 0.05$)
D_5	3.32	3.59	-0.26	-2.28	0.0236	Significant ($p < 0.05$)

Taken together, the deep-strategy findings show that students have not abandoned the pursuit of meaning, despite strong systemic pressures toward surface performance. Their self-questioning, search for real-life relevance, and additional study time signal an enduring drive for conceptual understanding within a tightly constrained, examination-driven pedagogy. At the same time, the polarized use of prior-knowledge connections underscores a systemic weakness: classroom practices and assessments rarely demand or model explicit integration of new and existing knowledge, leaving this critical aspect of deep learning to individual disposition rather than institutional design.

Reliance

Students show strong reliance on teachers for what and how to learn, but stop short of unconditional obedience, with no meaningful gender differences.

Table 7

One-sample t-test Results for Reliance

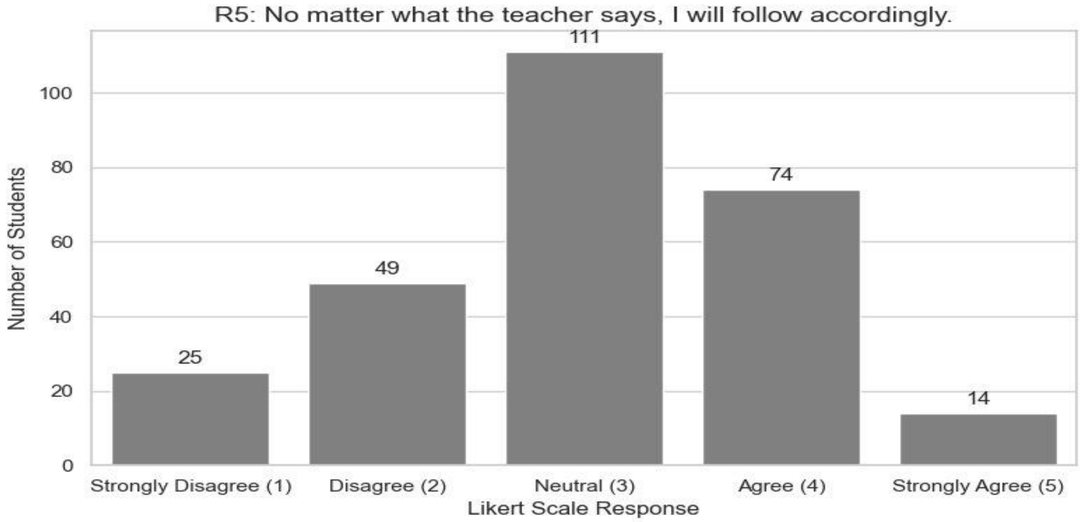
Survey Item	M	SD	t	p	Significance ($p < 0.05$)
R_1: Best way to learn is to follow teacher's instructions.	3.76	1.03	12.22	0.0000	TRUE
R_2: I would learn what the teacher teaches.	3.70	0.79	14.64	0.0000	TRUE
R_3: I would learn in the way the teacher instructs me.	3.53	1.01	8.65	0.0000	TRUE
R_4: I would solve problems in the same way as the teacher does.	3.19	1.02	3.08	0.0023	TRUE
R_5: No matter what the teacher says, I will follow accordingly.	3.01	1.01	0.18	0.8578	FALSE

As shown in Table 7, students strongly agreed that the best way to learn is to follow their teacher's instructions (R_1: $M = 3.76, t = 12.22$) and that they would learn what the teacher teaches (R_2: $M = 3.70, t = 14.64$). Furthermore, they agreed that they would learn in the way the teacher instructs them (R_3: $M = 3.53, t = 8.65$). Together, these findings highlight a strong deference to the teacher's authority regarding both the curriculum (what to learn) and the pedagogy (how to learn). Students likewise tended to model the teacher's problem-solving procedures (R_4: $M = 3.19, t = 3.08$), suggesting that replicating teacher demonstrations is a common strategy in mathematics learning.

However, this reliance does not extend to blind obedience. For R_5, the mean response was found to be essentially neutral (M = 3.01, t = 0.18, p = 0.8578). Furthermore, the response distribution (see Figure 2) confirms a genuine concentration at the neutral category rather than a hidden polarization. This pattern implies that many students are undecided about committing to unconditional obedience, drawing a boundary between strategic reliance and uncritical acceptance. In other words, they position teachers as central academic authorities but retain a degree of personal judgment.

Figure 2

Distribution of Student Responses for Item R5



The Welch's t-test results (see Table 8) indicate that there are no statistically significant differences between male and female students in the reliance dimension. Thus, gender does not appear to be a significant factor influencing the degree to which students rely on their teachers for learning.

Table 8

Welch's t-test Results for Reliance

Survey Item	M_m	M_f	d	t	p	Significance ($p <= 0.05$)
R_1	3.70	3.84	-0.14	-1.11	0.2699	Not Significant (*p* >= 0.05)
R_2	3.68	3.72	-0.03	-0.36	0.7197	Not Significant (*p* >= 0.05)
R_3	3.44	3.66	-0.22	-1.75	0.0808	Not Significant (*p* >= 0.05)
R_4	3.20	3.18	0.02	0.13	0.8944	Not Significant (*p* >= 0.05)
R_5	2.99	3.04	-0.06	-0.45	0.652	Not Significant (*p* >= 0.05)

Conclusion

This study reveals that high-achieving Nepalese students are pragmatic, strategic learners who navigate an examination-driven system through targeted surface strategies while maintaining active, deep engagement. They reject rote memorization as superior but endorse repetition and procedural memorization for exam success, engage in self-questioning and real-life connections, and show strong deference to teachers without blind obedience. Gender differences are minimal, except for females' greater commitment to spare-time study. These patterns represent rational adaptations to negative washback from high-stakes assessments that reward procedural fluency over conceptual flexibility.

The findings of this study present several critical implications for educational policy and practice in Nepal and in similar high-stakes contexts. While the mathematics secondary education curriculum 2078 (Curriculum Development Centre, 2021) has endorsed moving from "teacher-centered" to "active learning" methods and has included measures such as classroom participation and practical work in NEB scores, the shift has not yet been translated into widespread classroom practice. It is imperative to operationalize a systematic assessment reform. This requires careful redesigning and administration of examinations that include tasks requiring non-routine problem-solving and critical thinking. Moreover, this assessment reform must be supported by a corresponding shift in pedagogy. The key is to cultivate greater student autonomy, which is a powerful catalyst for deep cognitive engagement (Rotgans & Schmidt, 2011). The education system should create low-stakes opportunities for students to independently connect new knowledge with prior learning and explore real-world applications, signaling that these skills are valued. However, this pedagogical shift cannot be shouldered by teachers alone. The gap between policy and practice in Nepal highlights a critical need for sustained, high-quality professional development. Teachers require practical training and resources to effectively implement active learning strategies and foster student autonomy in line with a reformed assessment vision (Singh Pali, 2018).

This study has several limitations that offer avenues for future research. First, the study was conducted at a single academically selective school, which limits the generalizability of the findings to the broader student population in Nepal. Future research should include a broader range of schools to examine how cognitive strategies vary across academic contexts. Second, this study relied exclusively on a self-report questionnaire, in which students may have provided answers that aligned with social expectations rather than their true experiences, raising validity concerns (Hodgson et al., 2017). To create a more robust and valid picture of student engagement, future studies should employ a combination of self-reported and non-self-reported data (Cevikbas & Kaiser, 2021). Combining quantitative surveys with qualitative methods such as classroom observations, think-aloud protocols during problem-solving, and interviews would provide a richer understanding of how students truly engage with mathematics.

References

Alderson, J. C., & Wall, D. (1993). Does Washback Exist? *Applied Linguistics, 14*(2), 115–129. https://doi.org/10.1093/applin/14.2.115

Amrein, A. L., & Berliner, D. C. (2002). High-stakes testing & student learning. Education Policy Analysis Archives, 10, 18. https://doi.org/10.14507/epaa.v10n18.2002

Cevikbas, M., & Kaiser, G. (2021). Student Engagement in a Flipped Secondary Mathematics Classroom. I*nternational Journal of Science and Mathematics Education*, 20(7), Article 7. https://doi.org/10.1007/s10763-021-10213-x

Chapman, E. (2003). Alternative approaches to assessing student engagement rates. *Practical Assessment, Research & Evaluation*, 8(13), 1–10.

Curriculum Development Centre. (2021). *Secondary education curriculum 2078 mathematics*. Ministry of Education, Science and Technology.

Entwistle, N., & Ramsden, P. (1983). *Understanding student learning*. London: Croom Helm. https://doi.org/10.4324/9781315718637

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School Engagement: Potential of the Concept, State of the Evidence. *Review of Educational Research, 74*(1), 59–109. https://doi.org/10.3102/00346543074001059

Goetz, T., Bieg, M., Lüdtke, O., Pekrun, R., & Hall, N. C. (2013). Do Girls Really Experience More Anxiety in Mathematics? *Psychological Science*, 24(10), 2079-2087. https://doi.org/10.1177/0956797613486989

Hattie, J., Fisher, D., Frey, N., Gojak, L. M., Moore, S. D., & Mellman, W. (2016). *Visible learning for mathematics, grades K-12: What works best to optimize student learning.* Corwin Press.

Helme, S., & Clarke, D. (2001). Identifying cognitive engagement in the mathematics classroom. *Mathematics Education Research Journal*, *13*(2), 133–153. https://doi.org/10.1007/BF03217103

Hodgson, T. R., Cunningham, A., McGee, D., Kinne, L. J., & Murphy, T. J. (2017). Assessing behavioral engagement in flipped and non-flipped mathematics classrooms: teacher abilities and other potential factors. *International Journal of Education in Mathematics, Science and Technology*, 5(4), 248-261.

Joshi, D. R., Adhikari, K. P., Khanal, B., Khadka, J., & Belbase, S. (2022). Behavioral, cognitive, emotional and social engagement in mathematics learning during COVID-19 pandemic. *PLoS ONE*, 17(11): e0278052. https://doi.org/10.1371/journal.pone.0278052

Khanal, B., Bishwakarma, A., Acharya, S. P., Acharya, D., & Bhatta, L. D. (2022). *National Assessment of Student Achievement 2020*. Education Review Office.

Kong, Q.P., Wong, N.Y., & Lam, C.C. (2003). Student engagement in mathematics: Development of instrument and validation of construct. *Mathematics Education Research Journal*, 15(1), Article 1. https://doi.org/10.1007/BF03217366

Mathema, K. B., & Bista, M. B. (2006). *Study on student performance in SLC: Main report*. Ministry of Education and Sports, Government of Nepal.

Meece, J. L., Glienke, B. B., & Burg, S. (2006). Gender and motivation. *Journal of School Psychology*, 44(5), 351–373. https://doi.org/10.1016/j.jsp.2006.04.004

Nakawa, N. (2013). Current situations in pre-primary and primary mathematics education in Kathmandu, Nepal. *Tokyo Future University Research Bulletin*, 6, 31-39. https://doi.org/10.24603/tfu.6.0_131

Nepal, B. (2016). Impact of Gender and Location on Mathematical Thinking and Mathematics Achievement. *Journal of Advanced Academic Research*, 3(3), 11–21. https://doi.org/10.3126/jaar.v3i3.16803

Newmann, F. M., Wehlage, G. G., & Lamburn, S. D. (1992). The significance and sources of student engagement. In F. M. Newmann (Ed.), *Student engagement and achievement in American secondary schools* (pp. 11–39). Teachers College Press.

Panthi, R. K., & Belbase, S. (2017). Teaching and Learning Issues in Mathematics in the Context of Nepal. *European Journal of Educational and Social Sciences*, *2*(1), 1-27.

Pintrich, P. R., Smith, D. A. F., Garcia, T., & Mckeachie, W. J. (1993). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ). *Educational and Psychological Measurement*, *53*(3), 801–813. https://doi.org/10.1177/0013164493053003024

Paudel, K. C. (2025). Gender Difference in Mathematics Anxiety across Different Ethnic Communities in Nepal. *Education and Developmen*t, 34(1), 45–52. https://doi.org/10.3126/ed.v34i1.80277

Paudel, M., Acharya, K. P., & Acharya, M. (2023). Students Cognitive Development in Basic Level Schools in Nepal: Provisions and Practices. *Journal of Advanced College of Engineering and Management*, 8(2), Article 2. https://doi.org/10.3126/jacem.v8i2.55950

Paudel, T., Dahal, N., & Hasan, M. K. (2025). Female undergraduates' perception of mathematics: A mixed-methods study. *Frontiers.* https://doi.org/10.3389/feduc.2025.1555519

Phelps, R. P. (2011). Teach to the Test?. *The Wilson Quarterly*, 35(4), 38-42.

Rotgans, J. I., & Schmidt, H. G. (2011). Cognitive engagement in the problem-based learning classroom. *Advances in Health Sciences Education*, *16*(4), Article 4. https://doi.org/10.1007/s10459-011-9272-9

Scouller, K. (1998). The influence of assessment method on students' learning approaches: Multiple choice question examination versus assignment essay. *Higher Education*, *35*(4), 453–472. https://doi.org/10.1023/A:1003196224280

Singh Pali, B. (2018). *Teachers' perceptions and practices of active learning in mathematics classroom* (Doctoral dissertation, Department of Mathematics Education, Tribhuvan University). https://elibrary.tucl.edu.np/items/b470c2ec-5f3d-424c-83cf-47fc00753d48

Skilling, K., Bobis, J., Martin, A. J., Anderson, J., & Way, J. (2016). What secondary teachers think and do about student engagement in mathematics. *Mathematics Education Research Journal*, 28(4), 545-566. https://doi.org/10.1007/s13394-016-0179-x