

TEACHING MATHEMATICS THROUGH CULTURAL CAPITALS:  
A NARRATIVE INQUIRY

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A Dissertation

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Master of Education in Mathematics Education

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## DECLARATION

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19 October 2022

## DEDICATION

This work is profoundly dedicated...

To my father Hriday Kant Jha and Mother Suryakala Devi Jha who always motivates me to make the most out of available opportunities.

To my brother and sisters, whose frequent guidance, selfless sacrifices, and continuous support made my Master's degree journey possible, thank you once again for reminding me what is more important in life.

MEd in Mathematics Education dissertation Ajit Kumar Jha “Teaching Mathematics Through Cultural Capital: A Narrative Inquiry” presented on 19 October 2022.

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## AN ABSTRACT

Of the dissertation of Ajit Kumar Jha for the degree of Master of Education in Mathematics Education was presented at Kathmandu University School of Education on 19 October 2022. Title: *Teaching Mathematics through Cultural Capital: A Narrative Inquiry*

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The purpose of this study was to explore the possible cultural capitals and examine how such cultural capitals enhance meaningful teaching and learning of mathematics. To accomplish this purpose, I adopted narrative inquiry as a research methodology. The formal and informal interaction/interviews with four different secondary mathematics teachers adopting cultural capital in their classroom and their experiences/stories were the major sources of data in this study. The collected data were coded, categorized, thematized, and analyzed with supportive literature. The experiences of the teachers were analyzed under different themes like mathematics curriculum and our practices, contextualization of mathematical concepts and their impact, ethno-mathematics, and ethno-culture, culture as an integral phenomenon in mathematics learning, and difficulty in addressing mathematics through cultural capitals. From this discussion on the collected data, this study concluded that curriculum is content loaded and it is difficult to cover the course in time. In this situation, integrating cultural capital might be a nightmare for some teachers but for conceptual understanding and long-lasting knowledge, cultural integration is necessary for mathematics teaching and learning. Integration of cultural capital in

mathematics classroom practices not only makes the classrooms lively but can give authentic learning through real-world experiences. A teacher needs to be wise enough to address the learners' interest in learning and integrate that cultural perspective into the mathematics classroom. It is clear that without learners' motivation and interest, it is very difficult for a teacher to engage them in the learning process and get the desired outputs. The integration of cultural capital in mathematics classrooms can give real-life experiences of the learning phenomena and promotes experiential learning.

Mathematics is everywhere in the environment, community, and around us, but we as a teacher fail to connect them to our learning process. This is because the majority of the teachers are still guided by the traditional way of teaching-learning perspective, where lecture methods and teacher-centered pedagogy are highly dominant. The one-size-fits-all approach and textbooks are the ultimate source of knowledge are other factors which make mathematics more abstract and less interesting for school students. Mathematics cannot be isolated from society and the context of the learner, and cultural integration in the classroom helps to contextualize the abstract concept and helps learners to build their understanding from real-world practices. Finally, the integration of cultural capital in mathematics teaching and learning can build a learner from a holistic development in every possible aspect. The findings and results of this study are possibly fruitful for teachers, teacher educators, and policymakers who want to integrate cultural capital as a pedagogical tool in the mathematics classroom.

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## ABBREVIATIONS

|     |                                      |
|-----|--------------------------------------|
| CDC | Curriculum Development Center        |
| ICT | Information Communication Technology |
| KU  | Kathmandu University                 |
| TU  | Tribhuvan University                 |
| SLC | School Leaving Certificate           |
| SEE | Secondary Education Examination      |
| TPD | Teacher Professional Development     |

## CHAPTER I

### BACKGROUND

Mathematics has been one of my preferred subjects since my youth stage. I generally appreciate taking care of math issues. After confronting numerous obstacles and encountering a great deal of trouble in instructing and learning arithmetic, I felt that educating and learning science with social capitals may be the better methodology in mathematics training that can give applied and viable learning in science. Teaching and learning mathematics through cultural capital is one of the emerging issues in the research field. In our context, mathematics and culture seem detached and the learning of the learners is limited to their cognitions.

Teachers in mathematics classrooms limit the learning within the textbooks. The less contextualization of mathematical ideas and concepts makes mathematics learning abstract and less interesting for today's learners. The less engagement or disengagement of the learners in the mathematics classrooms directly impacts their performances and understanding of the mathematical ideas. Culture enables the learners to observe, represent, and investigate patterns and quantitative relationships in physical and social phenomena and between mathematical objects themselves. The culture sometimes refers only to the language, codes, values, jargon, beliefs, food and dress, habits, and physical traits of a particular community in the premature stage but the culture in this study is beyond that and closely linked with the daily-life practices of the learners. A teacher needs to be wise enough to integrate cultural capital into mainstream classrooms.

I rehearsed an inquiry multiple times to remember the means and to discover the predefined answer of the inquiry. Presently I understand that such sort of critical thinking was no other than acting on procedural information. Procedural information is a progression of steps, activities, or methodology performed to satisfy an objective, target, or to take care of an issue (Canobi, 2009, ; Johnson et al., 2001). Why did I not go for some inventive critical thinking? For what reason was I not supported for creating calculated information on Msathematics? Is that because of the methods of instruction followed by my instructors during those days? Perhaps or may not be! I realize that if educators utilize the neighborhood materials as an apparatus for mathematics instructing and learning, then the accomplishment level of mathematics is diverse in our specific circumstances. In this regard Hallden (1999) states that "to contextualize an issue can intend to relate it to a particular physical circumstance; however it can likewise mean to relate the issue to different thoughts" (p.60). For instance, an educator asked me to unravel the inquiry.  $x^2 + 5x + 6$  (understand) at that point I followed the means  $(x^2 + 2x + 3x + 6) = x(x+2) + 3(x+2) = (x+2)(x+3)$  along these lines I tackled the issues. However, I never needed to know, what is its real significance. Furthermore, my instructor never examined that. I investigated the issue basically, at that point, our mathematics teaching and learning ought to appear as something else. On the off chance that the instructor connected this issue into the genuine field and went into the connection of region. What it gives is the field zone that is exceptionally simple to learn.

I ponder why we could not take care of the concealed issues because of less idea of the topic. It implies our calculated information in the topics is not sufficient to consolidate with the new and certifiable issues. As indicated by a star (2005), the term calculated information has come to include what is known (information on the idea)



yet additionally one way that ideas can be known (profoundly and with the rich association). In this sense, I found that my Mathematics learning at the school level was less theoretical, and I was creating the repeated information in mathematics is helpful. If instructors had got the option to interface the nearby and social antiques in the study hall, then I would have learned mathematics differently that the facilitator utilized the distinctive social ancient rarities in the study hall, at that point the learning would be unique. Why have instructors just utilized the book instead of local materials? In my view, in the general public, there is numerous nearby materials that may be utilized in the homeroom practice to improve the teaching and learning exercises. These sorts of teaching methods enable mathematics teaching. I feel why understudies feel mathematics as a troublesome and exhausting subject. In such a manner, Luitel (2003) as he states that mathematics for him was a remote subject in his initial (school) instruction. My mathematics was just identified with remembering the equation and rehearsing it to an ever-increasing extent, so I never got the kind of logical trial of mathematics in my school life.

Had our educator encouraged us to connect the mathematics to our societies, as connecting math to the work being finished by bamboo craftsman, the material around us( sanctuary, shop) and the game we were playing would have been completely connected with the mathematics( running with the cycle tire). On the off chance that our instructor did that, at that point we could have a better idea of scientific shapes. If they had to encourage us to bring the materials found in our region, then I could realize that mathematics is the scholastic science as well as the mathematics that we rehearse in our day-by-day life.

### **Birth of my Research Agenda**

In my school life, just as in my professional life, I developed the procedural idea of the school. So my focus is consistently about the method as opposed to the calculated one. In the current state of various schools in Nepal, the principal center is about the outcome. The vast majority of the schools go after the outcome, so our learning level of science is diminishing step by step. From my previous age, for example, at the age of 16, when I was in class 10, then I told my educator that we can utilize science in our day-to-day life and it is more obvious for math if we utilize nearby social capital. Since that time, I have been extremely quick to peruse the arithmetic with neighborhood and social perspectives. So from that day to present, I have searched for the answer to that question.

After confronting numerous obstacles and encountering a great deal of trouble in instructing and learning arithmetic, I felt that educating and learning science with social capitals may be the better methodology in arithmetic training which can give applied and viable learning in science, so I picked this point as my agenda of exploration.

### **Statement of the Problem**

Mathematics is considered the brain of any society and the backbone of any system (Jha, Adhikary, & Pant, 2006). Teaching and learning mathematics through cultural capital is one of the emerging issues in the research field. In our context, mathematics and culture seem detached and the learning of the learners is limited in their cognitions. Though the curriculum seems little sound in terms of progressive ideas in some grades with integrated ideas, the pedagogies are still suffering from conventional practices. The curriculum is developed by educationalists taking the interest and ideologies of particular people, cultures, and societies (Howson, Keitel,

& Kilpatrick, 2008), which may not be able to address the interest of the learners in a particular context. Likewise, textbooks contain relevant examples, illustrations, and problems arising in the context (Johansson, 2003) which can make students feel like they are solving the problems only of a textbook but not in their context and not for them. Teachers in mathematics classrooms limit the learning within the textbooks. The less contextualization of mathematical ideas and concepts makes mathematics learning abstract and less interesting for today's learners. In this scenario, D' Ambrosio (1990) argued that mathematics was for a long time regarded as a neutral and culturally free discipline removed from social value. This culture-free classroom and unidirectional method focus only on the final result of the learners in board exams, make the learning within the frame. Our system focuses highly in the grades and marks of the students but the results in the board exams are in pathetic situation. The performance of students is very poor in the final results of Grade X, and the low achievement is a major problem in mathematics (Ghimire, 2010).

The less engagement or disengagement of the learners in the mathematics classrooms directly impacts their performances and understanding of the mathematical ideas. Culture supports the learners in “observing, representing and investigating patterns and quantitative relationships in physical and social phenomena and between mathematical objects themselves” (Barnes, 2005, p, 42). The culture sometimes refers only to the “language, codes, values, jargon, beliefs, food and dress, habits, and physical traits” of a particular community in the premature stage (Rosa & Orey, 2013, p. 62), but the culture in this study is beyond that and closely linked with the daily-life practices of the learners. As a teacher, I found that the majority of the learners fail to apply their learning to the problems they face in their real practices. I believe that applications of mathematics enable students for effective-decision

making in their life and solving the problems that arising in their real-life situations more effectively (Surif, et. al, 2012). Moreover, “mathematical knowledge and ability give people the power to function as critically thinking productive intellectuals capable of liberating themselves and their communities” (Rogers, 2017, p. 16).

According to Cates and Rhymer (2003, as cited in Finlayson,2014), in the traditional approach, teachers use directed instruction, with the power of authority; students passively receive information and do not question the teacher’s authority. Knowledge is taken from the fixed curriculum and textbooks, with little time for questions or an understanding of the process. Students work individually to find the correct answers; there is no time for group work and discussion. Too often, this means memorization and rote recitation rather than active concept-based learning. It has become one of the national problems of our country. Gresham (2007,as cited in Helal 2013), it is believed that certain instructional techniques, such as directly following textbook examples, lecturing, and emphasizing only one way to solve a problem are among the main causes of math anxiety. Nordin (2008 as cited in Alday & Panaligan,2013) states that teacher needs to be aware of the effects of anxiety on student achievement and motivation. Many researchers (Griggs & Dunn, 1984; Park, 2001; Smith & Renzulli, 1984; Charkins et.al, 1985 as cited in Zhenhui, 2001) have claimed that the teaching strategies of the mathematics teachers must be designed according to the learning strategies of the students. In this scenario, a teacher needs to be wise enough to integrate cultural capital in the mainstream classrooms. The above-mentioned problems and research gaps encouraged me to conduct this study.

### **Purpose of the Study**

The purpose of my research study was to explore the possible cultural capitals and examine how such cultural capitals enhance meaningful teaching and learning of mathematics.

### **Research Questions**

To fulfill the purpose of this study, I developed the following research question:

How do teachers narrate their experience of teaching mathematics through cultural capitals?

### **Significance of the Study**

Cultural capitals in this research study are not only focused on the existing arts in the temples, monasteries, or any religious practices. The cultural capitals in this study focused on the day-to-day practices and any other kinds of real-world practices existing in the learners' context. In this scenario, this study incorporates the exploration of mathematical concepts from real-world practices. It is true that mathematical concepts are derived from real-world phenomena and derived as a general concept to solve similar kinds of problems existing around the globe. But the mathematics in our educational practices is limited within the curriculum framework and between the outer covers of textbooks. Being a learner and an educator of mathematics for more than a decade, I realized that I (probably others) are solving the mathematical problems to finish the exercise and to prepare for the examinations but not for the use of our real-life practices. A student who can easily find the circumference of a circle by using the formula (Circumference =  $2\pi r$  or  $\pi d$ ) when radius or diameter is given in the question cannot find the circumference of *nanglo* (circular shaped material usually made from bamboo and used in the kitchen) or any other circular objects around.

In this scenario, this study explored the experiences of the teachers who are integrating cultural capital in classroom practices in teaching mathematics. The findings and exploration of this study might be helpful for the teachers and teacher educators who want to contextualize the mathematical ideas to the learners' practices and those who wish to give experiential learning to their learners. Similarly, this study can be beneficial for the curriculum designers to design a dynamic curriculum that can address the interest of 21st -century learners and make learner friendly curriculum to get the highest outcomes from it. On the other hand, this study may be valuable for those people, teachers, and educators who want to see the significant changes in Mathematics education in Nepal.

### **Delimitations of the Study**

This study is a narrative inquiry of the teachers incorporating cultural capital in teaching mathematics at the secondary level. I have selected the teachers purposively for this study who can serve the interest of this study. In this scenario, this study might not reflect the experience of the teachers guided by the traditional lecture- based approach only. The methodology was explained only from the basis of qualitative perspectives. So, the result of this study might not be generalized.

### **Chapter Summary**

The above chapter reflects my understanding and experiences of how I was groomed in mathematical orientation. I have critically reflected on my mathematics learning in my earlier days. Further, I have problematized my research issue and presented the purpose and research question of this study. In addition, I have presented the significance of this study where I have presented the importance of doing this research. In the next chapter (Chapter II), I have reviewed the literature under the headings :Thematic Review, Theoretical Review and Empirical review.

Chapter II also shows the research gap which makes this study unique from other studies.

## CHAPTER II

### REVIEWING LITERATURE

A review of literature is the review of the paper related to similar issues. There are two words 'literature + review' in which literature means any authentic and proven materials like; books, journals, previous studies, personal experience, individual ideas, etc. whereas, 'reviewing' means the process of investigation, inquiring, seeking, and finding 'what has already been done, and what is need to do' in the chosen area. Therefore, the word 'literature review' means 'a written document which describes the past and current status of the chosen topic. This idea regarding the literature review would help us to get the meaning of further one. Creswell (2011) mentioned that the entire literature review can be divided into three main groups and they are thematic review, theoretical review, and empirical review. They may be easy to understand by categorizing the literature in such groups.

#### **Thematic Review**

Thematic review is the most common form of analysis in qualitative research. It emphasizes pinpointing, examining, and recording patterns (or "themes") within data. Themes are patterns across data sets that are important to the description of a phenomenon and are associated with a specific research question. 'The thematic review is such type of review, in which I explored his/her topic based on 'what is it, what is significant, and how can we conduct. Researchers take these types of conceptual information regarding the chosen topic to make their concept clear. When we review the literature based on this any area, it makes the concept clear about the chosen issue, and then these types of reviewing work come under the thematic



review. On the way of the thematic review, we may concern with our friends, teachers, and different books and we may ask them about our issue, and also collect their suggestive feedback.

### **Culturally Responsive Pedagogy**

Culturally responsive pedagogy is the student-centered first approach in which students' cultures are identified and treated accordingly. In this approach, learning relates to the student's own culture, and hence it enhances the learning process. In this regard, Landson-Billing (1994) states that culturally responsive pedagogy recognizes the importance of including students' cultural references in all aspects of learning.

Nepal is a multicultural and multilingual country in which the students in the classroom are from different cultural backgrounds, so teachers should relate the topics according to their culture than teaching and learning are effective. For example, if teachers are teaching in Maithili community school, then the teaching would be more effective if they relate the topics to Maithili community capital. If a topic to be taught is a circle, then they can use *Changera* (made of bamboo and a circular shape), if they teach measurement, then it is better to relate the measurement that existed in the society. I do not mean to say that standard measurements should be ignored, but that pre-existed measurements should be compared with the new ones then learning is fruitful and effective. In this regard, Gay (2010) supported that culture is central to how all learning takes place.

This approach is meant to improve the engagement of all students by awkward the wealth of their culture and students lived experiences and finding their places in the globe (villages & Lucas, 2007). In this pedagogy, teachers should be highly committed and establish high expectations, and position themselves as both facilitator and learners. Integrating locally available materials and their values makes

mathematics learning lively and makes the students able to seek the mathematical concepts in their context. In learning mathematics, effective use of materials contributes to visualization, conceptualization, and understanding of mathematical concepts. Thompson (1994) mentioned that the use of concrete materials has always been intuitively appealing, and an instructional environment to understand the effective use of concrete materials, especially teachers' images of what they intend to teach and students' image of the activities in which they are asked to engage. In this scenario, cultural capital promotes the use of locally available materials in the learning process to generate life-long learning for the learners

### **Cultural Mathematics**

Culture is the set of beliefs, practices, and day-to-day practices in a certain society or ethnic group. So what we practice in society is our culture. In this regard, D'Ambrosio (2013) defines culture as understood in its most encompassing form and includes art, history, languages, literature, medicine, music, philosophy, religion, and science. While in the community, there are many cultural practices practiced and mathematics can be integrated with the majority ones. Our Vedic and Buddhist cultures support the use of bamboo materials which are considered to sanctifying and are widely used in cultural practices like ceremonies and daily practices. Mathematics is all around us. All mathematics evolved from our society and globe. So, whatever we practice in our daily life is mathematics, but we have not practised this type of mathematics flavour in our school life. We are focusing on memorizing the formulas, steps and finding the answers. So what we learned in our school was to solve the step-wise mathematical problems listed in the text books. In this regard, Banr (2003) states that such knowledge of mathematics sounds like a toolbox that includes facts, skills, procedures, algorithms, or methods.

Now I have come to realize that if our teacher would have used local cultural capitals as a tool for mathematics teaching and learning, then our learning would have been different. They could have used local materials such as *chagera*, *har*, *palo*, *kodair* (local materials used in Maithili community) as a teaching and learning materials in mathematics classes. Being a progressive teacher and an educator now, I can critically envision why the teachers are not using these types of cultural capital for meaningful teaching and learning. Does mathematics mean only problem solving and doing exercise? Why are teachers not using this type of approach for teaching mathematics? In my opinion, the cultural practices of the learners can make learning easier and more effective and may reduce the percentage of learners who are scared of mathematics. The pedagogy blended with the daily practices of the learners helps them to reflect critically on their cultural phenomena and questioned unjust and irrelevant activities. Teachers with critical assumptions recognize that they must challenge their own and their students' well-established ways of thinking that frequently limit their potential (Fatma Aslan Tutak, Elizabeth Bondy & Thomasenia Adams, 2011).

### **Contextualization Mathematics**

The term contextualization means the linkage of the content and society in the classroom. In my experience, the mathematics teaching and learning pedagogy in Nepal is less contextualized. The result of mathematics is decreasing day by day, and one of the reasons behind it might be the de-contextualization of mathematical concepts and pedagogies. Our teaching strategy highly focuses on the result or grades of students in their report cards rather than their understanding and holistic development, so we are not able to link the problem or content in the day-to-day life problem and the environment. In this regard, mathematics is not rigid rather, it is an

incomplete and everlasting work-in-progress (Ernest, 1996, p. 1). Integration of cultural capital in teaching and learning mathematics can make learning like mathematics as a journey, mathematics as a skill, mathematics as a daily life experience, and mathematics as a game or puzzle (Shrestha, 2011). Contextualization here means that teaching the concept or idea with the linkage of the day-to-day problems, environment connection, as well as through the cultural capital (Shrestha, 2019).

As a Mathematics teacher for more than a decade in school, I experienced that a mathematics teacher needs to be wise enough to relate the mathematical concepts with the context or contextual problems and need to have the ability to motivate students and engage them in activities in the learning process. The teacher can develop students' understanding of fundamental concepts not memorization of fact definition and procedures from the cultural and societal practices. I found that majority of Nepalese teachers teach mathematical content but fail to contextualise the ideas. According to Luitel (2009), from the beginning of grade four, I saw the subject of mathematics beginning to separate into three distinct unconnected areas—arithmetic, algebra and geometry and being more abstract algorithmic and de-contextualized in nature. In addition, mathematics teaching is not connected in daily life activities. It is limited to the four walls of the classroom and within the school compounds. I found that the meaning of learning in our context is to pass any level and to get a certificate for that level. The required skills which an individual needs to learn from that particular course is apart from the learning area. A student who can easily find the area of rectangle and square from the textbook in the classroom, can not even identify the length and breadth of a rectangular field. In learning, a teacher only focuses on textbook examples and practice exercises, not learning local context. Similarly, Luitel

(2009) added the learning in Nepalese schools is totally based on textbooks, which has been prepared according to the school curriculum. The teachers use the textbook as an ultimate means of teaching that does not provide the opportunity of relating their learning with a local context. I agree the learning in Nepalese school is totally based on textbook. I can still remember the mathematics teachers in my 10+2, and Bachelor level used their old note books to teach mathematics, physics and so on. It used to be similar to what they taught to previous batch students. They were just transferring the knowledge from their notebooks to our note books. I can say that there were not connections of those mathematical ideas with our day-to-day practices.

In our context, teacher focused on the problem solving rather than connecting the problems with the real world. The teacher in the classroom uses books In our context, we do mathematics that is too abstract. Contextualization is the seemingly a new learning approach for us where teaching and learning can be done with the help of local materials, using different resources of that society, i.e. teaching and learning is done with the help of cultural capitals (Shrestha, 2018, 2011, 2019).

As I am a student of mathematics, now I realized that if my teacher had brought the materials available in our society, then my learning would have been different. In this regard, I argue that the contextualization of mathematics not only increases the interest in the learning mathematics, it can also enhance their imagination power and creative skills (Shrestha, 2019). So, contextualization is the linking the topics/subject matter with the surroundings and day-to-day life.

### **Ethno-mathematics and our Practices**

Ethno-mathematics is the study of the relationship between mathematics and culture. It is also defined as mathematics which is practised in the cultural, and ethnic group. The term ethnomathematics is the combination of two words ethno and

mathematics, which clearly explains that mathematics practiced in the society, community or certain ethnic groups. According to D'Ambrosio (2013), ethnomathematics is necessarily transcultural and transdisciplinary, which is an integrated process of inquiry leading to new conceptual and methodological approaches. Ethno-mathematics can be used as a teaching tool that explores the culture as well as understands the value of the local mathematical ideas. So according to D'Ambrosio (1990), ethnomathematics as a research paradigm is much wider than the traditional concept of mathematics.

After encountering different theories, I came to realize why ethno-mathematics is considered as a better approach instead of traditional approach of teaching. Ethno-mathematics is not only effective for problem solving, it empowers the learner and focuses on critical analysis of generation and product of mathematics. So I accept the idea of Rosa (2000) that ethno mathematics is the intersection of cultural anthropology. Now I realize that if ethno mathematical approach is used in our class, then we can be much more aware and critically analyze the product of mathematics. Such practices in the mathematical classroom can make the learners feel valued and enjoy the mathematics class. If we learned from the material that we see daily, then we would be very happy and our learning would be different, so cultural anthropology provides us with tools that increase our understanding (Rosa & Orey, 2010).

### **Inclusive Mathematics Education**

Inclusive math education describes the human diversity and involves supporting the diverse learning needs of all the students in the classroom. In the case of inclusive mathematics education two discourses were construed—the discourse of inclusion in mathematics in society (DIMS) and the discourse of mathematics in the

classroom (DIMC) (Roos, 2019). Though there is no agreed definition for inclusive education (Graham-Matheson, 2012), the studies like .... focus on some sorts of inclusion in the classrooms like inclusion on the subject of gender (Neumann, 2014), inclusion in the minority and an unjust group of peoples (Feza, 2014). They define inclusion in terms of justice in mathematics education (Roos, 2019) and achieving equity for groups of people considered to be at a disadvantage, inequity of resources, teacher formation, mathematical content for social justice, etc. (Pais, 2014). Roos (2019) found two major themes in inclusive mathematics education based on the existing literature and are “general educational approaches to inclusion in mathematics education and inclusion in mathematics education from an overall societal perspective”. On the other hand, Diaz (2013) defines the term inclusive in mathematics education to include all. So, inclusive math education means no learners behind the learning platform and inclusiveness of all the supporting materials required for meaningful teaching and learning. According to Cologon (2104, p. 4) inclusive education is founded on the recognition of human diversity and involves all the people together. The mathematics we are teaching/learning is a unidirectional way of teaching and learning. Our focus is only on problem solving and finally on the result. For that reason, the mathematics in Nepal is in endangered condition.

To overcome such type of issues, inclusive mathematics will be one approach which involves and supports according to the need of the learner. For example, if anyone does not know how to solve the value of  $X$ , then facilitator should help them to find out the value of  $X$ . “The subject of inclusive practices is described as practices the students have access to in general mathematics education” (Roos, 2019, p. 31). So, this approach to teaching is the most relevant technique for classroom pedagogy. The key aspect of inclusive mathematics education is the acknowledgement of the

diversity inherent in all learners (Faragher et al., 2016). As mathematics teachers are always concerned about weak student, they always think how to improve their learning so in that case inclusive mathematics education is much more helpful for the improvement of teaching and learning as well as enhancing the learner. The authors like Forgazet al. (2015) stated that “an inclusive approach means that every facet of human experience and all knowledge domains have ethical dimensions” (p. 155), and “teachers are responsible for deciding how to implement and enact an inclusive mathematics curriculum” (p. 162). In this scenario, the inclusion of cultural capital in mathematics classes can give a meaningful understanding to the learners. They can also emerge in the active learning process. The inclusion of cultural capital in mathematics classroom is the “indicators of effective mathematics teaching” (Griffin, League, Griffin & Bae, 2013, p. 9). The inclusion of cultural perspectives helps the learners to apply their bookish understanding into the real-world practices.

### **Effective Mathematics Learning**

Mathematics teaching and learning in the context of Nepal throughout the years follows the unidirectional approach. Is that type of approach effective in the classroom? Can't teacher change their approaches to teaching and learning? Can teachers use enough material in the classroom? These questions arise in mathematics teaching and learning as the result, a number of students of this stream are decreasing in order. In my personal experience, most of students do not enjoy math classes unless games, arts and other activities are involved. In my view, for an effective mathematical classroom, we should have an alternative for today's class. We, teachers, have enough knowledge for the 21<sup>st</sup> competency classroom. We cannot keep our students in the classroom isolation. Today's classroom is totally about the algorithm, step-by-step solutions and finding the answers, which negates the



student's responsibility of brainstorming, creating, producing and strategizing solutions to the Problems (Gardener, 2006).

For meaningful teaching and learning, we (learners) have to relate our mathematics problems with the day to day life practices. So, mathematics is all about daily life practices. Mathematics with the linkage of cultural artefacts will be helpful for the learners. In this regard, Skovsmose( 2006) states that culture is the set of activities performed to produce meaning in the context. We can find the various mathematical practices in our society. For example, *Arpain* in Maithili society is used and inserted everywhere on occasion. We can teach different topics through this *Arpan* such as circle, sphere, fraction etc. So, cultural practices are sources of mathematical knowledge (Gutstein, 1997,).

Collaboration and collaborative work in the classroom between students to students and students to teachers can promote effective learning in learning mathematics. Integration of cultural capitals in mathematics teaching and learning promotes collaborative work, which is also student-centered teaching approach. In collaborative classroom, as a teacher, we help students to connect new information and ideas to their experience and learning in other areas. Collaborative classroom focuses on learning that is active and constructive process and depends in the rich contexts. In this approach, lots of minds are washed up, and credit goes to new ideas according to their experience or level. In collaborative classroom, students make new thoughts, knowledge and ideas to solve the problem themselves. Shared knowledge and authority, and mediating learning in heterogeneous groups of students are essential characteristics of a collaborative classroom. As a teacher, I should emphasize mediated learning, adjust the level of information and support the students, to maximize the ability and to make them responsible for learning.

## **Cultural Capital in Mathematics Education**

Cultural capital is a tool that makes learning meaningful. Cultural capital refers to the language, local material, and different contexts of different communities. In this regard, according to Bourdieu (1977), cultural capital exists in three states: embodied (language, mannerisms, preferences, etc.), objectified (cultural goods, books, works of art, etc.), and institutionalized (educational credentials). When we go deeper into the education sector, logic creativity and imagination do not associate with mathematics. The other dimension, such as algorithms, formulas, problem solving, sequencing, which needs step-by-step guidance is more dominant inside mathematics classrooms. In past days, when the information was limited and the classroom activities connecting real life problem required limited skills, and tools were limited. On the contrary, the technological revolutions and their uses, easily available cultural goods, technological tools and other classroom teaching and learning aid have added creativity as emerging cultural capital inside mathematics classrooms. Creativity has added as an asset to deal with all the current issues and future challenges. Creativity has been a driving factor in enhancing students' learning.

Cultural capital has been perceived in many ways by different people. Some of us have misinterpreted it as well and consider it a good for elite people. Moreover, the simple understanding and its availability in our surroundings had made us more privileged and create space to know its different dimensions. In our Nepali context, we can witness cultural capital everywhere, inside and outside the classroom. Our classrooms are culturally diverse, and the teaching approach, teaching resources which are culturally bounded are few examples of cultural capital. This is useful for students to learn about their culture and have an understanding of multiculturalism

inside the classroom. When students are taught and supported by their culture, they better understand the concept and have ideas about themselves and others. This can ensure knowing each other's cultures and improve academic achievement. A teacher can bring local culture, such as folks, and local games, inside the classrooms to know about the cultural practices and history of the place.

We can find the practice of cultural capital inside the classroom. As students come from different social backgrounds, they have their own identities and specific differences in terms of culture. The culture exchange activities, such as think –pair and share, where students are allowed to think about their current cultural practices, reflect upon them and then in a pair, they exchange the ideas and share the differences. The local festival, Jatra, local food, traditional games, and dance can be brought inside the classrooms. Students might ask to prepare local dishes and share the ingredients. And the role of a teacher could be making students more aware of the culture and show respect to each other. A teacher can raise a question which makes students think critically about their own culture. Some cultural practices need more and more discussion to have a deeper understanding. The writing task where students can give voice and critique upon own culture and appreciation can be used inside the classroom. The local food fiesta can also be held inside the classroom. Students can visit their friend's cultural foods and a brief description regarding the food, and telling other friends regarding their tradition and cultural food can widen the horizon of students to have commonality and respecting the differences.

Teaching cultural capital and using its different dimensions has numerous positive impacts in school. Living in a country where diversity in culture prevails, teachers are expected to be familiar, and respected in students' cultural aspects. Inside the classroom, the locally spoken accent, methods, and values can be incorporated,

which motivates the learners in the learning process. In doing so, a teacher needs to be very aware of the proper connections of the mathematical content with the learners' regular practices. Sometimes weak connection of the mathematical concepts with real world practices may cause confusion for the learners. In this scenario, a teacher needs to act like a facilitator who can support and provide a substantial learning environment.

It might be to measure the true impact of cultural capital inside the classroom, our current teaching and learning system and assessment practices might not promote cultural influence in education. However, its implication in the learning of learners plays a pivotal role in conceptualizing their theoretical understanding and critically reflect on and others' cultures. The integration of cultural capital in the learning process shapes the learner in such a way that he/she can easily accept others' cultures in any context and have equal respect for others' cultures. A such learner can compare and contrast one culture to another culture which advocates unjust practice. In this scenario, cultural capital not only promotes mathematical knowing but prepares a learner as a responsible citizen with holistic development.

### **Empirical Review**

In the very meantime, the empirical review is also one type of literature review, in which mostly the previous studies are reviewed. In empirical review, mostly, written documents which have already been published or done. But all those documents might be linked with our current issue. And we must choose from very nearer if possible. So the empirical studies carried out by different researchers and their review are as follows.

Shrestha (2016) conducted a study in which, he raised a question about the relation between culture and learning mathematics. To deal with the above research

question, he used an ethnographic qualitative research design. In his research, the major finding is that there was mutual relation between culture and learning mathematics. He finally concludes that there are effective teaching approaches in culturally diverse classrooms that integrate culturally relevant context and social issues, utilize culturally responsive instructional strategies and use of cooperative learning in mathematics are teaching approach in culturally diverse classroom.

Revina (2017) , in her study raised the question what factors could be accounted for the findings. Exploring the influence of culture on the implementation of RME in Indonesia, she used mix method of research methodology. She found on her study the alignments and divergence between RME and Indonesia Javanese culture. The collective feature of Javanese culture was found to align with the idea of learning both as an individual and through a social process.

Bhusal (2010) raised a question as what type of geometrical concepts are used by DARAI community. To deal with this question, he used an ethnographic qualitative research design. He explored in his research that while constructing any objects, they make a conceptual vision of the concerning objects. Then they constructed it using their indigenous method before they designed. The circular-shaped objects are mostly preferred. So that it covers more area. He further concludes that DARAI has been mainly using geometrical concepts like a circle, sphere, semi-sphere, cone, cylinder, parallelism, perpendicularity, and different angles to construct various objects.

Lama (2014) used ethnographic qualitative research design .The main finding in her research is as, if text books and curriculum include culture, that help in the preservation of culture and it needs to be introduced to children. It helps to increase the interest of the students in the process of learning.

### **Research Gap**

After reviewing the different literature what I point out that capitals are the major point in learning mathematics. Teaching and learning mathematics is affected by different cultural aspects. So, what the relation between culture and learning mathematics is and how teaching is effective through cultural capitals are the points to ponder, and it is important to explore it. So, through this research, I explored the ways of learning mathematics through cultural capitals and the relationship between culture and learning mathematics.

### **Theoretical Review**

Theoretical review is a type of review in which we as a researcher have to review the particular theories, which must be related to our research questions. In the path of our research journey, we as a researcher need to have at least one theory to guide the whole study. It seems integral because it helps to show the real path to go along. Our research questions help whether any theory is appropriate for our research or not. So, I preferred socio culture theory of Vygotsky as theoretical referents in my study which guide me from the beginning to the end of this research.

### **Socio-cultural Theory**

Socio-cultural theory of Vygotsky (Vygotsky, 1978) considers socio- cultural factors in cognitive learning and education. According to him, knowledge is constructed through social or cultural interaction that is interaction with parents, educators, classmates, friends, etc. He also added that knowledge is constructed through cultural practices. So the interaction with significant objects, such as books and culturally specific practice that learners engage in the school, at home and in the community (Torner et al., 2008). Asmy research study is linked with the ethnomathematics, I can construct the knowledge through the culture, which is

possible when I use the socio culture theory of Vygotsky's; hence it is another theoretical referent in my inquiry.

The learners' thinking and performance can be upgraded with the Vygotsky's ZPD theory, which describes that learning can be increased with the help of scaffolding. Learning development is possible through the use of cultural artefacts. In the society, there may be one who is skillful and help of that the development of learning is upgraded and so that there is the development of new skills and concepts. In this regard, learning would be meaningful if there are social interaction, and uses of cultural capitals by the facilitator .

## CHAPTER III

### RESEARCH METHODOLOGY

#### **Chapter Overview**

This chapter in this study incorporates the methodical dimensions of my research study. My research orientations, philosophical assumptions, research paradigms, and quality standards are the major focused areas in this chapter. In addition, this chapter also incorporates the research sites and how I choose the participants to accomplish the purpose of this study.

#### **Methods and Procedures**

The research methodology for my study is based on qualitative research. In this regard, Cresswell (1994) defines qualitative research as an inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting. In this method, the data analysis tool is observation, interview, and daily observation of day-to-day practices. I explored the experiences of the teachers in integrating cultural capital through the in-depth interview.

This chapter incorporates the experiences of the mathematics teachers in using cultural capitals in the regular classroom. As a researcher, I have looked for the schools and the mathematics teachers who are integrating cultures or cultural practices in teaching-learning mathematics. In doing so, I found very few teachers familiar with this approach. Initially, I talked with ten teachers for the interview and sat in multiple formal and informal settings to serve the purpose of this study. Among that ten teachers, I have selected four(4) teachers for the final interview who are



adopting cultural perspectives in teaching mathematics at the secondary level. I drew their perceptions and experiences on the question “How does the use of cultural capitals enhance the meaningful teaching mathematics?” The data were collected in multiple sittings with the participants. Among them, some were online, whereas some were in-person sittings. I have recorded most of the interviews on my phone, and a few were noted in my notebook. I have verified all the transcribed interviews with the respective participants to confirm that their views and experiences were not altered or the originality has not altered during the transcribing. I used the dummy names while transcribing the interview data from the respondents.

### **Philosophical Assumptions**

The philosophical directions are identified with the idea of the real world, information framework, esteem framework and the methods of their appearance, which are at last legitimately or by implication identified with the strategy of leading the exploration venture/study. Various presumptions under philosophical contemplations, ontological suspicions, epistemological suppositions and axiological suspicions are sequentially emerging, which thusly offer ascent to the issue of research instrumentation and information assortment forms (Cohen, et al., 2007). I embraced my philosophical contemplations as follows:

#### **Ontological Assumptions**

As the metaphysics for interpretive worldview is relativism, and as relativism sees reality as emotional, this will vary from individual to another. Henceforth, the idea of reality for this exploration is not particular, it is exclusively developed, and there is the same number of real factors as people. I accept that the connections and correspondences; among language and parts of the individual world; help the development of real factors. In spite of the fact that the significant worry of my

examination was a numerical request for the scientific strengthening of the understudies, I had not viewed that as a definitive core interest. I stayed mindful that the members and the field notes gathered, could conceivably bolster my primer presumptions identified with this exploration action. I likewise stayed mindful that my starter presumptions may stay right or might be tested all through the examination procedure. I consistently stayed unbiased while investigating the members' perspectives and traits and was wary that my convictions would not influence the examination of their thoughts and encounters. This exploration talk has even helped me also reevaluate this.

### **Epistemological Assumptions**

"Epistemology is about the idea of information about the truth or society and is worried about knowing this world and the connection between the knower and the known" (Guba & Lincoln, 1998; Brewer, 2000). The interpretive epistemology is between emotional information development (Taylor & Medina, 2011), that depends on true wonders. For this, they are somewhat developed through the communication among cognizance and common wonders, and the awareness may contrast contingent upon the individuals. Interpretivist analysts ever accept that the information has the nature of being socially inferred and truly arranged, and they make, adjust and decipher the world and look for self-manner (Cohen et al., 2007). In this examination, I consistently centered on delivering emotional information through delayed commitment and communications with the exploration members. I have additionally centered on various procedures of information development and jobs of a few perspectives in such procedures. As I have faith in different real factors of information and their development, I have consistently attempted to investigate such real factors from among the members' encounters and stories. I have consistently viewed

members' accounts as the wellsprings of information. I accept more after building numerical information and enable understudies in their learning through associations and community practices of mathematics in Maithili culture.

### **Axiological Assumptions**

The axiological thought of anything is identified with its worth. The incentive here alludes to either being sans esteem or worth-loaded. Cohen et al. (2007) state, "Axiology worries with human instinct and, specifically, the connection between individuals and their condition" (p. 8). Constructivists-interpretive keeps up the analyst's qualities and lived encounters and not withdraw them from the exploration procedure. For me science learning is esteem loaded; society and social practices, shared societies, exercises and standards, social organizations and associations, are totally identified with the numerical qualities and standards, and they even affect and contribute to the arithmetic learning forms. As each person and network have its own worth framework, the instructive qualities and practices are reliant on the individual worth frameworks. This examination study accepts that the members' characteristics, discernments and practices, their encounters and expert stories are for the most part, firmly identified with the worth framework they had been working with. I decided on their worth framework with the assistance of my individual qualities through which I attempted to build inter-subjective information.

### **Research Paradigm: Interpretivism**

Willis (2007) explains that "a paradigm is thus a comprehensive belief system, world view, or framework that guides research and practice in a field". The interpretive research paradigm gives me a clear view of the cultural perspectives of my participants in the research. It is helpful for exploring what they do and what their view about is. Thus, it supports me to construct the knowledge of how mathematics

teacher uses cultural capitals for teaching and learning mathematics. I also engage my research cloud for the interpretation of multiple realities. So, integrative research methods include ‘narrative inquiry’ and ‘writing as inquiry’, especially autobiographic and auto- ethnographic methods (Ellis & Bochner, 2000, Taylor & Settelmaire, 2003).

According to Creswell (2014), “along with methods and procedures, all research and research designs have philosophical assumptions” (p. 5). I believe that the context and the phenomena can be interpreted from multiple perspectives ,which can be different from person to person. In this regard, I had a depth interaction with the school teachers who are integrating cultural capital in real classroom practices. As interpretive research paradigm aims to generate reflective understanding, it is obvious that it can help me to see the practices of using different techniques to give and build a concept of mathematics for students. I interpreted the teachers’ experiences aligned with the existing literature in the analysis section in this study.

### **Narrative Inquiry as Research Methodology**

A narrative inquiry portrays the real-life practices of individuals, their encounters and gathers and retells their accounts identified with the exploration issue (Creswell, 2011). It regularly centers on examining a solitary individual, gathering information through the assortment of stories, revealing individual encounters, and finding and talking about the significance of those encounters for the person. It focuses on the small- scale logical image of individual stories instead of the more extensive image of social standards and theoretical speculations. It is commonly utilized when the people are prepared to recount their accounts and think of them as significant; the analyst needs to report them. Utilizing account look into a structure in my examination study, I, for the most part, centered around the members' observation

and practices on teaching and learning mathematics through cultural capitals through their accounts, singular encounters, convictions and study hall rehearses saw during fieldwork. During the meetings and other data assortment forms, I centered and furthermore spurred the members to share their own accounts and encounters. After I assembled their encounters and stories through a progression of meetings and investigations, I composed them in sequential request. I described them for additional investigation of their characteristics, convictions and practices regarding numerical request and scientific strengthening of understudies. I re-celebrated their accounts and coded subjects.

### **Research Site and Participants Selection**

As my examination has the account request approach, the fundamental data of my exploration is the experience of a member My inquiry is related to instructing and learning arithmetic through social capitals. For that, I approached four school mathematics educators.

### **Data Collection Tools and Techniques**

This is a subjective research, so the information collected from the interview is the data the members gave during the meeting and the field notes. The data is kept in literary or verbal structure. In the meeting, the member shared their perspectives on instructing and learning arithmetic through social capital. Not just the meeting, the archives acquired through a few bona fide sources had likewise been utilized as data.

### **Data Analysis and Interpretation**

Different writers have defined qualitative data analysis in different ways. The process of making meaning of study participants' ideas and opinions about events, associated patterns, themes, categories, and frequent similarities is known as qualitative data analysis (Cohen et al., 2007). Similarly, Gibbs (2007) has focused that

qualitative data analysis is the procedure of converting subjective information gathered into a concise, easy - to - understand, informative, trustable, and even unique evaluation. Also, Schwandt (2007) has proposed that analysis of data does not really follow a regular direction; instead, the action of understanding the meaning of, analyzing, as well as theory- building information symbolizes an exploration for generalizations between many categories and subcategories.

Interpretation is regarded as a critical component in deriving meaning and understanding from the detailed descriptions of participants' experiences. Thus, after carrying out the interviews with all the participants, I transcribed the data collected as field notes and responses to questions during interview sessions. The transcribed data was further proceeded for the coding process, then converted into different categories or themes, and the relations between themes are identified. Finally, by interpreting data, I constructed meaning and came to a logical conclusion.

### **Quality Standards**

Quality principles in an exploration connote the quality/ies of the data gathered, and the discoveries and ends determined through them. The nature of the examination relies on the strategies, methods and procedures utilized to get a handle on the real quintessence of members' perspectives. As a researcher, it is my obligation to make the exploration exercises solid and legitimate, yet such properties in subjective research are not straightforwardly determined, as in exploratory and semi-experimental plans. The quality measures for an interpretive worldview fluctuate. Be that as it may, I have kept up the accompanying quality principles for my e study.

### **Trustworthiness**

Cope (2014) mentioned that the usefulness and integrity of the findings are dependent on the authenticity as well as reality of the qualitative studies and the

transparencies of the study. Thus, trustworthiness measures the level of trust in information, analysis, as well as process to achieve the reliability of the research. In a qualitative study, trustworthiness is used to establish the four things. They are credibility, transferability, dependability, and conformability.

### **Credibility**

The degree of trust that can be placed in the accuracy of the research findings is referred to as credibility. It is similar to internal validity in quantitative research and is concerned with the truth-value aspect (Lincoln & Guba, 1985). In this study, I ensured my prolonged engagement with the female participants to build trust and get rich data on the subject matter. Other factors like triangulation and member checks also assisted me in establishing credibility and trustworthiness.

### **Transferability**

Transferability attempts to make generalizations of study results and relate those to different settings and events. Transferability, a form of generalizability, relates to how well occurrences or research results mentioned during one research work seem to be relevant or helpful to theorists, practitioners, as well as future studies (Lincoln & Guba, 1985). So, the concept of transferability is concerned with the aspect of applicability. For this, it is necessary to describe not only the behavior and experiences, but also their context, in order for the behavior and experiences to be meaningful to an outsider.

I believe that the findings of this study will be useful for other researchers and stakeholders related to a similar field. As a researcher, I provided a detailed description of the participants and the research process so that the reader can determine whether the current findings are applicable to their situation.

### **Dependability**

Dependability seems to be essential to truthfulness since this confirms the research outcome as coherent. According to Sandelowski (1986), dependability is the uniformity as well as reliability of this study, also an extent to which relevant studies are recorded, enabling someone from another research to implement, review, as well as criticize the methodological approach.

Therefore, in my research work, I attempted to maintain the consistency of the data and findings through a follow-up interview and a member check process. Moreover, I tried to ensure that nothing is ignored in the research study.

### **Confirmability**

Lincoln and Guba (1985) have stated that confirmability is the extent to which the research study's findings could be confirmed by other researchers. I maintained confirmability by conducting several rounds of interviews and interpreting their experiences without any kind of biasness. Moreover, I presented data with the help of more than one source for each claim or explanation to make sure that the data endorse the evaluation and discussion of the information.

### **Ethical Standards**

To investigate the scientific practices in school culture, I profoundly drew in by my exploration member about my examination. I guarantee that the idea of my exploration member and the area in which the examination procedure is being done can change the result of my examination. This exploration is helpful for the school teachers just as the understudies of another network (Punch, 2005).

I revealed the motivation behind my investigation and how they are significant as members of my investigation. It can be a matter of worry to stay away from the undesirable data that might be introduced during a meeting with the



participants (Panton, 2002). They allowed me to communicate. The collected information is kept classified from others. Essentially, I was mindful that there ought not to be any physical, or mental damage to the participants of my investigation.

## CHAPTER IV

### TEACHERS' EXPERIENCES IN TEACHING MATHEMATICS THROUGH CULTURAL CAPITALS

#### **Introducing First Participant (Mr. ABC)**

The first participant in this study is a secondary mathematics teacher teaching in one of the reputed private schools in Kathmandu. His background study is pure science and teaching mathematics for eight years in different secondary schools in the Kathmandu Valley. I found this person as a resourceful personality for this study which is trying to make his classroom more lively and meaningful by integrating the abstract ideas of textbooks with the cultural phenomena of the learners. He practices real-world projects and activities to integrate the learners' culture into the mainstream classroom. He is named Mr. ABC in this study to maintain the confidentiality. This interview was taken in an in-person conversation, so I collected the major ideas in my notebook in bullet forms. Later, I transcribed it in the conversation form and verified it with him in another sitting.

#### **Context of the First Interview (Mr. ABC)**

After knowing that he could be the right participant for my research, I called him at the mobile number 98++++... then on Facebook messenger and explained about my research after a short informal talk and requested him to contribute to my research by sharing his experiences, stories, and views in few interviews. At first, he was uncomfortable with the interview because he thought that he might not answer my questions properly, which may make him feel awkward, but he was comfortable after I explained it in detail. We had decided to meet in Zoom meeting for our

discussion. He said that he would be available for the interview after 8:00 pm in the evening because he needs to go to school duty in the daytime. So, we scheduled the interview in a Zoom meeting.

I visited the interview guidelines questions once again and we were in touch through phone calls and Facebook messengers. I called him on the interview day in the morning time to remind him of the evening. I was a little worried whether I could collect the desired stories for my research or not. With his permission and welcoming him in the interview, I started asking interview questions to him. I recorded our conversation with his permission.

### **ABC's Journey of the Teaching Profession**

I was eager to know about his educational journey from his initial days and onward, so I asked him if he could share his experiences in learning mathematics during his school days. He replied that he was good at mathematics as a problem-solver in those days. Taking a short pause, he said:

*I was good at mathematics in those days as I used to solve most of the problems easily. The majority of my friends used to feel it was a difficult one. I can still remember that my secondary mathematics teacher always used to say that mathematics is the most difficult subject in this world, and it can be learned only by those people who have high cognition power. Being a higher scorer in mathematics in those days, I used to feel like a hero of the class. My teacher and my friends always used to appreciate my problem-solving style and quickness in dealing with problems. Though I was unknown of the real-life applications of those problems and their existence in real-world phenomena, I used to enjoy solving mathematics.*

In addition, I asked him about the method adopted by his teacher on those days. He replied that his teacher used to follow lecture-based traditional strategies in the classrooms. He said:

*Our teacher used to teach on a lecture-based method in those days. Though they were our best teachers in teaching mathematics in those days; nowadays I find the lacking of real essence and conceptual understanding in solving mathematics in those days.*

Further, I tried to know his perception of that pedagogy and asked him if he thought that the way how his teacher taught was effective enough for him. Then he replied that the pedagogies adopted in those days were the best approach for him as that was the ultimate approach he knew but from today's perspective, he did not find it enough to address mathematics teaching and learning. He said:

*Well! I used to think that was the best approach for me in those days. But I remember some cases like learning algebra and geometry were out of my thoughts. I didn't use to see the existence of these topics in real life in those days. Because of this, I rarely used to enjoy these topics. But I can say that only a few students (so-called high achievers), including me, used to solve problems from those sections and from overall mathematics. The majority of my friends never enjoy mathematics class and they always show their negative attitude toward this subject. I also asked them about the real-life existence of the mathematical concepts with my teacher, but he always used to reply, "mathematics is to solve, don't look for its existence, read the formula, memorize the steps and apply on the problem...". Those types of teachers' replies always make us reluctant to interact with the teachers in learning mathematics.*

### **Connecting with Real-world Practices (Cultural Capital)**

In reference to cultural capital, I tried to know his opinion and asked him whether if he ever thought of learning mathematics through real-world practices (cultural capitals) and if he was unknown with such strategies and never thought of an alternative approach, though he felt some lacking in his learning. He said:

*No, the approach adopted by my teacher was the best approach for me in those days. Though I used to feel some lacking in my understanding of mathematical concepts in those days, I was unknown regarding contemporary practices in learning mathematics. I used to think that mathematics could be learned only with continuous practice in isolation. I used to solve similar kinds of problems multiple times.*

Further, I was eager to know about his teaching practices during the initial days of his teaching career. And I asked him if he could share his experiences of teaching mathematics in the initial days of his teaching career. Then he replied that he used to follow the same strategies that he was taught in his school days. He said that:

*At the beginning of my teaching career, I used to teach using the lecture method in the classroom as I was taught with the same approach. I used to solve most of the problems on the whiteboard and suggest students follow and solve similar kinds of problems after copying from the board. I used to think that was the only and best approach to teaching mathematics in those days.*

Then, I like to know how long he continued with the traditional approach and his beginning as a student-centric teacher who integrates cultural capital in the mathematics classroom. I asked him how long he had followed this lecture method in teaching mathematics, when do you feel that you need to get transformed, or you can

say, what struck him to change his teaching style? He shows his transformation from the days when he was pursuing M. Ed. degree at Kathmandu University. In this scenario, he said:

*I think my teaching mathematics was guided by this approach for one decade of teaching school mathematics. When I joined a new University in 2016 for my M. Ed. in mathematics, I encountered contemporary practices in teaching mathematics. These days, slowly my teaching practices got modified and nowadays I am trying to integrate the cultural practices of my learner in teaching and learning mathematics in the schools where I am teaching.*

### **Different Cultural Practices he Used**

Likewise, I wanted to know what sort of cultural practices he was adopting in his classroom. For this I asked him if he could share what type of cultural phenomena he was integrating into his mathematics classroom. In this, he shared his experience, taking a pause.

*I am trying to connect the textbook mathematics to the students' real-life context. At the beginning of each chapter, I asked them some provocative questions and they shared their experiences in relation to my concern. I don't explain the mathematical ideas directly but discuss different examples at first such as if I need to teach home arithmetic. I encourage them to bring the electricity bills/water bills or any other bill and encourage them to discuss this matter with their parents. On the next day, each of them shares their discussion with their parents and their understanding in the class. We (me and my students) participate in the discussion and discuss every possible component of their bills. Finally, when they are able to make sense of the bills on their hand and also the document which their friends have brought, I*

*connect the ideas of those bills with the concepts and mathematical components of their textbook. Sometimes, I have visited nearby temples and stupas to teach the concepts of geometry.*

From the above context, I found that he is using bills, and other vouchers to teach the topics like home arithmetic. Further, I asked him how helpful this strategy is for him in teaching mathematics, and to know the strength of cultural capital in teaching mathematics.

*I found it really very helpful for me in teaching mathematics at the secondary level. I found that students have many queries and questions about them, but because of the abstract nature of mathematics, they are not able to connect those concepts with their real-world practices. Whenever I tried to integrate cultural practices in teaching mathematics, I found that my students enjoyed the class and performed better than before in those sections.*

### **Difficulty in Integrating Cultural Capital in Mathematics Classroom**

To explore his difficulty integrating cultural capital in the mathematics classroom, I asked him about his hurdles in integrating those cultural phenomena in teaching mathematics at the secondary level. In responding to this question, he shared like:

*It was really difficult for me in the earlier days to search for the appropriate cultural practices for a particular topic. And the students were also not that much familiar with the approach. But nowadays it's not that much a problem for me. However, I always try to connect something new in each area of mathematics which takes some time to surf the internet and discuss with other fellow teachers.*

*(Taking a short pause, he again continues)*

*Sometimes it takes more than the allocated time to integrate those aspects. And sometimes it takes 2/3 periods also in the field visits. In this scenario, I have faced problems in some cases as other teachers and school administration sometimes do not show interest in such activities.*

### **Changes in Students after Integrating Cultural Capital in Mathematics**

#### **Classroom**

To know the changes and improvements in the students after integrating cultural capital in the mathematics classroom; I asked him what types of changes he found in his students He poured a glass of water from the jug in front of him and drank half from it, then he responded to this question.

*I think I might have discussed it before as well. In doing so, I found that my students are motivated to learn from real-world practices. They feel like they are solving the problem of their real life. I found the conceptual understanding and clarity in their knowledge after integrating cultural capital into the classroom. I also found those students who were so-called less active in the mathematics classroom also equally participating in the discussion and activity with this approach. This helps them to keep their interest in learning mathematics.*

### **Addressing Multi-cultural Context with Cultural Capital in Teaching**

#### **Mathematics**

In addition, there might be students from different cultures in a single classroom. I wanted to know how he addresses such a scenario in the classroom. For this, I asked him how he dealt with the students in the multi-cultural classroom in applying this pedagogy. Then he said:



*I believe a classroom is a miniature society, and the cultural perspective may vary from student to student. In this scenario, I believe that students can learn from each other cultures. The culture in my pedagogy does not mean the religious perspective but the practices and the way how people live in that particular society or their real-world practices, including some indigenous practices. I found the students of this 21<sup>st</sup> century are culturally tolerant, and they show equal respect towards other's cultures whenever we discuss such phenomena in the classroom.*

The scenario above shows that he integrates multi-cultural aspects in his mathematics classroom. He believes that students can learn from each other's culture and such practices help students to see the phenomena from multiple lenses. In addition, he reflects that a multi-cultural perspective can make the students critical enough to question their deep-seated beliefs and practices.

### **Introducing Second Participant (Mr. DEF)**

The second participant in this interview procedure is also a secondary mathematics teacher teaching private schools in the Lalitpur district. He is also from a science background up to his Bachelor's degree but completed his M. Ed. study in mathematics education. When I approached him for this interview, he was interested in this research study and shared his valuable experiences with me. I found him as an energetic and skilled person who is integrating different forms of arts like songs, performance arts, ICT, and projects in teaching mathematics. I have named this teacher Mr. DEF to maintain the ethical issues. I have verified this interview with Mr. DEF after the transcribing to avoid the altered ideas of his real experience. The interview with Mr. DEF goes in the following ways.

### **Context of the Interview (Mr. DEF)**

I contacted him on his mobile number and explained to him about my research and requested him to be my participant. He put him some queries about the topic and objective of my research study. After knowing all the background of my research, he agreed easily to be my research participant. Before this interview, he called me to observe his class at school where he used to teach. This visit made me more assured about their personality and I found that his experiences could play a significant role in serving the need of the purpose and research question in this study. I talked with this teacher in multiple forms (some were formal and some informal) and recorded this interview in telephone calls.

### **Reflecting on Academic and Professional Journey**

In the beginning, I was eager to know about the pedagogy in his schooling days and I asked him if he would share his experiences of how you learned mathematics during his school days. He replied with a short laugh and said:

*I may not remember each and everything as it has been many years. But I can remember that our math teacher was very strict. I never dared to talk with them in school days, though I was a good problem solver in mathematics. Math teachers were like the most powerful teacher at school and I was also similar kind in my earlier days of teaching carrier. It might be a reflection of my teachers' strategies.*

Then I asked him about his current pedagogy he adopted. For this, I asked him to share his experiences of earlier days in teaching mathematics. He accepted that he was following a traditional lecture-based approach in his initial days of teaching.

*Sure sir, at the beginning of my teaching career, I followed the teaching styles of how I was taught because that was the ultimate approach I*

*was known and that was the best strategy in my eye in those days. I used to solve a problem on the board and let them copy it. Then after I used to give some similar kinds of problems where the students had to replace the numerical values only. I used to engage them in solving the problems of textbooks and let them match the answer.*

I was trying to explore further in the same context, so I asked him whether he wanted to say that he also used to practice the traditional approach of teaching mathematics. He replied:

*Yes, actually traditional approach was only the best strategy to teach mathematics in those days. But nowadays, I practise different approaches to teaching mathematics.*

Then I wanted to know about the ‘different approaches’ that he argued above and I put my next question on him. The question was what it meant a different approach. He said:

*Different approach here means that I am using teaching-learning materials for some topics. For example, while teaching prism and pyramid, I am using chart paper. I cut the paper and showed them how the base is triangular, how many triangles are there, how they are congruent and it helped them for better understanding. We look at another example, while teaching profit and loss, students find it easy when we visit some store and let them calculate profit and loss. I visit the school premises and nearby locations for further exploration of the mathematical concepts of the learners.*

### **Comparing Initial Practices with his Current Practices**

He argued that his pedagogical aspects are changed from the days when he started to teach with current practices. I wanted to know what types of changes he

found in changing the pedagogies. For this, I asked him how compared his teaching practice as fresher and nowadays. Then he said:

*As a fresher, I was reproducing the conventional way of teaching approach and a banking pedagogy as discussed by Paulo Freire. But now, I find transformation in my teaching, like the use of ICT, project-based learning, contextualization of mathematical ideas, use of teaching materials, cultural integration, and so on.*

When he shared different approaches like the use of ICT, project-based learning, contextualization of mathematical ideas, use of teaching materials, cultural integration, and so on, I was eager to know whether he used all these strategies in a single chapter or in a different one. For this concern, I asked him if he was using all these approaches in a single chapter or idea. Then he replied:

*No, sir. I am using these approaches as per the need and demand of the chapter and my context. But I always try to integrate multiple approaches into the same idea so that students can learn multiple ways of learning a single idea. I believe that different students can learn in different ways, so I am trying to integrate multiple possibilities into the same idea or concept.*

### **Impact of Cultural Capital on his Experiences**

To know the impact of his cultural integration in teaching mathematics, I asked him if the learning was effective while using these tools in the classroom, and what kind of impact he experienced from these methods. In responding to this question, he replied:

*Actually yes. (Taking a pause) if I compared the learning of students with my earlier approach with the current approach, then I can find a huge*

*difference in it. This progressive way of teaching mathematics is really helpful for me and I found it effective in my case.*

*Well, students are also performing very well as compared with their earlier grades. Their conceptual understanding and application of mathematical ideas are also refined. The integration of cultural capital in the classroom makes the classroom lively and easily connects the students to their context, and makes them feel proud to learn that concept.*

### **Integrating Cultural Capitals in Mathematics Classrooms**

To know his difficulty integrating cultural capital in a mathematics classroom, I asked him if it was difficult for teachers to integrate cultural phenomena in the classroom as classrooms have multicultural students. Then he said:

*Of course, it's one of the difficult tasks for a teacher, but at the same time, we need to know that common cultural material is suitable. For example, when I am teaching fractions, I use roti as a reference for that, and that is well known to everyone.*

*(Taking a sip of water from a bottle near, he continues)*

*On the other hand, I found students culturally tolerant. They love to know and learn from each other's cultures.*

### **Connecting with the Real-world Practices**

To understand how he connects the abstract ideas of mathematics with real world practices, I asked him how he related mathematics to learners' day-to-day life. Then he said:

*Obviously, as you are also a mathematics teacher, you may know that our cultural practices are closely connected to our day-to-day practice. Knowingly or unknowingly, people are practising mathematical concepts in*

*different forms, but the teachers and learners are not able to connect that real practice to the classroom practice.*

To excavate further information on this, I again asked him what could be the possibilities of integration of cultural capitals in the regular classroom in his experience. Then he said:

*It is quite challenging in the present context, as I discussed earlier as well. But once you start practising it, you may feel comfortable. On the other hand, students may be reluctant at the beginning with the new practice, but you need to integrate those aspects in such a way that students do not feel any difficulty and enjoy the learning practices. They may get a chance to learn from each other cultures.*

Further, I asked him to give an example where he had integrated cultural capital in his classroom. Then he said:

*Yes, I have tried to integrate cultural phenomena in mathematics teaching and learning practices. Cultural artefacts like doko, mandro, gundri and so on can be the materials for teaching shapes and patterns. The shapes and art in monasteries and temples are other sources for me. I tried to integrate those things which exist in the learners' community and which are familiar to my learners. But sometimes, the cultural background of the teacher and students may contradict. I had one incident when I was in Solokhumbu where I was teaching ratio and proportion; then I gave an example of paddy, but the students there didn't get my idea properly as they were not familiar with paddy farming. As the region is in the upper hilly region, they have potatoes and maize farming the most. Later, I found that I could have given an example of their house made from stone with a stone roof. Later, when I got*

*familiar with the cultural background of the students and their community, then I felt comfortable in integrating learners' cultural capitals in my regular classroom.*

### **Difficulty in Integrating Cultural Capital in Mathematics**

To explore the difficulty in integrating cultural capitals in mathematics, I further asked him if it was difficult while choosing the appropriate culture as reference material for teaching . Then he said:

*Yes, of course, while I was giving an example of paddy, it's better to give Maize or something like that and other things that are found in their locality. As a concern for paddy, it's better to give such examples in the Terai region as there is paddy farming.*

In exploring further in this issue I asked him if he faced any other kinds of difficulty in his teaching. He replied:

*Yes sir. It was quite difficult for me to teach because we (me and my students) were not familiar with this noble practice, but now I am comfortable with this approach, and I found my students enjoying learning from this practice.*

With this, the conversation with the second participant (Mr. DEF) also ended. I found his experiences and stories somehow similar to the first participant, but this conversation has given me more insights and a chunk of additional information which could contribute to serving the purpose of this study.

### **Introducing Third Participant (Mr. PQR)**

The third participant for the interview is a secondary mathematics teacher and a HoD of the mathematics department at one of the reputed schools in Kathmandu. He teaches from grade VIII to grade XII at that school and has an education background

in his University education. He follows constructivist approaches in teaching mathematics at his school and uses project-based and activity-based teaching approaches as a dominant pedagogy in his classroom practices. He has more than a decade of experience in teaching secondary mathematics and he told me that he has been practicing these progressive pedagogies for four years since he joined M. Ed. in mathematics education at Kathmandu University. Further, he is a mathematics educator and a researcher who is trying to connect the progressive pedagogies in teaching-learning mathematics in the Nepali education system, which can help the learners to connect their real-world phenomena with abstract ideas in mathematics education.

### **Context of the Interview (Mr. PQR)**

After knowing that he could be the right candidate for my research, I called him over the mobile number 98<sup>x</sup> <sup>x</sup> <sup>x</sup> ... and then we were connected on Facebook Messenger and Viber. We had our further informal talk on Viber and I requested him to contribute to my research by sharing his experiences, stories and views in a few interviews. I was more confident this time because I had already taken interviews with other two participants. This was my third interview. We were getting quite familiar in informal chats, then we set an online meeting in Zoom meeting. I recorded the interview with his permission and recorded our conversation, which is discussed below in the narrative form.

### **PQR's Journey of Learning Mathematics**

Though my interest was to explore his cultural integration in mathematics classroom, I was interested in listening his story about how he had learned mathematics as a learner. For this, I started our conversation with a question if he



could share his perception and ways of learning mathematics during your school days. Then he said:

*Sure sir. Mathematics was my favorite subject during those days.*

*(Taking a pause)... Now also, it is favourite... (Hahaha)*

*I was a good problem solver in my class. The teacher and my friends always used to appreciate my problem-solving ability.*

*But now, if I reflect on those days, then I find that I was just an algorithmic problem solver. I had rarely tried to understand the phenomena from the real-life perspective. I had never searched for the existence of mathematical concepts in the real-world. Instead I had to solve the problems of textbooks to score grades in the examinations.*

### **Comparing PQR's Practices of Earlier Days and Today**

Further, I wanted to find what differences he experienced in his a decade long experiences. To explore this, I asked him if he was working as a mathematics teacher for more than ten years; how he compared his teaching of earlier days to today's teaching. Then he replied:

*In the earlier days of my teaching career, I was following the same strategies that I was taught. The conventional teaching styles were the ultimate practice for me. I was unknown with the contemporary practices and following the structured format where math was considered to be taught within the four walls and teacher-centered. But now it is almost changed. Though sometimes my past hits me in my teaching but my dominant pedagogy is guided by student-centered pedagogy and integrations of cultural capital and the western approach helps me and my learners to connect abstract mathematics to their real-life.*

In responding to the above question, he used the word ‘western approach’, so I wanted to know what it meant for him. I asked him if he was using the term western approach of teaching and how he could define the western approach of teaching in our context. He said:

*Sir, I mean to say the pedagogical practices in Western countries. But I am not telling you to adapt everything as it is. We can take an idea from them and involve our local practices and cultural phenomena. The innovative practices and student-centered pedagogy are the core approaches I am adopting.*

### **Effectiveness of Integrating Cultural Capital in Mathematics Classrooms**

After knowing about his short learning history, I wanted to see the effectiveness of integrating cultural capital in his classrooms. For this, I asked him how fruitful he found this approach in teaching mathematics. Then he said:

*Of course, it's challenging and it is difficult to contextualize the topics. We can find students from different cultures in the same class. Sometimes a teacher might not be able to understand the context and cultural practices of the learner. For example, Rangoli might be common for some students, whereas few might not have heard too. Bara (a Newari food) might be common in the Kathmandu valley but might not be in any other context. Though students can learn multiple ideas from multi-cultural perspective but a teacher needs to be aware of the learners' practice.*

*(Taking a pause....)*

*Our mathematics content seems abstract and our practices promote the reproduction of knowledge. In this scenario, a teacher needs to be aware*

*of the contextual practices and real- life applications of the mathematical concepts.*

### **Connecting with Real-world Practices (Cultural Capital)**

*To explore how he connects the abstract ideas and concepts of mathematics with the learners' real-world practices. I asked 'how he was contextualizing real-life applications of mathematics and if it was possible in all the content areas of mathematics, Then in responding to this question, he replied:*

*Yes, of course, there might be some abstract concepts of mathematics at a higher level which may exist only in the imaginations. But the mathematics taught at the school level evolved from the real-life context only, so we can connect it to the world. It might be a difficult task in the beginning, but it is possible. (Taking a sip of water in a bottle aside and continue)...*

*We can find mathematics even in the kitchen; while cooking rice we are using ratio and proportion to measure the amount of water with the amount of rice. Different materials such as doko, naglo, mandro can be connected with mathematical concepts. Temple is rich in teaching the shapes of mathematics. The application of algebra and the local materials can be easily connected with mathematical ideas.*

### **Changes Found in Students' Performances after Integrating Cultural Capital in Mathematics Classes**

To explore his students' strength and performances after the integration of cultural capital in mathematics teaching and learning, I asked 'him what kind of difference he experienced in his learners. Then he replied:

*Sure sir. After integrating cultural capital with mathematical concepts, I found that my learners are motivated toward mathematics learning. The students who used to neglect and feel lazy in the classes are also engaging in the learning process actively. In addition, they are improving in their achievement also.*

### **Challenges Faced by Mr. PQR**

To explore the challenges faced by Mr. PQR, I engaged him with a few questions, and the conversation excavated some important ideas. I start the interaction with a question how challenging it was for him. Then he replied:

*Umm... Initially, it is quite challenging as teachers also might not be aware of all kinds of contextual practices which can be connected in the mathematics classroom. But when a teacher and students are familiar with the approach and the practices, then it seems very easy. Nowadays, I don't feel any difficulty integrating such practices into the mathematics classroom.*

Further, I asked ' him how he integrated such practices with learners with different cultures to know how he was dealing with multicultural classroom setting.

*Sir, it is quite challenging in some cases, but it is an opportunity to learn about each other's cultures in the same classroom.*

To generalize his experiences, *I further asked if it was possible to adopt this approach (integration of cultural practices) in mathematics classrooms for any school.'* He responded to this question in this way:

*Actually, it is quite challenging in the earlier phase as we are guided by conventional practices. But if a school or a teacher wants and has a will for the change, then it is possible. A teacher can gradually make his/her classroom familiar with the approach, then it will be easy to adopt this*

*approach. In our context, the majority of the school educators and trainers are advocating for the change in their practices, where the integration of cultural practices in the classroom practice might be one of the easy tasks. This approach can make the classroom lively and engage learners in the learning process in an effective way.*

#### **Introducing Fourth Participant (Mr.UVX)**

To serve the purpose of this study, I further interviewed with the fourth teacher. This teacher teaches in one of the schools in Lalitpur district in the Kathmandu valley. He has an experience of six years of teaching secondary mathematics in different schools in the Valley. He is from the science background in his Bachelor's degree and completed his Master's degree in mathematics education. He also integrates cultural capital in teaching mathematics to his students.

#### **Context of the Interview (Mr. UVX)**

I got his contact from one of my classmates and got a chance to know about him and his experiences in mathematics teaching and learning. Same as in previous interviews, I contacted his teacher firstly on the phone and then on social media. We sat together for multiple times for this purpose where we discussed his practices and experiences in integrating cultural settings in mathematics classroom. He was pretty happy when I was keeping concern about his practices and was ready for the interview. After the informal talks and coffee dates to build the rapport, we set a Zoom meeting. I used Zoom meeting in each interview because it was feasible for me to keep the recordings. Same as before, I recorded this interview taking his permission which is presented below.

### UVX's Journey of Learning Mathematics

In continuing the interviews, I started this conversation also with his journey of learning mathematics. For this, I started with a question to share his mathematics learning experience from school level. Then he replied in this way:

*Sure sir. I think the way how I learnt mathematics at my school level might be the most common practice in our country. I think a majority of the people might have learned mathematics from this approach. I learned mathematics from the most traditional approach where the teachers were superior, and we used to follow them without any question. The rote memorization of the formula, multiplication tables, and algorithm of the problem were common to us. We had to learn mathematics as we were solving the problems of textbooks which did not have any concerns with our real life. I learnt mathematics to score good grades in then examinations.*

In addition, I wanted to know the reason behind his interest to choose teaching as his profession. I found that our community beliefs that the majority of the teachers are not interested in teaching. To explore his understanding, I posed a question as what factors influenced him to become a mathematics teacher. Then he replied:

*Being a student of mathematics, I was given some tuition and coaching classes for the school from the days when I joined the Bachelor's program. When I was in 3<sup>rd</sup> year of B. Sc. I applied in a private school where I got a chance to teach mathematics, and my journey of teaching mathematics began from there.*

## **Transformation from Normal Practices to Cultural Practices in Mathematics Classroom**

Similarly, to know his transition from his earlier pedagogies containing a lecture-based approach to a progressive approach with the integration of cultural capital, I asked some questions. The first question here was how he started teaching mathematics from cultural capitals. Then he said:

*I started teaching mathematics when I was in B. Sc. and taught for a few years. I was reproducing the same approach in teaching mathematics as I was taught in my school days. After teaching around 2 years, I joined Master's program at Kathmandu University where I got encountered with different approaches of teaching and learning practices. The influence of this new university has modified my teaching-learning practices to progressive pedagogies. I started integrating cultural capital in teaching mathematics from the days when I was at the Master's level.*

Further, I asked him to compare his earlier practices with current practices . as being a mathematics teacher, how he compared his previous teaching and current teaching of mathematics. Then he replied:

*Now it is different. Previously I imitated my teacher's pedagogy on how I was taught at my school days, but now I am gradually upgrading my teaching styles in progressive forms. Previously I was at the center of teaching but now, students are at the center. Previously I focused on the marks and grades of the students, whereas now, my preference is on students' understanding and its application.*

Likewise, I wanted to know whether he was using teaching aids or not to conform to his saying and asked him if *he was using teaching materials in his regular classes*. To respond to this query, he said:

*Yes, I am using the materials but not in all the classes. It depends on the nature of the concept and the topics. I am trying to teach each chapter from a different way, so only materials are not enough for me. Sometimes I use role play, field visits and games-like activities.*

### **Effectiveness of Integrating Cultural Capital**

Mr. UVX said that he has been integrating cultural capital in his mathematics teaching. I wanted to know how effective it is for him in his professional and personal practices. To explore this, I asked him how effective the cultural capitals are in teaching mathematics. Then his reply was like this:

*In my experience, it is an effective approach to integrate cultural capitals in mathematics classrooms. Students enjoy learning mathematics in my classroom. They are motivated and feel like they are solving their real-life problems. Integration of cultural capitals in mathematics classrooms makes the learning lively.*

### **Connection with Real-world Practices**

To explore how he is connecting the textbooks concepts with learners' real-world practices I asked him how mathematics is related to our daily life and culture. Then he said:

*Mathematics is everywhere and closely related to our real life. Being a learner and a teacher, I feel like our mathematics has failed to address its real-life application part. The understanding of the concept and its existence in the world is less prioritised in our practices.*



To excavate further into this issue, I requested him to share an example. Then he said:

*Whenever I teach area and perimeter in grades VII, and VIII, then I engage them in finding the area and perimeter of their desk, book, copies, and sometimes their classroom. I engage them in real-world problems before starting the abstract ideas from the textbook, then only enter the lesson and exercise from the textbook.*

### **Challenges Faced in Integration of Cultural Capital**

In addition, to explore his difficulty in integrating cultural capital I asked him what difficulties he faced in the class. In responding to my query, he replied:

*Sure sir. In the earlier days, it was quite difficult to shift from traditional practices to this practice. Students were also not familiar with such practices, but now they are also familiar with them. There might be some hurdles in the beginning, but it will be easy later. (Taking a pause)*

*But.... I felt that such types of classes are noisier than other classes . If we do the same thing in all the classes, then it might be challenging to complete the course content in some cases.*

Further, I asked him if it was possible to integrate cultural phenomena in a classroom with multicultural students Then he:

*I have a different view on this question; as students live in Kathmandu, then they might know Kathmandu's culture within a certain time. It's not a big deal, but teachers should be aware of it. As a teacher, we need to make our students culturally tolerant. On the other hand, students get a chance to learn and respect others' cultures as well. Integration of multi-culture ideas in a*

*single classroom can motivate students to think and learn from multiple perspectives.*

It can be seen that Mr. UVX is aware enough with cultural integration, and he believes in cultural tolerance. He also believes that a multi-cultural setting is not a challenge but a strength in our context from where students can get a chance to learn from one another's culture. His progressive experiences and ideas helped me to shape my analysis section.

### **Chapter Summary**

I have presented the narratives of my research participants in Chapter IV. The data/stories presented above are the experiences of mathematics teachers. I was conscious to preserve the originality of the data provided by the participants. The narratives collected from the multiple rounds of interviews are discussed and analyzed under the themes in the upcoming chapter (Chapter V).

## CHAPTER V

### DATA ANALYSIS AND INTERPRETATION

#### **Chapter Overview**

This chapter contains the discussion and interpretations based on the narratives presented in Chapter IV. The data from the interview have been firstly sorted, coded and then categorized, and reviewed for relevance. Thematic analysis is adopted for the interpretation and analysis procedure in this phase of the study. I, as a researcher, interviewed the participants in this study in multiple phases until the purpose of this study was not fulfilled. Firstly, I phoned the participants and connected with them on social sites, and made them clear about the purpose and objectives of the study. Secondly, I used telephone calls, Google Meet, and the ZOOM platform for the interview and discussion with the participants. I have also called some participants also through the phone during the transcription procedure incase of confusion and noted in a diary. Further, I started the analysis procedure after transcribing the interview data in written form. Yin (2003) argued that “data analysis consists of examining, categorizing, tabulating, or otherwise recombining the evidence to address the initial propositions of a study” (p.109). Similarly, Rubin and Rubin (2005, p. 202) write that data analysis is a process “to discover variation, portray shades of meaning and examine complexity” which moves from the raw interviewed data to evidence-based interpretations. The coded raw information is put together to generate the themes which are interpreted with the necessary supportive literature. According to Rubin and Rubin (2005), “using published literature to suggest concepts and themes by which code is perfectly legitimate as it will help you relate your findings to what

others have already written” (p. 209). On the basis of collected data from the participants, I formed four major themes for the analysis procedure.

### **Mathematics Curriculum and Our Practices**

When I interacted with the participants in this study, I realized that they also have a similar kind of perception and argued that they do not have enough space to connect the subject matter with real life. In this regard, one of my participants (Mr. ABC) argued that due to the pressure of finishing the course before the month of Mangsir, it is difficult to link the idea of culture in the classroom. Two of my participants shared the idea regarding this, due to the curriculum frame, we teachers are bound to only practice skills in mathematics. According to Mr. ABC, our mathematics curriculum is content loaded and teachers are less motivated to apply progressive pedagogies like cultural capital and contextualization.

The interaction with the teachers reveals that the majority of the teachers are guided by the rigid frame of curriculum and reproduce the orthodox pedagogical practices. This shows that the majority of mathematics teachers are still teaching skills and drills in ways that serve only a select set of students (Confrey & Kazak, 2006). They accept that they used to follow the chalk and talk methods in their mathematics classes in their earlier days of teaching carrier. Currently, most of them are integrating cultural phenomena in teaching mathematics. "*The integration of local practices and the practices with which the learners are familiar with the major sources for mathematics teaching*", argued Mr. UVX. Further, he added that the curriculum and the teachers' practices are more aligned with the teacher-centric approach and are not able to address the need and interests of the learners. As a result of this, students are less motivated and produce anxiety toward mathematics learning. In responding to the same question, another participant, Mr. DEF supported that the teacher-centered

approach can be replaced by the cultural capital in the mathematics classroom. He added that our context is full of culture, and the multi-cultural dimension of the Nepali context adds a different flavour to mathematics and students can learn from each other's culture. "*The cultural practices in their real-world and integration of those aspects in the classroom can provide the consensual understanding and life-long learning*", Mr. PQR argued. In listening to all of them, I realized that our curriculum has failed to address that perspective in teaching-learning mathematics. Still, an active teacher can integrate the cultural perspective and practices for better learning. The participants like Mr. ABC and Mr. PQR advocated that the integration of cultural practices and contextual phenomena can promote critical thinking in the learners. In this regard, Skovsmose and Borba (2004) are careful to suggest that the critical approach must always tend to "what if not" of school mathematics, that it must investigate the possible thing the otherwise and explore "what could be" (p. 211). Such practices do not only make the classrooms lively but contribute to the conservation of the cultural capital.

The achievement of mathematics in the BLE (Basic Level Examination) and SEE (Secondary Education Examination) also shows the poor performance of the students in mathematics. The literature indicates that Nepali students at the school level are less motivated in mathematics learning. In this scenario, as different practices inside the classroom, we mathematics teachers can integrate cultural capital to develop a positive attitude of students towards mathematics and give long-lasting knowledge.

In the interaction, I asked about the difficulty of integrating cultural capital in the mathematics classroom. In responding to this question, one of my participants, Mr. PQR shares the experience that, "*it is quite challenging in the earlier phase as we*

*are guided by conventional practices. But if a school or a teacher wants and has a will for the change then it is possible".* This statement was supported by the other participants as well. It seems that if a teacher can gradually make his/her classroom familiar with the approach, then it will be easy to adopt this approach. In our context, the majority of the school educators and trainers are advocating for change in their practices, where the integration of cultural practices in the classroom practice might be one of the common and easy tasks. This approach can make the classroom lively and engage learners in the learning process in an effective way. He further added that we might encourage the students to contextualize their solutions in their language and cultural practices. In this regard, Freitas (2008) suggests reflecting on the language of uncertainty allows us to reflect on the ethical dimension of our problem solving, to reflect on the implication of our proposed solutions.

Nepali mathematics needs to be concerned about our methods of teaching, it needs to get reformed. The current practices in the mathematics classrooms are not able to address the need of any community. The curriculum perspectives of the mathematics teachers motivate them only for the marks and grades in the exam and objective thinking that mathematics should limit to the question papers of the exam should be reformed. Mathematics should not be limited to the curriculum and the textbooks only, but a teacher needs to motivate his/her learners in the effective engagement in the real world. A mathematics teacher should be able to see and figure out mathematics and mathematical concepts in every possible practice around and engage the learners to extract mathematics from there. In this regard, one participant, Mr. PQR shares his experience, "*We can find mathematics even in the kitchen; while cooking rice, we are using ratio and proportion to measure the amount of water with the amount of rice. Different materials such as doko, nanglo, mandro can be*

*connected with mathematical concepts. Temple is rich in teaching the shapes of mathematics. The application of algebra and the local materials can be easily connected with mathematical ideas."* The overall sharing of the participants in the interview shows that our present curriculum is not able to address the contextualization of mathematical concepts, so a teacher needs to act as a change agent and can apply cultural capital in the mathematical classroom, which can give a better understanding and life-long learning to the learners.

### **Contextualization of Mathematical Concepts and its Impact**

The conversation with them provides a lot of evidence and experiences in contextualising mathematics and mathematical concepts. *"If I need to teach home arithmetic. I encourage them to bring the electricity bills/water bills or any other bill and encourage them to discuss this matter with their parents. On the next day, each of them shares their discussion with their parents and their understanding in the class. We (me and my students) participate in the discussion and discuss every possible component of their bills"*, Mr, DEF shared when I asked him for an example of his cultural practices in his classroom. His experience shows that if a teacher is aware enough of these approaches and can participate actively in the change of pedagogy, then we can teach mathematics from the local materials available in our context. Further, he added that *"...Finally, when they are able to make sense of the bills on their hand and also the document which their friends have brought. I connect the ideas of those bills with the concepts and mathematical components of their textbook. Sometimes, I have visited nearby temples and stupas to teach the concepts of geometry classroom."* The scenario was not only for Mr. DEF, but other participants had also advocated equally to this approach and shared the examples in the same way.

It is an approach that motivates the learners to know, understand, and appreciate cultural heritage (Bringas, 2014).

Their examples of teaching mensuration (topics related to perimeter, area, and volume) through cultural capital were like a practical class in any science laboratory. The concept of finding mathematics in the locally available material, the experiential learning approach strengthens their practices and finds its positive impact on the learners' performances and achievements. The students with a measuring tape, a copy, pen, and necessary materials for the collection of data on the school premises and their findings can give a real taste of knowledge in them. Research studies also indicate that the traditional way of teaching mathematics usually involves little active learning and causes students to become unmotivated and disengaged in mathematics classrooms (Tilson, et al. 2010). But on the other hand, teaching with cultural capital is a student-centered approach where students are involved in the meaning-making process for the extraction of knowledge. They argued that this approach could build up the learners from all three aspects of the cognitive, affective, and psychomotor domains. Their signature pedagogy as a teacher with such an approach makes them unique in their working station. The overall interaction and the teachers' experiences show that contextualization of mathematics through cultural capital could be an effective approach to teaching mathematics.

Contextualization refers to connecting something to the context of a real-life phenomenon. From the interaction with the participants in this study, I realized that contextualization in mathematics connects the abstract knowledge and ideas of curriculum/textbooks to the learners' real-life context (Yee & Bostic, 2014). In addition, I explored that this practice in teaching and learning can extract mathematical ideas and components for a better understanding of the learners. It is



one of the key approaches which helps students to connect their situations to their textbooks concepts (Reyes et al., 2019). The scenario in our context shows that our teaching and learning practices are highly guided by an algorithmic problem-solving approach, but the experiences of the teachers conclude that contextualization of mathematical ideas can give a real understanding and prepare an individual for the future.

Though examination-driven strategies are dominant in the Nepali context in teaching mathematics (Mainali & Heck, 2017); teachers who are integrating cultural capitals in their pedagogies found their learners are highly motivated in mathematics learning. They argued that the learners feel like their own problems through cultural practices. In our context, where the majority of the teachers follows similar kinds of teaching-learning practices guided by the traditional lecture-based method; it is a revolutionary idea to integrate progressive student-centered approaches. The teachers in this study were selected purposively who were integrating cultural capital in mathematics classrooms.

### **Ethno-mathematics and Ethno-culture**

We as teachers are teaching the topics as an exercise only but without linking the topics to the culture. Mathematics evolved everywhere in society, but we failed to connect textbook mathematics to society. In this regard, one of the participants MR. UVX shared his experience " We teachers must be aware of teaching mathematics. It is better to connect with the context of the learners to give a better understanding. He added an example, if we are teaching circles, we may connect with the round shapes in actual practices like *dalo*, *dhaki*, *plate*, *roti*, etc. He further added that in his society, there is *Nanglo* with the shape of a circle, and *Jato* (grinding mill) that is also circular and that exactly follows the properties of a circle. While taking the experience

of my participant, most of them argued that we facilitators are must be aware that we need to change the trend of traditional teaching to culturally responsive teaching. He further explains why we only teach meters, and centimeters. Instead , we are not teaching Kattha, Bigha, Mana, Pathi, etc., which are closely connected to our society. The connection of such community practices in the mathematics classroom makes the learners feel like they are solving their community problem rather than the problem of textbooks. Wise teachers can address the general environment of the classroom, which will make a lot of difference in the teaching-learning process, and the same is applicable in a multicultural classroom. In this regard, one of my participants Mr. UVX shared his experience that in the multicultural classroom, students are able to know others' cultures and celebrate them.. He further explained that the teaching method should include the voices and experiences of all the students to prepare them for their future. In a multicultural classroom, the teacher's role is always crucial. So as a teacher, we must define our strategies regarding such a classroom. In this regard, one of my participants, MR. PQR shared his experience that the teacher should prepare the students for the real world as the real world itself a multicultural. He further explained that teachers must share the student's cultural experiences and that might help teachers in preparing the classroom material. In this way, the integration of ethno-practices in mathematics can give meaning to learning mathematics.

The word Ethno-mathematics connects ethnic mathematical practices to academic mathematics. It shows the relationship between mathematics and culture. The interaction with the interviewee teachers shows that mathematics practiced in cultural and ethnic groups. The term Ethno-mathematics is the combination of two words ethno and mathematics that clears the idea about ethno-mathematics, which clearly explains that mathematics as practiced in society, community, or certain ethnic

groups. According to D'Ambrosio (2013), ethno-mathematics is necessarily transcultural and transdisciplinary, which is an integrated process of inquiry leading to new conceptual and methodological approaches. This study explored the experiences of the mathematics teachers where they had shared their ethno practices in teaching mathematics in school education and got a significant positive impact. This study finds that ethno-mathematics can be used as a teaching tool that explores the culture and the value of the local mathematical idea.

The word ethno refers to the ethnic practices in a particular community. The real-world practices through which a particular group of people live. I believe that terminologies and system of measurement of calculations might be unique to other cultural practices. After listening to the experience of the participants in this study, I came to realize why Ethno-mathematics is a better approach instead of the traditional approach to teaching.

### **Linguistic & Non-linguistic Tools in Mathematics Learning**

The participants like Mr. PQR and Mr. UVX advocate for the use of community language in mathematics classrooms. In adding an example to this question, they share that if a teacher is teaching in Janakpur (a district in the Terai region of Nepal), then he/she can use the Maithili language because for the majority of the learners, Nepali might be a second language. This concept is subjective, as a teacher of another context might need to address the classes in another language.

Mathematics is considered a subject that helps in logical reasoning and creative thinking. As I argued earlier that the culture in a community refers to the practices adopted over there and the way how people are living there. In this sense, the way how people express themselves and the way how they communicate with each other is also the culture. My experiences and the participant responses also show

that learners can learn in a better way if we teach their native communication skills. Mathematics cannot be isolated from society, and a learner cannot make real understanding and experience in isolation. The scenario of mathematics teaching in our community is limited within the four walls and the cover of our textbooks. The interaction with the participants in this study also shows that teachers rarely provide enough space for the students to interact with the environment. They added that the knowledge they learn from the mathematics classroom is just gathering information. They know the formula of  $(a + b)^2 = a^2 + 2ab + b^2$  ; they even know how to apply this and where to apply this in the numerical problems given in the textbooks and on the questions which are so-called important for the examinations. But they lack the real existence of this formula in our living world. They lack its origin; they lack its meaning that it can be an area of any rectangle. One of the participants shared that students/teachers even find it difficult to give a reason behind the concepts like  $a \times a = a^2$  and  $a + a = 2a$ . The participants like Mr. PQR and Mr. UVX reflect the teaching styles of their initial educational practices where they lack all those concepts behind the mathematical expressions, though they had the certificates of their educational degrees in their cupboards and a long experiences in their CV .

The cultural practices of linguistic expression matter a lot in mathematics teaching and learning. The terminologies and expressions used in mathematics could be the initial hurdles for the learners, and in addition to that, if we teach mathematics in a second/third language, then it increases the difficulty of the learners. The language of mathematics can sometimes be confusing and challenging when students bring their prior knowledge to it (Barwell 2011; Boero, Douek, & Ferrari, 2008). Firstly, the learners need to grab the concept and understand it, and in addition to that,

he/she should be able to express it as well. For this, one should be fluent in the language and as a human we are most familiar with our native languages. In this regard, Altieri (2009) argued that students must not only understand mathematical concepts but also demonstrate that they are able to connect their mathematical knowledge with their everyday life and communicate their knowledge to others. However, reasoning at complex cognitive levels through mathematical discourse is not something many students are able to achieve easily. This is often due to interference from everyday language and within the mathematical register (Schleppegrell, 2011). Teaching mathematics in non-native languages may create difficulty in connecting the mathematical concepts to the learners' daily practices. Sometimes they might be practising the same/similar concepts in their daily practices, but the textbook language might be different. This scenario can create confusion in the learners, and the learners may not be able to relate the concept with the phenomena. So, the linguistic and non-linguistic components of cultural capital have equal contributions to mathematics learning and its understanding in any learner.

A language is a form of delivery from one person to another. It refers to the way of communication, but better communication can be made in the language with which we are familiar. The terms like 'mother tongue' and 'native languages' touch the learners' affective domain and have the potential to involve one in a better learning process with depth engagement. On the other hand, the way of communication might be non-lingual approaches that do have enough space in mathematics teaching and learning. The experiences of the teachers in this study reveal that mathematics should be taught in that language in which the learner is familiar with it. The use of so-called second and third languages in teaching mathematics creates difficulty for the learners. They also explored that in a country

like Nepal where multi-lingual people exist, a teacher needs to be very conscious and aware of the learners' first language of communication.

As a learner, teacher, and teacher educator, I have experienced that effective materials can speak louder than words and can give a consensual understanding to the learners. Most of the participants in this study also advocate for the use of native languages in mathematics teaching and learning. In our context, Nepali language could be a better option to make students understand mathematical concepts.

### **Culture as an Integral Phenomena in Mathematics Learning**

Nepal is a multi-cultural and multi-lingual country where numerous cultural practices are in existence. *“If we take the classroom as a miniature society, then we can see different cultural practices in a single classroom”* argued by one of the participant in the interview. This statement was not new to me, as I have learned it from my facilitators in my Master's study. The integration of learners' culture in the classroom not only helps learners to develop their understanding of mathematics but contribute to the conversation of cultural capital. The interactions show that students and teachers both need to be aware of their own and others' practices. This can build cultural of tolerance and equal respect for others' cultures which is necessary for a country like Nepal.

A conscious and mindful teacher can build enough rapport with the people in the society from where he/she can learn enough about the contextual practices and can integrate them into mathematics learning, Mr. PQR argued. The exchange of culture and knowing other's cultures not only builds cultural harmony but encourages the learners to think from multiple perspectives and look at the phenomena from different lenses. Mr. UVX argued that searching mathematics in every possible phenomenon promotes critical thinking in learners. It builds the skills to think out of

the box and makes the learners creative. The consensual understanding and the real-life existences of every possible concept of mathematics encourage them to modify their real-life tools and practices to make them more efficient. Integration of cultural capital in mathematics teaching and learning can build a learner's holistic development in every possible aspect.

Mathematics is a subject to be taught and learned in academic fields; especially as a compulsory discipline in school education in Nepal and the majority of the countries as far as I know. Teachers in this study argued that the concepts of mathematics are limited in textbooks or in people's mind. Few of the teachers in the interview reflected on their earlier practices that established themselves as a positivist teacher. Mathematics can be learned by people with high cognition power and hard labour. It is universal and developed in so-called developed nations, so we cannot relate this to our context. They added that such assumptions and myths are widely spreading in our context. They further added, that reproductions of the same/similar strategies of teaching and learning approaches promote orthodox pedagogies at schools.

On the other hand, teachers in urban areas are trying to modify their pedagogies. They are getting a chance to involve and participate in training sessions and workshops where they can critically reflect on their existing practices and can modify their own practice; the teachers like Mr. PQR and Mr. UVX focused on this. As a result of this, teachers are adopting progressive pedagogies to some extent in their classroom practice. Integration of cultural capital in mathematics teaching and learning is also the product of such practices. All the participants in this study reflect that they were guided by conventional, teacher-centric, and lecture methods in their initial stages of teaching career. Afterwards, some joined newly approached

universities, whereas some of them were engaged in workshops and training and got a chance to modify their teaching skills. Now, the participants are integrating the cultural capital as a mathematics teaching and learning strategies and getting the desired performance and understanding in their learners. This scenario in this study shows culture as an integral phenomenon in Mathematics learning.

### **Difficulty in Addressing Mathematics through Cultural Capitals**

The participants, like Mr. PQR and Mr. DEF faced multi-cultural difficulty in integrating this practice into their context. As they were from different contexts and teaching in another context brings conflicts in the students' understanding of the learners. They also added that the cultural practices from one ethnic group to another, from one region (Himalayan, Hilly, and Terai in Nepal) to another, also have a great impact on the cultural conflicts. In addition to this, Mr. DEF argued that the pronunciation of the words and phrases also has a significant impact on mathematics learning and probably in other subjects as well. Such kind of difficulty also matters in the integration of cultural capital in mathematics teaching and learning.

Likewise, reluctant school administration and less support from fellow teachers also matter in integrating any kind of progressive pedagogies in school teaching. The impact of orthodox practices of teaching and learning and informing pedagogies are dominant. It is difficult to convince the school administration and directors in the initial stages, as argued by Mr. PQR. Students' collaboration and peer work are rarely appreciated in the majority of schools. It is like a curse pedagogy in the eye of those schools where pin drop silence and rote memorizations are praised. Mathematics can be learned only through hard and regular practice is like a mantra for many mathematics teachers, as argued by Mr. ABC. This setup in our school practices shows that they still advocate for the conventional mode of educational settings. Such



practices in Nepali schools seem as difficult to integrate the cultural capital into mainstream classrooms of mathematics teaching.

Finally, less support from fellow teachers is another hurdle for such progressive pedagogies. The participants shared that many of their colleagues and fellows in the school discourage them from such practices. They shared that some teachers do not want to participate, and some make fun of such practices. Whenever I used to take the students to the ground for their project works and some other activities related to mathematics, teachers and administration rarely supported these activities, Mr. DEF argued in the interview. The constructivist approach to teaching and learning in the mathematics classroom is fruitful but there can be some challenges and once we accept it and tried this approach to teaching mathematics; we can easily convince all of them with the outputs of such pedagogies.

All approaches and strategies have both sides of opportunity and challenges. I argue that integrating cultural capital in mathematics classrooms can create spaces for the learners to understand the concepts and can apply them in their real-life scenarios in the necessary cases. I am not in against the ideas that I shared above, but it is not that easy in all cases as well. A difficulty shared by the participants in this study also shows that they need to go through some challenges while integrating this progressive approach in their classroom settings. The participant teachers in this study also revealed their difficulties in integrating cultural capital with mathematics in school education which I discussed above.

The scenario of the multi-cultural classroom, reluctant school administration, less support from fellow teachers, and teacher/students from different contexts were some challenges faced by the participant teachers in this study. Being a teacher and an

educator at the same level in mathematics teaching, I also faced similar kinds of difficulties in my past days.

### **Chapter Summary**

The chapter above is the discussion section of the data collected from the participants. This chapter presented the arguments of my participants along with my observations and with supportive literatures. The next chapter (Chapter VI) in this study is the concluding chapter where I have presented my reflection and insights in making this dissertation to this level. In the upcoming chapter, I have reflected on my research journey, research question, research methodology, and the finding of this study. Further, I have presented the implications of this study.

## CHAPTER VI

### MY LEARNING AND REFLECTION

#### **Chapter Overview**

This chapter incorporates the summary, conclusion, implication, and findings of my research. During the research period, I encountered the use of cultural capital in classroom pedagogy. The purpose of my research was to explore the uses of cultural capital in mathematics teaching. In this chapter, I tried to explain how it is possible to connect mathematics and culture. Besides this, I tried to offer some implications involving the use of cultural capitals in a mathematics classroom pedagogy.

#### **Responding to my Research Journey**

While reflecting on my journey, I remembered these days when I was totally blank because I was in a dilemma. I was a student of a science background up to my Bachelor's study. As a Bachelor, my major subject is physics. I used to teach mathematics at every school. So my interest is to shift from science to mathematics. For that, I need to obtain a Master's degree in the same field. Due to different difficulties in my personal as well as professional life, I was unable to join KU. But after one year, I finally joined Kathmandu University.

When I joined Kathmandu University for my Master's in mathematics, I got to know how to develop my professional skill and how to improve my sense of professionalism. Before entering KU, I used to think that I was an excellent teacher among all teachers. But now I feel that I am still a learner, so big thanks to KU for transforming my beliefs into a broader horizon. At this stage of my life, I have

changed my thinking, viewing, and behaving in my teaching and learning after my research. Before joining KU, I was a traditional teacher. I believed that mathematics teachers should be strict and unfriendly with students. I was not even listening to any words of students, even if they understood or not. Students' voice has not been listened to in my classroom. Nowadays, if any student says anything to me, then I appreciate them. I feel happy because I enjoy teaching them. Now, I realize that students feel excitement after they understand any problems and show happiness with the solution.

While doing research, I got a chance to transform my teaching and learning. Before this journey of self-discovery, I mostly used to think mathematics was rigid and hard to teach. But I do not have any pressure, nor do I have any problem. Before that stage, I also used to think that in my teaching inside the classroom, only so-called excellent students were able to solve mathematical problems. But what I feel now is that not only as a high achiever, I need to take care of low achievers as well. Nowadays, if any students are not interested in my class, then I self-evaluate myself. And this journey also helps me to improve myself from the perspective of a transformative researcher.

At this stage, I understand research is not only about finding new things. It brings change to me. Before joining KU, I used to teach only textbooks and practice books. I also used to teach through lecture method, where the teacher describes the content and solves the problems. Nowadays, I use IT tools in my classroom. While doing so in my classroom, students are more engaged, and they actively participate in my classroom.

As an M. Ed. scholar and a teacher for school students, this study might set a benchmark in my professional and personal journey. This benchmark here refers to

my thoughts, beliefs, and practices. I am using narratives in this study to connect between the past, present, and future of scholastic practices, between yesterday, today, and tomorrow, and between many dimensions, facets, and incidents that reflect upon different nodes of time. The narratives in this study are the lived experiences of the teachers teaching in secondary schools. My journey at Kathmandu University as a scholar fostered different notions of pedagogical practices in me; the result of this schooling and the guidance of my facilitators helped me to shape this study in 'cultural capital'. I can remember those earlier days at university where I was limited by my conventional notions of practices in education that talk about objectivity and belief in a single truth. Being a mathematics student and a teacher, lecture-based pedagogy, one-size-fits-all pedagogy, banking pedagogy, pin-drop silence in the classroom, and a teacher as a transmitter of knowledge were my common and best practices in those days. But the university practices and critical-self reflections on my practices bring a considerable change in my personal and professional practices. I can still remember a speech mark of Dr. Luitel in our regular session of research methodology class in the second semester; "keep writing" when you feel happy, write; when you are sad, write! In every situation, keep writing. In my research journey, I was engaged in regular writing. The assignments of the different courses of M.Ed. I was taking included a literature review, a research design and narratives, and a final report that included my results and a discussion of implications. In addition to these inquiries, I kept updated most in an endnote of the thesis in the library. I was learning throughout the research process. Reading and writing are creative processes. By engaging in the process of reading and writing on a daily basis, I also came to understand how creative energy is needed before, during, and after designing and conducting research. This study establishes me as a life-long learner and a critical

self-reflector through which I can modify my beliefs and practices and keep stand with a more mature form.

This research study is not limited to me as a project to complete my Master's degree but a journey which helps me to modify my personal and professional practices. This study taught me to extract reality from the context. This study extends my professional journey from a teacher to a researcher and a teacher educator. The collaboration with different people like participants, teachers, and supervisors strengthen my capacity to expose what I have learned to others. The journey of designing the semi-structured questionnaires and taking interviews with the teachers was a completely new job for me where I reflected some hesitations in the beginning but later, I got habituated, and I enjoy doing all these things. My learning from this study helps me to establish myself as a more mature teacher and a responsible citizen in my community.

### **Responding to my Research Question**

It was any day in 2019, and our course facilitator of research methodology was talking about different paradigms like post-positivism, interpretivism, and criticalism. Further, he connected those paradigms with the research questions starting with what, how, and why. In those days, I was not very sure about those paradigms and their respective forms of research questions. It sounded easy to me when the facilitator was presenting his slides through the projector and discussing in the class, but my experience was not that easy when I immersed myself in designing my research question in this study. Each time when used to submit the draft for my proposal the research question had some changes. Sometimes it was not able to serve the purpose of my study, whereas sometimes, language, paradigms, and methodical issues. During this time, I studied others' dissertations and research work as much as possible to get

insights into such difficulties. Finally, my effort and my supervisor's regular support helped me to design this research question at this level.

### **Responding to Research Methodology**

Research methodology was just a chapter when I was in the earlier phase of the research study. I was not able to distinguish how each terminology under this guided me in the research study. I can remember my proposal defense day where one of the participants asked me; “How will narrative inquiry guide you to fulfill the purpose of this study?” At that time, it was not that much difficult for me to answer this question but when I engaged myself in the data collection and analyzing procedure, I found the real essence of those ideas which I discussed in Chapter III.

Selecting the participants was another hurdle for me during those days. I was already getting late because of COVID -19 lockdown, where I was not able to continue this study. After the second lockdown in Nepal, I tried to connect with some teachers at secondary level who are integrating cultural capital into their pedagogical practices. At the beginning, I approached to few teachers in my circle but found that only two among them are integrating cultural capital in their classroom practices. Fortunately, both of them graduated from the same university where I showed their positive response to help in my research study. In addition, for the remaining two participants, I tried to find female participants. For this, I contacted my circle, talked with my supervisor, and further, I made a contact with some school principals for the female mathematics teachers who are integrating cultural capital in their classroom practices. In doing so, I found one lady math teacher but she was practicing traditional lecture based methods only and was not aware of cultural capitals in teaching learning practices. Finally, I chose all male teachers in this study who are adopting cultural capitals as their means of teaching mathematics in their classrooms.

Narrative research methodology in this study not only guided me to serve the purpose of this study but also supported me to look at the phenomena as it is. The ethical criteria in this study were not limited in this study but helped me to be ethically aware of my day-to-day practices. Listening to the stories of other teachers was new to me. I found that each teacher has a different experience from one another, though we assume mathematics as an abstract idea. Their subjective experiences in integrating cultural capitals gave me insights of looking the phenomena from multiple lenses. Their experiences together with my experiences make me more aware and mature in my personal and professional journey.

Moreover, I have conducted interviews with four participant teachers to explore their experiences in integrating cultural capital in teaching-learning mathematics. I have interviewed the participants in multiple phases to maintain prolonged engagement with the participants and to get the desired outputs (data) from them. The collected qualitative data from the interview are analyzed in Chapter IV under six different major themes. The interview was first transcribed, coded, categorized, and create a theme from that category. The major ideas and knowledge from that analysis are presented down here.

### **Conclusions**

In the context of Nepal, the curriculum seems rigid as it takes a long time (10 years or more) to revise. This study also concludes that the curriculum is content loaded, and it is difficult to cover the course in time. As a result of this content-loaded curriculum, teachers are less motivated to apply progressive pedagogies in mathematics classrooms. It is also found that mathematics should not be limited to the curriculum perspective; a teacher who is aware of the progressive approaches can modify the national curriculum and make it contextual, which can connect the



textbooks curriculum to the learners' real-world practices. Such practices not only make the classrooms lively but can give authentic learning through real-world experiences. The participants argued that a teacher needs to be wise enough to address the learners' interest in learning and integrate that cultural perspective into the mathematics classroom. It is clear that without learners' motivation and interest, it is difficult for a teacher to engage them in the learning process and get the desired outputs. They strongly added that the integration of cultural capital in mathematics classrooms could give real-life experiences of the learning phenomena and promotes experiential learning.

This study shows the relationship between mathematical concepts and the cultural perspective. The participants of this study experienced that cultural tools can explore contextual mathematics. As our country is rich in cultural perspective, one can explore mathematics from own culture and community practices. They added that mathematics is everywhere in the environment, community, and around us, but we as a teacher fail to connect them in our learning process. Further, they added that this is because the majority of the teachers are still guided from the traditional way of teaching-learning perspective, where lecture methods and teacher-centered pedagogy are highly dominant. The one-size-fits-all approach and textbooks are the ultimate sources of knowledge which make mathematics more abstract and less interested for the school students.

The classroom itself is a miniature society, and a teacher has multiple options for cultural integration in the mathematics classroom. A culturally aware teacher can use the cultural tool wisely in the classroom and makes the learner feel like they are solving their real-world problems rather than the textbook problems. This multi-

cultural classroom allows students to learn from each others' cultures and contribute to cultural conservation as well.

This study explored language art as an integral phenomenon of cultural capital, which can make a significant difference in the mathematics classroom. Teachers experience that students can learn faster and understand the concepts easily in their mother tongue. They also added that language art can touch the affective domain of the learners. The cultural artefacts also contribute positively to mathematics learning. Teachers argued that effective materials can speak louder than words. They also supported that mathematics cannot be isolated from society and the learner's context. In this scenario, cultural integration in the classroom helps to contextualize the abstract concept and helps learners to build their understanding from real-world practices.

The majority of the people in our context believe that mathematics can be learned only by people who have high cognition power. In this context, the less-achiever students always feel like they cannot improve their mathematics understanding. The majority of our mathematics classrooms also declare few students as mathematics learners and focus only on those high-achievers. This pathetic situation of ordinary students, along with the better performers, can be addressed by cultural capital. The contextual practices of learners' culture can motivate the learners in the learning process and can give the real experience of participating in the mathematical applications. Finally, the integration of cultural capital in mathematics teaching and learning can support for the holistic development of a learner in every possible aspect.

### **Implications of the Study**

This study analyzed the learning strategies used in studying mathematics by integrating with cultural capital. This study provides educational stakeholders with the knowledge that students may approach learning through cultural capital. Knowing how students perceive mathematics through cultural capital can encourage them in the learning process. This section in this study represents the implication of the findings from a pedagogical perspective which is possibly helpful for the teachers and teacher educators. Secondly, the implication of this study can be seen from the perspective of the policymakers and curriculum developers. They can contribute to the integration of cultural capital in the curriculum and the policy as well, which can contribute to the educational dimensions of our country.

### **Implications for Pedagogical Practice**

In the case of teaching and learning mathematics, a lot of research has been conducted in the international context. But they do not represent the teaching and learning method used by secondary level teachers.

The study analyzed the use of cultural capital in mathematics teaching at the secondary level. The study is helpful for secondary level teachers in their classroom pedagogy. They can make their lesson with the full use of cultural materials. Even they can take the cultural capital as a reference tool for teaching strategies. The study provides teachers to rethink their strategies and make a plan for their classroom. It helps them to give concepts about the topics, and hence the classroom is enriched, and the achievement of students increases. By using cultural capital, teachers may realize that it is essential to teach mathematics in different situations and needs. Teachers need to use this to help students with difficulties in mathematics.

Teacher educators can use this as a teaching tool. Not only mathematics teachers but even other teachers as well can use cultural and local material as a teaching tool and makes their class interesting.

### **Implications for Policy Makers**

Teachers are habitual in the traditional approach but making the meaning of teaching does not only depend on teacher. So it has a direct implication for syllabus designing, material preparation, and teacher training in the context of Nepal, where students fear mathematics. Though teachers use various strategies in teaching mathematics, they may not be aware of the teaching methods and their impact on teaching. This study, in the sense of teaching mathematics through cultural capitals can be a valuable asset among the teachers. However, even mathematicians, curriculum designers, teacher trainers, learner trainers, etc. also, can apply it in different ways and for different purposes.

Reflecting on this research outcome, the educational implications of this study are drawn. Therefore, this study can be one of the reference materials in the case of secondary mathematics education. The study prefers especially mathematics educators. Similarly, teaching mathematics through cultural capital helps the teacher to rethink their strategies for classroom practice. Likewise, awareness about teaching through cultural capital helps stakeholders of mathematics education, including curriculum designers, school administrators, and mathematics teachers, to design mathematics curriculum, classroom practices, and instructional strategies.

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## APPENDIX

In this section I have presented the semi-structured questionnaires which I have used for the collection of teachers experiences. These questions had guide me in collecting the teachers' stories which help me to shape this study. The semi-structured questionnaires are presented down here:

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