

Teaching Role of Mathematics Teachers in Students' Mathematical Errors

Mukunda Prakash Kshetree, PhD

(Associate Professor)

Department of Mathematics Education, MR Campus
Tribhuvan University, Kathmandu, Nepal

Abstract

The specific objective of this research was to explore mathematics teachers' insight with reference to their own teaching role that how far it was responsible to evolve and develop students' mathematical errors. Thus, the study collected, analyzed and theorized the views and experiences of mathematics teachers in regard to students' mathematical errors which could be formed because of teachers' different teaching styles and processes. There were four main areas of investigation to explore that how teaching/learning (T/L) process lead by the teachers is accountable for seeding mathematical errors in students' learning progression. The study has basically followed a qualitative research design though it has processed some simple factual data. Thus, the perceptual information was supplemented and strengthened by the factual data gathered from the survey task. As a data collection procedure, it adapted interview, focus group discussion (FGD) and survey. For this, the required research tools developed were interview and FGD guidelines along with a set of surveying questionnaire. The qualitative information was coded as per the main themes of investigation of four areas and then they were critically judged, analyzed, and interpreted. At the end, the findings of the study were strengthened by a triangulation process with reference to relevant theories and previous research studies of the same field.

Keywords – Students' mathematical errors, teachers' views, constructivism, misconceptions, teaching experiences

I. INTRODUCTION

If teachers' perceptions and attitudes are compatible with the underlying philosophy, content, methods and materials of a curriculum, there is greater likelihood that the curriculum is fully implemented and successful (Richardson, 1990 cited in Gagatsis & Kyriakides, 2000). The teachers not only know and believe certain things, but apply such knowledge and beliefs in their work. The teachers build up their knowledge and perception towards students' errors through reflecting own student life, teaching experience, professional trainings, and different context faced while working with students. Thus, investigation of mathematics teachers' perceptions and attitudes has become a significant endeavor in teaching/learning (T/L) mathematics.

Those perceptions are closely linked to teachers' strategies for coping with challenges raised by students' errors in their daily classroom T/L practices. Teachers' perceptions shape up students' T/L environment and influence student motivation and achievement as claimed by Hill, Rowan and Bass (2005). Thus, it is understood as latent factor which is reflected on teachers' specific instructional practices. Yet today, as in the past, many students struggle with mathematics and remained under achieved as they continually confront obstacles caused by errors. In order to break this pattern it is imperative that the teachers should create the environment of error-tolerant classroom for their better understanding, discussing and treating them.

The greatest talent of teachers is to identify accurate picture of student's learning interest and ability from his/her error patterns (Li, 2006). Students make errors for many reasons where some errors happen because students have not taken sufficient time or care; others are the result of consistent, alternative interpretations of mathematical ideas that arise from learners' attempts to create meaning. It shows that making errors is a learning process so, teachers should not be afraid of them.

In fact, the mistakes are often the best teachers. This indicates the students' life having experience of dealing with numerous errors that can have positive effects. The theory of critical knowledge is also necessary to identify the boundaries of correct facts and processes. Thus, the students should also be taught about incorrect facts or processes (Oser & Spychiger, 2005, cited in Rach, Ufer & Heinze, 2013). From research studies, it has been found that effective teachers facilitate learning by truly caring and addressing students' errors. The teachers'

knowledge, positive attitude, good behavior and intended practices develop students' comfort level, enlarge their knowledge base, and give them greater confidence in their capacity to learn and make sense of mathematics.

The errors are like T/L tools which the students use to refine and craft their learning strategies. Further, errors show teacher an area where his teaching may not have been effective. It serves to evaluate and provide feedback on the quality of teaching techniques and materials. A good error will reveal the state of the student's problem to the teacher; that is, his/her areas of weakness whether he/she needs a help in specific area. Based on the nature of errors, a classroom teacher can either go ahead or revise his work. But, how do teachers perceive and deal students' errors keep crucial meaning. Teachers' right perceptions and knowledge of error analysis make the learning mathematics meaningful. But, for this, the mathematics teachers should have apparent knowledge towards students' errors. They should know about handling errors with positive attitude, proper communication among teachers and students, no risk for students to make errors, content wise identification of errors, anticipation of errors and learning from them. But problem is that we don't have such a formal system of error analysis and treating them in student-friendly environment. In this ground reality, this study was envisioned to explore teachers' perceptions towards their role reflected in students' mathematical errors.

II. STATEMENT OF THE PROBLEM

It is a common experience of mathematics teachers that most of the students fail to properly develop particular mathematical concepts, knowledge and skills even if they struggle hard in learning mathematics. The main issue is students' learning difficulties because of rampant errors as they are neither taken seriously by teachers nor properly treated even when they are in early stages. In this context, Li (2006) added that committing errors are neither inborn nor instantaneous; actually they are acquired in T/L process. It shows a crucial role of teachers and their T/L process.

Many students may have bitter experience with errors, which probably arise from being criteria to assess their performance level. Our school teachers generally manage the errors in two categories: punishment and empathy. In this situation, how can our students share their attitudes, behaviors, norms, and perceptions towards errors in order to learn and be benefitted from their errors. It has been a common practice that most of the mathematics teachers let their students sit by themselves with papers, workbooks and pencils to struggle independently to understand the concepts and solve the problems. This learning process can be boring, lonely and frustrating. Therefore, it is not surprising that most of the students, trapped in errors, and lost their interest in learning mathematics. Even a single error may prevent the progress and accomplishment, so we cannot say what happens if a student has a variety of errors. Obviously, the more errors a student has the more likely s/he is to experience failure in examinations which the teachers should take seriously.

Our conventional T/L practices bestow the information only and make the children fall in fear of failure, teach for tests, make T/L less exciting, follow teacher-centric method, don't care their diversified learning pace, full of rote learning, mechanical-drill-and-practice, one-size-fits-all, talk-and-talk then get fade up etc. (Kshetree, 2013). Teachers think that learning is an individual task and responsibility of student. Teachers are furious when they see students' errors and deal the errors with superficial correction. Because of which our T/L practice has hampered students' creativity, progress, and learning mathematics meaningfully.

The successful teachers fine-tune their teaching methods with students' current knowledge and interest to meet their learning needs. They should be well-informed about students' competencies including their learning ability to cope with errors. Thus, to help students to learn from their errors, teachers should know the factors that cause students commit errors. Out of them, teachers' inappropriate role is an important factor which causes germination of errors that mislead students' learning. So, the teachers should have knowledge of identifying and addressing students' errors in order to draw the attention of the students and guide them in the area of difficulties. Further, they need to have a positive perception and behavior so that students' errors could be practiced in classroom T/L approach for their systematic remediation. But, we don't have such a mechanism of T/L practice. In this context, this study was conducted to explore teachers' perceptions towards students' errors which are subjected to T/L process of mathematics teachers, themselves.

III. OBJECTIVE OF THE STUDY

The main objective of the study was to explore the teaching/learning role of mathematics teachers as a contributing factor for evolving and developing students' mathematical errors.

IV. RESEARCH QUESTIONS

The following four research questions were set forth in order to explore the teaching role of mathematics teachers in configuration and development of students' mathematical errors.

1. How is the role of teachers' teaching ways for formation of students' mathematical errors?
2. How is the role of questions asked by teachers to students in making their mathematical errors?
3. How is the role of alternative processes used by teachers subjected to students' mathematical errors?
4. What are teachers' views towards analysis of students' mathematical errors and their treatment system?

V. REVIEW OF LITERATURE

The researcher collected most relevant literatures (soft and hard, both the copies) and reviewed them properly. As they were studied categorically, the summary of those reviewed literatures (theoretical and empirical) have been put forth, turn by turn, as follows.

A. Review of Theoretical Literature

The study has adapted the philosophy of constructivism to explore, analyze and interpret teachers' perceptions which were collected in regard to their role in development of students' mathematical errors. Before the advent of constructivism, errors were negatively viewed as digressions, a result of student's confusions and as unfortunate events that had to be eliminated and avoided (Gagatsis & Kyriakides, 2000). If there are any gaps in comprehending and understanding the mathematical concepts correctly, they threat students' construction of knowledge and the coherent structure of mathematics (Li, 2006). The errors are caused by applying previously acquired and correct knowledge to mathematical situations where the knowledge is inapplicable (Gagatsis & Kyriakides, 2000). Some of the errors are germinated while using prior conceptions or misconceptions to interpret phenomena, events and situations in their construction of knowledge in the classroom (Chauraya & Mashingaidze, 2017). These constructivist explanations of errors highlight the centrality of students' mis-conceptual structures and how these structures are reused in developing further mathematical concepts and ideas.

The students use their prior knowledge or experiences to make sense of the new situations where they need to recall and apply them accordingly. According to Brodie (2014, cited in Chauraya and Mashingaidze, 2017), when students attempt to use previously acquired knowledge in novel situations, their prior knowledge becomes inadequate for explaining new concepts and solving new problems as a result errors occur. Thus errors are seen as reasonable and sensible for students that they think what they are doing is correct. This view of errors suggests the need for teachers to engage with students' errors in such a way that teachers enable them to identify the students' thinking or conceptions behind any observed errors. Such knowledge will enable teachers to deal with students' errors in appropriate ways that support students to reach to the correct mathematical concepts. But for this, teachers need to deal students' errors with positive attitude.

Teachers' perceptions regarding students' errors can be classified into three classes like; investigating teachers' interpretations of common students' errors, explaining the reasons for students' errors and understanding of students' errors (Gagatsis and Kyriakides, 2000). This study targeted to investigate teachers' perceptions in the periphery of these phenomena. Further, care has been given on the teachers who may describe the errors without explaining the students' reasoning behind the errors, that is, they might have explained students' errors by focusing procedural rather than conceptual.

As a part of theorization, the ingredients extracted from these literatures have been encoded and cited in different places as the guiding insights to understand teachers' perceptions in regard to students' varieties of mathematical errors caused by the teaching/learning role of mathematics teachers.

B. Review of Empirical Literature

In order to avoid duplication and confine the area of study on specific issues and locate them in new area, it was essential to study empirical literatures which were as provided below.

Chauraya and Mashingaidze (2017) studied about in-service teachers' perceptions and interpretations of students' errors in mathematics. They used a survey research design which incorporated questionnaire having two parts. In first part, they found out teachers' perceptions towards nature of errors whereas in second part, teachers were asked to describe five common algebraic errors. It helped to design a research method. Further, this study helped to differentiate mathematics errors are different from slips. They have argued that in teaching/learning situations, students make slips these are often easily identified and corrected either by the student or the teacher. Slips usually do not recur once they are corrected. Errors are mistakes that tend to recur. Teachers need to have this understanding of errors if they are to engage productively with errors in their teaching for the benefit of students'

understanding of mathematical concepts. Students’ errors were regarded as evidence of learner thinking on which teachers could draw to help learners understand mathematical concepts. It helped to view errors as connected to learning mathematics and examine how mathematics teachers view and explain students’ errors.

Hudson and Miller’s (2006) study found that students’ lack of knowledge could be a major reason for making error so that they cannot solve certain problems consistently. They found that there were three types of errors: procedural (not following correct steps), factual (not recalling facts or not mastered basic facts), and conceptual (unknown to specific concepts). Procedural and factual errors (also known as ‘slips’) are generally not due to inherent misunderstandings. They found that the slips are due to memory deficits, impulsivity, or visual-motor integration problems and are easier to identify than conceptual errors. They argued that the conceptual errors (or ‘bugs’) which are more serious may look like procedural errors, but they occur because the student does not fully understand a specific mathematics concept. This study helped researcher to identify the type of students’ errors.

The study carried out by Gagatsis and Kyriakides (2000) has asked teachers who participated in an in-service course in mathematics about their understanding of causes of students’ errors and their explanations of particular errors. In the study, they found that the teachers no longer attributed errors to students’ attitudes. They saw and explained errors as a result of the nature of mathematical knowledge and the rules in mathematics, for example viewing errors as a result of previous correct knowledge which is not applicable in a new situation. The teachers also attributed students’ errors to the ‘didactic contract’ in which students don’t see the practical part instead they deal mathematical problems in non-applicable or impossible situation. Here, their study helped to investigate the teachers’ understanding of the nature of errors and their attribution of the sources of errors in mathematics. The study has used their questionnaire with some modifications.

Upadhyay (2001) has carried out a research on the effectiveness of constructivism in students’ mathematics achievements. His study has given the philosophical, psychological and anthropological bases of constructivism which supported to capture teachers’ perceptions towards students’ construction and misconstruction of mathematical knowledge and skills, and understand the T/L situation of Nepalese mathematics classrooms as well.

Cathy (1987) study showed that the students’ academic performance in mathematics was weak and they were showing low interest and confident in learning mathematics. The social interaction in the class during the teaching and learning of mathematics in the class was low as well. Moreover, most of the children often made some errors that caused them to lose marks in the mathematics tests. But, they showed a high interest in learning when they were treated on the basis of their errors. It gave researcher confidence to be confined in this area of research.

C. Conceptual Framework of the Study

As per the reviewed literatures (theoretical and empirical), the ideas developed thereafter helped to conceptualize a road-map (for exploration of mathematics teachers’ perceptions towards their role which is accountable for forming and developing students’ mathematical errors) has been designed as given below.

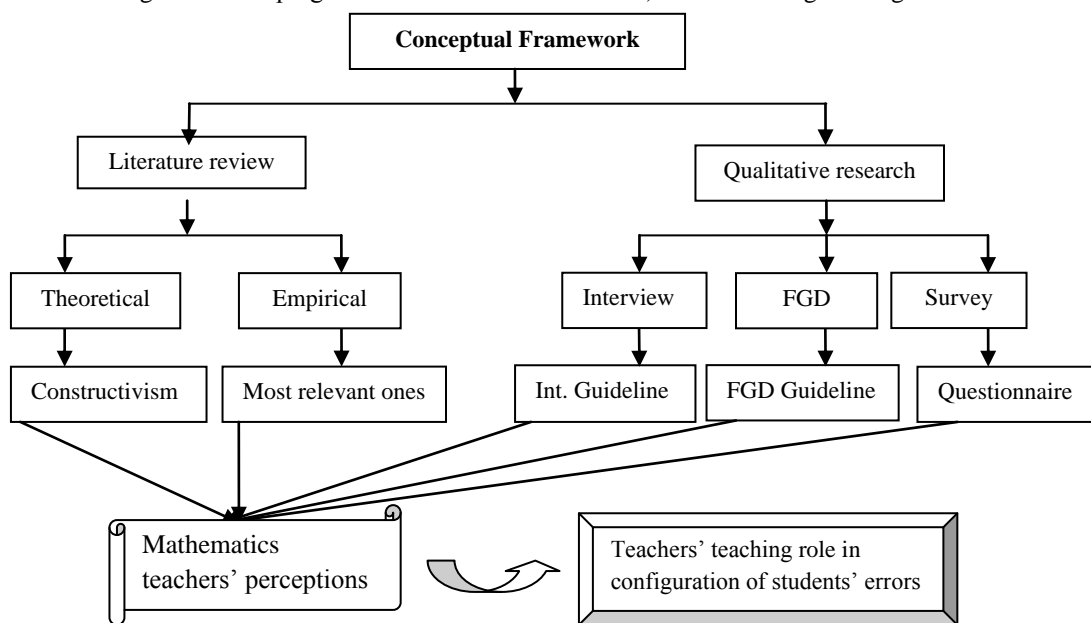


Diagram 1: *Conceptual framework of the study*

VI. RESEARCH METHODOLOGY

A. Research Design

The research design adapted was basically a qualitative though there were some quantitative data collected through survey questionnaire. The quantitative data were processed and dealt through the simple calculation and diagrammatical presentation. The researcher collected and used all the first hand data. The sources of data were all the responses of mathematics teachers which were in the form of narratives based on their teaching experiences. The qualitative data were collected through interviews and focus group discussions. In addition, the study conducted a survey among the mathematics teachers teaching in different public schools.

B. Research Tools

The research tools prepared for this study were interview guideline, FGD guideline and survey questionnaire. The statements of the questionnaire for surveying purpose were prepared by following the Likert scale design. There were mainly four themes of study to explore mathematics teachers' perceptions in regard to their teaching role and strategies which are accountable to form students' errors while learning mathematical concepts and solving the problems. Then, the research tools were piloted in other two schools. Afterward, some simple changes were made in both the interview guidelines but not in survey questionnaire. However, they were finalized by consulting with senior researchers, colleagues and teachers.

C. Sampling and Data Collection Procedure

There were randomly selected ten mathematics teachers from four public schools who were interviewed, one-by-one, by the researcher. It was carried out by using interview guideline consisting four themes of investigation. Other nine mathematics teachers of two schools (each has four and five teachers) were engaged in FGD, separately, within the framework of FGD guideline. However, the interviews and FGD were conducted more like a normal conversation, but with a purpose to gain insights into teachers' views, constructions, interpretations, and reasoning processes towards students' errors. The opinions of the teachers were recorded and later on transcribed as per the theme of the investigation.

Among the teachers of forty public schools, one hundred sixteen sets of questionnaires were administered with the view of having a broader coverage of teachers' opinions. The schools were selected randomly from the list of the schools of Kathmandu Valley. The Valley consists of three districts such as Bhaktapur, Kathmandu and Lalitpur. Out of which one hundred three were found duly filled up and received back. In order to make a task of converting teachers' responses into percentage easier, those three sets were removed randomly and made a total respondents' number one hundred. Without loss of generality, it avoids only the decimal calculations.

VII. ANALYSIS AND INTERPRETATION

The qualitative information were first obtained by interviewing mathematics teachers and then the information were verified, refined and strengthened by conducting focus group discussions among other mathematics teachers. Further, the data were broadly examined and scrutinized by collecting other data through surveying questionnaire administered among larger group of mathematics teachers. The data thus obtained were organized and presented in four thematic areas for their systematic analysis process. Further the information was triangulated with the findings of the previous studies and related theories. In this way, the trustworthiness of the findings of the study has been established with the help of interviews, focus group discussions, surveyed questionnaire, pre-existed findings that of previous studies and theoretical closure. Regarding the teaching/learning role of mathematics teachers in contributing students' mathematical errors, the four major themes reported and analyzed on the basis of teachers' opinions as follows.

A. Inappropriate ways of teaching

Teachers agreed that they use mostly lecture method of teaching. It is like a one-way-traffic system. Actually, they don't prefer peer leaning or learning in small groups, don't deal individually and don't care upon diversified background of students. They just come to class and start talk-and-talk then get fed up. They also don't use teaching/learning materials which they justified as they don't have time and course is not complete in time if they use them. Their teaching may work only for average students. They have no idea about drawing attention of the students towards teaching content as well.

As their teaching process is not working well, the math-teachers pretend that they are extra-ordinary and most talented teachers. If not how could they show them as smart teachers, as a senior teacher reported. He recalled an interesting story:

There was an art competition in our school. Many students were taking part in it. The topic of the competition was “My School and Teachers”. One of the students drew a picture of math-teacher. His art was so fine where he had drawn a giant picture with very long hair, sharp and long teeth like tusk of elephant, big nose, big and oval eyes etc just like a ghost. It was colored completely by black color.

It showed that how was students’ attitude towards mathematics teachers. Actually, students feel terror when they see mathematics teachers. Even students don’t dare to ask questions to teachers. No interaction at all, so how can students learn from math-teachers without being a trustworthy and easy going on person. It causes incomplete operations and meaningless learning, as a result they commit errors (Li, 2006).

B. Asking inappropriate questions to the students

In a focus group discussion, teachers came in consensus that teachers ask questions either to prove their superiority or to dominate students that they know nothing or just to get them on trapped. They use inappropriate language (dominating and disrespecting) with like a terrorist body gesture as their personality and pretending their smartness. They, actually, see their future and personality in their hard and unanswered questions. They ask even the same level of questions to different level of students. Neither they use student-friendly language nor do they encourage or facilitate students for their further learning. One of the teachers shared his experience as:

While students appearing math-examination, I use to visit each and every room because they remember some questions’ clues and hints by recalling my teaching style in the classroom as if I am quite popular. But, they don’t want to see those math-teachers who are not popular as they have spreaded terror in their classroom teaching.

The math-curriculum and books are written by focusing average level of students. They think that one-size-fits all (Bishop, 2008). It would be better if they were written as per the level of students like questions for level I or II or III and so on. The questions set forth are also very abstract and not easy to understand their language. The book writers think that as hard questions as they collect they seemed more intelligent. All this is the illusion of those teachers who have no idea about educational pedagogy. But, students have been suffering in any means and committing errors.

C. Lack of use of alternative processes in teaching/learning mathematics

The interviews show a big illusion among teachers that they use hardly a method to teach students. Some of them claimed that students get confused if they teach by using different methods. For this, the senior class teachers instruct junior ones to follow their methods so that the students cannot get confusion. They are further aware that they instruct students to follow the same process if they go to join coaching or tuition. In the same vein, students also don’t want to learn alternative methods as they hardly know either one and don’t want to miss the memorized one method. If the students were learning by using different methods, they would remember another one if they forgot the rote memorized one. Further, their learning method by following different processes would be strengthened and removed the confusions if they got a chance of verifying them. But problem is that the students get no opportunities of following different methods and comparing them to select a more suitable one. One of the teachers argued:

There are so many instants to check and verify the matters as students write wrongly $7x + y = 7xy$ but what about addition of 7 cows and 1 buffalo could be asked to correct it. Further, students don’t care the written content of any bill while taking them from market where they see only cost price. If teachers had used practical approach the students could have learnt practically.

It showed that students need practical approach of learning so that they could visualize many things in a concrete way (Egodawatte, 2011). As a result, they could have a meaningful learning. Another teacher added that the students who were not comparatively good in mathematics they did well in math-exhibition program where they developed so good math-materials rather than by so called good students of mathematics. In the exhibition program, the weaker students not only showed their great interest rather they learnt much from their peers.

D. No system of error analysis and treatment

Teachers honestly said, “They have no idea about how to extract students’ errors and make a plan to address them. They have no ideas and skills about the treatment of errors. Even they have never taken any orientation or trainings about error analysis and their treatment plan. A group of teachers agreed as:

We generally check students’ some class works and home work copies where we marked by red pen as and when we noticed the mistakes. If there are minor mistakes we correct them as well. We thought such a work is enough as they would understand it and would not repeat the errors again. Also, we don’t have time to reach every student’s concerns and errors. However, we aware students that where should they take care to avoid errors while teaching them. Though, it does not work properly.

It showed that teachers had no idea about error analysis and how to remove them in systematic way even by counseling students. The teachers added:

The students even don’t want to collect their examination copies as if we sought them in their each and every error. Therefore, students don’t come close to us after examination. The students also don’t show their examination copies to their parents as they don’t understand their mistakes instead they sought them for their poor marks in mathematics.

The teachers’ opinions showed that they just awaked students about possible errors which were too general so they couldn’t be taken as treatment. Because there are as varieties of errors as the different students think differently (Matlin, 2005). Further, he added that students’ mind gets continue repairing and renovating on the basis of perceiving new information as per the principle of constructivism. Thus, the general type of understanding, awareness and treatment cannot hit to specific type of errors and their causes.

E. Analytical Presentation of Surveyed Data

Actually, the survey research was carried out to extend and take the research into a broader domain of investigation which helped to strengthen and authenticate the qualitative information. For, as mentioned above, the statements in the questionnaire were related with four categories which contribute to generate students’ errors due to role of teachers in teaching and selecting mathematical tasks. In order to take the responses of the teachers, there were five levels of choices. They were as ‘agree (A)’ and ‘strongly agree (SA)’ for representing their agreement in the statements whereas ‘disagree (DA)’ and ‘strongly disagree (SDA)’ for representing disagreement upon the given statements. Further, there was a provision of ‘undecided (UD)’ if they are not that much sure about their opinions. But, finally these five options were categorized into three choices as per their responses which were squeezed in agreed and very few in disagreed and undecided. There were one hundred three questionnaires which were duly filled up and received back in hands. The three questionnaires were randomly removed in order to express easily the frequencies of each statement into percentage. The collective responses of the teachers in each theme were converted into percentage, which have been depicted in the following diagram.

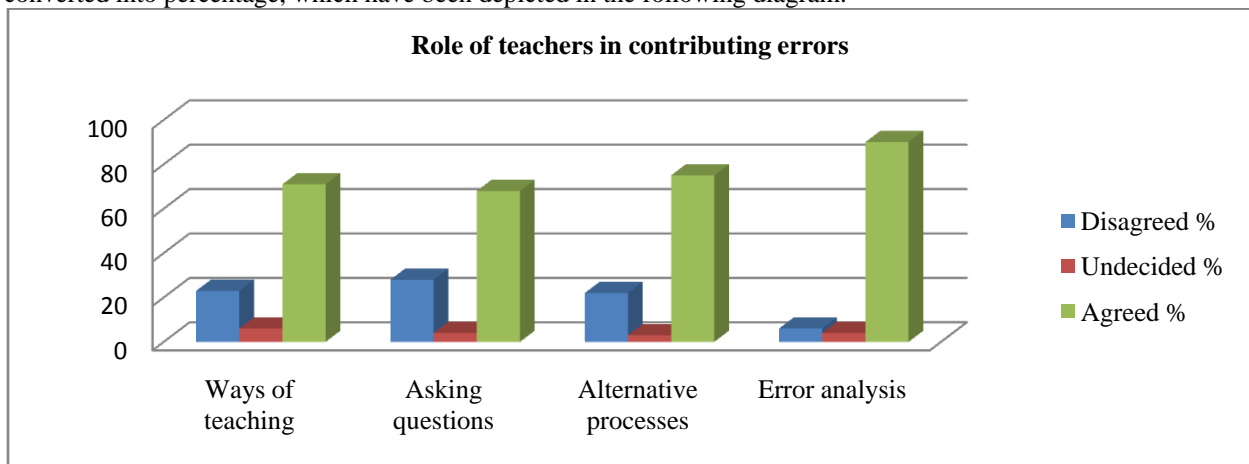


Diagram 2: Role of teachers in contributing students’ errors

In this section, teachers had rated own roles on contributing students' errors, themselves. The graph showed that they scored relatively less in three roles such as inappropriate ways of teaching and learning, asking inappropriate questions as per the students' ability and no use of alternative methods of problem solving. However, they have clearly realized that they have no idea about error analysis and their treatment system properly which has scored the highest percentage, that is, ninety percent.

VIII. FINDINGS OF THE STUDY

Most of the teachers' perceptions showed that errors are not only evolved and developed just because of students' role in learning process. There are also other contributing factors which have a cause and effect relationship with errors. Out of them, the teaching/learning role of teachers is very crucial in making students' mathematical errors as the teachers realized it. Their main roles were subjected to inappropriate ways of teaching, not asking proper questions as per the ability of the students, lack of use of alternative processes for solving problems, and no system of error analysis and treat students' errors. The teachers also agreed that errors could be useful sources of inquiring students' status of mathematical knowledge and skills logically and consistently. It indicated that errors are part and parcel of learning mathematics which is more or less existed in each learner.

According to mathematics teachers, the students considered mathematics as a cultureless subject like a foreign subject and it would be used in advanced subjects of science and technology as practiced by well developed countries. They did not see any practical use of other parts of mathematics except arithmetic as they were unable to connect it with their real life experience. These kinds of psychological learning, thoughts and behaviors were also found responsible to detach the students from the attraction of learning mathematics and further laid foundation to breed errors.

Teachers added that students memorize rules or steps of solving problems without understanding clear concepts of their meanings. Teachers also emphasized in making students to find correct answers. Such a process leads students to forget or mix up the processes and commit errors. In this way, erring is not only a matter of blaming students. However, there were few teachers who thought that they knew where students make errors, and errors are avoidable too. Further, they were likely to blame students for their errors. These kinds of teachers showed the correct solution of problems to the students without engaging them in errors. Some of the teachers just correct students' errors in their copies superficially without informing students about their real causes. These kinds of conventional practices cultivate students' mathematical errors in either way which has suffered them severely and put aside from main stream of learning mathematics meaningfully.

IX. CONCLUSION

The overlook of errors has got continuity since a long time as still there is no error analysis system and treatment plan. Actually, neither such a system and plan is taught in any level of courses of college nor it has been a content of teacher training program. In this context, this research has unveiled the perceptions of teachers towards students' errors though they had no idea and skills for their extraction and remediation. There is a gap between formation of students' mathematical errors and teachers' understanding about them. Until and unless they get break through the gap, the teachers cannot be engaged productively to address the errors. Thus, teachers should learn about origin, nature, causes and adverse impact of errors which will help teachers to be more professional instead of blaming students for their errors.

In this regard, teachers' beliefs in mathematics as absolute knowledge needed to be changed to mathematical knowledge as fallible and human activity so that teachers could give importance to every reasoning of the students by analyzing their pre-existed knowledge as per the philosophy of mathematics. The conceptual learning demands construction of own knowledge in their own way being based on individual experience, context, and culture. In this approach, they can take active part on their own behalf to interact, accomplish own and team task.

The teacher should put himself/herself in shoes of learners. The teacher and students together must reach to the schemata of students to uncover their misconceptions and incomplete understandings. Teachers should not be anxious of students' errors. Even the students' wrong answers can guide to reach to the origin of errors that they may be the best tools for crafting their learning experiences. Thus, teaching towards understanding of mathematical

concepts and removing errors, it is first necessary to understand students' prior knowledge, examine it, and then provide ample opportunities for their significant learning.

X. IMPLICATIONS OF THE STUDY

The study has identified classroom applications for students and teachers which can be used in their regular teaching/learning practices. This study has provided an opportunity for students to have a better understanding about teachers' specific teaching role. Then the students would know how to get teachers' help and support efficiently. It will also make easy to address students' erroneous problems and make their learning meaningful. This study provides a window for teacher to see and determine where a student lacks basic conceptual understanding. So by identifying and locating the contributing factors for students' errors, the teacher can provide required instructions targeted to their area of need. For this, there is a crucial role of teachers so that their real status of perceptions towards students' errors should be known for their further professionalism development as well.

Moreover, the findings of this study could be useful for subject experts, trainers, book writers, educationists, and curriculum makers. In this way, it has drawn important implications from the finding so as to bring a positive change in teaching/learning mathematics.

XI. DELIMITATIONS OF THE STUDY

The research study was restrained among the mathematics teachers of public schools only which are located in Kathmandu valley. It was just because of the constraints of time, cost, resources, and limited purpose of the study. However, the in-depth interviews and focus group discussions were carried out in addition to a survey conducted through a set of questionnaires. With these research procedures, a special attention was given to make it a landmark in the area of learning mathematics successfully and draw some important conclusions along with the educational implications based on the findings of this study.

XII. RECOMMENDATIONS FOR FURTHER STUDY

The focus of the study was on exploration of teachers' perception towards students' errors caused by the teachers' role, themselves. On the way, the researcher was interested in a number of issues that were surfaced in this study; and these issues have further broadened the scope of research work to be carried out in future. Some of probable studies are recommended as follows.

This study has not included classroom observation for the reflected behaviors of teachers and the opinions of students. Also, the study has not collected the data from researchers, educationists, and curriculum makers. Thus, a further research would be conducted by incorporating these variables.

A study can be conducted in the form of a case study so that it may be an intensive diagnosis of errors. If so, it can provide specific inputs for the treatment of individual mathematical errors.

Anybody can do a research on finding the remedial strategies of errors. Similarly, the high and low achievers' attitude and understanding level of errors are also subjected for further study.

Other studies are also recommended to carry out in multi-lingual and multi-cultural classroom setting.

The further researches of this kind can be conducted in diverse geographical locations and different types of schools (private and community) even by focusing some other extraneous variables which are not included in this study.

ACKNOWLEDGEMENT

My sincere thanks to MR College, Kathmandu for providing me necessary help and financial support to carry out this study. Further, the Research Management Cell (RMC) of MR College accepted my proposal and guided me throughout this study. So, I am gratified with RMC's highly scholar researchers who provided me guidance, constructive comments, and suggestions. I would also like to thank my seniors and colleagues of our department of mathematics education who facilitated my research work by various means. At last but not the least, I am grateful with all sampled schools and their teachers for providing me their needy help and support.

REFERENCE

- [1] Bishop, A. and et al. (2008). Educational algebra: A theoretical and empirical approach. Boston: Springer
- [2] Cathy, G (1987). Enhance Year 5 Pupils Performance in Mathematics through STAD Model retrieved on July 2, 2017 from file:///E:/Downloaded%20researches/Enh.
- [3] Chauraya, M. & Mashingaidze, S (2017). In-service teachers' perceptions and interpretations of students' errors in mathematics. International Journal for Mathematics Teaching and Learning 2017, Vol. 18.3, 273 – 292.
- [4] Egodawatte, G. (2011). Secondary school students' misconceptions in algebra. An unpublished dissertation. Canada. University of Toronto. Retrieved on April 17, 2018 from <http://hdl.handle.net/1807/29712>
- [5] Gagatsis, A., & Kyriakides, L. (2000). Teachers' Attitudes Towards their pupils' Mathematical Errors. Educational Research and Evaluation, 6(1), 24-58.
- [6] Hill, H., Rowan, B., & Ball, D. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. American Education Research Journal, 42, 371-406.
- [7] Hudson, P. & Miller, S. (2006). Designing and Implementing Mathematics Instruction for Students with Diverse Learning Need. Boston: Allyn & Bacon.
- [8] Kshetree, M. P. (2013). Extracting Errors in Mathematics Learning. In (Ed.) Mathematics Education Forum. II (34) (pp 15-18). Kathmandu: Council for Maths Education.
- [9] Li, X. (2006). Cognitive analysis of students' errors and misconceptions in variables, equations, and functions. Doctoral dissertation. Texas A and M University. Retrieved on January 2, 2015 from <http://oaktrust.library.tamu.edu/bitstream>.
- [10] Matlin, M. W. (2005). Cognition. USA: John Wiley and Sons.
- [11] Rach, S., Ufer, S., & Heinze, A. (2013). Learning from errors: effects of teachers' training on students' attitudes towards and their individual use of errors. PNA, 8(1), 21-30.
- [12] Upadhyay, H. P. (2001). Effect of constructivism on mathematics achievement of grade V students in Nepal. Doctoral dissertation. Chandigarh: Punjab University.