

A NARRATIVE EXPLORATION OF CONTEXTUAL TEACHING PRACTICES OF
SCHOOL MATHEMATICS TEACHERS

Vikash Khadka

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DECLARATION

I hereby declare that this dissertation has not been submitted earlier for the candidature for any other degree.

2 August 2021

Vikash Khadka

Degree Candidate

DEDICATION

This work is profoundly dedicated:

To my late father Gokul Khadka who always had faith on me of delivering positive action in every step of my life and my mother Anuradha Khadka who loves and cares for me indefinitely.

To my wife Namrata Singh for her prolonged support in completing my research work and my daughter Vani Singh Khadka whose smile is the energy booster to do any task.

To all the teachers and the teacher educators who always showed me the right path for my overall development.

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APPROVED

3 August 2021

Indra Mani Shrestha
Dissertation Supervisor
Lecturer, Department of STEAM Education

3 August 2021

Asst. Prof. Binod Prasad Pant
Acting Head, Department of STEAM Education



3 August 2021

Amrit Bahadur Thapa
External Examiner

3 August 2021

Prof. Bal Chandra Luitel, PhD
Dean/Chair of Research Committee

I understand and agree that my dissertation will become a part of the permanent collection of the Kathmandu University Library. My signature below authorizes the release of my dissertation to any reader upon request for scholarly purposes.

3 August 2021

Vikash Khadka, Degree Candidate

ABSTRACT

An abstract of the dissertation of *Vikash Khadka* for the degree of *Master of Education in Mathematics Education* presented at Kathmandu University, School of Education on 3 August 2021.

Title: *A Narrative Exploration of Contextual Teaching Practices of School Mathematics Teachers*

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Indra Mani Shrestha

Dissertation Supervisor

According to Curriculum Development Center [CDC] (2014), the school level Mathematics primary objective is to develop the problem solver of practical problems and acquire competencies on Mathematics for life long and for higher education. But I hardly find it as per above statement. The school level Mathematics has different definition; Mathematics is a subject to score higher numbers and good students. It is the subject with lots of problems in the exercise that requires rigorous practice and learning Mathematics strategies seems memorizing all the formulae and includes continuous practice of problems until and unless they get imprinted in students' mind. The student's critical thinking and the creativity, making sense, developing and realizing the usefulness of the mathematics are overshadowed. To address it, I intended to explore the possible causes and their solution through this research project.

This research project is the result of the narrative exploration of teachers' experiences in contextual Mathematics teaching practices guided by theories of

constructivism and transformative learning theory. I used the paradigm of interpretivism which helped me in interpreting/explaining the contextual teaching practices of mathematics teachers. The Contextual Teaching Learning (CTL) approach (Selvianires & Prabawanto, 2017) involves active students in the learning process to find the concepts learned by linking the material with the knowledge possessed and experienced in daily life. I have interviewed with two school level teachers to explore their contextual teaching learning practices from Kathmandu and Lalitpur districts. I have tried to make meaning from the experiences shared by the research participants. Moreover, the finding shows that Contextual Mathematics teaching practices are helpful to develop conceptual understanding of students, engagement and involvement of students to learn mathematics and developing creativity and critical thinking.

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ABBREVIATIONS

MoE	Ministry of Education
SEE	Secondary Education Examination
CTL	Contextual Teaching Learning
SLC	School Leaving Certificate
MEC	Council of Mathematics Education
MiC	Mathematics in Context
TLT	Transformation Learning Theory
CDC	Curriculum Development Center
B. Ed.	Bachelor of Education
M. Ed.	Master of Education
KUSOED	Kathmandu University School of Education
VAT	Value-Added Tax
TU	Tribhuvan University

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CHAPTER I

INTRODUCTION

Context of the Study

As I had to recall my school days, I did my schooling in one of the renowned schools in the western region of the Kathmandu district. I still have a vivid image of how Mathematics would be taught in the classroom. There were two Mathematics subjects in primary grades namely, Mathematics I and Mathematics II, where two different Mathematics books of different publications were used. Though two different course books were used, the two Mathematics teachers would run the course almost similar to the contents in the curriculum. It was the same till grade six, and from grade seven onwards two Mathematics subjects were divided into compulsory and optional Mathematics.

If I have to discuss the teaching procedures, it was a mechanical way of teaching Mathematics; a teaching methodology where the teachers present the information that they want the students to learn. According to Hiebert (2003), different research over recent years indicates teachers continue to teach much like their forbears did. It emphasizes teaching procedures are more focused rather than conceptual understandings. Here, teachers would introduce topics, formulae and some illustrations and then assign practice works as the class and home assignments. And all those practice works were likely to be the drill work of a football player in a training session which had to be used in the field during the games and we being students had to use them in the terminal and annual

examinations. I still remember my algebras class of my school days in middle school; my Mathematics teacher would start algebra with algebraic formulae:

$$(a + b)^2 = a^2 + 2ab + b^2$$

$$(a - b)^2 = a^2 - 2ab + b^2$$

$$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$

$$a^2 - b^2 = (a + b)(a - b)$$

$$a^2 + b^2 = (a + b)^2 - 2ab = (a - b)^2 + 2ab$$

These were simply algebraic formulae that were used to solve different questions related to algebra and in some problems of Trigonometry. Similarly, if the topic “Solid figure” was taught in our class, the teacher would draw those figures on the black board rather than introducing solid figures. There were almost similar cases in all the grades whereas some formulae derivation, discussion and analysis of question were done in few occasions in middle school. This method could not offer me the experiences to figure out the things for myself which generally happens in student-centered teaching providing hands on experiences, experiment, explorations and observations.

I can still remember my Mathematics teacher and what he told when I was in grade 10; he announced a cash prize to those students who would score 100 in SLC (School Leaving Certificate) examination in his subject (i.e., Mathematics). So, we all students focused our learning on securing 100 marks in Mathematics and went through almost all the practice books available in the market during that time. Now, I realize that instead of focusing on marks and going through many practice books, it would have been better if we could go through different hands on activities, experiments, observations and

explorations to get information about different topics, its connection to real-life and tried to make meaning on different topics. The teaching process was following exactly the teacher's banking pedagogy (Freire, 1970); teachers are subject, and the students are objects, where the teachers know everything and the students are ignored. Students are treated just as a container or a piggy bank into which knowledge is deposited by the teachers. Instead of knowing and understanding what the teachers have taught, students are asked to rote down and memorize the contents as well as the curriculum. My teachers also acted the same way; I can recall that during the mathematics class, teachers would explain and define each and every step and content of Mathematics and we were compelled to listen and observe carefully and follow the same steps of problem-solving, while key concepts and ideas were mostly ignored. There was hardly any effort from my teacher to make sense of Mathematics and their teaching was all about securing good marks. Moreover, as per my formal and informal conversation with other Mathematics teacher of other schools, this was not only the problem of the teachers because they were also instructed in the similar way by the school administration, as the school administration is concerned with cashing the results for getting larger number of admission of students during a new session. The aim of learning Mathematics in my schooling was to secure good marks in initial grades whereas in higher grades was to secure good marks and get admission in +2 college in science faculty with an aim of going to technical fields like engineering. But unfortunately, due to different circumstances, I could not continue my ambition of moving onto technical field and it got faded away after my +2 study. Then, I had to take the responsibility of my family and had to engage myself in some economic activities so that I could help my family. During

those times, only one option was there for me according to my academic qualification i.e., teaching Mathematics and Science in high school.

Almost 10 years ago, I started my teaching career as a lower secondary and secondary Mathematics teacher. I taught my students as I used to be taught during my school days. I thought I was doing my best being a Mathematics teacher because I was helping my students individually and making myself available whenever they sought help from me. But later, I gradually realized that I was nowhere near to a good Mathematics teacher because I was focusing on the same ways of teaching as I used to be focused on by my Mathematics teacher during my school days. Moreover, I was just preparing them for an exam rather than making them realize the beauty of Mathematics and usefulness of Mathematics in their daily life. “Mathematical beauty is regarded as something deeper in domain of meaning and not just that of the sign perceived”,(Ernest 2015, p. 23). So, we can say that Mathematics is not only about solving the routine problems of textbooks and practice books and getting the correct answers; rather it is about making meaning from what students learn and explore the connections in daily life and usefulness of mathematics which I was not able to do while teaching Mathematics. Preparing for the examination was my sole motive during that period of time.

Fortunately, the Principal of the school from where I began my teaching career was a Mathematics Teacher and Mathematics Teacher trainer who helped me a lot to be a better teacher. When I started working on that school, at the beginning, I was imitating the same as my teachers used to do when I was a student. I used to solve different problems from the textbooks and explain them. I used to tell the students to solve similar problems and practice as much as they could. But in the meantime, I could not address

the students who used to struggle with problems from exercise and the students who wanted to do better in exam. Then I realized that practicing the problems help them to solve same or similar problems but not the problems which have twists and turns in them. As the problems started getting bigger, I consulted with the principal and got different ideas like starting the lesson with connection of Mathematics with real life, discussing the usefulness of Mathematics, clearing the concepts of Mathematics, involving students as much as possible, etc. This helped students to develop the key ideas of the chapter as well as their problems. Through his guidance and support, I started to improvise myself and develop the perception that Mathematics exists in every part of our life and activities.

For the first time he gave me the idea of a^2 . The initial idea of a^2 was simply the product of two 'a' i.e., $a^2 = a \cdot a$ which I learned in my school days. Rather than this, it is an area of a square whose length is 'a' unit. Using the same concept, I tried to contextualize

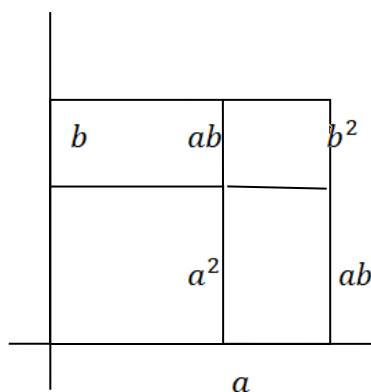


Fig.1. Geometrical representation of algebraic formula

the $(a+b)^2$ formula as ' a^2 ', represents the area of a house, using $(a+b)^2$ as a house along with its compound. The area of the house along with its compound is the area of 4 different parts which are a^2 , ab , ab and b^2 and their sum results to $a^2 + 2ab + b^2$.

Furthermore, I used the concept in $(a + b)^3$ as a cubical object packed in the cubical box.

I really enjoyed using this concept and when I shared this with my students, I could see a positive response and noticed their enthusiasm in Mathematics. The positive changes in interest and attitude in students were visible when contextualization of Mathematics was introduced.

He made me involve with the different Mathematics activities conducted by the “Council of Mathematics Education” as he was one of the founder member. I also got the opportunity to work on a pilot project called “Mathematics in Context” (MiC) where I could execute and explore many things and I learnt about the contextualization of Mathematics. After that, I started to introduce some relevant context during the teaching learning process and surprisingly I could notice students’ active involvement and interaction of the students which gave visible outcomes. I can still remember one of the classes in grade 4, while teaching the chapter “Measurement”; I asked my students to measure the length and breadth of a basketball court. Along with the correct measurement of the length and breadth of the court, they even surprisingly derived the concept of formula to calculate the perimeter of the rectangular shape. When they completed the measurement and went through the notes they had after the measurement, they realized that, out of 4 sides, two opposite sides have the same measurement and they had to measure only the length and breadth and they could easily find the perimeter by multiplying the sum of length and breadth by 2 i.e., $\text{Perimeter} = 2 \text{ times the sum of length and breadth } \{P = 2(l + b)\}$. During my involvement in “MiC”, I realize that contextualization of the curriculum has greater importance in showing the beauty of Mathematics and the usefulness of Mathematics. Andersson and Ravn (2012) stated,

“Mathematics teaching should give students the mathematical knowledge and competencies for taking well-grounded decisions in everyday life and to interpret the flow of information and thereby follow, understand, and participate in political discussions in society” (p. 315). Mathematics teaching is not only for getting solutions of textbooks exercise. It can bring the critical awareness in everyday life events such as managing number of chairs in a seminar hall, developing football pitch and badminton court etc.

Contextualizing the school Mathematics has a greater importance as well as necessity. In today’s context, it is rare that the abstract nature of mathematics is well addressed with real life situations or activities due to which I found students are struggling to acquire basic skills of Mathematics required to drive everyday life. For example, the coordinate geometry has been limited with plotting the coordinates and problems related with finding the distance, midpoints, section formula etc. I can find rare practice where coordinates are used in maps and finding the distance and midpoint of two different locations. I could also notice that students have developed the mindset that graph paper is the only place where coordinates are used.

Contextualization can play a vital role in bringing changes in the concept of students that Mathematics is an abstract subject, and it is not in everyone’s reach and also makes them feel that Mathematics is the study of human activities and practices. Contextual teaching and Learning is an approach created the daily life or students’ problem as their learning object (Khotimah & Madsuki, 2016). Students face different challenges in their daily life such as amount of water required to bath and the water vessel to fill water. This challenge provides opportunities to deal with the mathematics

topic like capacity. Similarly, managing their daily routine provides opportunity to deal with time. Contextualizing the school Mathematics related activities are more students-centered and with lots of interaction, communication and collaboration, the opportunity of first-hand experience of the different applied concepts of Mathematics. Students can get a chance to enhance their concept, skill and knowledge of Mathematics which they are generally deprived of. I feel the best way is to experience the curriculum which requires context as the introduction of context helps to develop concepts and the teacher can also anticipate how students might answer the question.

When we start with context, we will probably see more text and fewer problems than in traditional textbooks which are important because they establish the context, pose questions to the students and summarize the important concepts, as the entire context led to certain mathematical models. Van den Heuvel-Panhuizen (1999) argues that contextual problems allow students to start with informal strategies. Hence the contextual problems offer opportunities for students to solve the problems at different levels of formality. I changed working with the unit or the topic of any grade with the problems or the problem-solving strategies into developing concepts, ideas and logic should be the primary objective and contextualization of Mathematics helps me to get the way which promotes the usefulness of Mathematic sand the thinking of students.

When I started with Contextual Mathematic teaching practices, I encountered with lots of challenges for contextualization of school Mathematics, so it is not an easy task. One of the major challenges could be the willingness of the teacher as is not the practices we had been transferred and it requires extra time and effort to research, think and design. We can still see teacher's effort is to teach the prescribed textbook to the

students and we enjoy because we don't have to put extra effort and do preparation as we have been using the same book for a number of years. We don't want to do any research and let the students learn something more which are useful for them because exploring the connections of Mathematics or usefulness of Mathematics requires extra time and effort. When I involved students in these kinds of activities it will just occupy the larger time period to complete the course for teachers due to which at the end of the academic session, we will get less time to make students practice and prepare for the final examination. I also felt and realized that our school level Mathematics curriculum seems to lack contextual illustrations and events due to which it hardly motivates teachers to introduce the context during the teaching learning process. The assessment system is all about the question answer that has to be solved by the end of the year in the exam. What I can observe and experience is, in our assessment system the real life understanding and applications of Mathematics are rarely integrated and focused on the understanding of routine problems of textbooks and practice books and applications of formulae in solving the problems.

Statement of the Problem

From the year I was appointed as a Mathematics teacher in an institutional school at Kathmandu valley, I tried to enhance and develop the level of mathematics of the students, explaining the solutions of the textbooks and making them understand all the procedure of solving problem and make them able to solve the similar problems from the textbook. The main focus of teaching Mathematics in the beginning of my teaching career was to make students a good problem solver and scoring better marks. For this, explaining the solutions and asking them to do rigorous practice continuously was my

teaching learning practice. I used to get frustrated as in spite of my huge effort to make students understand the problem-solving process and their rigorous practice they fail to solve many problems from textbooks.

Students often have difficulty solving computational problems solely focused on formulaic computations, without real-world connections (Khat, 2010; Puri, Cornick, & Guy, 2014). When I carried out my Mathematics classes with explaining the procedures and asking them to practice, it didn't provide the good outcome as many of them could not connect the understanding and problem solving process of mathematics in different scenario. In later phase of my career, I felt that developing level of mathematics and making them score better marks could not be the only goal of teaching Mathematics. Instead of only exploring Mathematics as a subject of school level curriculum, it has to be addressed as the tool for development, as Mathematics is integrated or incorporated in each and every event, situation and activities directly or indirectly. So, teaching learning practice has to be transformed into contextual teaching practices which link the real-life activities. Lenhard and Carrier (2015) have stated Mathematics as a tool where mathematical analysis can be helpful in practical respect even if the pertinent fundamental processes cannot be understood or caught productively in mathematical terms. Mathematics deals with structures and such structures can be found at various places, not alone in the makeup of bodies and their interactions.

As Mathematics teacher with my experience and observation while working in different schools and having interaction with the mathematics teachers of different schools, I rarely find Mathematics has been explored as the tool that helps in analyzing and thinking, making connection and assisting the living process of the individuals. We

hardly see that students are making any contribution in their work, home and the society, as they acquire many skills and concepts. The main reason is that Mathematics has not been explored as the tool which connects Mathematics practically and contextually and helps to live smoothly and effectively. Connecting Mathematics with real world connections enhances the concepts of Mathematics and develops Mathematical abilities form textbook exercises to real life problems.

Dahiya (2014) stated that Mathematics is generally regarded as the driest subject at school, made up of routine, boring, arcane and irrelevant calculation which have nothing to do with discovery and imagination. The existing issue in teaching learning process is, almost all the books are focusing on the exercise and the practice work. Mathematics is being taken as the subject to score rather than a subject which can change our life. Teachers, parents, school administration and students all want to score better marks rather than learning mathematics as a component to change life in a positively. In a Mathematics class using traditional method, the teacher reviews previous material and homework, and then demonstrates low-level problem solving followed by seatwork, imitating the teacher's demonstration (Stonewater, 2005).

As a student and in my earlier days of teaching career I didn't find Mathematics defined as the part of life and Mathematics linked with the human activities. Instead I found Mathematics focused moreover with the problem solving and the procedural knowledge of the mathematics. Even the assessment system is based on only the paper pen test which only emphasizes the problem-solving approaches, and the achievement of learning Mathematics has been defined with the score of the students which has limited Mathematics as only a subject. In recent context, problem solving develops adaptation in

changes and helps to solve unexpected problems related to the careers and our daily life. Problem-solving lies beyond Mathematics teaching dimensions so that students experience the influence of Mathematics in the world around them (Taplin, 2011). The teaching learning practice has to come out of rote learning or banking pedagogy where students are asked to solve the problems which they have been given or asked to solve. The periphery of the problem solving has to be with the experience and the impact of the mathematics in the world around them.

To address the problem, I believe that contextual teaching practices of school Mathematics is necessary which will provide the sense of life within Mathematics. From this research work, I am hopeful that it will make a significance contribution in teaching learning pedagogy of the school level Mathematics.

Purpose of the Study

The primary purpose of the study was to explore the practices of Mathematics teachers on contextual teaching. Within this primary purpose, I narrated how contextual teaching helps mathematics teachers connect Mathematics concepts and understandings in the classroom and how such contextual teaching practices helped students improve their performance in Mathematics.

Research Questions

To address my research problems, I have developed a principal research question and based on which I have developed two subsidiary questions.

Principal Research Question:

How do Mathematics teachers narrate their contextual teaching practices in teaching school Mathematics?

Subsidiary Research Questions:

- How does the contextual teaching help mathematics teachers connect mathematical concepts in the classroom?
- How does the contextual teaching help improve student's performance in mathematics?

Significance of the Study

Contextualization of Mathematics is essential to promote Mathematics education in every level because Mathematics is connected to everyone's day to day practice. Everyone has to be aware about the implementation and existence of Mathematics in their life. This study will emphasize the achievement of universal participation in education, and it will be fundamentally dependent upon the quality of education available (Education For All [EFA], 2005).

This study will be helpful to bring awareness about that – mathematics is an essential ingredient in the knowledge society, and it exists within human activities rather than only in schools' curriculum and textbook. This will also enhance creativity, effective communication, critical thinking, and collaboration. It will emphasize the idea to rely on curricular activities heavily on the primary source of knowledge rather than relying heavily on textbooks and workbooks and also highly value pursuit of students' questions and their conception on usefulness and making sense rather than strict adherence to fixed curriculum and correct answer.

Delimitation of the Study

To provide the proper shape to my research study as per the demand I delimited my research study. My research objective is to explore the Mathematics practices on

contextual teaching through which I tried to make meanings. I had a focus to work only with Mathematics teachers who has idea about the contextual teaching practices and practiced contextual Mathematics during teaching learning process. The study is limited with two experienced mathematics teacher one is from community and next is from institutional school.

Chapter Summary

From this chapter, I tried to explore the importance of my research. I tried to explore what made me do this research on this particular topic and why it is essential for the current situation. The context for the study indicates the factors that motivate me to do research on this topic. The school curriculum has failed to address Mathematics practically, due to which the decontextualization of curriculum has overshadowed the importance, implementation and existence of Mathematics in the school level. Students don't know why they are learning Mathematics. If we are able to make the connection of Mathematics with students' practice, observation and experience, then we can develop the positive attitude among the students. This is the signification of the study where students will be explored in real life rather than sticking them in the textbook and the practice copy.

CHAPTER II

LITERATURE REVIEW

There is a remarkable contribution of theories in research work. It helps in developing a framework relating the theory and the research methodology. The study of existing literature plays a vital role to provide the right way for the research study. This chapter highlights the theories, themes and practices of research work and advocates the meaningful teaching-learning process. Here in this chapter theoretical, thematic, and empirical reviews are done of the previous research respectively.

Thematic Literature Review

In this section, I presented the thematic review for ‘Contextualization of School Mathematics’ on the basis of its definition and meaning. Also, I elaborated on the effect of ‘Contextualization of School Mathematics’ on students’ Mathematics learning.

Contextualization of Mathematics in the Classroom

Here, the context refers to the situation, materials, environment and the actions involved that interacts with the individual. Setiawan (2010) asserted that one of the growing trends in Mathematics education in the world today is the shift in Mathematics education from formal shape to its application, processes of activities and problem-solving in a real situation. Mathematics is a science dealing with the logic of quantity, shape, and arrangement and also an integral part of human life. We use Mathematics in various fields as it is directly or indirectly applied in our daily life. Learning to think in Mathematics terms is an essential part of becoming a liberally educated person.

Geometry, statistics, algebra, arithmetic are the topics which are mainly useful in our daily life. Profit and loss, discount and tax, percentage, ratio, and proportion, etc. are the parts of arithmetic. Data collection, analysis, interpretation or explanation and presentation of data are the components of statistics with prediction and forecasting based data. Geometry is a subject that deals with the shape, size, structure and relative position of figures with properties of space. All the branches of Mathematics are related with different parts of daily life Mathematics such as dates, time, money, grades, computers, cell phones, banking, travels, cooking, buying, selling, investments, etc.

A honeycomb is an array of hexagonal cells providing the sting shape with no gap, wheels and lights of a car are in circular shape, basketball and football field are in rectangular share; these are simple examples of mathematics that we generally ignore.

Though there are various uses of Mathematics in our daily life, we are ignoring them we are not able to address them. As we are not able to address these parts of Mathematics, Mathematics has become abstract and vague for the students. The contextualization of Mathematics is important to introduce the usefulness of Mathematics, to develop Mathematics of students rather than of teacher and to reduce the abstractness and the vagueness of Mathematics. The contextualization has to been done in curriculum to improvise the attitude of the teachers and the students.

Actively engaging students in learning and understanding, enrich Mathematics with this research-based curriculum that uses representation models, strategies and familiar problem-solving contexts. Maintaining the practice and contents standard is the major idea of my research study. Being a Mathematics teacher for number of years, what I have felt is, if we teachers are unable to address the usefulness of Mathematics and only

present Mathematics as an abstract subject, then the level of the students will keep on degrading.

Students 'interest in learning Mathematics is directly proportional to the daily use of their Mathematics curriculum or the contextualization of the curriculum. Luitel (2003) has stated 'using subject matter creatively and contextualizing it can bring many changes even within the traditional curriculum images' (p. 107). If the topic they are learning is related to the daily uses and topics easily found in their surroundings, they will show keen interest in learning Mathematics. So, I thought of "Introducing contextualizing Mathematics classroom."

According to Selvianiresa and Prabawanto (2017) in CTL (Contextual Teaching Learning), students are asked to be active in finding, searching for themselves through activities that do. The learning of CTL emphasizes that the students are active in working and experiencing, until the inquiry process is done by the students, making the students more independent and learning is more meaningful for the students. The activities such as finding, searching, working and experiencing helps them to acquire the knowledge (Ketter & Jonathan, 2003).

Students' Performance in Mathematics

Mathematics has been always a part of national curriculum framework from school level to university level. It has been a higher priority that Mathematics education has to be given to all the students starting from elementary level to provide them ideas about calculation, thinking, creating, logical and analytical abilities. Mathematics is a subject that has greater impact in development of people; from counting to calculation and from creation to construction.

Mathematics is a way to find answers to the problem faced by humanity, such as a way to use the information, using the knowledge of propagating shape and size, using the knowledge of the counting and the most important thing is thinking about the inside-self of human being and using the connections (Hasratuddin, 2014, p. 30). Mathematics has to be bringing out from solving the problems of exercise to solving problems of real life. The thinking and knowledge acquired by the classroom activities during learning can use it meaningfully in measuring by using metric units of area and volume. If a student is able to solve problems of area and volume from book's exercise; if they are able to solve the problems related to it in real life, such as size of paper required to cover the book, size of carpet for carpeting the floor, amount of water required to fill the swimming pool, size of the box to pack the gifts, etc. then it will be meaningful learning.

Pant (2015) argues, "The overemphasis on de-contextualized mathematical problems developed me as a machine to reproduce answers. At this point, I was searching for the straightforward responses on what the best of teaching Mathematics were" (p. 11). The approach of teaching and learning Mathematics requires triggering the moment of learning so that learning is linked with real life in a meaningful way and enhancing the performance of students. Mathematics has to be connected with learners' interest and requirement. Many algebraic equations are not being used in learners' life. Students are not aware that the activities in many interest areas have underlying relations between quantities which can be modeled.

We can find many students arguing Mathematics as one of the difficult subjects, students have to memorize too many formulae and do many problem-solving activities from the exercise that sounds a bit complicated. Mathematics is characterized as an

abstract, and its application part is not discussed much and is also not visible in every day. In Rusman (2011), Keneth explains that CTL is contextual teaching is teaching that enables learning in which student employ their academic understanding and abilities in a variety of in-out of school context to solve simulated or real-world problems, both alone and with others. More and more students can relate lesson material with contextual activities to get more meaning from lessons. I feel like contextual teaching learning provides effective alternatives for rote learning of memorizing formulae and the problem-solving procedures which develops the learning and performance of the students.

Theoretical Literature Review

Theoretical literature review focuses on a pool of theory that has accumulated in regard to an issue, concept, theory, phenomena. In theoretical review, review plays an instrumental role in establishing what theories already exist, the relationship between them, to what degree the existing theories have been investigated (Dudovskiy, 2018). My research work is based on some of the existing theories to advocate arguments based with established and published theories, not only relying on the research work on certain theme or the collected data.

Constructivism

Constructivism refers the concept of generating the knowledge by learners rather than absorbing knowledge from other sources. This constructivist approach stresses construction of the knowledge as learners are the center of the teaching learning process. Learners have to be provided with enough chance to generate the knowledge. According to Von Glasserfeld (1989) constructivism is based on the belief that, “Knowledge is not passively received but actively built up by the cognizing subject and the function of

cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality"(p. 163).To make the students active, Mathematics has to be student centered and the contextualization will make it easy to develop the participation, as it indicates the usefulness and connection of student's daily life. In meaningful teaching learning process of Mathematics, we must come out of only problem-solving and assuming ourselves (teachers) as the only source of knowledge. There are many contextual situations and materials which students are familiar with, which can easily be used to construct knowledge. Covering the textbook, keeping the books in bookshelf, framing the photos can be best situations and the materials to construct the knowledge regarding perimeter, area, and volume. A major theme of Bruner's (1986) constructivism theory is that learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge. So, every person should or can construct knowledge through active participation on the basis of current and prior knowledge.

Students have to construct new knowledge, concepts and ideas on the basis of daily use of Mathematics and deepen their knowledge for the usefulness. Involving students to collect the data and interpret it, shopping, etc. are some of the activities where students are actively engaged and generate different ideas related to Mathematics. Contextualization of Mathematics leads student to develop the knowledge of Mathematics and the interest level.

Transformative Learning Theory

I would like to emphasize transformative learning theory (TLT) as a researcher and a practitioner, as I feel it will carry out meaningful teaching and learning process.

The learning ability and the knowledge of each individual have to be enhanced. The major part of learning is bringing positive changes within the learners; they have to change from one form to another form making them better and better. Transformative learning (Mezirow, 1991, 1995, 1996; Cranton, 1994, 1996) is the process of effecting change in a frame of reference. Frames of reference are the structures of assumption through which we understand our experiences. As mentioned above, transformative learning is an effective change to be developed by reforming the curriculum and classroom practices. The learning process of students has to focus on making sense rather than getting the answers of the problems.

Mezirow (1990) elaborated two dimensions of making meaning: meaning schemes and meaning perspectives. Transformation signifies the changes and transformation learning indicates changes by establishing meanings, beliefs, etc. Contextualization of the curriculum and classroom practices brings the change in students' belief and attitude of students as they can easily encounter the usefulness and relate their learning with their daily life. Contextualization helps to answer the learning objective of mathematics.

My research work is focused on transformations in mechanical Mathematics which is just a problem-solving of the textbooks to the context and application-based Mathematics where students will directly know the importance of learning Mathematics. Teachers should always be aware to bring awareness to the students. Students must make understanding to insight transformation learning as powerful aspects aims to expand conscious awareness of our context in the world and our understanding of who we are and what we will be as both individuals and social beings.

Empirical Literature Review

Empirical means experience or data derived from observation or experiment. Empirical research is the study and review of the previous research done under same research design. Empirical literature reviews deal with original research or let's just say previous research such as scientific experiments, surveys and research studies. It includes the findings, main ideas and the conclusions. This review presents the review of some different research projects and dissertation studies under the contextualization of school Mathematics.

In the article, "Perimeter and Area in Our Daily Work" Pokhrel (2007) has shown different aspects of contextual examples of area and perimeter. He has stressed that, We can introduce the roof top, a wall, door, window, ventilators, etc. to engage our children so that they become able to construct the meaning of various mathematical relations. He also argued teaching perimeter and area can be done from the locally available materials such as door, window, roof, floor, wall, etc. The concept of area and perimeter can be given not telling them formal definition but by giving them different activities and let them formalize themselves. This indicates that we can simply use different context and the materials to develop the mathematical learning which provides better concept and hands on experience and develop the feeling of their math.

Shrestha (2011) had conducted research on, "My Journey of Learning and Teaching: A Transformation from Culturally Decontextualized to Contextualized Mathematics Education". In this research, the researcher has tried to address and bring positive transformation on Mathematics as a foreign subject; Mathematics is a body of pure knowledge (Luitel 2009 as cited by Shrestha); fear of Mathematics; distraction from

Mathematics and drop-out from Mathematics learning by introducing the contextualized artifacts and the acts we do in our real-life to decontextualize Mathematics learning.

Going through the article “The Shanai, the pseudosphere and other imaginings: envisioning culturally contextualized Mathematics education” by Luitel and Taylor (2007), we can find that the above article is trying to address the ethnographic part of Mathematics in Nepali society (critical cultural perspective) as Nepal is a country rich in cultural and linguistic diversity, along with this it also advocates the failure to incorporate salient features of Nepali culture related to Mathematics which has been deconstructed by the naivety of the conventional western Mathematics.

In the research work of Yee and Bostic (2014) which investigates how the students contextualize mathematical problem solving but not the actual problems and it talks on When students attempt to solve problems; what contexts (situational, cultural, or conceptual) do they evoke to describe their experiences with problem solving? This research results mostly on middle-school students stuck primarily with symbolic representations, which demonstrated misunderstandings of situational context and perception of Mathematics as abstract due to its highly symbolic nature. These may be encouraging the middle school students to abstract Mathematics problems prematurely.

Research Gap

The research studies done above were done to explore the context for the culture. From the above empirical review, I could conclude that it is based on the cultural artifacts and directly related to the contextualization of decontextualized curriculum and practices. My research work is not exactly the culturally based Mathematics contextualization, rather it is the situation and practice based contextualize where the context will change on

the need basis as well as time, place and person. Context problems “are used both to constitute and to apply mathematical concepts” (Van den Heuvel-Panhuizen, 2001). This research work will also advocate the students’ performance due to contextual Mathematics teaching practices. Although many researchers have been done on this topic, I am hopeful that my research will demonstrate the different lens for contextual Mathematics teaching practices.

Chapter Summary

This chapter highlights the supporting literature for this research work. Working on the themes, theories and the common understanding and practices on the construction and transformation of knowledge; this chapter stresses on the contextual teaching and learning of school Mathematics. The researcher has explained how contextual teaching learning of Mathematics is helping students to construct the knowledge as well as transfer the knowledge from textbook based activity to context-based activities through observations and hands on experiences.

CHAPTER III

RESEARCH METHODOLOGY

This chapter portrays how researchers are going to carry out their research work in the research area and helps to build a framework of the research. The researcher will explain the data collection process and also the population from where the data is collected. According to Cohen et al. (2016), research methodology is simply moving beyond a technical exercise which recognizes the research as concerned with the understanding of the world. This chapter explains the epistemology, ontology and axiology related to the study as well as the methods applied for the study and ethical considerations. It also includes the detailed process to be taken in action for the research with planning for the research work with paradigmatic and ethical consideration. This chapter describes methodology, research design, nature and sources of data collection, selection of the study area, population and data collection and data analysis procedures.

Research Paradigm

In my research study, I am trying to introduce contextualized teaching-learning practices of school Mathematics, where the research questions are about how contextual teaching learning boosts the mathematical competencies of the students. I think I have to go through an interpretive paradigm, as my objective is to find out different viewpoints of teachers and address the agenda for change. Interpretive paradigm is more related with the subjective experiences of the research participant to understand the world which is very much essential to explore and make meaning to advocate the contextual teaching

practices. Interpretive paradigm enables researchers to build rich local understandings of the life-world experiences of teachers and students and of the cultures of classrooms, schools and the communities they serve (Taylor & Medina, 2011). I have tried to understand and interpret the practices and experiences of contextual mathematics as an interpretive researcher.

Philosophical Consideration

In this section of philosophical consideration, I have described about ontological, epistemological, and axiological considerations concerning contextual teaching learning practices of Mathematics.

Ontology

Ontology means the theory of reality. Reality is interpreted, negotiated and based on an abductive logic using both deductive and inductive form of reasoning (Creswell, 2009). As per the individual, different individual will have different perspective about the ontological reality through which their lives are guided. Ontology deals with the nature of reality whether it is objective or subjective, single or multiple. Moreover, this is the study on reality which includes questions like what, why and how. The participants have different experiences, practices and approach for contextual mathematics teaching practices. They have different beliefs and the realities as obtained from their narration of experiences of contextual mathematics teaching practices. Contextualization may differ from time to time, place to place and person to person as it is different participant's experience and applications, thus, my ontological assumption will be subjective and multiple.

Epistemology

Epistemology is all about the nature of knowledge. It has a concern about nature, forms of knowledge, and how it can be received and expressed with others. According to Cohen et al. (2016), epistemological forms “concern the very bases of knowledge- its nature and forms, how it can be acquired, and how communicated to other human beings” (p. 7). The participants have constructed subjective knowledge through interaction with different people and through their long period of lived experiences.

So, as an interpretive researcher, I provided fair importance for constructing this subjective knowledge that Mathematics has to be linked with the real-life of the learner. I conversed with the participants where participants’ narrations are the source of knowledge which is collected by the participants’ subjective narration. This research is about dealing with context and the materials where the participants are engaged as a critical observant and the reality of knowledge is dependent on the meaning and the sense created by the individual.

Axiology

Axiology is all about the value or let’s says science of human value and value judgments. Axiology refers to the researcher’s beliefs regarding the role of values, ethics and power in generating knowledge (Auricombe & Holtzhausen, 2014). The value can be different for each individual and I personally value the experience and thought of each participant. In this study I have valued the practices and ideas based on their experiences on contextualization because it differs from place, time and person and also making values of that person who will be directly and indirectly involved in the contextualization of the mathematics teaching practices.

I have conducted this research study from above ontological, epistemological and axiological stances to explore the experiences and stories regarding contextual mathematics teaching practices.

Research Method

Narrative inquiry research aims to explore and conceptualize human experience as it is represented in textual form. Aiming for an in-depth exploration of the meanings people assign to their experiences, narrative researchers work with small samples of participants to obtain rich and free-ranging discourse (Salkind, 2010). In this research method, researcher conduct interviews with the research participants regarding their experiences and stories collected as field notes and audio videos which are later transcribed and narrated. The study of narrative is the study of the systematizing, defending and recommending humans experience the world. This general concept is refined into the view that education and educational research is the construction and reconstruction of personal and social stories; learners, teachers and researchers are storytellers and characters in their own and other's stories (Connelly & Clandinin, 1990).

Narrative inquiry research as a mode of inquiry is used by researchers from various disciplines, which include anthropology, communication studies, cultural studies, economics, education, history, linguistics, medicine, nursing, psychology, social work and sociology. Chambers (2003, p.214) writes, "different perspectives further open up possibilities for engaging in the process of reflections in that they offer specific and sometimes comparable or contrasting points of view". There may the possibilities of different explanations and explorations of the situations. A goal of narrative inquiry is for participants are to learn and possibly change their thinking as a result of this learning

(Clandinin & Connelly, 2000). One of the learning form this narrative inquiry is strengthening my beliefs on contextual teaching practices.

“Narrative inquiry is understood as a spoken or written text giving an account of an event, action or series of events/actions, chronologically connected” (Czarniawska, 2004, p. 17). In my research, I will be narrating the stories of teachers who had applied context and real-life examples during the teaching learning process. It helps me find out in depth understanding of the participants regarding contextual teaching learning process of teaching school Mathematics.

Participants of the Study

Teachers are the person who drives the teaching-learning process, and they play a vital role in the contextualization of teaching-learning process of school Mathematics. Teachers are the participants of this study. Interaction and in-depth interviews with research participants and transcribing their experiences will be done as the research work. During the interviews I will be focusing on studying the individual participants, collecting data from the stories and the experiences they narrated and making meaning from them. In my narrative inquiry, I am dependent on the research participants for the information of research study which will be collected and generated from the stories and the experiences shared by them. I have purposively chosen the participants to explore the experiences of the contextual teaching learning practices.

I have made some criteria for the selection of the research participants. The participants must meet 3 different criteria (a) taught Mathematics in school level (b) had at least 5 years of teaching experience (c) had followed contextual teaching-learning practices. In search of the participants, I communicated with some of the Mathematics

teachers from Kathmandu and Lalitpur districts. I could find many teachers who are Mathematics teacher and experienced, but it was not easy task to find Mathematics who have practiced the contextual teaching in classroom. Finally, I was able to select two participants who could meet all the criteria. I decided to go with them and make meaning from their experiences and the stories.

Both the teachers have been experienced teachers teaching Mathematics for more than 25 years, where one of the participants is from Kathmandu district and one is from Lalitpur district. I used pseudonym names for the participants maintaining their privacy. Arun is a retired headmaster who taught Mathematics for more than 34 years in a government school from primary to secondary level in Kathmandu District. Nirvigna is another passionate Mathematics teacher from Lalitpur district with almost 30 years of teaching experience in an institutional school.

Data Collection Tools

To address my research study, the interview questions are developed that can address the purpose of interaction which will be recorded in field notes or some audios and videos. Since the method of research study is qualitative and methodology is narrative inquiry, I will conduct interview in a conversational way so that participants would be encouraged to share their stories easily. As a narrative inquirer, I would be involved in transcribing and interpreting the participants lived experiences and practices.

According to Connelly and Clandinin (1990), interviews are conducted between researcher and participant, transcripts are made, the meetings are made available for further discussion, and they become part of the ongoing narrative record. Critical analysis will be emphasized as it covers the area for meaning making of the experienced and the

stories narrated by the participants as it will be difficult to carry out in all the areas. Different literatures and articles will be studied to support the research.

Data Collection Procedure

Raw data will be gathered first from different research participants in different form which will be further analyzed in the perspective of critical paradigm; transcription and interpretation of different data files will be done to get the general sense of information. Rogan and Dorothea (2005) unpacked the narrative inquiry processes in conversational interviewing, from choosing the narrators to determining the interview style to selecting the methods of analysis. Description of people and themes has to be conducted and representation of data with argumentation and addressing different situation such as socio-cultural, gender and empowering the mathematics class and curriculum with context and making the participants aware about it.

During interviews, I used open ended questions. Interview questions were generated on the basis research questions purposing to help the participants to share their stories, experiences and ideas in relation to contextual Mathematics teaching practices it's effect.

Data Analysis and Interpretation

Creswell (2012) has stated that the different steps of research for the data analysis. At first for data analysis, data are organized and made ready, and transcribing of data will be carried out of different filed notes, audios and videos providing the general sense of information and reflecting on overall theme and ideas. And with different theoretical approaches and method categorization of data with different code, will be done.

At first, I organized and prepared the data and transcribed the audio recording into textual form. I continuously checked the audio so that I will not miss the facts and the important information because of which I could transcribe the audio very well. Next, I transformed the large textual data into related themes and further used them to develop the narratives of the research participants. Then, through the written transcripts, I organized them in sequential order as per the individual experiences.

I concluded with the meaning making and interpretation beginning from taking interview, transcribing the audios, thematizing and constructing the narratives.

Quality Standards

A research work must maintain its quality standard and since my research work is based in interpretive paradigm, I tried to ensure the quality by maintaining its trustworthiness and the authenticity. The quality standards that regulate interpretive knowledge construction are varied, but arguably the most well-known and coherent are those of Guba and Lincoln (1989) who developed standards of trustworthiness and authenticity that are distinctly different but ‘parallel to’ the validity, reliability, and objectivity standards of positivism.

Trustworthiness

I have addressed the criteria for trustworthiness by the credibility, transferability and dependability to describe my research findings process, how the data were collected and transformed into textual data. The trustworthiness criteria include: credibility (did the researcher undertake prolonged immersion in the field, check his/her interpretations with his/her informants and display a process of learning?), dependability (did the researcher engage in open-ended or emergent inquiry?), transferability (is there sufficient rich

description for the reader to compare his/her own social context with the social setting of the research?) (Taylor & Medina, 2011).

Credibility concept is all about believability of statements, as the research study is going to different person of different purpose, establishing the confidence in the truth will be in major priority. I have to get some critical responses and feedback. I have to assure the credibility of my research study by making them clear about the research study too. I had my research participants review the transcript of interviews and had regular informal conversation regarding the interview with the research participants.

Dependability is about conducting subjective, open-ended or emergent inquiry where researcher can depend. The research work must be dependable, it must gain trust from the people. It's all about the consistency and reliability. Similar type of interpretation is necessary for it so that contextualization can be advocated in broader sense and broader area. Dependability involves participants' evaluation of the findings, interpretation and recommendations of the study such that all are supported by the data as received from the participants of the study (Lincoln & Guba, 1985, as cited in Moser & Korstjens, 2018). In this research study findings and the interpretation is supported by the experiences and story of the participants and depends on their sharing.

Transferability is the ability to be transferred as the external validity exists. As I have said that the contextualization differs from place, person and situation, it should be transferable so that it will be valid in different situation and context too. And in my research work, I have collected authentic data and document. Two different narrations are involved of the participants which is aimed to make transference regarding the experience and the practices of teachers on contextual Mathematics teaching.

Authenticity

According to Taylor and Medina (2011), the authenticity criteria focus on the ethics of the relationship established by the researcher with his/her participants and include fairness (are the informants represented fairly), educative (did the participants benefit by learning about their social world?), catalytic (did the participants benefit by identifying problems associated with their social world?) and tactical (did the research empower the participants to improve their social situation?). The research work must have its authenticity as the criteria focuses on the fairness, educative, catalytic and tactical when the researcher establishes a relationship with the research respondents. During the research study, I carefully conversed with them regarding the real data for my research work. They reflected on their own practices of contextual Mathematics teaching with different wow moments and the challenges they faced and challenges existing in present scenario. The research participants shared their experiences and beliefs which are valued and respected in my research work.

Ethical Considerations

Ethics is a moral principal of right and wrong and it is not absolute, it may vary from person to person, time to time and place to place. The ethical conduct of researchers has received increasing attention because of the mistreatment of human research subjects in experimental projects (Bums & Grove, 1987). I conducted my research on well experienced Mathematics teachers of Kathmandu valley who have established their own goodwill within the students as well as Mathematics fraternity. I called them via mobile phone and explained them about my research work and requested to them to be my research participant because they met the criteria for the right participants who can

contribute in my study to find real findings. Both the participants agreed to be my research participant when I requested them with explanation of my research work.

It supports the research to be more systematic and also defends and recommends concepts of right and wrong conduct. Many scientists identify the following scientific ethics principles: honesty, objectivity, morality, prudence, openness and respect for intellectual property, confidentiality, responsible publication, responsible management, respect for colleagues, social responsibility, anti-discrimination, competence, legitimacy, and security of people involved in the research (Andriukaitienė, 2015). Norms promote the aims of research, such as knowledge, truth, and avoidance of error. For example, prohibitions against fabricating, falsifying, or misrepresenting research data promote the truth and minimize error). Since research often involves a great deal of cooperation and coordination among many different respondents of different background; and ethical standard promotes the values that are essential for collaboration like trust, accountability and mutual respect, displaying cooperation, mutual respect and being accountable in my research work will be carried out with sincere responsibility Resnik (2020). Voluntary participation, informing the consent such as purpose of the study, scope of research in coming future, confidentiality of responses and contact information of the researcher too, has to be made clear. Chauhan (2016), "Many of the norms of research promote a variety of other important moral and social values, such as social responsibility, human rights, and animal welfare, compliance with the law, and health and safety. When I requested to be a research participant, I also got their verbal consent expressing my respect to them and their experience and understandings which are their asset. I also clarified them regarding the purpose of my research. I explained ethical issues to the participants which

needs real information's for the authentic result during the first call. So, I also convinced the participants that all the information will be destroyed after the research. I requested them with courtesy rather than compelling to be part of my research and also allowed them to quit the involvement in my research any time if they uneasy by making them feel free as they will be helping me in a volunteer basis, free of cost. I took permission from the participants to record the audio of our interview for the proof.

Chapter Summary

In this chapter, I have expressed the methodology of my research work and committed to maintain the privacy of the respondents. I have explained that my research methodology is a narrative inquiry with research respondents' site. I also tried to explain the epistemology, ontology and axiology of the research method maintaining the quality standards. I have expressed my trustworthiness via credibility, transferability, dependability, confirmability, and authenticity. I have mentioned regarding the ethical considerations and the consent I have taken from the participants.

CHAPTER IV

CONTEXTUALIZATION OF MATHEMATICS TEACHING-LEARNING PRACTICES

In this chapter, I have discussed the educational background, professional background, their motivation for being a teacher and transforming them from mechanical (based on problem-solving and paper pen test) to contextualized teaching practices of Arun and Nirvigna. They shared their process of being just a teacher to a teacher who practices contextual teaching and contextual development of students. I tried to analyze their experience of involving in contextual teaching practices. During the collection of their narratives, I have developed different themes relating theory of constructivist theory and transformation learning theory and discussed on how they have perceived contextual teaching practices of Mathematics based on the following two subsidiary research questions:

- How does contextual teaching help Mathematics teachers connect mathematical concepts in the classroom?
- How does the contextual teaching help Mathematics improve students' performance in Mathematics?

Arun's Narration on his Practices on Contextual Teaching Practices in Mathematics Approach to the Research Participant

As I was getting ready for the interview based on my research question, I thought to find the teachers who have practiced or have been practicing the contextual teaching

practices on Mathematics. It was difficult for me to find the teachers who practice contextual Mathematics because many of them are unaware about it, and many do not want to go through the practices as it requires a good amount of effort and time. Most of the teachers are focused on course completion and raising students' marks in summative assessment where they are asked or compelled to make more practice work so that the students can do questions asked in the exams. I approached many teachers from Lalitpur and Kathmandu district who could meet my research criteria of contextual teaching practices. To make confirmations on their contextual teaching practices I had informal talk on what is contextual Mathematics teaching and what are the ways of introducing contextual mathematics in a class as well as discussed on the challenges on contextual mathematics. Finally, I approached Arun as my research participant as he fulfills my research criteria. I called him on 18th June 2021 and explained my research. I asked for his permission to be my research participant. I explained about the ethics of this research and took consent for the interview and audio recordings. He was ready and happy to share his experiences. He was excited to have the conversation. So, I had asked him to provide his time on 20th June 2021. He said, *“Okay, I am ready for it and wish you all the best. Please remind me a few hours before, so that I will be ready and make my time available.”*

I also informed him that it is not possible to meet physically due to the Covid-19 pandemic and the lockdown. So, we finalized the schedule of the interview on 18th June 2021 via Zoom Meeting.

Arun is a retired secondary Mathematics teacher in one of the public schools located in Ganabahal, Kathmandu district who has good experience of attending national

and international trainings as well as working as a teacher trainer. He lives nearby Paropakar Nawajwan Kendra, Kathmandu. He had also worked as a textbook writer in Curriculum Development Center (CDC), Bhaktapur. He passed his school level education in 2031 B.S. from the same school he taught before getting retiring as a Headmaster. After passing the School Leaving Certificate (SLC) examination, he joined Mahendra Ratna Campus, Tahachal taking Mathematics as a major subject. He completed his bachelors' level and master's level from Tribhuvan University (TU). He started his teaching career in 2034 B.S. and got retired in 2072 B.S.

I selected him as one of the participants for this study because I found him the right participant who could help me go deeper in my research by sharing his variety of experiences. Firstly, he is a community schoolteacher having experience in different teaching practices in Mathematics. Secondly, he is an experienced teacher trainer in Mathematics, helping Mathematics teacher develop conceptual understanding of students and the usefulness of Mathematics in daily life. Thirdly, I wanted to explore his experience in contextual teaching practices while teaching Mathematics in school. Moreover, he participated in high-level interaction program organized by the Council of Mathematics Education, Nepal and the Department of Mathematics, Tribhuvan University. He had worked in the pilot project conducted by the MEC which aimed to prepare teachers' manual to guide for contextual Mathematics practices. I wanted to explore his experiences in contextual Mathematics practices.

On 18th June 2021, I was excited and a little nervous too as this was my first interview for my research. To boost up my confidence, I went through the interview questions again. After thoroughly going through the interview questions thoroughly, I

called him at quarter to 11 and asked him to be ready by 11:00 a.m. I asked him to be ready with Zoom application for the meeting. He was struggling with the application initially, so we had talked in phone so that I could provide him instructions to set up for the meeting.

Contextual Mathematics Teaching Practices for Development of Conceptual Knowledge

Arun began his teaching career as a primary teacher in 2034 B.S. from Adasrha Madhyamik Vidhyalaya, Ganabahal Kathmandu. This was the same school where he completed his school education in 2031 B.S. When he passed his SLC, he was in a dilemma which subject and faculty to choose for higher studies. He had appeared the entrance exam conducted by Thapathali Engineering Campus where he was able to publish his name in the list in the Department of automobiles. He was completely unknown about it, as he was only aware of the faculties like science, commerce, arts and education in that time. The result of the entrance exam was published almost after a long duration of 6 months. Instead of waiting for the entrance exam results that he had appeared, he decided to join Mahendra Ratna Campus, Tahachal, in education faculty taking Mathematics as the major subject.

From the beginning of his teaching career, he always wanted his students to understand of the chapter and the problems rather than simply focusing on the solutions and the marks they will secure in exams.

During his school days, Mathematics was more focused with computations. As he reached to bachelors' level and joined the central campus, Kirtipur, his teachers always focused on the concepts and applied approach of learning Mathematics; they would focus

on why and how. He said, “I was delighted to learn the concept of equations using beam balance in the Mathematics Lab of the campus”. He never thought that the beam balance which a shopkeeper uses to sell the goods and does addition or subtraction of goods or weights could be a good way to develop the concepts of adding and subtracting the variable or constants to teach the equations. He added, “I realized that, the real-life situations are so realistic and practical to teach Mathematics and develop the conceptual knowledge of students”.

He always tried to relate the concepts and the content of the chapter with the concrete materials as well as the real-life daily activities. He would carry the brochure of the banks to discuss the simple interest, rate of interest and also comparing the rate of interest and the interest between the banks. He said, “I was amazed that they could draw good concept of what is rate of interest provided by the bank and how interest is calculated. Students were also able to understand the application of the interest, choose the bank for better interest”. He stressed, “Every student in the class should gain the concepts of the topic and be able to solve the questions when I entered the class as a Mathematic



Fig.2. Construction of a wall

teacher”. Even in the case of Algebra, he introduced the 2D and 3D model to give the concept of the algebraic formula like $(a + b)^2$, $(a - b)^2$, $(a + b)^3$ and $(a - b)^3$ instead of making them to rote down the formula. He followed the same model making process for the factorization of different two and three-degree expressions.

He said that, “I do not limit my students within the four walls of the classroom and take them out to explore mathematics in real life events and activities whenever possible”’. Once, he made it possible for students to visit a nearby building construction area and relate it to concept of volume of wall and the numbers of bricks required to build the wall. He also took his students to a man who would sell ice cream bar. The seller would have big cuboids of ice cream bar and would divide into small size ice cream bar, that helped students to gain the concept of $V = v \times n$, where V is the volume of big bar, v is volume of small bar and n is the number of small bars. In case of walls, the volume of walls and the volume of bricks to find the number of bricks required to build the wall, i.e. $V = v \times n$, where V is the volume of wall, v is the volume of brick and n is the number of brick.

As per his narratives, I generated the theme contextual Mathematics teaching practices helps in the development of conceptual knowledge which is very important. It is one of the themes in order to advocate my research questions. After listening to his narratives, it is clear that there are many real-life events where Mathematics is embedded knowingly or unknowingly. We are doing different activities which are related to Mathematics. To do such activities, most of us do not rely on the formula or the problem-solving procedures that we learn in our formal education. Learning begins with examples of cases and towards a concept (Masykur, 2009). Arun introduced real life examples, situations and cases of Mathematics which helped students to relate with its concept and usefulness which make students feel that deeper understanding and generation of key ideas are inherited to people with series of real-life practices and sense-making. Arun has stressed that context ignites the idea which they have observed or experienced which is

very much helpful for the development of concept. The mathematical connection ability will make it easier for students to understand certain concepts because with the ability of connection can look for relevance or relationship concept that is being studied with the concept ever studied (Selvianiresa1, 2017). As the students see the connection of the Mathematics in real life, they will analyze the relevance and the interconnection of the idea they have studies. The narrative of my research participant is based on the development of conceptual knowledge in Mathematics as a result of contextual Mathematics teaching practices.

As Arun got groomed in his higher studies by his teacher with different practical approach of teaching-learning Mathematics and the workshops he attended, he realized that if we can explore or connect Mathematics with real-life situations, examples or materials, it helps to develop a deeper understanding of Mathematics and trigger the conceptual knowledge. His main focus of teaching Mathematics was to relate Mathematics with the contents and the concepts of the chapter with real-life events or materials, deduct ideas from real-life situation and applications of the learned content with daily life activities. Contextualized instruction focuses on the development of an academic concept within a real-life activity or natural routine, as opposed to placing the emphasis on completing a task and teaching the associated academic skills to accomplish the goal in the traditional functional academic model (Saunders et al., 2017). Contextualization will make connections with events and focuses on developing concepts which is not merely stuck with solving the problems of the textbooks. When contexts are introduced it provides students are more focused to know it and find the solutions.

As a teacher, when I began my teaching career, my focus was to make students get the solutions to problems from the textbooks or the practice books. I never thought of linking Mathematics concepts or contents with real-life. I have groomed as a problem solver, and I always want to transfer the same to my students. However, when I reflect myself as a beginner and an experienced teacher after a decade of my teaching career in school Mathematics, I find myself getting engaged to relate the contents with real-life activities. The more I explore connections of Mathematics with real life to my students, I feel satisfied as they are able to develop better conceptual understanding. As my research participants narrated, *“Contextualized Mathematics teaching practices is the key for the development of conceptual knowledge in my students”*.

Contextual Mathematics Teaching Practices or Development of Engagement and Participation of Students

From the beginning of Arun’s teaching career, he always focused that every student must be able to learn mathematical concepts and procedural knowledge of problem-solving. For this, he believed that until and unless each and every student get themselves involved, learning is not possible. As he narrated, during his bachelor's degree, he was excited to learn Mathematics. Learning became fascinating when his teachers introduced Mathematics through practical approach and by displayed different real-life tools and materials like beam balance for teaching equations. He said “My enthusiasm level rose when I got connected with materials and events”. He also did the same with the students and found that his students had changed the attitude towards the mathematics as they started taking initiation in the discussion carried out in the classroom as well as actively participated and get involved in activities like experiment

and observation. The way he experienced students' enthusiasms, he made himself involved in the learning activities and always focused on similar activities in the classroom with the students.

He stated that one of his teachers, once during the workshop introduced different instruction. The participants were asked to measure the length and breadth of the mathematics book they were using and multiply them as a product of inch \times inch to formulate the formula of area and further related to the perimeter. Similarly, in the next instruction, all the participants were asked to write x on a sheet of paper and keep some pebbles as their wish. Since the number of pebbles differs from each other, there was no fixed value of x . Then, his teacher related the activity with the concept of constant and variable. Arun added that these activities involved all the participants as this was not limited to chalk and talk. Every participant was involved and engaged. This also helped to develop the meaning making in Mathematics.

Arun said, "Once I was going through the first aid box of his school, I found an empty bottle of medicine and got stuck with the composition of medicine which was expressed in the form of percentage. I took that empty bottle to the class, described the composition of medicine and oriented on the components required for making medicine. Then I asked students to find the number of different components so that the compositions were collected in the same amount and the medicine could be made". He added, after his instruction, every student of his class was attracted as well as excited to find the number of different components of the composition in ml and found that most of them were able to find it and those who could not were interacting with their elbow partner for the process of finding the answer.

He said that contextual Mathematics teaching practice has a greater impact on learning, as involvement increases, and students initiate for the activity and interaction. He stated, "In my experience, I found the students who were taught as per the contextual Mathematics practices and the students who were not taught in these practices had a gap in excitement as well as the understanding of Mathematics concepts".

From the above narration, I can relate that students get attracted and excited to know and learn Mathematics due to the introduction of real-life examples and materials, Arun was very much aware about the involvement and participation of the students. He eternalized more when he was a university student and while he attended different workshops and trainings. According to Heckman and Weissglass (1994) traditional teaching strategies in mathematics often perpetuate the gap between learning and not learning by failing to stimulate interest and engage students in purposeful activities. As per his convenience, he was ready to introduce real-life context and materials which ignites the learning attitudes and involve them in learning activities because he was aware that if all the students do not get involved the graph of learning will not rise and we cannot encourage and motivate students to learn Mathematics. Arun said that the students were happier to learn Mathematics incorporated with games as well as motivated learning with materials rather than learning through only books, copies and pen; and the performance is overwhelming even in exams. Mathematics becomes difficult if the teacher introduces non-attractive topics or methods, but as we introduce the context, the topic becomes attractive, and this is all about the connection of topic of real-life due to which involvement and participation of the students increases. Studies indicated that student lacks sense in the community and at work, does not reflect their knowledge in the

real world, and offers little room for the discussion (Artis, 2008; Berns & Erickson, 2001). Moreover, studies indicated that traditional way of teaching mathematics usually involve little active learning and causes students to become unmotivated and disengaged. To address this problem, teachers need to make a paradigm shift of teaching pedagogies so that their students get involved in teaching-learning process (Reyes et al., 2019). In traditional approach, teaching learning process was limited within the textbooks and talks and chalk method which do not encourage students to learn mathematics. So, there is necessity to change the approach and contextual teaching practices in Mathematics helps students to get involved in learning process. This will not only enhance their involvement, also change their performance in classroom of taking initiations, getting them involved in the discussion and the task like experiment and observations.

At the beginning of my teaching career, I was not aware of contextual examples. I usually asked them to practice as much as they could. I focused on the involvement of students in practice work and revision work, I never thought of making students get involved in real-life examples or materials and never made them involve in those activities. I had a strong belief that the students' practice work is directly proportional to the learning. The adequate amount of practice work will make them familiar with the problems of books and able to solve the problems. As they will be able to solve the problems, they will get excited to do more problems and involve in Mathematics learning. It was the same in my case during my school education. But in the later period of my teaching career, I came in contact with the people who were working with the context for connection of Mathematics with real-life. Tomlinson et al. (2003) suggested to the teachers to conduct contextualized instructions that will address students'

readiness, interest and learning in a wide range of classrooms. I slowly started introducing the context and the materials during the teaching and was fascinated by the overwhelming responses with the active participation of students to learn Mathematics and found them involving in exploring the uses of Mathematics, engagement in experiment and observations.

Contextual Mathematics Teaching Practices for the Development of Different Skills

Arun assigned different projects and real-life problems, such as, he asked his students to make a lidless cube with the help of graph paper of dimension $10\text{cm} \times 10\text{cm} \times 10\text{cm}$ in grade 8 and used them to develop the ideas that 1000cm^3 is one litre by pouring sand in the box to make it full and later transformed it to one litre vessel which is the jar to measure 1 litre kerosene that he brought from a nearby shop. He said that it helped them to develop the concept of 1 litre and amount contained in one litre. This also helped students learn the skill of making sense on the relation between the 1000cm^3 and the litre as well as the volume of solids and the liquid.

He had also assigned students to visit nearby finance companies and find different interest rates and calculate the problems related to it. He also made it possible to visit a nearby building construction area and relate it to numbers of bricks required to build the wall. He took his students to a man who sold ice cream bar. The seller would have a big cuboid of ice cream bar and would divide into small size ice cream bar, that helped students to gain the concept of $V = v \times n$, where V is volume of big bar, v is volume of small bar and n is the number of small bar. He asked the students to explore the perimeter, area and volume of the windows and the doors of the school building. He said, "Here, my students worked in groups which built up the sense of teamwork and skill of

collaboration also the communication skill when they visited the finance office and the construction area". He excitedly narrated, "My students were able to analyze the number of bricks to build the wall and the space occupied by the cement due to which the volume of the wall and the total volume of bricks differed". He said that the role play of the shopkeeper also helped the students to know about the profit and loss, as well as discount and VAT (Value-Added Tax). For the unitary method, he asked students to buy a copy of different numbers and compare the price and develop the concept of direct variations. It helped students to make comparisons and skills to explore what they have learned.

Arun emphasized that contextual Mathematics has been meaningful Mathematics because due to this, students were being able to solve different household chores. For example, if the window glass is broken, it has to be replaced. Now, students have been able to do correct measurement and buy window glass of right dimension. He added that due to contextual teaching, the students became clear on different mathematical procedures of problem-solving such as dividing 210 by 2 where students simply missed the zero in quotient which does not happen if we asked to solve contextually. If we asked them to divide 210, there is high chance that the quotient is 15 as 2 divides 2 one time and 2 divides 10 five times but if we ask them to divide Rs. 210 they will simply divide into 105 each.

He stressed that due to contextual mathematical teaching practices, students were transformed from problem solvers of textbook exercises to real-life problem solvers. He explained that students had improved in Mathematics as they have been creative and initiative to solve real-life problems.

As per the narration of different examples, Arun was not merely focused on developing mathematical problem-solving skills of students with the introduction of context, he helped students to be an analyst who analyze the dimension of the window span as well as making sense while deducting and inducting mathematical relations. He advised that we should not stick within the walls of the classroom; we can get many contexts on the way from school to home, home to market and in our surrounding. So, we have to think constructively to find the context. Stone et al. (2006) hypothesized, “The creation of explicit connections between situations is critical if students are to transfer their knowledge and skills outside the classroom, whether it is to another context or to an abstract testing situation” (p. 11). Contextualization is the internalization and the transformation of skills through the connections of situations and real-life events.

A study of contextualization in credit-bearing vocational courses in community colleges in one state found very few examples, and those found were almost exclusively in math (Wisely, 2009). Arun realized that different people have different profession, they are doing various tasks and by different means they are related to Mathematics. So, when we walk from home to school and market, if we observe properly, we can get different context where we can ask students to explore and connect Mathematics and learn the skills of different people.

As a person or teacher before I came to encounter the contextualized Mathematics teaching practice, I never realized tailors use different geometry for making a dress; I was surprised why the level pipe is used by the mason. Now, after a decade of teaching experience I find myself relating and connecting Mathematics with real-life examples and

the skills people have acquired due to Mathematics. For me, every human activity is Mathematics or connected to Mathematics.

Summary

Arun defined Contextual Mathematics teaching practices as practical approach of learning where students are connected with real-life examples, materials and games. According to him, relating the contents and concept of the chapter with the concrete materials as well as the real-life daily activities is a part of contextual Mathematics teaching practices. The contextualization of basic skills in disciplinary content is used in elementary, secondary, and postsecondary education as a way to engage students, deepen content learning, and promote transfer of skill (Perin, 2011, p. 34). He stressed that context in Mathematics helps students solve mathematical problems by facilitating their learning, providing an avenue to try different ways of solving the problem, developing good problem-solving skills, and allowing them to figure out the mathematical solution steps.

According to his knowledge and experience, whenever the context or the materials are introduced during Mathematics teaching practices, the participation and the interest of learning Mathematics of the students had raised. He stressed that contextual Mathematics teaching practices provided the hands-on experience which helps students to eternalize the concepts as well as develop different skills. The level of performance of the students to take initiations in sharing and discussion, participating in exploring the uses of Mathematics as well experiment and observations had significance changes.

He believed that contextual Mathematics teaching practices transform the students from problem solver of book to a real-life problem solver. Students develop the skills like

collaboration, teamwork, creativity and critical thinking. He says that contextual Mathematics teaching practice has a greater impact on learning the concepts of Mathematics in students. He stated that in his experience the students who were taught as per the contextual Mathematics practices and the students who were not taught in these practices had a gap in excitement as well as the understanding of Mathematics concepts.

Nirvigna's Narration on his Practices on Contextual Teaching Practices in Mathematics

Approach to the Research Participants

In the process of getting ready for the interview with my interview questions, I was in search of teachers who have practiced or have been practicing the contextual teaching practices in Mathematics. It was not an easy task for me to find teachers who had a clear idea about contextual teaching practices in Mathematics and good experience on contextual Mathematics teaching practices because many of them are unaware about it and many do not want to go through this practice as it requires a good amount of effort and time. Most of the teachers from Nepal even from the cities like Kathmandu and Lalitpur are focused on course completion and raising students' marks in summative assessment procedure as they're asked or compelled to make as many as practice work so that students can do questions asked in the exams. I approached many teachers from Lalitpur and Kathmandu district who could meet my research criteria. Finally, I approached Nirvigna as my research participant as he could be kept within my research criteria. I called him on 18th June 2021 and explained my research work and asked for his permission to be my research participant. I narrated him about the ethics of this research and took consent for the interview and audio recordings as well. He showed readiness

and was interested to share his experiences and was excited to have a conversation. So, I had asked him to provide his time on 20th June 2021 in the evening. He said, *“Alright I am ready for it and wish you all the best. Please give me a call as a reminder a few hours before so I will be ready and make my time available.”*

I also informed him that it is difficult to meet physically due to the Covid-19 pandemic and the lockdown. So, we finalized the schedule of the interview on 18th June 2021 virtually.

Nirvigna is a secondary Mathematics teacher in one of the secondary schools located in Lagankhel of Lalitpur district who has served as a secondary Mathematics teacher for about 25 years and for about 34 years as a primary teacher. During this period of time, he had participated in many trainings and workshops of Mathematics and among these; he also got a chance to take part in a training where only teachers of government schools were allowed which was held for the first time by TU. This was an in-service training which was conducted for 4 years and was organized in phases of two-two years. After completing the training, he was awarded with a one-year B. Ed degree. After that, he joined masters in Mathematics but after attending the first year's exam his health condition degraded and he dropped his study. Though he dropped his study he participated in many trainings conducted for 10 days and 15 days. However, after 16 years he again thought of doing masters degree and started his Masters in economics from TU, Kirtipur where some of his classmates were his students and in the meantime, he also continued his teaching career. He was fascinated and did quite well in different areas of Economics which were more related to Mathematics.

During his school education, he completed his school at Shree Ram Higher Secondary School. He was one of the brilliant students and had a keen interest in Mathematics and completed his graduation taking Mathematics as a major subject. He never thought of being a teacher. He tried for second lieutenant two times, one after completing an intermediate degree and another after a bachelor's degree but he could not make it as he was rejected both the times in board interview. After that, he thought of being a teacher because he was good in Mathematics and his major subject was also Mathematics. He was delighted to learn economics because he could find the uses in learned content of Mathematics like derivation and different theorem in economics.

I selected him as one of the participants for this research study because I found him as one of the right participants who could help me in my research by sharing his variety of experiences and practices in contextual teaching practices in Mathematics. Firstly, he is a teacher who had taught from primary level to secondary level in school having experience of different teaching practices in Mathematics. Secondly, he is experienced in different teacher trainings and workshops in Mathematics who had also participated in high-level interaction programs, working in developing conceptual understanding of students and the usefulness of Mathematics in daily life. Thirdly, I wanted to explore how he is been using his experience of contextual teaching practices while teaching Mathematics in school. Furthermore, he has participated in high-level interaction program organized by the MEC and the Department of Mathematics, TU and worked in the pilot projects conducted by MEC which was aimed to prepare teacher's guide for contextual Mathematics practices. I wanted to explore what was his experience in contextual Mathematics practices.

In the evening of 18th June 2021, I was excited, little nervous and confident enough for the interview of my research. To be well prepared, once again I went through the interview questions. After going through the interview questions thoroughly, I called him at quarter to 6 in the evening and asked him to be ready by 06:00 p.m. I asked him to be ready with Zoom application for the meeting. He was struggling with the application in the beginning as he was using lowercase letter instead of uppercase letter in passcode. So, we had talk in phone, and I provided him instructions to set up for the meeting.

Contextual Teaching Practices in Mathematics for Development of Conceptual Knowledge

Nirvigna started his teaching career as a primary teacher almost 34 years ago and has been working as a secondary school located in Lagankhel of Lalitpur district from last 25 years. During this span of time, he engaged himself with trainings and workshops related to Mathematics. He had participated in many trainings and workshops of Mathematics and among them, one was in service training which was conducted for 4 years which was organized in phases of two-two years. He was trying in a government job of second lieutenant before joining in teaching field. As he failed to make to that post in government service, he decided to be a Mathematics teacher as his favorite subject was Mathematics. The trainings and workshops that he attended helped make him a competent teacher and so he chose teaching as his profession.

From the early days of his teaching career, Nirvigna said, "I never wanted my students to limit themselves as a problem solver or communicator instead I wanted them to be a creative and critical thinker. I always tried to make Mathematics class interesting by connecting Mathematics with real-life and exploring its applications". Nirvigna was

not a happy teacher as most of mathematics teachers were only focusing with the unit and the problems mentioned in the exercise of the book. He gave an example of LCM as: LCM is only defined as Least Common Multiple not the depth meaning. So his main focus while teaching Mathematics was to develop conceptual knowledge of the students and exploring the context and application of Mathematics.

Nirvigna said that if we could connect Mathematics in different context of life and applied Mathematics in daily uses, then it becomes the contextual Mathematics teaching practices. He provided the example of Pythagoras theorem as it would divide lands which he had observed in the village used by his villagers, but teachers and students are simply focusing the theorem $a^2+b^2=c^2$ and doing exercise based problems. Similarly, he added that a contractor came and calculated all his expenses without using formula for plastering the four walls. But we were not using real-life problems and the concept of calculating it. He further said, "We must be able to calculate or solve the real-life problems instead of getting stuck with textbook problems like finding the cost of plastering the walls of room, carpeting the floor, cost of coloring the walls and ceilings which were very much contextual and helped us to understand the concepts of Mathematics and its applications". He said that students were well known about the formula but could not estimate the amount of water a vessel holds because they were not taught in that way due to which they were unaware of the mathematical concept in daily life. He stressed that if we connect Mathematics with real-life, we can involve the students in exploring the concept of the mathematics.

Once, he asked his students to share the idea on number of students that can be kept in a classroom. He also brainstormed on the standard number of students of that

room and what happened when it exceeded. These kinds of Mathematics could be addressed only by contextual teaching of Mathematics and could easily develop the concepts. These activities helped him provide clear ideas of area and volume. He was always against the rote learning, and he shared about it in many parents teachers meeting. He had experienced many arguments, as parents always would compare with the marks scored by the students whereas he always stressed on the knowledge and the understanding gained by the students.

While teaching the topic 'Transformations', he used the work of an excavator as a context for rotation where the whole body of that particular machine is point of rotation and transforming the different thing from one place to another represent the direction and angle of rotation. Similarly, the clothes examples as the context of reflection where the left hand of a t- shirt is same as the left hand, left pocket is also same as well as equidistance from the middle of the shirt which works as a line of reflection and also follows the lateral inversion. He said these contexts provided the proper concept of the transformation as well the idea about the elements of transformation such as center of rotation, angle of rotation , lateral inversion etc.



Fig.3.Reflection in shirt

While teaching the chapter 'Coordinates', he started with the position of the each student as each student was asked to share their position. Many students were related to their position with placement of bench and the position of the bench. He brainstormed on the position of the student as different students were expressing the position way; and he further facilitated them to represent it mathematically. He raised the question, "Which is the authorized first bench as there are three rows to bring the context for the origin as the point of reference or the starting point which is vital to locate any position?" Because of this where the real-life situation would present the location of the students, the concept of origin and the coordinates was well developed.

Going through the narration of Nirvigna, I generated that development of conceptual knowledge from contextual teaching on Mathematics is possible and established this as a theme for my research question. It is clear that conceptual development is major part of learning Mathematics and with connection to real world it is clearer and more effective. As he went through different trainings, workshops and the interaction program, he was motivated to make the contextual teaching possible, and he tried to develop and explore the context where Mathematics is embedded. CTL learning is basically a learning concept that aims to equip students with knowledge that can be flexibly applied from a problem or from one context to another so that students' understanding is expected to learn through experiencing non-memorization (Nurhadi, 2003, as cited in Rajab et al., 2013). He stressed that surface knowledge is temporary and for better learning we can go for the application or the exploration of Mathematics. He added that Mathematics should not be limited within the textbooks as this may lead to

memorization of formula as well as the problems in some cases rather than learning Mathematics.

Nirvigna was always clear that conceptual knowledge is vital for Mathematics and introduced different real-life situations and the materials that provided the key ideas of that chapter. Johnson (2002) said that the contextual learning is a system that stimulates the brain to compose patterns that embody meaning. Nirvigna linked the daily life of students with contents of Mathematics and developed the concept about them. He added that connecting Mathematics with real-life and involving the students exploring the concept of the mathematics is the part of contextual teaching practices of Mathematics as well as makes mental process active to make connections and develop understanding.

As a person working in study of contextual mathematics practices, I realized more that connecting not only the outside of the classroom but even the classroom itself could be a good spot for contextualization where we can relate different context connected with students. Contextualized instruction has been effective in teaching mathematical computation which provides students with greater access to understand Mathematics curriculum (Flores, 2010). The more we relate student's activities, the more they will be eternalizing the concepts of Mathematics and understanding the content of Mathematics. People are doing different types of Mathematics and relating them with our curriculum helps students develop the concept and understand Mathematics.

Contextual Teaching Practices in Mathematics for Development of Engagement and Participation of Students

Nirvigna stressed, " Marks is not a primary part of teaching Mathematics; understanding and concept development is the major part of teaching learning

Mathematics". He emphasized whether Mathematics is useful or not and also said that Mathematics had to link to its application due to which the level of interest of students would rise. Along with the concept development, contextual Mathematics teaching helps the students raise the involvement and the participation in learning. He used a situation around the school where people were planting crops, flying kites; where he developed the level-based questions such as: how many people were there, what were the different activities they could find in those pictures, could they represent in bar graph, what was the shape of the hat used by the people who were planting the crops, distance between the people, etc. Students were habituated with the same routine problems of textbooks but when those situations were introduced, students were attracted towards it. They showed the high level of enthusiasm to find the answers to the questions raised. He said, "I was delighted with the change in their performance of the students as they were able to visualize Mathematics and make connections".

Once, he used the pictures of a house and inquired with the students with different topics of Mathematics. Such as, how many different shapes they could find, what were they? Did they find any shapes which were similar to each other or congruent to each other? What different solid figures were there? Instead of inquiring about the formulae or the problem-solving procedure, students found those much more interesting and enjoyed getting involved in it.

He further said, "We must be able to calculate or solve the real-life problems instead of getting stuck with textbook problems like finding the cost of plastering the walls of the room, carpeting the floor, cost of coloring the walls and ceilings which are very much contextual and requires students' active involvement also help them to

understand Mathematics and its application. If we could be able to take students out of the classroom to the similar construction sites, then the interest as well as the involvement of students will increase”.

From Nirvigna’s narrative above, I developed Contextual teaching practices in Mathematics for development of engagement and participation of students as one of the themes addressing my research questions. I explored that Nirvigna had clear idea that Mathematics can be learned through active participation and the involvement of the students. As he introduced the context and the materials during teaching learning process, he realized that development of engagement and participation of students is possible through the contextual teaching in Mathematics. He said that due to the connection of Mathematics with the real-world and students’ daily life activities, students will construct knowledge of mathematics themselves. Hence, students will feel the ownership of learning and he found that it made students more enthusiastic to learn Mathematics.

Contextual teaching is targeted for exploration and application. So, when teachers practice contextual teaching, students have to go for it and involvement is necessary. Because of this we can bring changes in students’ performance of involving actively in teaching learning process, taking initiations and developing positive attitude towards Mathematics. Patterns of learning from teachers who more often monotonous or lectures and rarely bring props and invites students mengkontekskan (contextualize) matter of Mathematics in everyday life, thus, causing fewer active students in the classroom (Wijaya & Mardiantoo, 2016). Nirvigna was convinced that the teacher is the role model for the students who bring the context from outside the class and also relates with the students’ activities due to which students are motivated to participate and engage

themselves in teaching learning processes. Giving lectures and explaining each and every step of problem solving will be monotonous and provides fewer guarantees that student had learned. So, introducing materials, conversing on their activities directly and indirectly related to mathematics, connecting Mathematics with surrounding, exploring the usefulness of mathematics enhances the involvement and engagement of students in learning process.

In daily life of students, there are many factors that play a vital role in their studies but the major aspect that plays a vital role in their involvement is when they are learning about their own activities. According to Orpwood et al. (2010) the term “Contextualization” may include one or more of the following components: interdisciplinary learning, use of students’ informal out of school knowledge, teacher collaboration to distinguish real world examples, student collaboration and active student-centered learning. As a passionate teacher to raise students’ involvement in learning, he was aware and thoughtful to introduce the context within the students and collaboration with daily life.

As a researcher when I remember my past, I also have similar experiences. When students were involved in teaching-learning procedure they were excited and always initiated to brainstorm and communicate. I was trying well but not to that extent because teaching was not my passion. When I got myself engaged and eternalized about contextual mathematics, I started working with it and thought about student’s involvement rather thinking only about the coverage of the course. So, I utilized my time in exploration activities, implementation, reflection and incorporation of the learning again.

Contextual Teaching Practices in Mathematics for the Development of Different Skills

Nirvigna added that if a student passed the exam on the basis of the answers copied from the teacher's work on board, it is one of the biggest tragedies being a Mathematics teacher because these develop the trends on students to solve every problem from someone else. However, he encourages students to solve the problems on their own so that they would gain the problem-solving skills of not only the exercise but the exercise of their life too. Students should be allowed to think in multidimensional way and develop creativity as well as critical thinking.

He again added that due to contextualization of the mathematics teaching, students will not fear with the questions which are twisted as compared to the questions of the textbooks and these days we can see some questions in board exam which are contextualized as he gave the example of finding the cost of coloring the post of the gates which has a square based pyramid on the top of it. For the development of skills to solve the problems like above, students must be aware of these situations, and it requires contextualization of Mathematics. Here, students would connect different ideas of mensuration, visualize the context and solve the real-life problems which will ultimately develop the competencies of students in reference to real-life situations.

He asked some of the interesting questions to the students which he would assess the learning based on real-life exams:

- a) *If carpet of your home is to be replaced, how would you replace it? He said that this question not only allows students to measure the length, breadth and area but also helps the students to use and compare the*

standard breadth of the carpet which may not be the exact breadth their room. This question helps to assess the understanding of the measurement concept, estimation skills and comparison of two different areas.

- b) *If you go to the shop where they sell clothes which have to be stitched and ask to provide the cloth of certain length, let's say 1.5 meter, the shopkeeper shows two bundles of the same color, same company and same quality but with different price. Why the price of the clothes is different find the mathematical answer as there is no cheating? He shared that in this question students may be aware about the clothes calculation of price but maybe unaware about the breadth of the clothes may be different.*
- c) *The number of pieces of biscuits in a packet is same as before 10, how could this be possible?*

He advocated that these types of questions help teachers assess the understanding of the content which ultimately enhances the critical thinking as well as the creativity of the students. This also makes a meaningful learning of Mathematics and if you ask the students to find the solutions in group the collaborative skills, teamwork as well as the communication skills also develops. He added with a third question, although the numbers are equal the weight may differ. It brings awareness in students so that contextualization of Mathematics teaching is important and advocating the meaningful learning of Mathematics.

After going through Nirvigna's narrative above, I generated Contextual teaching practices in Mathematics for development of different skills addressing my research key question based on contextual teaching practices in Mathematics. From the narrative

above, I explored that he could help students to develop different skills rather than sticking with the problem-solving from the textbooks. He has exhibited good idea of assessing the learning of students as well as pushing students forward to develop other skills like communication, sense making, critical thinking, logical thinking and creativity which we can see from the questions he had developed and applied in his class with the students. There is an inter relationship between thinking and Mathematics because Mathematics improves the ability of thinking which helps in enhancement of reasoning and logical thinking. So, when context or materials are exposed or explored it acts as a tool to think and later enhances thinking ability.

Recent developments in mathematics education seek change from the traditional exposition and practice methodology to reform methods which link mathematics to the real world and help develop critical thinking and problem-solving skills (National Council for Curriculum and Assessment; NCCA, 2012). As he started exploring and using contextual teaching practices in Mathematics, he started transforming the problem-solving skills of students to real-life problem solvers. He thinks that a student who is good in Mathematics is not a problem solver. He/she should also be a critical thinker, creative as well as connecting Mathematics with the real-life. He said that with this exploration of connection of Mathematics helps students learn meaningful Mathematics by developing the sense making ability which ultimately helps our country with better human resources.

Summary

Nirvigna stressed, if we can connect Mathematics in different context of life and apply Mathematics in daily use; it becomes the contextual Mathematics teaching practice. He said solving problems from the does not make students competent, solving the real life problem is important. According to the Mardianto (2016), the researchers observed, the students' learning activities in class that many students have not been able to solve mathematical problems in everyday life in accordance with good mathematical reasoning. p. 4

He is always aware that instruction from the teacher is not enough, there must be a platform of the situation where students can play with the problem and the situation. Because of these opportunity, contextualization of Mathematics is easy as well as students themselves explore for the connection of Mathematics with real world. He said that with this exploration of connection of Mathematics helps students learn meaningful Mathematics which ultimately helps our country with better human resources

He added that a context, material, situation adds the interest in students and enhances the participation of the students. Heckman and Weissglass (1994) believed that mathematics will be learned by more students (1) if taught with other subjects in a real-world context, (2) if practical learning apprenticeships are developed, and (3) if educators articulate and challenge their own beliefs and values about mathematics, learning and teaching. He advocates that if we are able to develop the ownership of students linking Mathematics with student's daily life activities, involvement and usage where they are doing Mathematics knowingly or unknowingly, the level of interest will increase. We can see the participation and involvement of the students in a better way. Nirvigna said that

teacher should have mindset of teaching Mathematics is developing Mathematical competencies rather than completing syllabus and making students pass the exam.

He thinks that a student who is good in Mathematics should not only be a problem solver but also be a critical thinker, creative and connect Mathematics with the real world. He emphasized that we could use the real-life activities and problems within our assessment criteria as the assessment system relies on paper pen test. These assessment activities will help students to develop themselves as logical, creative and critical thinker.

CHAPTER V

REFLECTION AND CONCLUSIONS

In this chapter, I have stated my reflection and conclusion of my research work. I have reflected the learning outcomes from my research work as well as the research procedures. I have explained and discussed my research agenda and questions. I have also explained how I developed the methodological map and how I have responded my research questions. I have also presented the implications and conclusions.

Envisaging My Research Agenda

My research study aimed to explore how contextual teaching helps Mathematics teacher connect Mathematical concept in the classroom and how it helps Mathematics teachers improve the performance of the students.

I was born in the capital of our country Nepal, but that does not mean I was born and brought in the city areas with full of private and boarding schools. My birthplace fell under the village development committee which recently changed into municipality. Though our village was in the capital of our country, most of the people were asked to study in government schools as there were no nearby private schools. During the time I was born, some of the local people who were educated decided to run a private school in my village.

Many of the people who could afford or who could manage the fees kept their children in that school and I was one of them who studied in that school from nursery and passed SLC from the same school. Since it was a private school, they had different

approaches to teach Mathematics. I still can have vivid remembrance that we were taught two different Mathematics, Mathematics I and Mathematics II. In Mathematics I, it was according to the curriculum prescribed by the government; and in Mathematics II, it was also according to the government curriculum but of the succeeding class. I can recall those days that student who were good in Mathematics enjoyed learning Mathematics II, but the students who were not good enough in Mathematics they would struggle in learning Mathematics II. Now, when I analyze the plan and the policy of the school regarding Mathematics was not inclusive to all the students and it repelled students in learning Mathematics because the content was heavy, and the teachers were compelled to finish rather than assessing the students' achievement. Knowing and doing Mathematics needs to provide opportunities for students to apply mathematics to everyday life and to provide possibilities for Mathematization, that is, opportunities for students to organize information mathematically and to use their pre-existing knowledge and experiences to use that information to complete a mathematics task (Wijaya et al., 2014). Working with heavy contents and provision of the subject does not always enhance the learning of the students. It is about the getting opportunities for the students to involve for meaning making of any mathematical task were organizing and connecting the information and using their experience and the knowledge has to work out which becomes possible with introducing the contextual problems.

When I have to talk about my Mathematics teacher, they were from different background, some of them were the teachers who belong to different parts of the country coming to Kathmandu and working as a part time Mathematics teacher. Many of the teachers were very strict as they wanted the homework and the class work done

completely in the allocated time. There were not any excuses if a student fails to do the assignment. Only few teachers were there who cared about the students and were ready to help the students whenever needed. Though there were different teachers of different behavior, the teachers were of same kind as they had same teaching methodology. They would follow mechanical Mathematics teaching approach where they would introduce and use formulae to find the solutions and ask us to follow the same. We were asked to practice as much as we could. They made us feel that practice is the only formula or tool to learn Mathematics.

Mathematics teaching was a one-way trafficking method where teachers were the giver, and the students were the receiver. Teachers would provide lectures or solve one problem most probably the difficult one from the textbook on the board as an example and asked us to listen and copy the solution. On the basis of that we were asked to do the remaining problem going through the problem solved by the teacher or by looking at the examples. Students who would score good marks were categorized as an intelligent and talented one where creativity, critical thinking of students were ignored because the skills or ability were never assessed. Exams were more emphasized in memory rather than problem-solving skills. A context suitable for such a mathematics task according to PISA strives to be relevant to students, to shift between the mathematical and the everyday, and to be relevant to the production of a task solution (OECD, 2009). In mathematics class, if we could introduce the contexts which are relevant to students then, it will help them to acquire different skills like reasoning, meaning making and connecting. These things were missing during my school days.

When I started my career as a teacher in my nearby school, in my first year, I started teaching in the same way as my teacher taught and focused on the same part like memorizing the formula and lots of practice work. I could not find improvement in my students and often humiliated them as a lazy and careless fellow who did not like to practice and do their work on their own and usually copied their assignment from other students or asked support from home or tutor to complete their tasks. When I started my teaching journey, I got opportunity to attend a meeting organized by MEC. The principal of that school was a part of the council from its establishment, and he was invited to attend the meeting. Since, he was busy, he asked me to join the meeting. When I went to join the meeting, I was delighted as well as nervous because the attendants of the meeting were the big names of Mathematics fraternity. The meeting organized a high-level interaction program in collaboration with Mathematics expert of Korea on Mathematics in context (MiC) and incorporating the same approach in teaching learning practice of Mathematics in Nepal. I was completely unknown about the context that has to be introduced or relate while teaching Mathematics.

From that day of meeting, I started to learn and practice contextual Mathematics teaching practice and at the same time with the same team I had several meeting and interaction regarding the contextual Mathematics teaching practices. I also became the part of a pilot project lead by MEC based on MiC, where being a teacher we had to design lesson and demonstrate in the real classroom which ended with feedback and suggestion session. I started thinking and studying about contextual Mathematics teaching practices due to which I could relate Mathematics content with real-life events, situation and materials. I worked closely with the team regarding developing contextual

Mathematics practices and learned much. It motivated me to be a Mathematics teacher and develop my passion to work in Mathematics. The process of learning mathematics in every level of education is very important, therefore it is necessary to have fun to realize the role of teachers in the implementation of the learning process to realize the goal of learning Mathematics (Zulyadaini, 2017). As a role of teacher, teaching the content and the taking exam is not the sole responsibility. Developing the attitude to learn mathematics is required too which has to be realized by the teachers and enhance their role as a teacher. So, I believe that limiting the teaching job for teaching and taking exam gas to be improvised with developing the competencies as well as attitude of the students for learning.

I decided to continue my further education in Mathematics leaving physics behind which was the major subject in my bachelor's degree. Then, I joined KUSOED (Kathmandu University school of Education in Mathematics). During my two years of learning in KUSOED, I learnt many things about teaching pedagogy, andragogy, teachers' professional development and recent trends in Mathematics teaching. I had interaction with my classmate and the teachers about the contextual Mathematics teaching practices where I got mixed response as some of them are aware and practiced it to limited extent and some of them are not aware. The teachers encouraged me to work on contextual teaching approaches and even provided me resources as well as the work they had carried out. So, I decided to choose contextual Mathematics teaching practice as my research which would help me to explore my experiences regarding it as well as making other Mathematics teachers aware of the usefulness of contextual Mathematics teaching practices.

I visualized that I would conduct my research with my narrative inquiry with the experience of Mathematics teachers who used contextual Mathematics teaching practices.

Formulation of My Research Problem

I was in need of my research question which would provide me with the pathway to focus on the area of my research study. Selecting the research questions seemed quite easy in the beginning but it was not the fact. I had to develop relevant as well as a meaningful research question. In order to develop relevant and meaningful questions, I went to the flashback where I had the experiences in developing and adapting contextual teaching-learning practices, their usefulness and the challenges as well as the context I had developed during my teaching practices.

I was restricted in many ways due the pandemic, such as physical observations or practices for contextual Mathematics teaching. I was in a dilemma to choose the methodology and change my research questions. Then, with the help of my research supervisor, we decided to go with the story of the teacher on their contextual Mathematics teaching practices as it provides us different evidences as well as ideas of contextual Mathematics teaching. At the meantime, I felt like other ideas and evidences they had shared would help me advocate the contextual Mathematics teaching.

In reference to the above lines, I developed a principal research question and two subsidiary research questions with the help of my research supervisor. My research has the following principal research question and subsidiary questions so that I could explore the narratives of experience of involvement in contextual Mathematics teaching practices of two research participants and its impact on them.

Reflection on My Theoretical Perspective

Based on my principal research question and two subsidiary questions, I looked back to my theoretical references so that I could use those theories in my research work. I went through different articles, journals and research work and even had a rigorous talk to my teachers and research supervisor so that I could find suitable theoretical references. I chose constructivism and transformation learning theory as theoretical perspectives of my research.

The supreme objectives of my research were to find out and to explore the practices of Mathematics teachers on contextual Mathematics teaching and their impact on the meaningful learning of Mathematics from the eye of constructivism and transformative learning theory.

In this research work, I have narrated the teachers' practices and the works based on the experiences of practicing contextual Mathematics teaching. Vygotsky's constructivist theory and Mezirow's transformative learning theory helped me to understand the real story of teachers' experience of practicing contextual Mathematics teaching. These helped me a lot to narrate the story of my research participants on contextual Mathematics practices.

Pant (2015) has addressed, "The focus of transformative learning is on expanding conscious awareness of our situated ness in the world or, to put it more simply, in our understanding of who we are and who we might yet become, both as individuals and social beings" (p. 196). When we begin our Mathematics teaching practices as per the situation around us we can get aware about the Mathematics concepts, usefulness and developing sense about Mathematics embedded on it. As a student and a teacher, one of

my focus was to establish different beliefs and meanings through contextual examples and materials which we hardly get in text books and traditional approach of teaching where solving problems is the only meaning and belief of teaching Mathematics. Next focus is to transform students from being a textbook problem solver to real life problem solver as well as developing the other skills of creation, thinking, analyzing.

Knowing and doing Mathematics needs to provide opportunities for students to apply Mathematics in everyday life and to provide possibilities for mathematization, that is, opportunities for students to organize information mathematically and to use their pre-existing knowledge and experiences to use that information to complete a Mathematics task (Wijaya et al., 2014). Applying Mathematics in different everyday life and social context can help students to construct the knowledge and gain experience to make sense of using concepts and process of doing problems. We should create space for the students where students will relate their activities with mathematics. When students get involved with the concrete materials, their own activities where mathematics they start to interact and converse more as they are familiar which helps constructs the knowledge.

Reflecting on My Methodological Map

My research study is based on interpretive paradigm. I have chosen two school level teachers; among them one is a retired headmaster from a government school from Kathmandu district and one is an experienced secondary Mathematics teacher from an institutional school from Lalitpur district. I chose them based on their involvement in MiC and their work to advocate and implement contextual Mathematics teaching practices. There was a difficulty to visit them personally and physically because of Covid-19 pandemic. I organized a virtual meet via Zoom meeting with them taking their

consent. Before the virtual meeting, I explained them about my research topic, questions and its objectives. Then, I requested them to cooperate for my research by giving their valuable time to share their experience, stories, views and examples. I also assured them that the interview will be followed by the ethical considerations that I was supposed to be followed during the research. All the research participants accepted to be the research participant and they were happy to share their stories.

I have applied narrative inquiry method as my research methodology in my research study. I conducted single in-depth interviews to collect the teachers' experience of learning contextual Mathematics and implementing them in their classroom with my research participants. I took the interviews using the interview questions which were based on one principal question and two subsidiary questions in two different days for two participants via Zoom meeting respectively. I did the audio recordings of their in-depth interviews taking their consent and following ethical consideration.

After that, I generated themes on the basis of narratives of participants based on the research questions. I could gather enough evidence and information from the interview. My supervisor suggested me to develop more themes and write individual narratives of each participant. Finally, I analyzed and interpreted the meaning of each narrative using Transformative Learning theory and Constructivist theory.

Responding to My Research Questions

In this section, I have answered my research questions on the basis of theoretical perspective. How does the contextual teaching help Mathematics teachers connect mathematical concepts in the classroom? How does the contextual teaching help Mathematics improve the mathematics performance of students? During this process, I

had interview with them and gathered stories and examples of the two research participants, both male teachers from two different schools. Then, I transcribed the stories of my research participants into narrative form.

I transcribed the narrative and developed into a chapter with the themes like Contextual Mathematics teaching Practices for the development of conceptual knowledge, Contextual Mathematics teaching practices for the development of engagement and participation of the students and Contextual Mathematics teaching practices for the development of different skills.

Based on the narratives from the chapter, here I have discussed about different practices and the outcomes or changes noticed by different impact of contextual Mathematics teaching practices by the participants separately targeting to address the research key questions.

Arun's Practices on Contextual Mathematics Teaching and his Advocacy

Going through the narratives of Arun, I could explore that he was always conscious about the conceptual development of the students. He is a trained teacher who got opportunity to work in different trainings and workshops and later established himself as a trainer, curriculum developer and textbook writer. During his school days, Mathematics was more focused with the computations. His teacher would limit Mathematics in problem-solving and the computation skills. So, in the beginning, he had the same concept about Mathematics that Mathematics is for computations and solving problems of textbooks.

As he reached to bachelor level and joined the central campus Kirtipur, his teachers always focused on the concepts and the applied approach of learning

Mathematics, they would focus on why and how. Then he realized that Mathematics is more about conceptual learning and its applications. He started exploring the concepts of Mathematics and its applications. Being a teacher when he went in the class, his main focus was always to develop the concepts of Mathematics in students. He always tried to relate the concepts and the content of the chapter with concrete materials as well as daily activities related to our real life.

Instead of rote learning of the formulae, he started representing the formulae with the materials or generalized with the real-life activities. He said that providing the daily life materials as context and asking them to play, exploring and calculating are a part of contextual Mathematics. He added that Mathematics is embedded while introducing the context or real-life materials. He said that to extract Mathematics from them and developing the mathematical concept, contextual Mathematics practice is necessary. He experienced that both the daily life situation as well as the materials can be used as the context, if the context is made easily available or used in the school premises then we can explore them, such as using classroom or nearby locality. He recommended that we should not stick within the walls of the classroom. We can get many contexts on the way to school to home, home to market as well. So, we have to think constructively to find the context.

He found that students were attracted and excited to play, explore and calculate with the context and the materials introduced and also were able to relate Mathematics knowingly and unknowingly. He experienced students who were taught as per the contextual Mathematics practices and students who were not taught in this practice had a gap in excitement as well as the understanding of Mathematics concepts. Students who

were not taught as per the contextual practices were focused on only problem-solving whereas other students always wanted to know the concepts as well as the connection with the real world. If we can introduce the events and materials students are familiar, then it will be easy for understanding Mathematics.

He could discover that students always exhibited the positive response to the contextual Mathematics as it provided clear ideas and brought excitement to learn Mathematics. Students were happy to learn Mathematics incorporated with games. They were motivated with the materials rather than books, copies and pen. He added that students' performance was overwhelming and even performed well in SLC examination. During his contextual Mathematics teaching practices, he realized that that if we keep some extra effort, think, and explore the context around us, there are higher chances to get the context related to school Mathematics. But we teachers are engaged in so many other areas that we hardly think about contextual Mathematics teaching. Due to contextual Mathematics, Mathematics has been meaningful, and students were able to solve different household chores and had improved in Mathematics; they have been creative and always initiated to solve real-life problems.

Nirvigna's Practices on Contextual Mathematics Teaching and his advocacy

Going through the narratives of Nirvigna, I could discover that he never wanted his students to limit themselves as a problem solver or communicator; instead, he wanted them to be creative and critical thinker. He always tried to make Mathematics class interesting by connecting Mathematics with real-life and exploring its applications. He is an experienced teacher who got the opportunity to participate in many trainings and workshops of Mathematics and among them; he also got a chance to take part in training

where only teachers at government schools were allowed to take part which was held for the first time by TU. This was an in-service training which was conducted for 4 years which was organized in phases of two-two years. After completing the training, he was awarded with a one-year B. Ed degree.

He said that if we can connect Mathematics in different context of life and applied the mathematics in daily uses, then it becomes the contextual Mathematics teaching practices, and we must be able to calculate or solve the real-life problems instead getting stuck with textbook problems. But we are not using real-life problem and the concept of calculating it. He said that students are well known about the formulae but could not relate it with real-life context because they were not taught in that way due to which they were unaware of Mathematics in daily life.

He is always against the rote learning and stressed on the knowledge and the understanding gained by the students. He advocated that a student who is good in Mathematics should not just be a problem solver but also should be a critical thinker, creative as well as connect Mathematics with the real world. He was aware that instruction from teachers was not enough, there must be a platform or context of the situation where students can play with the problem and the situation and because of these opportunity students themselves can explore for the connection of Mathematics with the real world. He said that with this exploration of connection of Mathematics helps students learn meaningful Mathematics which ultimately helps our country with better human resources. He said that due to contextualization of Mathematics teaching, students will not fear with the questions which are twisted as compared to the questions of the textbooks.

For the development of skills to solve the problems, students must be aware of these situations, and it requires contextualization of Mathematics. He said that due to connection of Mathematics with the real world, students will feel the ownership of learning and he found that the students were enthusiastic to learn Mathematics.

He added that we don't have the textbook which fosters the contextual teaching practices in Mathematics and there are very few topics from algebra and trigonometry which are difficult to contextualize. He emphasized that the assessment system is not appropriate as per our curriculum because it does not provide guide to assess the student as he added that we can use the real-life activities and problems within our assessment criteria as the assessment system relies on paper-pen test.

He shared that contextual Mathematics practices have helped to develop the interest within the students, and it motivates students to develop positive attitude in students. He added that if the instructor can provide clear instruction and facilitates in a better way, then it helps in effective learning of Mathematics and also helps in developing conceptual knowledge in the students. He repeatedly stressed on the effort and the patience of the teachers which is very vital for the contextual teaching practices.

Transformative Learning during the Contextual Mathematics Teaching Practices

My research work is based on the narrative inquiry. From this research, I gained knowledge, understanding and lessons from the stories and experiences shared by both of my research participants. Both of them had different stories from the beginning of their career, the environment of the school, the background of being a teacher, but both of them were focused on the conceptual development of the students rather than working in computation and solving the problems of the textbooks from the beginning. They

somehow had similar backgrounds as they both got the opportunity to take part in various trainings and workshops at the beginning of their career and the stories of success, determinations and challenges they experienced in their career while practicing contextual Mathematics.

According to the narratives of the research participants, Arun practiced contextual Mathematics teaching as he wanted his students to know the usefulness of Mathematics and transform students from the person who computes the calculation and solve the problems to a person who applies Mathematics in their daily life and a thinker who thinks and eternalize the concepts of Mathematics. Introducing context and the materials helped him exhibit the usefulness of Mathematics to the students and the concepts of Mathematics.

Similarly, Nirvigna was always aware of the importance of Mathematics. So, he never wanted his students to be only a problem solver or a communicator but be creative and critical thinker. He always tried to make Mathematics class interesting by connecting Mathematics with real-life situations, events and materials and exploring its applications.

Both of these research participants are the transformative learners who practice changing the mindset of Mathematics as computation and problem solver into a critical thinker, creative and analyst who think about the meaningful learning, usefulness and making sense while learning Mathematics. The belief and the attitude of my participants that Mathematics is not merely a subject; moreover, it is a tool where students learn many skills which are useful for life long.

My research participants always tried to transform the traditional way of Mathematics teaching practices into contextual Mathematics teaching practices. The traditional approach of teaching Mathematics focuses only on computation and problem-solving of the textbooks. This has been transformed into exploration of Mathematics in real-life, the application and usefulness of Mathematics. One of the participant said that the mindset of the parents, students and the school administration regarding Mathematics was just a subject for high scores where regular practices and revision was required. So, he attempted to transform Mathematics into a subject that advocates and develops the skills of thinking and connecting and learners into a crater, thinker and analyst.

However, my research participants reflected that limitation of time and lack of passion in teachers are the major challenges in the contextualization of Mathematics. They also stressed that workshop; discussion and interaction on these teaching practices are not as per its requirement. If we can motivate teachers and organize programs to make people aware of it, we can do better work for contextualization of Mathematics teaching practices.

Conclusions

During my research study, I collected the stories with the experience and the views of my participants through their narratives to understand how they have been practicing contextual Mathematics teaching based on their experience, effort and its impact throughout their teaching career. I have analyzed their practices in contextual Mathematics teaching from the lens of transformative learning. As per their sharing and narration, it can be concluded that contextual Mathematics teaching practice is very much useful as this is the transformation of traditional pedagogy of textbook problem solving to

contextual pedagogy where real life problems are solved for the conceptual development of the students, involving them in the learning process as well as developing different skills which they require for lifelong.

In the meantime, I can conclude that the advocacy for contextual Mathematics learning is less and there is only nominal effort from the related authority to enhance it and motivate it to the new teachers. The research participants have shared that contextual Mathematics practices have helped develop the interest within the students and motivated students to develop positive attitude. They also added that if the instructor can provide clear instruction and facilitate in a better way, then it helps in effective learning of Mathematics and also for the development of conceptual knowledge of the students. They repeatedly stressed the effort and patience of teachers which is very vital for the contextual teaching practices for which professionalism is also a major factor where teachers must exhibit passion towards the profession and if it can be executed properly it makes the teaching process very meaningful.

Implications

As the trend of our curriculum, assessment system and the society which is more focused on scores rather than the learning; teachers put themselves in a dilemma whether to go with traditional and mechanical approach of teaching where students are engaged in problem-solving or with Contextual Mathematics where teaching Mathematics is related with connection of Mathematics with our real life and developing the skills for life long.

From the narratives of the participants above, I discovered and realized that the teachers need to put some effort and experience the improvement in understanding learning and the performance of the students. These studies will gradually influence

teacher, students, teacher educator, curriculum developer, planner transforming their thinking and attitude positive towards the contextual teaching practices. Even the government and the Curriculum Development Center (CDC) can bring changes in the contents and assessment process which ensures the learning as well as assess the learning. This study generally focuses on Mathematics teaching practices where the students must know the usefulness of Mathematics and construct Mathematics from their day-to-day activities. It will help teachers, educators to reflect, analyze and bring changes in their experience of teaching Mathematics and know the value of meaningfulness in learning Mathematics.

Recommendation

After going through several articles, journals and research papers on contextual Mathematics practice and analyzing the narratives of my research participants, I would like to recommend the researchers to conduct the research to explore the ways and the examples of making Mathematics contextual where we can show that Mathematics is also embedded in human activities, and we can construct Mathematics from day-to-day real life situations. I would also like to request to come up with different ideas to address the challenges for contextual Mathematics teaching practice.

Chapter Summary

In this chapter, I have accumulated all the events that happened during my research study from the beginning to the end. I wanted to represent the process of my research, advocating the contextual mathematical practices resulting to the product. I have also presented how I envisaged my research agenda, my research problems, reflecting and relating my theoretical perspective, reflection on my methodological map,

how I responded my research questions, conclusion, implication, and recommendation of my research study.

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APPENDIXES

Questions for the interview**1. Participants Background**

- Can you tell me a little about yourself? profession, education background, motivation, workplace and education and career history

2. Contextual Teaching practices

- How do you plan your daily agendas of the classroom? What are your major focus being a mathematics teacher? Objectives of teaching mathematics
- What do you mean by contextual learning process?
- What motivated you follow contextual teaching? Why do you follow this teaching method? Do you think that your previous teaching method didn't help your students learn mathematics meaningfully or they did not score better grades/marks in mathematics?
- How do you plan your contextual mathematics class? Any special activities you follow to begin your class like review, games, pre knowledge test, non-routine problems that provokes contextual background? Can you provide/describe me the contextual lesson plan you have been following or you have developed?
- What are the real world contexts you have been introducing in your class?
- Is our curriculum guided by the contextual learning process?
- How do you connect school mathematics with real life contexts? Why do you think that contextualization of mathematics is necessary?

- How difficult or easy for you to implement this teaching method? What were the students' responses?

3. Assessment on contextual teaching learning process

- What are the observations or the findings you have notice for the conceptual development of mathematics through contextual teaching and development of students performance? Please give examples
- How do you assess students learning in contextual teaching process? Did you rely on paper pen test or design any other tools to assess them? E.g. context based exam questions, projects
- What was the performance of students after using contextual teaching?
- Was contextual teaching useful meaningful while teaching mathematics?
- Were there changes in learning habits like problem solving skills not only the book based questions also the real life questions, creative skills , sense making , critical thinking, self-motivation to learn mathematics?

4. Constraints to contextual teaching practices in mathematics

- What are the challenges in contextualization of teaching learning process of mathematics?
- What did you plan to overcome these challenges in teaching practices?