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Unlocking Mathematical Thinking: Effective Learning Strategies for Primary Students in Nepal

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Abstract

This study investigates the learning strategies employed by students in mathematics at the basic level in Birendranagar, Surkhet. Grounded in Vygotsky's sociocultural theory and critical pedagogy, the research adopts a descriptive statistic with quantitative data. A total of sixty students were randomly selected from three public and three private schools. Data were collected using a five-point Likert scale questionnaire and semi-structured interviews to identify cognitive, metacognitive, and social/affective strategies. Findings revealed that students predominantly relied on cognitive strategies such as memorization and repetition, while their use of metacognitive and social/affective strategies remained limited. Comparative analysis indicated little difference between students of public and private schools, though overall practices suggested a need for more balanced and reflective strategies to enhance learning outcomes. The study concludes that effective strategy use is essential for improving students' mathematical understanding and achievement, and it recommends integrating contextualized, student-centered pedagogical practices to foster deeper and more sustainable learning.

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Introduction

Learning strategies of the students are the combined efforts used by them with the process, comprehend, and apply the information presented during learning (Toy, 2013). Learning strategies are such actions of students to make the sense of information through their thinking and emotional processes (Kafadar, 2013). A conscious thoughts and behaviors employed by the learners to improve their knowledge and understanding (Kalati, 2016). This implies that learning strategy are depends on the learning process and concerning on how to learn and how to use what students have learned to solve problems and be successful.

Strategies and styles of learning are improved from processes of interaction with the teacher, among classmates, as well as with the classroom environment (Frota, 2008). Students absorb and handle information in various ways, such as through seeing, hearing, reflecting, acting, logical thinking, intuition, analysis, and visualization. Therefore, recognizing their learning challenges based on these strategies for providing timely feedback is essential for improving their learning outcomes. Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge (NCTM, 2000). Gestalts emphasized student learning through visualization of shape, size, form, figure, orientation, distance, and configuration of objects in a holistic approach (Belbase, 2010). Cognitive learning theory states the learning process as an internal and active mental process. Bandura (1986) added that learning occurs as a result of interaction between students and their social environment. The students may use several strategies like replicating, researching, note taking, translating, deducting, and recombining their prior ideas. 1Students conceptualize the lessons through imagery, mnemonic thinking, and physical actions (Polya, 1945). Constructivists argue that knowledge cannot be simply passed on from a teacher to learner, but it is constructed individually by the learner. In this context, the study extracted other learning strategies as variables to study upon, such as time and study management, effort management, critical thinking, peer learning, help seeking, and elaboration (Johnson & Johnson 2018). This showed that every student learn mathematics through their individual and social interaction, acquisition of experience and change in behavior.

Students' success in mathematics learning can be viewed from five pedagogical actions as understanding, computing, applying, reasoning, and engaging (Goos et al., 2007). The first pedagogical action related to understanding helps students to comprehend mathematical concepts, their operations, and their relations. The second pedagogical action helps students to carry out routine computational functions with standard operations. The third pedagogical action in mathematics is related to the application of mathematical tools and techniques to solve problems using conceptual and procedural strategies. The fourth pedagogical action is associated with the mathematical reasoning of students that helps them to explain and justify mathematical solutions, proofs, and applications. The last pedagogical action in the mathematics classroom is about engaging students in making sense of mathematics through their involvement in its use not only in textbook problems but extend it to other areas of applications (National Research Council, 2002). This indicated that students learn their mathematical knowledge through the chain of actions.

It is difficult to find out and it is not clear about the bases of selecting particular strategies and preference on them rather than others (Gu, 2005). Learning strategies are classifies into meta-cognitive strategies, cognitive strategies and socio affective strategies as the learning strategies. Meta-cognitive strategies are used to express executive function. The strategies are required for planning, learning, and thinking about the learning process as it is taking place, monitoring of one's production or comprehension and evaluating learning after an activity is completed. Cognitive strategies are more specific to learning tasks and they involve more direct manipulation of the learning materials itself. Repetition, resorting, translation, note taking, contextualization (Dhungana, 2025) and elaboration are the most important cognitive strategies. Similarly, the strategies which are related with social-mediating activity and transacting with others are socio-affective strategies.

In Nepal, the results from the 2013 National Assessment of Student Achievement (NASA) indicated that grade 8 achievement in mathematics declined from 43% to 32% (Acharya et al., 2013).

Recent small-scale pilot assessments such as the Early Grade 1111Mathematics Assessment (EGMA) and Annual Status of Education Report (ASER) similarly found learning outcomes so low as to demand immediate attention. In remote western Nepal, the EGMA report (Ranabhat, 2014) found that less than 5% of children in grades 1-3 demonstrated grade level mastery of both number sense and basic operations tasks. The Annual Status of Education Report (ASER Nepal, 2016) found 30% of students age 5-7 in community schools could not recognize single-digit numbers, and another 21% could recognize single but not double-digit numbers. Nepal's School Sector Development Plan (2016-2023) aims for improvement in math achievement, with target increases of 8 percentage points for grade 5 and 18.5 percentage points for grade 8. A poor grasp of mathematical concepts early on undermines achievements in higher grades when rote learning and use of standard procedures is no longer sufficient. Why learning outcomes for math are so poor in Nepal is not clear, and many factors could influence low learning achievement (UNICEF, 2019). This implies that without understanding the learners' strategies and their problems, improvement in students' early mathematical achievement is difficult. Thus, this research aims to address this difficulty in mathematics.

According to Dhungana et al. (2025), traditional mathematics education in Nepal has been more concerned with making children remember mathematical facts and using algorithms to solve problems without including the involvement of children in developing their mathematical abilities. Mathematical skills in children are important not only for their personal development but for the progress of the entire society as well. Improving math skills thus becomes an immediate and inevitable objective for Nepal as a country. Learning strategies aim to make students more active participants in the learning process, helping them apply their knowledge effectively to achieve success. Students also gain useful insights into how to assess situations, plan their actions, and choose suitable methods to understand, learn, and retain new mathematical concepts (Sahito et al., 2025). This indicated that the students' achievement in mathematics at basic level is so poor, also the ways in which the students' learning achievements may be improved through many strategies, like contextualized learning (Dhungana, 2023) with connecting real-world problems. To fulfill the research objective: to identify the learning strategies that is practiced by students in mathematics at basic level, researcher taken two research questions as, what learning strategies are practiced by students in mathematics at basic level? And, which learning strategies are most frequently used by basic level students while learning mathematics?

In this study, I have employed two theories: Vygotsky's theory of learning and critical pedagogy in learning mathematics. According to Vygotsky (Dhungana et al., 2025), cognitive development is related to the physical, symbolic, cognitive process of children. Cognitive development has shown that children's intellectual development takes place in different ways according to which learning takes place. It is a process of learning to operate with physical, symbolic and cognitive process.

This theory considered MKO (More Knowledgeable Others) and ZPD (Zone of Proximal Development), difference between child's individual and that child's performance when guided by experts in metaphorically described by Vygotsky's ZPD (Dhungana et. al., 2025). In this ZPD a learner, although not capable of solving problems independently, can do so with help of other. The ZPD was described by Vygotsky (1978) if the teachers provide guidance, counseling and support to the children with the same level of mental development; the level of learning achievement of such children is seen to be good. Because of that, mental development of children is not equally dynamic. Children's learning outcomes will be influenced by family environment, school environment, age and gender etc. Solving

mathematical problem collaboration would be easy and helpful to solve math problem. In addition, mathematics is a fun subject that focuses on the mental development of children by developing logical skill. Vygotsky consider that teacher need to provide special assistance to increase the ability of children with low ability in mathematics only then the learning achievement level of low-level children would go up. Also, even if there is good relationship between friends, it would be help to solve mathematical problems together. In this method, teachers and students collaborate in learning and practicing four key skills. Summarizing, questioning, clarifying and predicting. The main aspect of this theory is that the learners build new knowledge using the pre-existing knowledge and mathematics knowledge can be a creation by social interaction (Pandit & Bhattarai, 2011). Another theory which I employ was 'critical pedagogy in mathematical classroom' adopts the pedagogical theories and practices of critical pedagogy, while explicitly using mathematics as an analytical tool for examining and challenging social injustices. Critical pedagogy is not a one size fits for all pedagogy but rather a humanizing pedagogy that values students' background knowledge, culture, and lived experiences. Gutstein's (2006) mathematics pedagogical goals are reading the mathematical word, succeeding academically in the traditional sense, and changing students' orientation to mathematics. Reading the mathematical word means developing mathematical power, defined as deducing mathematical generalizations, constructing creative solution methods to non-routine problems. This implies that Critical theorists (Heberle et al., 2020) contend that an examination of these systems of domination will bring about an awakening of consciousness and awareness of social injustices, motivating self-empowerment and social transformation. Teaching mathematics for social justice has two dialectically related sets of pedagogical goals: one set focuses on social justice and the other set focuses on mathematics.

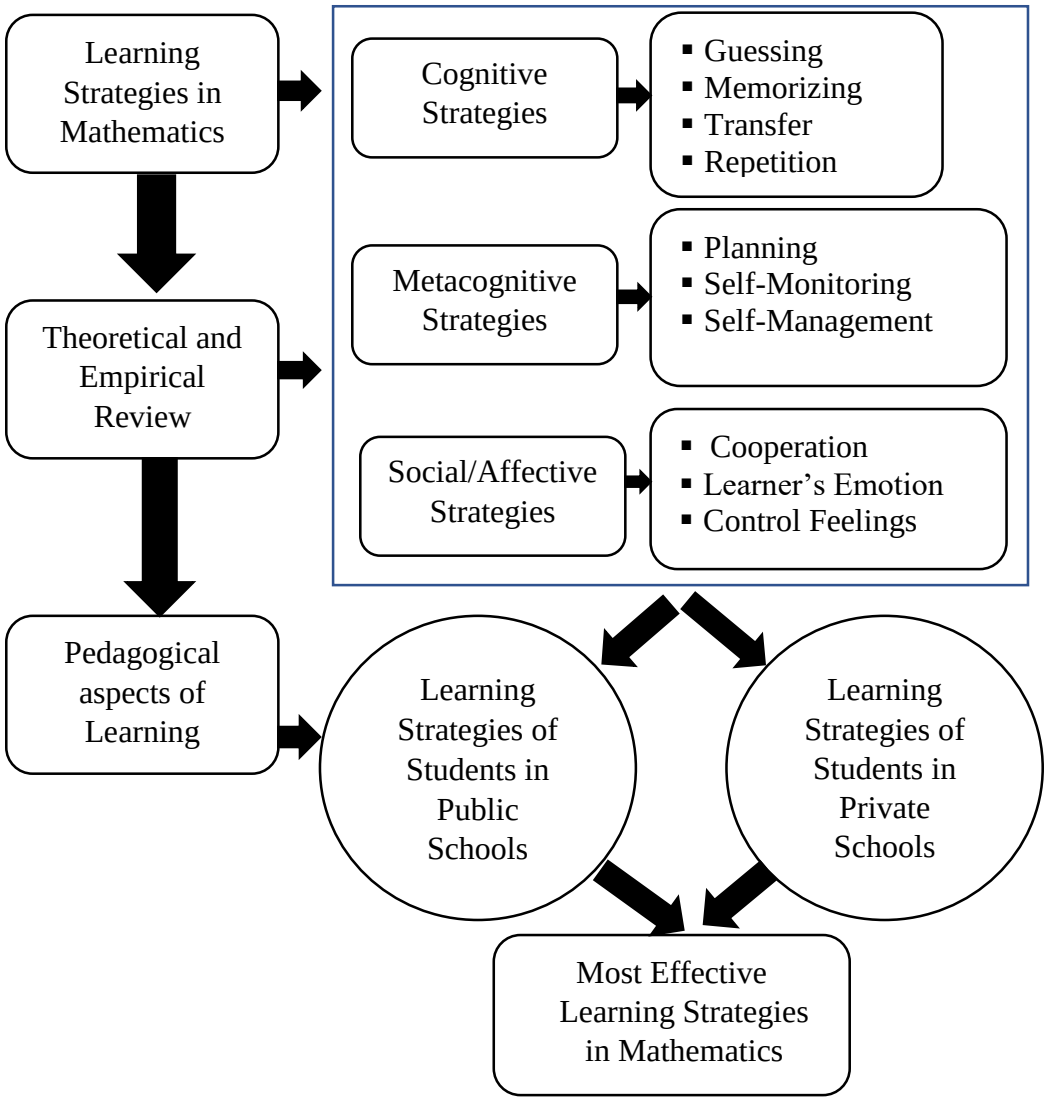
In general, critical pedagogy supports pedagogical theories and practices that encourage both teachers and students to develop an understanding of the interconnecting relationship among ideology, power, and culture, rejecting any claim to universal foundations for truth and culture, as well as any claim to objectivity (Heberle et al., 2020). This pedagogy motivates both critique and agency students through a language of skepticism and possibility and a culture of openness, debate, and engagement (Giroux, 2007). This study is focuses on learning strategies of students in mathematics at basic level. The students make their learning strategies toward their individual and social interconnection. But the critical pedagogy focuses students have their learning strategies through the effect of real world problems.

The teacher's planning should include a strategy that can connect the content with a real life situation. Mathematics educators increasingly agree that connecting school mathematics to experiences, situations and contexts outside of school, including students' own experiences and understandings of the world, is a critical element important to student learning (Ladson Billings, 2009).

Conceptual Framework

A conceptual framework provides a map of the study based on theoretical review. Theory and conceptual framework are interrelated. The conceptual framework is the frame of the study. It determines the guideline for report. The study focused on learning strategies of students in mathematics at basic level. The conceptual framework of this study has presented as the following figure:

Figure: 1 Conceptual Framework of the Study



From the Figure 1, the researcher was collected data and analyzed and interpreted the result of the study three type of learning strategies as cognitive, metacognitive and social/affective strategies. The researcher was compared the learning strategies of students at public and private schools at basic level. The most effective learning strategy was found out through the pedagogical practice and comparison and then conclude the results.

METHODS AND PROCEDURES

The design of the study was focused on descriptive statistics. The researcher was followed quantitative data for assessing the mathematics learning strategy which was adopted by basic level

student. Coghlan & Brydon-Miller (2014) stated that quantitative methodology is the dominant research framework in the social sciences. It refers to a set of strategies, techniques and assumptions used to study psychological, social and economic processes through the exploration of numeric patterns. Thus, the exploration process of this study was on numeric patterns.

The report exposed that there are sixty public and one hundred thirty two institutional schools at that study site (Shaikshik Jhalak, 2080). Among them thirty-five public and seventy-five institutional schools that lunched at least basic level class, were as the population of the study. The researcher was selected three public and three institutional schools and sixty students were chosen randomly from entire population including ten students from each school.

Descriptive statistics advocate the different research tools to collect the data and information as questionnaire, observation, interview, portfolio and case studies. In this study, the researcher adopted questionnaire and interview to collect data. The questionnaire was the main tool of the quantitative study. It consisted of a list of printed statements to be completed by the respondents to express their opinions. The researcher designed the questionnaire using a five-point Likert scale (Phakiti, 2013) with the response categories: Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), and Strongly Disagree (SD). For positive statements, the scores were assigned as SA = 5, A = 4, U = 3, D = 2, and SD = 1. For negative statements, the scoring was reversed, i.e., SA = 1, A = 2, U = 3, D = 4, and SD = 5. The respondents had given a chance to choose the option of their view as they had practiced their learning strategies in mathematics at grade VIII. The statement for the quantitative survey were conveyed to three aspects of learning strategies of mathematics as cognitive, metacognitive and social or affective strategies of students in mathematics at basic level. The questions should be asked based on respondents view The researcher was assessed the questions firstly to identified the learning strategies of students that they were using at existing time, then questions about learning strategies of students at public and private schools and lastly the questions were related to the students best strategy that they accepted in mathematics. A key information interview was conducted to collect primary data. It was used here with in this study as involved asking about topic detailed. It was based on the semi-structured guideline. This method allowed researchers to obtain detailed information that might not be available through other tools. The researcher used closed interview schedule to ask questions for respondents. Validity refers to the extent to which an assessment tool accurately measures the intended outcome of the study. In this research, the questionnaire was developed with the support and guidance of the supervisor to ensure its appropriateness and relevance. The content of the statements was prepared on the basis of the conceptual framework of the study, so that each item reflected the variables and objectives of the research. Furthermore, the researcher ensured the validity of the instrument by considering content validity, criterion-related validity, and construct validity. Content validity was maintained by including items that adequately covered all dimensions of the study variables. Criterion validity was ensured by aligning the questionnaire items with the expected outcomes and established measures. Construct validity was achieved by designing the statements in such a way that they accurately represented the theoretical constructs of the study. Thus, the instrument was able to measure what it was intended to measure.

First of all the research was took the permit of data collection from the respondents and administration. After being taken permission, the researcher was applied plan of collecting data through questionnaire. The researcher went to study site and meet respondents who were selected for study. He

distributed questionnaire to respondents and asked them to fill up. Researcher supported to respondents if confusion. After some time, researcher collected questionnaire after respondents filled up it. The administrative task of the questionnaire distribution and receiving was done carefully through the side of researcher.

This learning strategy questionnaire was designed to the self-reporter instrument that developed to measure students' use of the learning strategies at basic level mathematics course. The learning strategies section of the questionnaire contains 30 items. Cognitive Strategies include 12 items, Meta cognitive strategies contains 9 items and affective strategies also contained 9 items. Students respond to the items using a 5-point Likert-type scale, ranging from 0 Strongly Disagreed, 1 Disagree, 2 Undecided, 3 Agree and 4 Strongly Agree Some negative items are reverse-scored. For these items, any scale score was calculated by taking the mean of the responses to all items in the particular scale.

The researcher asked the questions related to their learning strategies and noted them after respond on the diary. Situational activity, pedagogical activity and mathematical activity were focused on interview process. In this process, the researcher asked questions of cognitive strategies, meta cognitive and social or affecting learning strategies in mathematics course. The information that was relied through the respondents was noted and kept on record.

In this research, it was assured and respected for privacy that the privative information such as beliefs, attitudes, opinions and record. The researcher adopted the ethical considerations to maintain the ethicality of researcher himself, participants, and every one who were involve in this study (Dhungana, 2023). It was informed the respondents about the purpose of the study and about the confidentiality regarding the information of the respondents. It was assured to respondents were not to cause any harm to the informants when collecting data and did not to analyze data subjectively. The researcher made them sure about the honesty, trust, truthfulness, sincerity, attention on accuracy in research study. The information that obtained through the respondents kept safely.

Results and Discussions

The analysis of the data from questionnaire was organized, analyzed and interpreted through use of statistical tools and graphical presentations. In order to answer the research questions, the data from the questionnaires analyzed with the aid of statistical analysis software. Generally, the quantitative data presented using high mean score. Particularly, the students' most use of learning strategies the frequency was calculated by mean and comparative analysis was examined by using total mean score of strategies students used, the most and to determine whether there was difference in the most frequently was used strategies between public and private students. The information noted on diary that obtained through personal interview was frequented converted into quantitative data and calculated through the use of central tendencies and deviation tools.

This chapter deals with the analysis and interpretation of the collected information from the study tools for the study. The existing practice that was practiced by students, comparison of students' use of learning strategies in mathematics and the most effective learning strategies in mathematics at basic level was described.

This is a descriptive research related to the student's learning strategies in mathematics at basic level. In the study, the data was collected from 120 students of three different public schools and three institutional schools with the help of the questionnaire. The collected data were classified, tabulated and

analyzed according to the objectives. The obtained data were analyzed and interpreted using by the tools such as frequency high mean score, percentage and the data from the interview schedule were analyzed by using qualitative techniques and interview by the teachers for the justification. The scale with the highest mean score indicated a students' most frequently used learning strategies. The analysis and interpretation of the results has described in the following sections as given: -

Existing practice of students' learning strategies in mathematics at Basic Level

Cognitive Learning Strategy

Cognitive learning strategy is a kind of the learning strategy by which learners use in order to learn to get more successfully. In the classroom activities which can be described as cognitive strategies include making mind maps, visualization, associaion, mnemonics, using clues in reading comprehension, underlining key words, scanning and self-testing and monitoring. Cognitive strategies component which includes scales for rehearsal, learners can engage in several learning strategies believed to influence the learner's. Encoding process and performance of simple tasks, performance of more complex tasks, and how individuals relate prior knowledge to influence performance.

Four components as guessing, memorizing, transfer and repetition were included in the questionnaire. After calculating the data through use of Microsoft Excel program, the average practice of different components of cognitive learning strategies in mathematics has shown on the table below:

Table: 4

S.N.	*Statements*	*SA*	*A*	*U*	*D*	*SD*	*Mean*
1	Guessing	34	48	10	9	19	2.6
2	Memorizing	52	59	7	1	1	3.3
3	Transfer	17	23	78	2	0	2.5
4	Repetition	46	53	12	7	2	3.1
	Average	37.3	45.8	26.8	4.8	5.5	2.9

From the above table 4.1, the total mean value which has 2.9. It refers that the more favorable case of the cognitive learning strategy. The students gave high preference value to memorizing with mean value (3.3). Like- wise students gave high preference to repetition with mean value 3.1. But, the students give average preference to guessing and transfer with mean value 2.6 and 2.5 respectively and since it could not affect for effective learning.

The researcher further to be convinced, and inquired with students. They responded regarding to the context in following ways:

We can learn or memorize for a long time without having confusing and troubling better in learning mathematics. Definitions, process, formulae and operation are repeated for memorization …based on the interview of the teachers on Feb 14, 2024.

The researchers got the conclusion that memorizing and repetition learning strategies in mathematics gave high preference to generating new ideas from the material to solve problem avoid it. This means, the teacher have provided the environment of deep memorization and self-practice environment while learning mathematics according to the student's activities, interest and ability is necessary in the Birendragar content.

Meta-Cognitive Learning Strategy

Meta-cognitive strategies refers to methods used to help students understand the way they learn. It means processes designed for students to think about their thought. It involves awareness of how they learn, an evaluation of their learning needs, generating strategies to solve problem and then implementing

while mathematical problem. The findings of this study indicate that several factors significantly support student learning, as evidenced by mean values in favor of: pre-course discussions, deep conceptual understanding, adapting study methods, and seeking teacher support. Additionally, the results highlight the importance of solving mathematical problems through diverse approaches, maintaining organized class notes and outlines, and utilizing supplemental materials. Interestingly, maintaining a consistent study location was not considered essential by the participants.

The researcher categories all the 9 questions into three components as planning with routine, self-monitoring and self-management. The response of the students that they practiced as their learning strategies in mathematics has presented on the table below:

Table: 5

S.N.	*Statements*	*SA*	*A*	*U*	*D*	*SD*	*Mean*
1	Planning with Routine	13	32	28	17	30	1.8
2	Self-Monitoring	11	15	62	29	3	2.0
3	Self-Management	7	23	10	58	22	1.5
	Average	10.3	17.5	25.0	26.0	13.8	1.3

The researcher used 9 questions under meta-cognitive strategy. As respond of the student the total mean value has favor. This means, majority of students have poor practice of Meta cognitive learning strategies in mathematics at basic level. The students gave respond with the favor mean value 2.0 for self-monitoring activities. But, the student did not have satisfactory practice in planning with routine and self-management learning strategies with average means value 1.8 and 1.5 respectively. This means, the students had poor practice of meta-cognitive learning practices in mathematics at basic level in Birendranagar.

In the query, what learning strategies as you use in mathematics at the time of understanding, ability and ability to do problems in mathematics, the students relied on:

We can learn easily when the teachers should have create the environment to do work easily, provided time and opportunity for group discussion and develop the own idea by the different source and draw the chart, diagram and table on the board because we can memorize long time through by the figure effective learning mathematics. Self-motivated and self-monitoring with scheduled planning assignment in mathematics deepen our mathematical understanding. So, teachers and school administration should have enable environment as so… Based on the interview of the teachers on Feb 29, 2024.

From the above analysis of the data it is clear that the students preferred to do the work by the support of the teachers because teacher's guide, facilitator, motivator and so for us. It was found that the teachers' have a plane of create the effective environment of practice on meta-cognitive learning strategies in mathematics at basic level in the context of Birendranagar.

Social or Affective Learning Strategies

Each student is basically a social creature who always do the interaction with other students in their learning environment (Apriliyanto et al., 2018).The ability to social interaction optimally is one of the goals of the learning process of the students held in the school. The interaction between the learners

in the learning environment involves the emotional development of imitation and identification in the form of knowledge that is capable of evoking sympathy and motivation in learning. The result of the interaction is the change in the behavior of the students both in terms of academic or attitude. Learning environment has a great influence on students' academic achievement in Mathematics. Environmental factors such as the school environment can be seen from social interaction with friends and teachers. Social interaction is the key of all social life because without social interaction, it is impossible for having life together because social interaction with individuals or other groups contribute to our well-being. Mathematics included various different subjects, topics, activities, which were united by some common features (Apriliyanto et al., 2018).

The researcher categories three components as cooperation, learners' emotion, control feelings. From those components, there were 9 items were asked. The response on students' learning strategies that they used in mathematics has presented on the table below:

Table: 6

S.N.	*Statements*	*SA*	*A*	*U*	*D*	*SD*	*Mean*
1	Cooperation	23	28	2	46	21	1.9
2	Learners Emotion	37	13	17	42	11	2.2
3	Control Feelings	3	24	10	62	21	1.4
	Average	21.0	16.3	7.3	37.5	13.3	1.4

The researcher used three types of the question were asked to get the data of social or affective learning strategies in the questioner of this study with mean value 1.4. Indicated that students were most high preferred to practice based on their emotion with mean 2.2 and least practice of control feeling with 1.4. That means, an average students were not interested on social learning strategies. Poor practice of social learning strategies that students were used in mathematics was found.

For the justification, the researcher asked questions related to practice of social or affective learning strategies in mathematics. The response of students relied on:

We have to build relationship with able and motivated students for help because peer relation sharing the knowledge, discussion, encourage and interaction us to learn. Teachers should give environment of cooperative work, use of technology, project based learning. We can learn in the different and better way… [Based on interview with students on March 03, 2024].

From above the study, the researchers concluded that majority of the students' demands on their group or team network for learning mathematics. The provision of accept new technology and pedagogical practices must effective for students that who were unable to use social learning strategies in mathematics. So the teacher, students and administration should have thought about it.

Conclusions

This study is a descriptive type of research study. The main purpose of the study was to identify the existing practice of students' use of learning strategies in mathematics, their comparative practice in public and institutional schools and to find the most effective learning strategies in mathematics at basic level. It was argued that the independent and successful learning requires effective use of learning strategies. The collected data were quantified of the Likert-5 scale. Responded of the student's was descript analysis from the data. The statically data was The high mean valve score identify the most

frequently used strategies of the learners as well with the data was highest mean score that used to test for gender differences in learning strategy use.

Results from the learning strategies questionnaire indicate that basic-level students effectively utilized strategies to optimize their study hours and select suitable learning environments. These approaches not only facilitated their overall progress but also enabled them to persist in achieving their learning goals, even when faced with significant challenges in mathematics. Students demonstrated a clear preference for seeking assistance from instructors and peers when facing academic challenges. This tendency suggests that observing the diverse problem-solving strategies used by others is a vital part of their learning process. Indeed, seeking help remains an effective strategy, as it allows students to gain new perspectives when they cannot resolve problems independently. Data showed that students from both public and institutional schools utilized similar learning strategies, with both groups showing a high mean preference for applying these strategies to relevant activities. In conclusion, these results suggest that although students have an extensive range of methods used in learning, the use of such techniques is largely determined by the particular context, teaching strategies utilized, and mathematics content involved.

The result of the study enforces to shift the alternative ways of learning strategies in mathematics in this 21st century. So, the results should be beneficial to teachers to shift their teaching activities due to child friendly leaning. The findings should be implications for systematic mechanism support teachers during implementation of mathematics curriculum. The research has indicated that the opportunities and possibilities of expanding pedagogical thoughtfulness in mathematics classroom teaching-learning practices. The result should aware stakeholder to improve follow up of students learning strategies in mathematics.

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