ISSN 2087-8885
E-ISSN 2407-0610

Journal on Mathematics Education
Volume 12, No. 1, January 2021, pp. 17-48

MATHEMATICS EDUCATORS' PERSPECTIVES ON CULTURAL RELEVANCE OF BASIC LEVEL MATHEMATICS IN NEPAL

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Abstract

The main purpose of this paper was to explore mathematics educators' perception of the cultural relevance of basic level mathematics in Nepal. The design of this study involved an interpretive qualitative approach by administering in-depth interviews with five purposively selected mathematics educators teaching at five higher education institutions in the Kathmandu valley. Each interview was audio-recorded and transcribed for coding and constructing themes. The major themes that emerged were teaching in a mother language, contextualized Ethnomathematics, and the local knowledge in the curriculum as a teaching approach. The findings of the study can be helpful to curriculum designers and teachers at the basic level of mathematics. The study also adds to the literature of cultural aspects of mathematics teaching and learning and curriculum design.

Keywords: cultural relevance, curriculum, pedagogy, basic level mathematics, Nepal

Abstrak

Tujuan utama dari artikel ini adalah untuk mengeksplorasi persepsi guru matematika tentang relevansi budaya terhadap matematika tingkat dasar di Nepal. Desain penelitian ini melibatkan pendekatan kualitatif interpretif dengan melakukan wawancara mendalam kepada lima guru matematika yang dipilih secara purposif yang mengajar di lima institusi pendidikan tinggi di lembah Kathmandu. Setiap wawancara direkam dan ditranskrip untuk pengkodean dan membangun tema. Tema utama yang muncul adalah pengajaran dalam bahasa ibu, etnomathematika yang dikontekstualisasikan, dan kearifan lokal dalam kurikulum sebagai pendekatan pengajaran. Temuan studi ini dapat membantu perancang kurikulum dan guru pada konten materi matematika tingkat dasar. Hasil penelitian ini juga menambahkan literatur tentang aspek budaya pada kegiatan belajar-mengajar matematika dan desain kurikulum.

Kata kunci: relevansi budaya, kurikulum, pedagogi, matematika tingkat dasar, Nepal

How to Cite: Acharya, B.R., Kshetree, M.P., Khanal, B., Panthi, R.K., & Belbase, S. (2021). Mathematics Educators' Perspectives on Cultural Relevance of Basic Level Mathematics in Nepal. *Journal on Mathematics Education, 12*(1), 17-48. http://doi.org/10.22342/jme.12.1.12955.17-48

One of the meanings of culture can be depicted as how the members of a cultural group make sense of experience through their language, symbols, values, norms, social practices, and use of material artifacts (Banks, 2016). The origin and development of mathematics have been traced to different cultures, for example, Harappa, Egyptian, African, Minoan, Mycenaean, Greek, Roman, Arabic, Indian, Chinese, Aztec, Mayan, Incas, Native Americans (Indians), and Eskimos (Scriba & Schreiber, 2015). Therefore, historically, mathematics and its teaching–learning process have been a part of cultural reproduction and advancement of knowledge for generations. Mathematicians have attempted to standardize the knowledge and process of mathematics for developing shared understandings and uses. The standardization of mathematics became a norm through the Renaissance, the scientific revolution, Enlightenment, and modernism with the dominance of Eurocentrism (Ravn & Skovsmose, 2019). The

curriculum and teaching and learning of mathematics have been affected by Eurocentrism, directly (under colonialism) and subtly. There was a "widespread attitude that mathematics lacking a utilitarian bent is in some sense a finer or better mathematics," which also influenced the mathematics curriculum in schools to promote elitism in mathematics (Joseph, 1997, p.75).

Nonetheless, the root of mathematics lies in the material and artifact development to solve practical problems before taking the form of cognitive and metacognitive, logical and formal structures (Joseph, 1997). Standard Eurocentric mathematics and its pedagogical practice alienate learners from mathematics in the family, society, culture, and nature (Alangui, 2017). In this context, ethnomathematics can be an appropriate approach for the classroom as a cultural group's mathematics (D'Ambrosio, 1984). In other words, ethnomathematics examines how different cultural groups use mathematics to solve day-to-day problems. This view reiterates that teaching and learning mathematics in schools should be culturally relevant to the students (Aronson & Laughter, 2016; D'Ambrosio, 1985), so that it helps in reducing the achievement gap (Jordt et al., 2017). However, teacher education programs, despite offering multicultural and social justice courses, have not been able to connect the preservice teachers' mathematical experiences to the community and culture to understand issues of equity, fairness, and justice (Jackson & Roberts, 2017).

In this respect, mathematics is a product of human creation. Its uses are dependent on individuals' actions grounded on their lived or living experience, and "it is limited and structured by the human brain and mental capacities" (Lakoff & Nunez, 2000, p.1). This view was supported by Hersh (1997), who stated, "The rule of language and of mathematics are historically determined by the working of society that evolves under the pressure of the inner workings and interactions of social groups and physical and biological environment of the earth" (p. 8). These views signify how mathematics is deeply connected to people, their practices, and the environment that collectively determine their cultural and social identities and values. Ravn and Skovsmose (2019) stated, "Today, we busy ourselves with little else than to measure, weigh, model, approximate, and calculate on our environment, nature and culture alike" (p. 21). Their view of mathematics is and should be practically connected to students' life and culture, making it culturally relevant to what they do and what they must do as part of their everyday life (Glanfield & Sterenberg, 2020).

Historically, mathematics is deeply rooted in culture through symbols, operational processes, and representations in arts, crafts, and literature (Barton, Poisard, & Domite, 2006). Therefore, mathematics is inseparable from culture and the evolution of cultures. In this sense, there is no difference between using mathematics and doing mathematics. The learning of mathematics seems to be influenced by learners' cultural background (Acharya, 2015) and how they connect mathematics to day-to-day life through games, plays, and artifacts (Pradhan, 2017). Therefore, mathematics should enable learners to perform operations of mathematics in their cultural milieu (Acharya, 2020).

The students should be able to ask for their role in a democratic and multicultural community in the classroom (Ladson-Billings & Henry, 1990; Ladson-Billings, 2014) through a culturally relevant

pedagogy of supporting and engaging them with funds of knowledge (Gay, 2002; Civil, 2016; Gallivan, 2017). However, the practice of culturally relevant mathematics in the classroom depends on the national curriculum policy, framework, curriculum, teacher preparation and training, assessment, and daily classroom activities. Some scholars and researchers (Krasnoff, 2016; Moyer, 2001; Wachira & Mburu, 2017) have discussed the symbiosis of culture and mathematics in curriculum and teaching in the forms of culture and mathematics teaching, making mathematics culturally relevant, and culturally responsive teaching. They have focused on varieties of activities to promote the cultural relevance of mathematics, for example, caring and community building, building cross-cultural communication, recognizing diversity, maintaining an equitable classroom, counting in different cultures, recording and calculating practices in different cultures, developing mathematical plays, using learner-centered activities, valuing students' prior knowledge, and creating a collaborative learning environment.

Few studies have investigated the cultural aspects of school mathematics in Nepal. For example, Pradhan (2017) studied the relation of *chunara* culture (an occupational culture to produce wooden artifacts) and mathematics by outlining what types of mathematical concepts are used in *chunara* cultural artifacts and how they can be connected to classroom mathematics. Likewise, Sharma and Orey (2017) discussed mathematics concepts in making drums and how the connection between mathematics and artifacts can support culturally relevant pedagogy in Nepal. In another study, Wagley et al. (2008) outlined some mathematics concepts of middle school mathematics in children's play, daily farming duties, and basket weaving practices by Gopali and Tamang people in Nepal. These studies have been artifact-based and based on local contexts without focusing on the school mathematics curriculum in Nepal and the perspectives of teachers and mathematics educators. It is important to study the perceptions of mathematics educators about cultural relevance of school mathematics because these perceptions may affect their actions in teacher education programs in Nepal for inclusiveness, social justice and cultural relevance. Mathematics teacher educators' perceptions of the cultural relevance of basic mathematics may influence the way they develop or train mathematics teachers.

In this context, the purpose of this study was to explore the selected mathematics educators' perceptions of culturally relevant mathematics at the basic level of education in Nepal. To achieve the objective of this study, we focused on the following research question: How do mathematics educators perceive the cultural relevance of basic level mathematics in Nepal? The research question is justified in the context of the National Curriculum Framework (NCF) of Nepal (Curriculum Development Center [CDC], 2007), which emphasizes cultural aspects as one of the challenges to be mitigated while developing the school curriculum of all grade levels. We focused on the basic level curriculum for which the framework envisioned an integrated curriculum to be child-centered, inclusive, local, and need-based. The NCF stated:

> The curriculum will be developed on the basis of the child-centered approach. The growth and learning of children are possible in various methods. When their learning order and strategies are hindered internally, the external elements of learning like classroom learning

> technique, environment, and medium of instruction, sociocultural and economic background affect their learning achievement. Therefore, in the process of curriculum development, the child-centered approach will be adopted in selecting subject matter, teaching–learning activities, assessment procedures according to their interest, needs, and their pace of development. (CDC, 2007)

Further, the NCF outlined the precedence of mother tongue in basic level education in Nepal:

> Mother tongue will be the medium of elementary education. The medium of school-level education can be in Nepali or English language or both of them. However, in the first stage of elementary education (Grades 1–3), the medium of education will generally be in the mother tongue. In the case of the non-Nepali citizen, there will be a special provision of choosing any other language as a subject instead of Nepali." (CDC, 2007, p.34)

The curriculum framework also highlights the priorities of the local needs while designing the curriculum. These priorities comprise local knowledge and historical and cultural contexts, to localize the curriculum socially and ensure its cultural relevance. In this regard, NCF outlines these priorities:

> In the course of designing the curriculum, priority will be given to the local needs. While incorporating local knowledge and skills, historical and cultural aspects in the curriculum, the local and need-based studies can be one of the areas of teaching and learning. The provision of the local need-based studies should be brought into effect to fulfill the various needs and interest of students and to give room for localization in the curriculum to make it relevant. (CDC, 2007, p.35)

Basic level mathematics is the mathematics for the primary and lower secondary schools (grades 1-8) in Nepal. The NCF of 2007 has categorized school education as basic education in grades one through eight and secondary school education in grades nine through twelve (CDC, 2007). In this scenario, this study focused on mathematics educators' perception of the cultural relevance of basic level mathematics in schools of Nepal because they teach, prepare, and supervise preservice teachers and engage in curriculum design and in-service teacher training in collaboration with the Ministry of Education. Some of these educators have teaching experience in basic level mathematics. This paper was mostly derived from the first author's doctoral dissertation research (Acharya, 2015). In the remainder of the article, we present a review of the literature, a theoretical framework, the methodology of the study, the results and discussion, a conclusion, and the implications.

Several studies have focused on the production and implementation of culturally relevant pedagogical resources in school mathematics. Some of these studies and their contributions to culturally relevant mathematics teaching and learning have been discussed briefly in the following reviews.

Gutstein, Lipman, Hernandez, and Reyes (1997) conducted a study to examine culturally relevant mathematics instruction in an elementary/middle school. The school was located in a Mexican American community in the United States. The project was based on the Mathematics in Context middle school curriculum, and subsequently, the project was extended to study culturally relevant pedagogy in the school. The participants of the study were three elementary grade teachers and two middle-grade

teachers. This study used a qualitative method with observations while applying ethnographic fieldwork. The qualitative data comprised field notes, open-ended interviews, materials produced by the teachers, classroom assignments, students' tasks, meeting records and notes, teachers' reflections, and the school's documents. They applied a grounded theory approach to code the data and generated the categories. The findings of the study revealed that the teachers used the children's informal mathematics knowledge with critical thinking, built a connection of school mathematics with families and their practices for the empowerment of students, and opened a multilevel dialogue for the collaborative endeavors of educational communities for reform in mathematics education through culturally relevant teaching–learning (Gutstein et al., 1997).

Education Sector Advisory Team (ESAT) (2005) published a report on the study and analysis of curriculum from the *Janjatis* (indigenous people) perspective. This study critically examined the injustice of language issues, teaching methods, and evaluation techniques from indigenous perspectives and suggested adopting cultural knowledge, artifacts, and objects, such as poems, folk songs, and household objects in creative art. The study also suggested applying the local contexts and artifacts familiar to the indigenous people in science curricula and the indigenous number system in mathematics curricula. The outcomes of the study recommended diversified teaching methods and evaluation techniques to improve student learning and participation in science and mathematics activities in the classroom by applying various teaching methods, such as active participation, cooperative learning, and panel discussions.

Sharp and Stevens (2007) explored culturally relevant algebra teaching in the case of African drumming. They focused on algebra teachers to provide teaching and learning opportunities that promoted access for more students through insightful pedagogical knowledge and algebra knowledge practicing culturally relevant pedagogy and suggested that teachers develop and apply the types of knowledge that would allow students to respect, appreciate, and celebrate other cultures. Wagley et al. (2008) conducted a study on contextualized mathematics based on the observations of local daily life practices of the Tamang and Gopali people near Kathmandu valley. The study was a collaborative project of Kathmandu University and UNESCO Kathmandu. The project aimed to develop a set of culturally relevant and contextualized mathematics resources for the curriculum of middle schools in Nepal. More specifically, the project focused on the sociocultural context of the indigenous practices of women and disadvantaged ethnic communities, such as the Tamang and Gopali people of the hilly regions of Nepal (Wagley et al., 2008). The research findings suggest that numerous local practices are linked to the formal mathematics of grades 6–8. In particular, they designed the materials based on local farming, business, and daily household activities. The curricular materials also included children's games, local cultural rituals, and material artifacts. Subsequent analysis of the mathematics curriculum of grades 6–8 in Nepal demonstrated that the concepts in geometry, arithmetic, algebra, and basic set theory could be integrated into the local social and cultural practices and day-to-day activities (Wagley et al., 2008).

Gallivan (2017) conducted an intervention study to support prospective teachers' learning of culturally relevant mathematical tasks. A three-week intervention was planned as a part of the methods of teaching mathematics coursework for four preservice elementary and middle school teachers. The intervention was planned with three phases: knowing the students, revising the tasks, and conducting post-interviews. In the first phase, the classroom discussion on the method of teaching mathematics was related to students' culture and funds of knowledge through their critical consciousness (David, 2016; Llopart & Esteban-Guitart, 2018). In the class, the preservice teachers had opportunities to read papers, watch videos, and discuss what makes a pedagogy culturally relevant and a mathematical task culturally rich. The participants were taught how to be familiar with a student culturally different from themselves and how to gather information on students' interests, activities, families, and other academic strengths and weaknesses. In the second phase, the participants identified and constructed culturally relevant tasks for teaching mathematics by focusing on the cognitive demands of memorizing, connecting, and performing mathematics. They used an analytical framework to revise the school mathematics tasks to be culturally relevant. In the third phase, the researcher conducted semi-structured interviews with the participants. These interviews focused on the participant experiences of revising the high-level mathematical tasks to observe the cultural relevance of implementing the tasks. The findings suggested that a majority of preservice teachers could revise the high-level mathematical tasks to link them to the local culture, although some participants required additional support to understand the task revision. The intervention-based classroom activity helped preservice teachers to their knowledge, skills, and positive attitudes toward culturally relevant pedagogy by considering their experiences and funds of knowledge (Gallivan, 2017).

Lim, Tan, and Saito (2019) studied culturally relevant pedagogy to offer a theoretical framework for describing pedagogical practices that involved teachers' struggles in relating mathematics and culture. They employed a qualitative research design to study how five Singaporean teachers engaged students in tasks or activities related to the students' cultural backgrounds. The data collection tools were class observations, semi-structured interviews with teachers, small group interviews with students from the observed classes, research team members' field notes, and analytic memos. The findings of the study revealed important constructs that related content relevancy to personal experience, representative artwork, accessible forms of cultural capital, transformative opportunities, and hierarchical patterns of culture (framed). These constructs provided the teachers and students opportunities to add various cultural, social, and political dimensions to classroom discourse to build students' identity in terms of "who they are" and "what they want to be like." They used external classification and internal frames to categorize the cultural experiences of students and teachers in classroom discourses (Lim et al., 2019).

In a recent study, Prahmana and D'Ambrosio (2020) explored batik patterns from Indonesian cultural context integrating geometry concepts to the local contexts and artifacts. They applied ethnographic approach to study geometric patterns in batik art in motifs. The findings of the study

revealed several interesting geometric patterns that can be integrated to school mathematics. For example, symmetric patterns in the Babon Angrem, translation of patterns in Parang Barang, reflection transformation in Parang klitik, and two transformations (reflection and translation) in Sidomukti patterns. These patterns and others they explored have a deep cultural values and connection to and relevance in Indonesian school mathematics (Prahmana & D'Ambrisio, 2020).

The aforementioned reviews have demonstrated a sustained effort to acknowledge and justify the need for developing and implementing culturally relevant mathematics curricular materials. The discussion also reveals a need to prepare teachers for such an endeavor to promote social justice in mathematics education through school mathematics as a cultural process and action.

Culturally relevant education can be defined as an "appropriate relief" of an educational problem that prompts questions of whose problem it is, where it is located, what should be done, and who should be involved (Nicol, Archibald, & Baker, 2013, p. 75). The main component of the culturally relevant pedagogical model is the connection between critical mathematical thinking and a critical view of knowledge. The connections between students' informal mathematical knowledge, the local culture and practice of mathematics, and the students' orientation to their home culture and day-to-day experiences are the major components in this model. The model presents a relationship between the standard document (NCTM, 1989) and the cultural relevance of mathematics teaching (Figure 1).

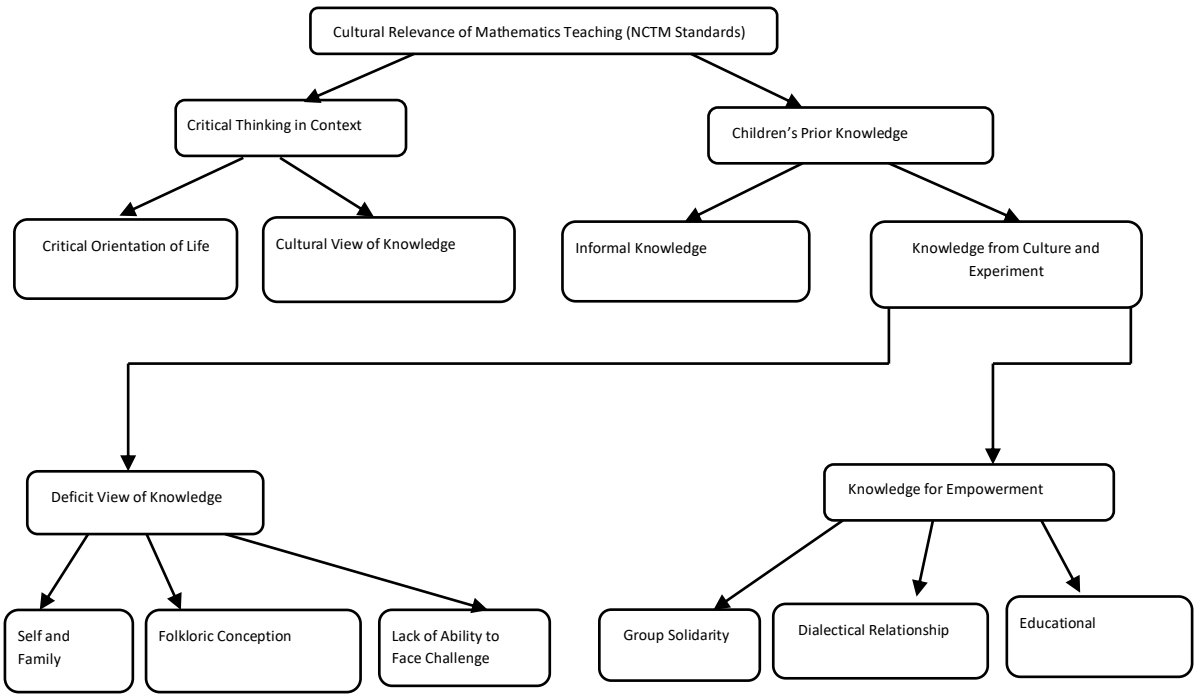

Figure 1. Culturally relevant teaching is based on the National Council of Teachers of Mathematics (NCTM) standards (adopted from Gutstein et al., 1997)

Students should internalize mathematical knowledge in a critical manner; that is, they should develop as a critical thinker in the mathematical context so that they can make conjectures and

arguments. Students should investigate mathematical ideas and justify their solutions to problems and be able to validate their thinking and reasoning. These aspects are the principal components of the National Council of Teachers of Mathematics (NCTM) standards (NCTM, 1989). Thus, teachers should encourage students to develop multiple perspectives while reasoning through mathematics. Also important is to develop students' questioning skills to raise their voices and concerns while constructing mathematical knowledge (Gutstein, Lipman, Hernandez, & Reyes, 1997). The second aspect of this model involves a perspective of children's knowledge; that is, the teachers should use children's prior knowledge and day-to-day experiences in classroom activities. According to NCTM (2000), children's informal knowledge is vital in the process of teaching–learning with the cultural relevance of mathematical concepts and meanings. Mathematics teachers should be conscious of local contexts to add children's prior knowledge into the mathematics classroom.

The third main component of this model depicts two orientations: the local culture, and experience with a deficit model (Aguirre, Berry, Gutiérrez, Martin, & Wager, 2016) and knowledge for empowerment. In this model, the mathematics teachers should be familiar with students and their home culture. Teachers might be aware of individual and community relationships and folklores in the community but lack the ability to face the challenges within the cultural orientation. By contrast, the concept of knowledge for empowerment helps teachers orient themselves toward the surroundings and students' home culture to connect their experiences to develop a sense of empowerment (Gutstein et al., 1997). Ladson-Billings (2009) emphasized three criteria for culturally responsive pedagogy: (i) students' experience of academic success when applying critical thinking, (ii) students' cultural competence for empowerment and self-identity, and (iii) students' development of critical consciousness and agency to challenge the social and developmental status quo state of the power relation and social order.

This theoretical framework integrates these criteria through the interconnection of critical thinking and children's knowledge. These theoretical constructs guided the ontological, epistemological, methodological, and axiological assumptions of this study while identifying research problems, constructing research questions, designing the study, collecting the data through in-depth interviews, and analyzing and interpreting the data to draw viable interpretations of the cultural relevance of mathematics curriculum and pedagogy from the participants' views.

METHOD

This section elaborates on the research methodology: the selection of the study site and participants, the in-depth interviews as the data collection tool, the data collection procedure, and the analysis. The study attempted to explore the cultural relevance of mathematics on the basis of teachers' perceptions, experiences, and daily classroom practices at the basic level. The researcher adopted an interpretative research paradigm to conduct this study because it assumes a relativist ontology, a subjective epistemology, and a naturalistic set of methodological procedures (Creswell & Poth, 2018).

The ontological stance of the study was that different teachers have different experiences because they have diverse cultural backgrounds, embodied knowledge, and practices.

To understand the reality of the cultural relevance of mathematics, educators experienced in teaching students of different cultural backgrounds were interviewed. The interviews were conducted with the following purpose: understanding the interviewees' multiple narratives and interpretations as per sociocultural diversities. We critically discussed before assessing the meanings of the participants' narratives. In this manner, the knowledge on the cultural relevance of mathematics was generated by analyzing and interpreting individual educators' experiences, perceptions, and day-to-day working practices. While interpreting the data, we assumed that there existed multiple truths of social realities from the perspectives of the participants. In this sense, this study was guided by an interpretive research paradigm.

Study Site and Selection of Participants

Kathmandu valley was selected as the study site. This valley is the center of social, cultural, political, and business activities in Nepal. People from different parts of the country come and stay here for jobs, education, business, and other purposes; there is a mix of all the cultural groups. This study was based on the cultural perspectives of the Indio–Aryan, Tibeto–Burman, and Newar cultural groups, and the Kathmandu valley represented the country's multicultural and multiethnic or multicaste system. For this reason, the three districts of the Kathmandu valley were used as the site for this study.

Qualitative researchers usually work with a small sample of people nested in their context and conduct an in-depth study (Miles & Huberman, 1994). The objectives of the research, nature of the questions, and the characteristics of the study population determine which and how many people to select as research participants. The qualitative information is based on participants' subjective views. In this study, it was important to identify the appropriate respondents who could fulfill our criteria for the interviewees. Further, to capture the cultural spectra of the multidimensional realities in the studied societies, it was necessary to connect with the appropriate potential respondents. Some mathematics educators in the sampled areas were contacted and prepared a list of the most appropriate teachers as the potential respondents.

This list of potential participants helped identify the most appropriate teacher educators based on their familiarity with the culture, context, and mathematics education practices in schools and higher education in Nepal. The researcher purposefully selected the participants who had taught preservice mathematics teachers and supervised them during their practicum. One of the participants also had teaching experience at basic level mathematics. These participants were engaged in designing the basic level mathematics curriculum with the Ministry of Education. They were also engaged in curricular research, and training the basic level mathematics teachers in collaboration with the National Center for Educational Development. The researchers selected five mathematics educators working at different

schools and higher education institutions from the Kathmandu, Lalitpur, and Bhaktapur districts within the Kathmandu valley.

Participants of the Study

The five participants of the study were Saurya, Rabindra, Eshu, Maheshwor, and Chaitan (pseudonyms). Saurya (a male participant) had an M.Phil. degree and years of experience teaching elementary and high school mathematics at the school level. He had been teaching undergraduate and graduate students (preservice teachers) at a university in Nepal for six years. The second participant, Rabindra (a male participant) had an M.Ed. degree and had been a school teacher for twenty years. He was involved in a team that was designing the mathematics curriculum at the school level and had been invited to do so by the Ministry of Education. He had been involved in teacher training as a mathematics subject expert. The third participant, Eshu (a female teacher) had an M.Ed. degree, had been teaching school mathematics (i.e., elementary and secondary grades) for 15 years and was working as a headteacher in a school. The fourth participant was Maheshwor (a male professor). He was a professor of mathematics education at a public university in Nepal with 30 years' of teaching experience in mathematics and pedagogical courses at various levels. He was also an author of several textbooks of mathematics for the school level and had supervised preservice teachers in their practicum. The fifth participant, Chaitan (a male participant), had an M.Phil. degree and a few years' of teaching experience in teaching school mathematics (i.e., elementary and high school). He had been teaching various content and pedagogy subjects at a public university for 15 years; had supervised several undergraduate students in their practice teaching; and had published research articles related to teaching–learning, social justice, and equity in the mathematics classroom.

In-depth Interviews

An in-depth interview is a flexible tool for qualitative data collection that enables multisensory channels to be used, for example, verbal, spoken, and heard (Cohen, Manion, & Morrison, 2008). The in-depth interviews were administered by deeply exploring the issues related to the study topic and the full range of concepts and ideas of the cultural relevance of mathematics (Sullivan, 2001). An interview guideline was prepared with a sequence of questions to evoke a descriptive account of the participants' opinions (Moustakas, 1994). The interview often began with a social conversation to build trust and create a relaxed atmosphere so that the researcher could establish a rapport with the participants. The interviews focused on questions related to one main question: To what extent does basic mathematics education emphasize critical thinking with multiple perspectives and children's prior knowledge of mathematics from their homes and communities that they bring to the classrooms? The interviews also emphasized the link of mathematics curriculum and pedagogy to the students' funds of cultural knowledge, diversity, and sense of empowerment. Each interview session was audio recorded for transcribing, translating, and analyzing.

Data Analysis

Qualitative data were collected through in-depth interviews with the five research participants. After the interviews, the recorded data were transcribed and translated from Nepali to English. The translated transcripts were read and re-read several times to make sense of the ideas and concepts that emerged and were related to the main research question. After having a full understanding of the data, the important concepts and ideas in the data were coded based on the meanings, and their relevance to the major research questions. The coding involved segmenting and labeling concepts from the transcription text to form descriptions and broad themes in the data. A focus was the four domains highlighted in the theoretical framework of the study—critical thinking and the children's knowledge, deficit, and empowerment—while making sense of the data. After the encoding, meaningful categories were generated from the data. This process helped to link the codes to themes and align the themes to the research questions. While performing this step, we adopted the Mishler (1995) models of narrative analysis and focused on "reconstructing the told from the telling" (p.95). We reconstructed the participants' narratives from the pieces of interview data while organizing them into a coherent thematic construction and interpretation. Several themes were generated from the data, and we discuss three major themes in the next section. A follow-up interview was conducted with each participant and focused on the three themes while considering the theoretical domains from the framework—critical thinking and children's knowledge, deficit, and empowerment. The follow-up interview data helped us consolidate the themes. The other remaining themes have been commissioned in other companion manuscripts.

RESULTS AND DISCUSSION

This section discusses the research question: How do mathematics educators perceive the cultural relevance of basic level mathematics in Nepal? The main themes that emerged from the analysis of the data were teaching in the mother language, contextualized ethnomathematics, and the local knowledge used in the curriculum as a teaching approach. These themes evolved through thematic analysis of the interview data. However, these themes not only highlight the significant perceptual categories of mathematics teacher educators on the cultural relevance of basic mathematics in Nepal, but they also extend further studies and theories of culturally relevant and culturally responsive pedagogy explored in Abacioglu, Volman, and Fischer (2020) and Lim, Tan, and Saito (2019). Each theme is described and interpreted in the following subsections.

Teaching in the Native Language

Native language instruction, in general, refers to using learners' home language as the medium of instruction in the classroom (UNESCO, 2003). The instructional language in the classroom affects the quality of students' learning in the elementary grades. Providing classroom instructions in students' mother language helps them develop their competencies naturally and improves student achievement

in mathematics and other disciplines. According to the Central Bureau of Statistics (CBS, 2001), Nepal is a multilingual country with more than 92 spoken languages. The students in Nepalese school classrooms are children from different social, cultural, and ethnic backgrounds. In this situation, employing the students' mother language in teaching and learning activities in mathematics classrooms has become a challenging task. Another substantial challenge is for the centrally established curriculum development system to address the diverse needs, values, and aspirations of the diverse population. In this regard, the participants expressed their views, which we present as Narrative 1.

Participant Narrative 1

Saurya. *First, I think language is a matter of raising the active involvement of students in the learning process. As we commonly agreed, it is not so easy to switch to another language from the language that we learned at home. In this regard, when there is a difference in language between home and school, mostly in early grades, students become puzzled, and we become unable to obtain the desired learning outcomes from the students. So, I first recommend allowing students to use their mother language, and as far as we can, as teachers, we must use their mother language in the teaching–learning process that helps create a culture friendly environment in the mathematics classroom.*

Rabindra. *There are many advantages and disadvantages of teaching in the mother language. Especially at the primary level, the mother language is necessary so that students can have a clear concept of various objects and things in general, particularly in mathematics. As we have multiracial and multiethnic classrooms, we should thus first identify the individual identity, level of language, level of students, and use of language for the improvement of students' performance. When the language of schooling begins from the primary school in a different language, it is difficult for students to develop mathematical concepts. The reason is that mathematical symbols are introduced through written language rather than informal oral language. The second language comes to hinder the children's learning of mathematical ideas through symbols. In this context, it is necessary to integrate mathematics teaching with language so that the language will be helpful in understanding the mathematical concepts.*

Eshu. *The mother language is the one that a child hears first. Many researchers have pointed out that the use of the mother language as a medium of instruction is effective, and this attracts children to school as well. The Constitution of Nepal has made provisions for basic education in a mother tongue as a fundamental right. The integrated curriculum of grades 1–3 also has focused on the mother language in classroom teaching. But it has great issues and challenges when applied at the school level because Nepal is a multilingual and multicultural country. In many places, the country has a mixed society. Its influences can be observed in the classrooms too. Then, the teachers face language problems in the classroom. On the other hand, many languages do not have their scripts. There is insufficient*

manpower to develop curriculum materials in different languages for the basic level mathematics curriculum.

Maheshwor. *First, every child uses a particular language at home for conversation. S/he exchanges her/his views or ideas by using that language, the mother tongue. A child goes to his/ her school with the capacity to deliver her/his feelings in the mother language. I think if the teaching and learning activities are being operated in the children's mother language, the learning will be easier. The child can obtain high learning achievements. S/he can share her/his confusion about the subject matters to the teacher. S/he can express her/ his other problems to the teachers. S/he can be adjusted in school and peer groups easily in a short period of time. Her/his elaborated code of language makes her/his learning easier. By understanding this reality, there is a tendency toward a greater focus on education in the mother tongue. The Constitution of Nepal (2015) also states that every Nepalese community in Nepal shall have the right to obtain a basic education in their mother tongue. Because of these reasons, I am also in favor of teaching mathematics in the mother language. To achieve this objective, the teachers should know the languages such that s/he can facilitate students' learning in their mother tongue. If that is not possible, the teacher should at least know the local culture in order to teach with references to the local language.*

The major concepts from the narrative are the strength of the mother tongue, hindrance from the second language, language for teaching with understanding, and teacher being familiar with a student's language. The aforementioned narrative text data reveal that teaching–learning mathematics activities must be conducted in the children's mother tongue. This approach helps them understand the mathematical concepts without having to learn the structures of their second language. Young students learn the content of their ethnicities, cultures, and identities through the medium of their parents' dialect, which is in their mother tongue. Therefore, teachers may have a significant impact on students' cultural sensibility and multicultural attitudes integrating multilingual perspectives in teaching-learning mathematics (Abacioglu, Volman, & Fischer, 2020). The bilingual or multilingual social and school contexts have been reported as detrimental for students to effective learning (Chronaki & Planas, 2018).

Constructivist learning encourages students to discuss mathematical tasks and negotiate mathematical meaning and develop mathematical concepts. In this context, the notion that students are capable of constructing their knowledge of mathematics in their unique manners (Ernest, 2009) is acceptable to most teachers; notably, this approach is one of the means of acquiring mathematical learning. Becoming an effective mathematics teacher requires the development of various professional skills, including being familiar with students' language. One fundamental skill is the ability to enter a classroom and speak in a manner that holds the attention of pupils. The implication of this process is that it may be at least as valuable for pupils to negotiate, construct, and articulate their understanding of mathematics in their language. Hence, language plays a significant role in sense of belonging in the classroom and school environment if students' mother language and classroom language is the same

(Harrison & Tanner, 2018). A single-language (the mainstream language) policy in education may cause an adverse impact on children's learning outcomes, specifically for those from the ethnic communities whose language is different from the mainstream. A growth mindset of teachers is an essential element to help students improve in their learning of mathematics and other disciplines, and it is more prominent for the minority group students (Fink et al., 2018). Culture-based contextual teaching-learning of mathematics problem-solving may support in addressing the multilingual and multicultural aspects of mathematics at school and higher education (Samo, Darhim, & Kartasasmita, 2018).

Corson (1998) proposed a perspective of this phenomenon, "Language is the vehicle for identifying, manipulating and changing power relations between people" (p. 5). Educational discourse can routinely repress and dominate certain minority groups through the use of the dominant language. Perpetual domination leads to the disempowerment of the diverse groups due to discrimination among races and castes. The teachers should acknowledge the racial disparities in the classroom to address these discriminatory practices (Carter et al., 2017). Implementing a uniform language policy over a language diversity policy has negatively affected the education of many children, such as those from diverse communities, who in our study are mostly from the Tamang, Gurung, Rai, and Newar communities in Nepal (Awasthi, 2004).

Contextualized Ethnomathematics

Luitel (2009) argued that the contextualization of mathematics education is essential to promoting pluralistic mathematics education and valuing non-Western corpora of knowledge traditions for developing a justifiable mathematics education. To devise culturally relevant mathematics education, the concepts of mathematics should be integrated with the work of carpenters, businessmen, tailors, homemakers, or children playing games. Creating a link between academic mathematics and students' experience is important because then, they can simplify abstract content and enjoy mathematics. The benefits of mathematics for students are at least twofold: It develops their logical thinking and increases their opportunities, for example, courses for further study career paths.

If mathematics is taught as a body of knowledge, activating students' intrinsic motivation for learning becomes challenging. Students then perceive mathematics as a difficult subject; notably, most teachers find it challenging to create lesson plans that inspire learners to be active, creative, and imaginative. From the cultural perspective, learners may feel that their ownership of mathematics activates them to learn mathematics. Applying contextualized ethnomathematics may help identify the connection between school mathematics and mathematical knowledge in a society that provides space for imagination and uses of mathematics in daily life. Therefore, cultural contextualization of mathematics helps students to motivate toward learning mathematics. Thus, to create culture friendly mathematics, the curricula must change from the traditional type of teaching–learning processes to those of ethnomathematics. The practice of ethnomathematics would also help students understand the role of mathematics in their life and its impact on their school and social life. Regarding this connection,

Davison and Mitchell (2008) said, "If mathematics is taught as a body of knowledge to be memorized or to regurgitate, it may lose its dynamic character and become a set of painful mind game only" (p.151). To illustrate this connection, the participants' views are portrayed in Narrative 2.

Participant Narrative 2

Rabindra. *While developing a mathematics curriculum, the focus should be the context and practical application in life. Local knowledge and activities should be considered in the basic level mathematics curriculum. In the context of Nepal, the basic level mathematics curriculum should be provided by the local government; however, the implementation has been very weak. The authorities at the school level should consider indigenous knowledge while developing the basic level mathematics curriculum. Mathematics supports culture. The culture may create knowledge of mathematics. Therefore, using various artifacts and materials can facilitate mathematics teaching–learning and curriculum design. Mathematics can be interlinked with social, cultural, and historical contexts. Ethnomathematics is the empowerment of cultures. The main component is how much time a teacher gives to a child while teaching. In Nepal, teachers are paid low salaries; thus, they must have a second job and can neither devote a fulltime schedule to their students at school nor take the time to reflect on how to deliver the most effective teaching.*

Saurya. *The curriculum always needs to pay attention to the local knowledge (e.g., counting, measuring, calculating, estimating) of the community in the curriculum of basic mathematics. This helps to preserve and enhance the deep-seated local ideas of the people that lead our students to a deeper understanding of the concept. That is why integrating indigenous ideas/knowledge in curricula makes students motivated to learn mathematics, which helps in creating the foundation of culturally relevant teaching. Gradually, it may help in changing the public image of mathematics from a dry subject to an interesting subject. Mathematics can be connected to social, cultural, and historical contexts. For example, for Judgyey at puja (a cultural ritual of worship and prayer), we observe several geometrical patterns, and we can relate these patterns to the teaching of geometry in basic mathematics. This may help in student motivation, and they can easily understand the concept of basic geometry.*

Maheshwor. *Ethnomathematics represents a way of life that has evolved through time with the local culture and environment. Thus, indigenous knowledge is adapted to the requirements of local conditions by the local people. Indigenous knowledge must be incorporated into every subject of the curriculum, to make teaching–learning more effective. Children are more familiar with the indigenous knowledge in their community than the other types of knowledge. If the indigenous knowledge is contextualized in subject matters, such as basic level mathematics, students will more easily learn and improve their achievement in mathematics. The students may perceive that learning and understanding the content is easier. Basic mathematics is the study of numbers, shapes, and patterns. Therefore, teaching basic mathematics includes the teaching of numbers, shapes, patterns, and their applications or uses. To*

make the teaching–learning of mathematics easier and more effective, it is necessary to contextualize the students' knowledge in the subject matter of mathematics. In the starting grades of basic education, indigenous commodities can be used for teaching mathematical matters. We can teach the numbers by showing the pictures or models of indigenous goods. By showing the shapes of indigenous goods (artifacts), mathematical shapes can also be taught. Thus far, mathematics and culture are concerned, culture is associated with human behavior, and mathematics aims at its applications in human service and use. To sustain day-to-day operations, human beings have shaped a system, namely, culture. In this sense, mathematics and culture are means to increase the convenience of human beings' lives and have a very close relationship with each other.

Chaitan. *Indigenous knowledge is adapted from the life affairs of the indigenous people living in a certain part of the country. The indigenous people are those who belong to this part of the land over a long chain of ancestors. They have their own culture, habits, and occupation-based skills. These cultural, habitual, and occupational matters represent their unique life and antique records. These aspects are universally unique and antique. These matters must be included in the school curriculum and basic mathematics. Therefore, I think that the addition of these matters in schools and curricula may help people think about who they are and how their lifestyle is valuable. Mathematics can be linked to social, cultural, and historical contexts, but we are still unable to show how they are related. If we relate these components in teaching mathematics, it will become more interesting, which ultimately helps students in their understanding of mathematics at the basic level.*

Eshu. *Contextual indigenous knowledge is crucial to making the curriculum more relevant and promoting context-based knowledge. Indigenous knowledge consists of a local community's traditional technology, social, economic, and philosophical learning grounded on spiritual skills, practices, and ways of being in nature. The integrated curriculum should focus on indigenous knowledge. Because of the globalization of knowledge, different impacts can be observed in the indigenous contextual knowledge of mathematics. In my opinion, these are the major issues. Almost all students and teachers are familiar with the connection of ethnomathematical practices, namely, the use of indigenous knowledge, and this way of knowing is more relevant. And students want to learn things related to their communities. Teachers can explain the indigenous phenomenon with the use of teaching materials on the subject. The school textbooks can contain indigenous knowledge. I argue that ethnomathematical practice is a more powerful approach to learn modern mathematics. There are students from a range of cultural backgrounds in our classrooms. They have different cultural practices at home. So, we must apply these practices in teaching–learning modern mathematics in the basic level curriculum. The practices differ from one situation to another situation, from one person to another person and one place to another place.*

The major concepts from Participants' Narrative 2 are empowerment, teacher motivation, geometry in rituals, mathematics as a service subject, and cultural network. Mathematics should play a leading role in every social arena and be flexible per the context and support. Every problematic feature of any mathematics education should be a means of empowerment and not be an element of oppression and discrimination. Although empowerment is contextual, mathematics can empower individuals through the concept of ethnomathematics. Related to this perspective, Acharya (2020) reported that the mathematical practices in the classroom should support students' managing of their daily life problems. Likewise, Gallivan (2017) suggested that teachers should engage students in mathematics by applying a culturally relevant and rich pedagogy to hone their funds of knowledge. Every child has an equal right to read and write mathematics; thus, there should be no racial and other discrimination, for example, ethnicity and gender (Joseph, Spencer, Johnson, & Kitchen, 2016). Mathematics teachers may teach math concepts using the perspective of ethnomathematics, in which the cultural diversity of pupils' is respected, and their everyday mathematical practices in and out of school are considered relevant (François, 2007), being aware of their own and students' racial differences (Russell, Haynes, & Cobb, 2016). The students from minority and marginalized groups perform low in mathematics and many of them drop out of school (Christian, 2017; Mathema & Bista, 2006). Therefore, they need mentoring from the teachers to retain in schools (Braun, Gormally, & Clark, 2017). Students can be confident in constructing and critically assessing the teaching process. From our experiences and the findings in the literature, we conclude that ethnomathematics enables students to question themselves and reflect on their journeys to becoming more aware of, more critical, more appreciative, and more self-confident in mathematics and its use in problem-solving. Thus, the practice of ethnomathematics in mainstream pedagogies empowers teachers and students to change their visions of mathematical knowledge and teaching with diversity beliefs and transformation of knowledge and skills (Alhanachi, de Meijer, & Severiens, 2021).

D'Ambrosio (1985) introduced the mathematics of cultural groups through informal education. This introduction inspired several types of research on the sociocultural basis of mathematics education. Before discussing the role of culture in developing mathematics knowledge, we introduce ethnomathematics. Ethnomathematics is the mathematics practiced by distinct cultural groups, identified as indigenous societies, groups of workers, professional organizations, and groups of children of a certain age (Upadhyay, 2001). It comprises the mathematical ideas, perspectives, and practices of individuals in different cultures as manifested and transmitted in diverse modes (D'Ambrosio, 1985). Culture is depicted as a manner in which a particular group develops symbols, artifacts, and language to exchange the meanings of their beliefs and social practices (Banks, 2016). Therefore, teaching mathematics requires accommodating the diversity of the pupils of different cultures and linguistic backgrounds. Mathematics might play a vital role in the advancement of culture and civilization if school mathematics accounts for this social need. Then, the development of culture and mathematics may enhance each other. Furthermore, mathematics helps individuals transmit, preserve, and enrich

their culture. In this context, Prahmana and D'Ambrosio (2020) interrelated Indonesian cultural art, such as Sidowirasat pattern, Soblog, Sidoluhur, Semen Bodhat, Sidomukti, Parang klitik, Parang Barong, and Babon Angrem. These arts deeply connect the geometric patterns to the school mathematics in Yogyakarta. Likewise, Supiyati, Hanum, and Jailani (2019) explored the culture of sasak community building and their cultural relevance to mathematics in terms of housing architecture. Ethnomathematics has been a growing interest in mathematics education in terms of multicultural aspects of mathematics and its cultural relevance to school curriculum and pedagogy (D'Ambrosio, 2006; Rosa & Orey, 2016).

In our opinion, knowledge is not absolute but a cumulative product of historical and cultural practices. We considered that the everyday life of a person or group in culture was amalgamated with their prior knowledge and practice within social and cultural values. In this regard, Upadhyay (2008) claimed that "mathematics is the body of knowledge accumulated thought culture and historical development, and it is shared experience" (p. 233). Therefore, ethnomathematics emphasizes the historical importance of mathematics. History is a significant tool to assess human behavior in different situations to manage that situation. If schools and teachers consider students' social and cultural values inside the mathematics classroom, their learning will be more meaningful. In this regard, Ladson-Billings (1994) argued that all children, despite their backgrounds, can be successful in mathematics when their learning in the classroom is integrated with their home cultures and material referents.

Student engagement in the classroom can be increased by incorporating culturally responsive mathematical practices in teaching and learning (McCallops et al., 2019; Powell et al., 2016). Such types of practices help students have a deeper understanding of the local environment and circumstances by including and enhancing the sense of sharing respect and cooperation with others. When a cultural perspective in the school teaching and learning process is implemented, it becomes dialogical, and a network between culture and mathematics practices forms. This networking provides opportunities to interact with teachers, community members, and students. Ultimately, these interactions between culture and others create a learning system for students and could help in realizing new possibilities for transformative education. Social constructivism emphasizes education for social transformation. Individual development is derived from social interactions within which cultural meanings lead to new understandings.

The subject of this study is the "dialectical relationship between the individual and the social and cultural milieu" (Akar, 2003, pp.76–77). In this regard, the practice of mathematics with culture is crucial. Thus, promoting a cultural perspective in the context, we have presented would help realize the latent capacity of learners and relate their cognition to mathematics contents. When developing a mathematics curriculum at the school level, D'Ambrosio (2007) emphasized three terms: literacy, numeracy, and technocracy. In our context, the majority of people are inadequately literate but require mathematics to perform everyday activities. Therefore, mathematical literacy is a critical factor in integrating mathematics with culture.

Local Knowledge for Teaching

Mathematics learning of children can be empowering if they are engaged in real-life situations and challenges. In this context, mathematics learning can be a fun, interesting activity when children are deeply engaged in mathematics connected to their day-to-day activities. Making mathematics learning a fun activity does not mean avoiding or reducing the standard of mathematics in instructions and processes. Teachers should engage students to find a meaningful connection between the localized mathematical practices in communities and families and help them bridge standardized mathematics to their daily life and informal practices. Regarding this connection, the participants' views have been portrayed in Narrative 3.

Participant Narrative 3

Saurya. *In the teaching–learning process, we must always focus on those activities and materials that they (students) are familiar within their day-to-day life. I mean, the learning in school should be connected and based on the students' common practices and culture, which encourages students to actively participate in the learning process, and helps us in creating a culturally relevant teaching–learning environment. Mathematics is the outcome of the social process. Therefore, I try to relate the topics of mathematics to social contexts. I am familiar with the students' community, language, and culture. It helps me a lot in giving examples from cultural contexts while introducing new concepts in mathematics. Students understand mathematics faster when it is related to their culture or social contexts; otherwise, it takes more time. If we follow the methods, it will be difficult to finish all the content of the curriculum within the specified time frame. It is difficult to finish the content if we try to relate it to day-to-day life situations. However, without doing this, the majority of the students cannot understand the concepts we are teaching.*

Rabindra. *The aim of education is to identify the social difficulties and find the proper solution to enrich and simplify the living standard of individuals, families, and communities. So, we should focus on the local people's viewpoints while designing the curriculum. Likewise, the newly formed multidisciplinary integrated curricula of grades 1–3 include physical, emotional, mental, social, cultural, moral, intellectual, and language skills and knowledge on health, nutrition, safety, and the environment. To provide such skills and knowledge, we should integrate and inter-relate their [students'] previous knowledge in the process of creating a curriculum with a multidisciplinary approach. As a matter of fact, this is the issue of research. In my opinion, there is an interrelation between culture and mathematics. There is always a wide use of mathematics in culture. Similarly, there is a culture in mathematics. In my opinion, our basic mathematics curriculum does not incorporate any culture. It could be culturally inclusive. For example, while teaching ratio and proportion, we can give the example of preparing Jibanjal (a mixture of salt, sugar, and water in a certain proportion). It could be a good example of teaching ratio and proportion. Similarly, while teaching a rectangle, triangle,*

angle, and right angle, we could use the structure of schools, houses, playgrounds, temples, etc. In addition, the local objects available can be used, for example, a plow, yoke, and other things that can be used as effective teaching material. To make the class enjoyable, the subject matter can be related to local knowledge and activities. Students understand better if they can link to their experiences.

Chaitan. *During my five-year-long service in a government school as a mathematics teacher and a faculty member of mathematics education at a university for the last fifteen years, I have not seen or did not have any sort of experience of primary or secondary level school curriculum incorporating the local knowledge. Most of the schools are running through general streams, which has a language, mathematical, and social context curriculum, but none of them focuses on the local skills, costumes and culture, language, etc. It is obvious that the school is a society in miniature where children from the multiple local contexts are represented. If we could only collect their local life-skills, it could enrich the other community children with intelligibility, decision power, and lifestyles. It certainly adds variety in their life. The way they make food, farm, harvest, greet, receive, and suppose, etc., could be universalized. Therefore, I understand that we need to teach children by showing different types of cultural heritage and artifacts connecting with different types of mathematical concepts; then, mathematics teaching–learning can be meaningful and contextual. Mainly, the teacher should be skillful.*

Eshu. *Mainly, the teacher should be skillful. A child can enjoy if the role of a teacher is of a guide or a helper who makes the teaching in the form of guided discovery. We have to develop a curriculum in a way that the teacher can relate every topic to the daily life of the children. To make the curriculum more relevant to culture, we have to give puzzles and emphasize home arithmetic related to the students' culture. In my opinion, puzzles enrich students' thinking ability, and home arithmetic is directly linked to their day-to-day events. Students are already familiar with such problems; thus, it helps motivate them. It's indisputable that children learn better if they understand the language of instruction. Therefore, while designing the curriculum for basic level mathematics, we should consider the background of the students and their culture.*

For us, this corpus of mathematics knowledge is significant informal mathematics education; since this mathematical knowledge arises directly out of the children's real-life experiences, its incorporation into school-work can serve to motivate students as they begin to see that recognition is given to what they do and say in their communities. Mathematics identity is closely connected to cultural identity (Abdulrahim & Orosco, 2020); therefore, school teachers should use cultural referents to explain mathematical concepts connected to their students' cultural and experiential knowledge (Clark, Badertscher, & Napp, 2013). They should have local knowledge for effective engagement of students in various actions and learning processes (Nergaard, 2017). Especially, teachers' indigenous knowledge at the personal and social level may help in several functions in mathematics education, such as the cultural connection of class activities, assessing students' learning through cultural projects and

artifacts, and creating an environment of self-respect and respect of otherness in opinion and value (Tsindoli, Ongeti, Chang'ach, 2018).

Some major concepts drawn from the aforementioned narratives are teaching with examples, difficulty with contextualizing mathematics, teaching with cultural artifacts, the local contexts in the curriculum, and teacher knowledge of the local context. In this sense, the mathematical knowledge for teaching in the classroom can be integrated with "culturally diverse knowledge base…" (Abacioglu, Volman, & Fisher, 2020, p. 737). The local knowledge for teaching in terms of using local resources may support in engaging students in meaningful tasks and activities making lessons interesting and cognitively graspable by the students (Madrazo & Dio, 2020), and increasing students' self-esteem through the contextual teaching-learning of mathematics (Nabila & Widjajanti, 2020). The curriculum should respect the indigenous methods of learning and teaching. Thus, the curriculum must link students' personal experience with mathematics with formal mathematics. If students enjoy solving practical problems embedded in the cultural setting rather than the problems in the text, mathematics education becomes culturally relevant and responsive (Brown & Crippen, 2017). The views of other mathematics educators on this topic were also explored. Notably, Rabindra considered it important to relate mathematics with the daily life problems of the children. Other participants expressed similar views. They think that the curriculum becomes more appropriate if it incorporates realistic strategies as much as possible. Contexts should be from the real world that the children are familiar with and can model problem-solving in real context bridging formal and informal mathematics, such as area measurements (Haris & Putri, 2011). Indigenous mathematics is acquired by learners through the accumulation of experiences, informal experiments, and an intimate understanding of the environment in their culture (Akullo et al., 2007). However, this systematic body of knowledge is disappearing because of the preference for modern, imported non-local/indigenous knowledge and modern mathematical knowledge. Therefore, it is generally accepted that such mathematics has often been forgotten or neglected in schools (Sharma, Bajracharya, & Sitaula, 2009).

Notably, the inclusion of students' prior knowledge in the school mathematics curriculum fits squarely into the constructivist philosophy (both Piagetian constructivism and radical constructivism) that "learner's abstract understanding from experience" (George, 2005, p.84). We argue that the education system of Nepal has given less preference to protecting and promoting the local mathematical knowledge. In other words, "the main hurdle to be overcome is the fact that the local mathematical knowledge is not normally 'packaged' as school materials are" (George, 2005, p.84). It is from the perspective of critical theory that formal learning has been structured and limited by the unequal exercise of power and "it must understand adult education as a political process in which certain interests and agendas are always pursued at the expense of others, in which curriculum inevitably promotes some content as 'better' than other content, and in which evaluation is an exercise of the power of some to judge the efforts of others" (Taylor et al., 2012, p.135). In this case, from the Freirean perspective of banking education, the formal structured education does not focus on creativity and

transformation of knowledge and it does not help learners critically consider their reality (Freire, 1993). This view is against the problem-posing instructional strategy weakening the students' cultural bond in the classroom (Nicol, 2018). Before discussing the participants' views on a child-friendly learning environment, we share a quotation:

> When you allow students the choice of working alone or working with others, you address their need for belonging. When you put students in charge of choosing which activity to complete, you focus on their need for power and freedom. When you offer students creative ways to show what they know, you address these needs, the more we foster intrinsic motivation of learners. (Dodge, 2005, p.51)

This quotation indicates that if learners have the opportunity to do work and behave according to their needs and interest, they create what they know. This phenomenon also motivates a learner. Regarding this topic, a participant, Maheshwor, said that culture friendly teaching means incorporating the students' culture in teaching mathematics. Nepal is a multicultural country, and this cultural pluralism can be observed in mathematics classrooms.

The subject matter of mathematics should be related to the students' experience and local knowledge and activities. Students understand better if they can relate the subject matter to local knowledge and activities. The teacher should be familiar with the students' culture and understand that mathematics is a desirable subject. In this context, a teacher may develop tasks and activities for students' critical thinking by implementing contextualization of mathematics at the elementary grades (Kurniati et al., 2015). The teacher should ensure equitable access to mathematics by all students developing their agency and identity (Larson, 2016). Lim et al. (2019) also emphasized the importance of the strong relationship between culture and teaching. The teacher should have theoretical and practical knowledge of culturally responsive teaching or culturally responsive pedagogy (Aceves & Orosco, 2014; Civitillo et al., 2019). Culturally responsive mathematics teaching provides an educational environment (Gutiérrez, 2008) within the equitable framework for mathematics instruction (Celedón-Pattichis et al., 2018).

The book "Responsible Classroom Discipline," by Jones and Louise (1981), explains how to create a learning environment appropriate for children in elementary schools. According to Jones and Louise, "Student disruptions will frequently occur in classes that are poorly organized and managed where students are not provided with appropriate and interesting instructional tasks" (p.101). Thomas (2000) stated that the significant characteristics of student-friendly teachers are as follows: (i) teachers must continually monitor students to be aware of students' difficulties, and (ii) teachers must understand students' problems, fears, or confusion to improve their understanding of students' learning difficulties. On becoming aware of a student's problem, the teacher will have more patience with that student, making the students feel secure or less confused during learning in the classroom.

The three themes analyzed and discussed above focused on language, contextualization, and local knowledge of teaching mathematics for culturally relevant basic mathematics in Nepal. These interpretive findings from the qualitative analysis of the perceptions of five mathematics educators are also related to

other contexts and studies for example, use of wooden artifacts constructed by Chundara in teaching-learning mathematics in Nepal (Pradhan, 2017), developing mathematical meaning by using musical instruments such as dhol constructed by indigenous people Rai in Nepal (Sharma & Orey, 2017), culturally responsive schooling through pedagogical and assessment practices in Australia (Vass, 2017), cultural transmission of mathematical knowledge in India (Divakaran, 2016), integration of ethnomathematics in African nations (Zaslavsky, 1994) and geometry in their cultural heritage of Sub-Saharan people (Gerdes, 1999). However, more study is needed to explore the cultural aspects of Nepalese mathematics and its relevance with basic level mathematics in the school curriculum and pedagogy. There are several studies in connection of cultural artifacts, and geometric and numeric patterns in Javanese Primbon (Utami, Sayuti, & Jailani, 2019), Yogyakarta batik pattern (Prahmana & D'Ambrosio, 2020), Kuba and Chokwe network in Africa (Zaslavsky, 1994), Mexican, Colombian and other Latin and South American cultural contexts (Campos, 2004).

The major themes that emerged from the analysis of data are teaching in mother language, contextualized ethnomathematics, and local knowledge integrated into the curriculum as a teaching approach. This study could be perceived as an essential document for all the related stakeholders, for example, students, teachers, researchers, teacher educators, curriculum planners, and policymakers. Among these stakeholders, student researchers will benefit the most. In this regard, the themes of this study may inspire further research to generate more knowledge in the area of the cultural relevance of school mathematics curricula. Although students at the basic level have sufficient content knowledge of mathematics, they feel comfortable in working in their cultural context. In this regard, this study helps researchers accumulate the real experiences of participants for generating research on the basic level mathematics curriculum. The thematic results in this study may guide neophyte researchers to problematize the everyday experience of mathematics in and out of the classroom for further research. The first theme related to teaching mathematics in a mother language may help teachers relate mathematics activities to students' daily life and culture.

The teachers should focus on culturally contextualized mathematics in the implementation of the basic level curriculum in schools. The teachers should play a major political role to empower students in collaboration with parents, other teachers, school leaders, and other stakeholders (Gutiérrez, 2016). The mathematics teacher educators and teacher education programs should emphasize the training and development of the basic level mathematics teachers to blend mathematics with culture, awareness about inequities, and related pedagogical issues (White, Crespo, & Civil, 2016). The policy leaders in education should be aware of how the synchronization of the local knowledge and mathematics curricula facilitates the meaningful teaching–learning of mathematics in schools. The overall education system should reform all basic level curricula in general and mathematics education, in particular, to transform the country's education to culture friendly teaching and learning. Therefore, if taken seriously by all concerned stakeholders of basic education in Nepal and elsewhere, the themes generated in this study have pedagogical, research, and policy implications for transforming teacher education in Nepal, in general,

and basic level school mathematics, in particular. The thematic findings may help in school policy to address racial and gender differences of students to promote inclusiveness in the classrooms (Killpack & Melón, 2016; Moss-Racusin et al., 2018; Rainey et al., 2018).

Mathematics educators' perceptions about the cultural relevance of basic level mathematics may have a significant impact on the development of curriculum and pedagogy in promoting instructions in the native language, contextualizing of mathematics, and educating children in the local language. Their perceptions about cultural relevancy of mathematics might reflect their beliefs and values and influence teacher training and development for socially just and culturally rich mathematics teaching-learning in Nepal and elsewhere in a similar context. Therefore, these findings suggest that teacher education programs should focus on these three key areas to enhance the cultural relevance of mathematics teacher education, and school mathematics teaching and curriculum.

There are three general limitations of this study: theoretical frame, sample size, and interpretive themes. We proposed the theoretical framework of this study to observe deficits and empowerment orientation. The study subjects or participants were five selected teacher educators, who were interviewed. The participants' views in the interviews explicated some referents of deficit and empowerment orientation in general. For example, they reported their perspectives on culture friendly teaching and the synchronization of mathematics with culture. However, these referents were not the practical points but an elusive intellectual voice of a small sample of educated elites in Nepal. Therefore, the theoretical framework of the study had a limited scope of the potential impact on the production and implementation of culturally relevant mathematics in Nepalese schools. The second limitation was related to the sample size of the study. The source of data was in-depth interviews with five mathematics teacher educators of the Kathmandu, Lalitpur, and Bhaktapur districts of Nepal. The interview data from the five participants was insufficient to draw generalizable findings or themes. Therefore, similar to most of the qualitative studies, the results of this study cannot be examined from the generalizability criteria. The third limitation is associated with the interpretive accounts of the participants and the researchers. The qualitative data analysis was intended to observe a pattern of concepts and then generate themes or categories. While attempting to achieve this objective, much of the information is lost due to the analytical filter that researchers use to determine the specific or dominant concepts or ideas that relate to the major themes. In quantitative data analysis, every data point is considered (counted) in the analysis, whereas in qualitative interpretive analysis, meanings are generated from the most significant voices of the research participants. Therefore, the themes in this study do not incorporate all the ideas in the transcribed texts or verbal expressions (intonations) in the records and the body language of the participants.

CONCLUSION

This study explored five mathematics educators' perceptions about cultural relevance of basic level mathematics in Nepal. The three central themes related to instruction in native language, contextualization of mathematics with the notion of ethnomathematics, and integration of local

language as means of instruction signify a pressing need of culturally relevant mathematics at the basic level curriculum and pedagogy. The notion of native language for instruction demands strengthening basic education in children's mother tongue, which is also a national priority in Nepal to provide basic education in local language. This provision may reduce the hindrance in mathematics learning due to compulsion to learn it in the second language. There is a growing concern about teaching mathematics by contextualizing it in the local community practices. Therefore, the participants' views about contextualization of mathematics education for empowering and promoting cultural capital through mathematics teaching and learning signifies the need for teacher motivation, integration of mathematics concepts with the cultural rituals, and developing basic level mathematics as a service subject rather than a pure discipline of logic and reasoning with contextless numbers, shapes and variables. The notion of local cultural knowledge for teaching implies teaching basic level mathematics with examples using cultural artifacts and transforming the curriculum and teacher practice.

ACKNOWLEDGEMENTS

The authors express their gratitude to the University Grant Commission of Nepal for providing support to the first author to initiate this study. We would like to thank anonymous reviewers for their constructive feedback to bring the manuscript in the current form. We are also thankful to the research participants for their participation in this study.

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