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Abstract

The process of constructing knowledge in mathematics education is critical in developing it as a discipline with an impact on the field of teaching, learning, and assessment based on theory and practice. How do mathematics educators perceive the processes of knowledge construction in mathematics education? It may have an implication in the methods of teaching, learning, and researching to enrich this discipline. In this context, the purpose of this study was to explore the Nepali mathematics educators' perspectives on critical conscience for the construction of knowledge in mathematics education. The research participants were five university-level mathematics educators who participated in in-depth interviews on critical conscience in mathematics education. The qualitative thematic analysis of the interview data unveiled four major thematic groups in terms of four idiographic passes– culture, communication, collaboration, and context (4Cs); discourse, dedication, deliberation, and development (4Ds); equity, engagement, elaboration, and extension (4Es); and formation, fusion, frame of reference, and faculty of cognition (4Fs). The thematic interpretations of critical conscience may portray the paradigmatic assumptions of ontological, epistemological, and axiological primacy of mathematics education from the participants' views. Policy and pedagogical implications of the themes have been discussed.

Introduction

Teaching and learning at schools in Nepal are highly influenced by the national examinations, rote memorization, and grades (scores) despite efforts to improve pedagogical practices (Ministry of Education, 2016). Many teachers do not well understand the curriculum, and textbooks are considered to be the "end-all and be-all" resources for teaching-learning (Ministry of Education, 2016, p. 23). Education in Nepal is mainly insufficient in developing students' creativity, analytical, critical, and creative thinking (Ministry of Education, 2016). The issue of critical thinking practices and creative abilities among students has not been well addressed in Nepali classrooms, despite practical knowledge and skills with the development of multiple talents for creativity, critical thinking, and effective communication has been emphasized in the new National Education Policy of 2019 (Ministry of

Education, Science, & Technology, 2019). The policy also emphasized student engagement or participation in teaching and learning. Even other policy documents of Nepal, for example, School Sector Development Plan (SSDP) 2016–2023, National Education Policy 2020, and National Curriculum Framework 2019, have focused on enough practices of critical thinking and creative skills in the classrooms for strengthening the quality education. Only statements in policy documents do not mean that things are going right in the classrooms, especially when they are related to the construction of knowledge by teachers and students. These issues seem to be a byproduct of teacher preparation and development programs in Nepal in terms of knowledge construction in the classrooms. In this context, the critical construction of knowledge is one of the most emergent issues in teaching-learning mathematics. Generating or constructing, or developing mathematics knowledge by teaching-learning activities requires educators' and students' critical conscience. Critical reflection helps mathematics educators in critical inquiry in their practices of teaching-learning mathematics or mathematics education courses through the conscious consideration of their ethical concerns of teaching practices, self-reflection, examination of views, and expectations in the process of teaching and learning (Larrivee, 2000).

Still, many mathematics educators might be embracing the notion of one single correct method of problem-solving with symbols and algorithms, exclusively hegemonizing mathematics pedagogy (Hersh, 1997). There seems to be a dominance of problem-solving as a purely mathematical endeavor, decontextualized from everyday life. In this context, mathematics education practice in Nepal seems to be guided by the notion of banking pedagogy (Freire, 1970). Students are seen as passive listeners in the classroom, uncritically accepting the teachers and textbooks as a source of knowledge without engaging learners in real-life contexts (Luitel, 2009; Rai & Acharya, 2021).

Mathematics educators are expected to be critical in their practices in supporting their students to open up a healthy discourse in the classroom practices, especially it is a crucial matter in Nepalese higher education. Being critical does not always necessarily mean being negative or being in opposition; instead, it means being conscientious with a commitment to the principles of equality, equity, and social justice (Tutak et al., 2011). In this context, critical mathematics educators may promote alternative perspectives among their students regarding fairness, equality, equity, and justice in mathematics education (Tutak et al., 2011). Critical mathematics educators should be critical of themselves too in an ongoing process of critical conscience and develop critical conscientiousness within themselves and their students (Frankenstein, 1983). They may embrace the values and potentials of critical pedagogy with critical reflection and critical conscientiousness to develop socially just mathematics teaching and learning practices (Tutak et al., 2011). However, there is a scarcity of studies on mathematics educators' critical conscience to develop a culture of honesty, humility, dignity, identity, and respect for the diversity and alternative views and practices beyond general content, pedagogy, and technology-related knowledge, skills, and dispositions in their students. This lack of studies raises an issue in terms of how Nepali mathematics educators may play an agentic role in the context of the diverse, divergent, contradictory, and incommensurable interpretation of current educational practices (Doll, 2008). Therefore, the current study aimed to explore the research question: How do Nepali mathematics educators view their agentic role in the critical conscience in current mathematics education? This research question is further supported by a theoretical domain of critical conscience founded on critical pedagogy, social justice, and transformative education, which served as a theoretical framework.

Critical Conscience: A Theoretical Framework

Mathematics education is a discipline with research, teaching, and learning of mathematics from schools to higher education institutions that focuses on curriculum, assessment, pedagogy, and other cross-cutting issues that affect these domains. An individual or a group involved in the discipline has the responsibility to reform the curriculum, assessment, and pedagogical practices to meet the needs of the current and future demands of mathematical skills, knowledge, and students' dispositions. Mathematics educators have their responsibility to rethink the meaning of mathematics education, reform the curriculum, classroom practices, and current assessments that have created a havoc of injustice and critically lacking desired skills (Hsiu-hwang, 1995). While carrying out these responsibilities, the stakeholders of mathematics education have to act on concrete rules, plans, policies, and guidelines together with their inner judgments that can be called their conscience. The judgment they make is based on their experiences, knowledge, skills, awareness, needs, visions, anticipations, and potential outcomes from their actions. These judgmental elements may have a differential impact on one's decisions based on the individual's conscience. Therefore, conscience is an individual's inner vision about the actions to be taken in a context (Salomone, 2000; Schar, 1973; Sprinkle, 1994). Critical conscience is one's ethical and moral value-laden thought process to make a judgment of events and actions based on his or her true spirit of humanity, equity, justice, and ecological consciousness, which mathematics education literature has not discussed widely and deeply.

Every individual in mathematics education has the right of conscience or freedom of conscience (Salomone, 2000) to take or not to take a particular route in teaching, learning, assessment, and research activities. The quality of their actions, through binding in conscience (Salomone, 2000), may have a critical impact on the outcomes of mathematics education programs and processes. Therefore, actors' voluntary individual conscience (Salomone, 2000) may play a significant role in what kind of teaching-learning and research is carried out and with what vision and mission. In this context, the matter of conscience (Sprinkle, 1990) should be considered as a critical element of mathematics education in the success or failure or quality of actions based on whether they were performed with a clear and good conscience integrating an individual with a social conscience (Sprinkle, 1990). In this way, critical conscience emphasizes one's inner personal sense of what is true or untrue in terms of his or her everyday conducts, behaviors, actions, and motives that may drive him or her toward a right judgment and action (Hitlin, 2008; Muhamad et al., 2019). Hence, mathematics education communities may apply critical conscience as a compass to guide their decisions and actions in the right direction with moral and ethical behavior and power for integrity, humility, and justice (Schar, 1973).

Mathematics education is a discipline and intellectual practice of reforming pedagogy, curriculum, and assessment through research that requires actors' collective actions. In this sense, it is a relational action in which the actors consciously examine their actions and behaviors that may affect themselves and others (e.g., students and their families). Therefore, these actions are associated with the critical conscience of the players in mathematics education to bring the best outcomes through the collective conscience of moral and ethical development, democratic value, and humanity with justice and equity (Haynes, 2009), with an "inseparable bonding of cognition and feeling" (Holtam, 2012, p. 5). A critical conscience in mathematics education is essential for transformative

research, curriculum, and pedagogical practices with the integrity of leadership, the reflexive judgments of all stakeholders with full intellectual, ethical, and moral values (Lehman, 1963). These practices may ensure the goodness of learners and teachers, together with the broader communities through the reflexive judgment of the things that matter to all in multiple ways. Therefore, mathematics educators may apply their critical conscience in mathematics education, focusing on the goodness of the broader community and society because "goodness is the first principle of conscience" (Holtam, 2021, p. 60), benefiting humanity (Taylor, 2009) with a collective voice and broader consensus with respect and values of diversity (Feldman, 2006).

Critical conscience in the construction of knowledge in mathematics education stems from the idea of social, cultural, political, and historical contexts of pedagogical practices in the classrooms and research to inform the practices through a critical lens toward the authenticity of the knowledge construction process in the classroom and outside by teachers and students. The notion of critical conscience can be elaborated and supported within three critical domains of knowledge construction, dissemination, and preservation processes – critical pedagogy, social justice, and transformative education. Each of these domains of critical conscience in mathematics education has been discussed under separate subheadings.

Critical Pedagogy

A pedagogy of change in mathematics education may develop an awareness of identity through reflectivity and meaning-making of one's lived experience (Walshaw, 2010). In this context, mathematics educators may engage themselves in critical observation of their actions in the classrooms and research practices to keep up with "the word and world simultaneously" (Driessens, 2018, p. 40). One may not understand the meaning and sense of the word presented in the text (written or spoken) unless he or she is able to understand the context in which the text is written and read. Mathematics education is a domain of knowledge, skills, and dispositions to develop such an ability in a critical way to make sense of everyday lifeworld, not just symbols, formulas, equations, and algorithms. In this sense, mathematical literacy is more than a simple act of processing mathematical texts; rather, it requires both teachers and students to interpret social, political, historical, and cultural issues that shape the texts with meaning (Freire, 1970).

Freire's critical pedagogy has contributed to mathematics education with a renewed interest in the critical ontology of existing social injustice and unfair educational practices and their related epistemological consequences in terms of how mathematics educators engage in social, cultural, historical, and political dimensions (Kincheloe, 2003; Tutak et al., 2011). Mathematics educators have a responsibility to develop awareness and skills in their students to have a critical view of the ongoing "banking concept of education" (Freire, 1970, p. 73) and to promote "problem-posing" (Freire, 1970, p. 80) mathematics education in Nepal. Mathematics educators may engage students in activities of generating and examining the problems of their everyday life in a collaborative and participatory way and help them find possible solutions.

Teaching and learning of mathematics together with research practice can be developed into a program of transformative education to challenge the status quo of social injustices and malpractices. Students and teachers

may engage in a dialogical process of collaborative pedagogy in which "the teacher-of-the-students and the students-of-the-teacher cease to exist and a new term emerges: teacher-student with students-teachers" (Freire, 1970, p. 80). Can Nepali mathematics educators envision such a powerful vision of blurring the student-teacher and teacher-student interfaces in the Non-Western context? Teachers can think of another problem-posing practice in developing a research agenda that is leveraged from the notion of problem-posing pedagogy of Freire (1970). In critical pedagogy, the teacher may stimulate the students' questioning, but not imposing his/her views on them (Stinson et al., 2011). The role of the teacher is not only to shape the learner but also to empower them to encounter the social and cultural dominations in their world. There are three emergent domains in the critical pedagogy of mathematics education-- ethnomathematics, culturally responsive pedagogy, and equity issues in mathematics classroom practices (Skovsmose, 1985). However, the notion of critical pedagogy is beyond classroom practices in Nepal, despite some efforts by scholars to introduce the notion in higher education contexts (Sharma & Phyak, 2017).

Social Justice

Social justice in mathematics education may include access, opportunities, and resources for students based on their needs. For this to happen in every classroom, mathematics educators need to commit to transforming the educational structure for their students with a fair and inclusive educational setting in the classroom. Social justice provides incentives that inspire all students to equally grow and develop their potential in all possible ways (Bond & Chernoff, 2015). For various reasons, mathematics educators may face challenges in maintaining socially just practices in the classroom. For instance, overcrowded classrooms, inadequate resources to practice in the classroom, and discriminatory in economic factors that hinder students' full participation in the classroom practices as obstacles to didactic chances (Darling-Hammond, 1995). Quality in mathematics education needs equity-based support with high prospects of care for all students (National Council of Teachers of Mathematics, 2000). In this regard, mathematics educators should be aware of opportunities for all students to share their knowledge, skills, and dispositions and learn from each other in an equitable manner, making sure that gender, class, ethnicity, and economic status should not bar students from accessing high-quality mathematics education (Young, 1990). Therefore, it is high time for the mathematics education community to eliminate the struggle for socially just pedagogical practices in the classrooms (Esmonde & Caswell, 2010). While looking through the lens of access, all students should have equal opportunities and access to study and learn mathematics or other subjects (Vomvoridi-Ivanovic & McLeman, 2015). Do Nepali mathematics educators embrace the principles of equity, quality, and access in their pedagogical practices in the Non-Western context?

In order to elevate social justice in mathematics education, mathematics educators need to be aware of various social, cultural, political, environmental, and historical contexts in Nepal and understand the role of race, class, ethnicity, gender, beliefs, and achievement gaps in mathematics. As Ferguson (2000) highlights, teachers also need to be aware that race can function as a resource of capital in didactic backgrounds. Pierre Bourdieu discusses "capital" as a source that supports one's position or status within a given context (Bourdieu, 1977; Bourdieu & Passeron, 1990). Bourdieu discussed four kinds of capital: economic (money and property), social (connections, social networks), cultural (cultural knowledge, educational credentials), and symbolic (symbols of prestige and

legitimacy) that may influence one's knowledge or subconscious level to shape interactions and power relations (Lewis et al., 2008). In this context, achievement differences due to lack of support and equity-based access may endanger the identity of marginalized students (Gutierrez, 2008). It seems that the current education system does not emphasize equity in terms of ethnicity, language, culture, age, and gender despite increasing pressure and awareness of people (Atweh et al., 2011). There are ongoing issues related to the bureaucratization of school performance, supervision, and curricular practices with negative implications for equity and social justice (Kaur, 2012). Therefore, the focus in mathematics education should be shifted from the perspective of equity to inclusiveness to promote socially just classrooms, schools, and communities of practice (Boylan & Woolsey, 2015; Burton, 2003; Xenofontos, 2019).

Transformative Education

Transformative education has been a subject of study in several disciplines in education, including mathematics education. Transformative education emphasizes problematic frames of reference and assumptions to change educational practices into an inclusive and democratic environment by shifting practitioners' thoughts, self-awareness, and consciousness of who they are and what their responsibilities, accountabilities, identities, values, and beliefs are (Mezirow, 2003). Therefore, mathematics educators have a high time of revisiting their taken-for-granted practices, roles, and responsibilities to develop a root of transformation from a different perspective, challenging the status quo (Hamm, 2016). Nepali mathematics educators may embrace the notion of transformative pedagogy by encouraging teachers to practice questioning pedagogy, doubting the existing knowledge and practice, and challenging the status quo with the hope of enhancing critical awareness, as suggested by Mezirow (1997). This endeavor can be achieved through critical reflection, critical consciousness, and questioning at the taken-for-granted educational practices and commonly accepted assumptions (Larrivee, 2000).

The transformative education includes five distinct interconnected ways of knowing, such as cultural self-knowing, relational knowing, critical knowing, visionary and ethical knowing, and knowing in action (Taylor, 2013). Embracing these five ways of knowing promotes the multiplicity of knowledge construction and a plurality of views, opinions, and values about these knowledge sources. Mathematics educators may develop the notion of transformation by emphasizing context-based knowledge with people's thoughts, beliefs, values, and actions (Taylor et al., 2009). The purpose of mathematics education in schools and higher education should be to empower learners, teachers, and researchers to promote social justice in mathematics education. To achieve this purpose, mathematics educators and teachers need to develop themselves as reflective practitioners, moving beyond a knowledge of the existing base of discrete skills to a stage where they integrate and modify skills to fit precise situations to create new strategies and develop the necessary sense of self-efficacy with personal resolutions to the problems (Larrivee, 2000). They may diversify the students' classroom engagement modes through different ICT tools and integrate their indigenous knowledge in teaching-learning activities (Rai & Acharya, 2021).

The framework in Figure 1 has been used to design the method to construct meaningful narrative interpretations of research participants' views about the construction of knowledge in mathematics education in Nepal. These

theoretical notions of critical conscience with critical pedagogy, social justice, and transformative education guided our further actions in data construction, analysis, and interpretation. We framed the study process to understand the selected mathematics educators' (research participants') views and perspectives on critical conscience as a basis to examine the knowledge construction in mathematics education in Nepal.

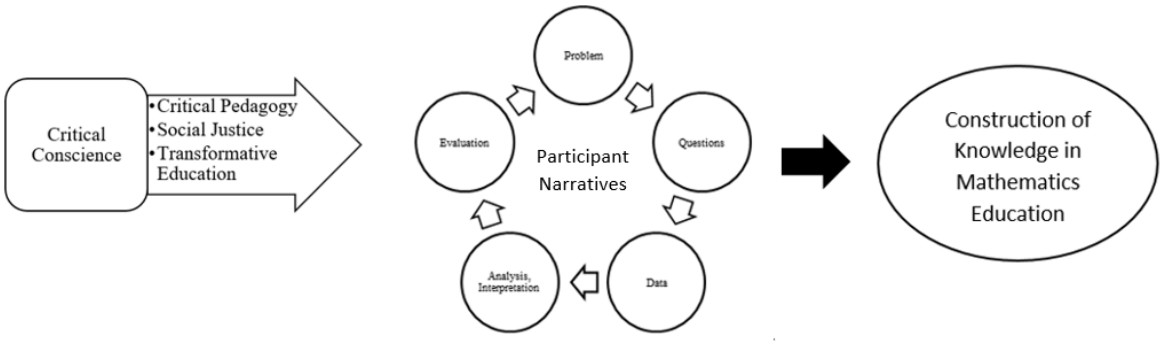

Figure 1. A Conceptual Framework of Critical Conscience for the Construction of Knowledge in Mathematics Education

Methodology

An interpretive design with a narrative inquiry approach was implemented in this study. The interpretive design enabled the researchers to study the lifeworld experiences of the research participants (Taylor & Medina, 2011). The narrative was a means of developing and nurturing critical reflection and reflexivity skills that are necessary for anyone researching their own practices (Bold, 2012). In this study, narrative inquiry has been used as a spoken or written text of an account of events and actions chronologically connected (Czarniawska, 2004) by capturing the experiences and developing modes of analysis and interpretation with explanatory power for understanding those experiences (Hendry, 2007), through interviews and reflections on the life experiences of research participants (Polkinghorne, 2007). The narrative inquiry, in this study, has been used to represent the participants' views and the meanings they make of their experiences (Atkinson, 2010), representing the modes of their transformation (Clandinin & Connelly, 2000), in terms of method and phenomenon (Creswell, 2012), and making meaning of experiences. The purpose of this study was to explore the Nepalese mathematics educators' perspectives on critical conscience in mathematics education. In this study, we narrated participants' views to interpret their meaning of mathematics education from the perspective of critical conscience within three domains: critical pedagogy, social justice, and transformative education. As we selected the mathematics educators' experiences in mathematics education through the lens of critical conscience, we have explored their experiences and stories in the process of narrative inquiry.

Site and Participants

The study site was Kathmandu valley. We embraced the notion of accessibility and reachability to participants by purposively selecting the study site and participants (Creswell, 2012), who were willing to share their views and experiences on the issues of study (Omona, 2013). We adopted three criteria for participant selection—should

have a minimum of master's degree in education, teaching mathematics education in higher education institutions, and familiarity with the critical paradigm of research and education practices. These criteria were set in order to have participants with relevant knowledge, skill, and experience in critical conscience in mathematics education. Based on these criteria, five participants -- Prabin, Rabin, Indra, Ray, and Rasmi (pseudonyms) were selected purposively.

Prabin is a male participant with an M. Phil degree in Mathematics Education from one of the universities in Nepal. He has 12-year of experience in teaching mathematics. He has a keen interest in research on transforming teaching practices in Nepal by promoting equity, social justice, and critical pedagogy. The second participant, Rabin (a male teacher) with an M. Sc. degree in statistics and M.A. in economics, has been teaching mathematics at school and a university college. He has teaching experience in mathematics for more than a decade. He is currently doing Ph. D. at a university in Kathmandu. He is keenly interested in classroom discourse in mathematics, the transformation of mathematics education, and critical discourse analysis. The third participant, Indra (a female teacher), has a Ph.D. degree in education. She is a professor of mathematics education at a university in Kathmandu. She has 35 years of teaching and research experience at the university. She teaches pedagogical courses at the master's degree level and supervises the thesis students. She is interested in research in mathematics education related to inclusive, critical, and transformative education. The fourth participant, Ray (a male teacher), has a Ph.D. degree. He is teaching at a university in Kathmandu. He has a long teaching experience in school-level mathematics. He facilitates the courses of the master's level at the university. He also supervises students for dissertations at M.Phil. and other master levels. The fifth participant, Rasmi (a female mathematics teacher), has a Master's in Mathematics Education degree. She has been teaching mathematics education courses at a university in Kathmandu. She has seven years of teaching experience in different courses of mathematics at different levels of higher education. She is interested in studies related to educational problems and challenges, ICT integration in mathematics education, and indigenous knowledge in higher education.

Data Collection

A qualitative researcher can use a variety of techniques for data collection (Cohen et al., 2000). In this study, we used in-depth interviews as the data collection tool/procedure. We conducted unstructured interviews with each participant to understand their views, experiences, and practices of knowledge construction in mathematics education. Each interview lasted for about 60 to 70 minutes. Each interview was audio recorded. While conducting the interviews, a brief note was taken by the interviewer to keep track of questions, and important points discussed with the participants. As qualitative researchers, we attempted to understand the world from the subjective points of view of the participants to unfold the meaning of their experiences to uncover their lifeworld (Kvale & Brinkmann, 2009). Among different ways of making a narrative inquiry (Bold, 2012), this study employed in-depth unstructured interviews with mathematics educators to understand their knowledge, experience, and views through the lenses of critical conscience (Muylaert et al., 2014). The interviews started with a major question: In your opinion, how do students construct mathematical knowledge? Other subsidiary questions and prompts were used based on the participants' responses to the main question. They were asked to elaborate on a variety of ways that students make sense of mathematics, mathematics learning, and mathematical knowledge.

The potential participants were contacted by the first author through a direct phone call to inform them about the purpose of the study, process of the interviews, and requested their consent to participate in the study. The participants were fully assured of the confidentiality of the information and of their privacy. The first author conducted in-depth un-structured interviews with each participant at a place where the participants felt comfortable.

Data Analysis

In qualitative research, the data collection and analysis processes must go simultaneously (Creswell, 2003). We adopted the general inductive approach for qualitative data analysis to analyze the verbal data of field notes and interview transcripts. In the process of data analysis, we transcribed the recorded interviews. We read the interview transcripts repeatedly to identify patterns of voices, issues, and participants' thoughts on critical conscience in mathematics education. Based on the reading and searching for meaningful units in the data, the researchers generated the primary themes, which were examined with all the interview data and brief field notes to consolidate the final themes (Thomas, 2006). While consolidating the final themes, we organized the main ideas into four broad thematic groups represented as four Cs, four Ds, four Es, and four Fs for the ease of organization and related meanings in the form of *ideographic passes.*

Quality Criteria

We adopted three different quality criteria in this study. First, we shared the interview transcripts with the respective research participants to maintain the authenticity of the texts from the interviews. This process helped us maintain the trustworthiness of the qualitative data while transferring the recorded interviews into textual forms and having them re-examined by the participants as a part of member checking of the data (Coffey, 2014; Phillips, 2014). Second, we maintained the voices of the research participants' in their words. Presenting their voice in the first-person perspective through narratives helped us maintain the authenticity of the data (Gilgun, 2014; Lincoln et al., 2018). The participants' narratives were examined with the interviews and transcripts to make sure the truthfulness of the representation of their voices. Third, we also used the field notes in order to corroborate the main ideas presented in the interviews and subsequent thematic interpretations as a part of data triangulation (Flick, 2018).

Results and Discussion

The results of this study focused on mathematics educators' perspectives on critical conscience in mathematics education through the lenses of critical pedagogy, social justice, and transformative education. The final thematic groups were generated as culture, communication, collaboration, and context (4Cs); discourse, dedication, deliberation, and development (4Ds); equity, engagement, elaboration, and extension (4Es); and formation, fusion, frame of reference, and faculty of cognition (4Fs). These themes have been discussed in three layers –

narrative excerpts in participants' voices, conceptual analysis of narratives, and interpretation in relation to the relevant literature.

Idiographic Pass 1: Culture, Communication, Collaboration, and Context (4Cs)

Constructivism suggests that prior knowledge supports understanding and developing new mathematical concepts and ideas (Snively & Corsiglia, 2001). Social constructivism assumes that knowledge is constructed by students or learners by himself/herself, not transmitted by others (e.g., teachers) to students' brains (Vygotsky, 1978). The research participants were asked to express their opinion about how students construct mathematical knowledge. The following narrative excerpts are participants' views on students' construction of mathematical knowledge through culture, communication, collaboration, and context.

> **Prabin.** When knowledge is related to mathematical experiences in a *culture*, the learners are connected to mathematics. In my view, many mathematics teachers believe that mathematics is a *non-cultural* subject. It is, however, clear that mathematics is not a *culture-free* discipline. In my opinion, all *cultures* are rich in artifacts that exhibit mathematical concepts. For example, in basket weaving, one can see many geometry concepts. In my opinion, mathematics knowledge must be created using a variety of resources, most of which can be located in the community outside the school, which means it is *embedded in our culture*.
>
> **Rabin.** The construction of mathematical knowledge is concerned with epistemic *discourse*. There are several ways through which mathematics knowledge is constructed. It is believed that knowledge is constructed in the process of *engagement* in the lifeworld of people through linguistic *communication* and *persistent observation* of the phenomena. This is an experiential knowledge of the world of people. This kind of *dialogical* way of constructing knowledge is pervasive in human's day-to-day lives.
>
> **Indra**. In the world, there are many ways students may construct mathematical knowledge from different sources. In my opinion, the main way to construct knowledge by learners is through their *problems* that they are facing in *their surroundings*. That problems always lead him/her to resolve that situation. While learners think that they are in a problem, they try to solve such a problem with different techniques and methods. They may *observe each other's practices*. They may *ask others for help*. They think of many alternatives and try to find out the best. If students are not able to solve the problem themselves, then only they *go to their society* or environment to solve that problem.
>
> **Ray**. In my opinion, the construction of mathematical knowledge may go through the analysis of a person's *worldview* and their new *experience* that they encounter. When a person encounters a particular situation, he/she gains some *experience*. The experience influences his or her previous understanding. They analyze their *socio-cultural situation*, their *prior understanding*, and *new experiences*, and then they construct knowledge. Knowledge construction is not what teachers or some others say, or what the listeners receive from others.

> **Rasmi**. In my opinion, students construct knowledge from their *personal experience*, family, society, community, school, *social-cultural norms, and values*. Formally, students construct knowledge from the school, where they *communicate* with their teachers and peers to gain knowledge. Informally, they construct knowledge from their family, society, and different types of digital tools. Accidently they construct knowledge from radio, television, and newspaper, etc. On the other hand, knowledge construction is a *collaborative process* that aims to produce meaningful knowledge, which is something new that anyone alone could not achieve (before).

From the above narrative of the participants, we came to know that knowledge can be constructed in a dialogical manner among different people, either formally or informally. The construction of mathematical knowledge is a process by which teachers and their students generate ideas and understanding. Mathematical knowledge seems to be widely accepted through group discussions, collaborations, and healthy debates that connect contents with contexts and experiences (Moreno-Guerrero et al., 2020). When the knowledge is related to the mathematical experiences of culture, the learners are connected to mathematics, and they become productive mathematics learners (Meyer & Aikenhead, 2021). The topics of discussion may be cultural values and norms that help students generate new knowledge. This knowledge can be constructed through studying different kinds of resources. Similarly, knowledge can be generated through multiple ways, such as communication, observation of the situations, critical reflection on the subject matter, and multiple logics. Likewise, the other ways to construct mathematics knowledge by students can be asking other students, practicing problem-solving, and observing phenomena under different situations (Cobb et al., 1991; Steinbring, 2005).

From the viewpoint of the participants, mathematical knowledge can be generated by students through analysis of worldview and new experiences that they encounter and interpret the situation and compare it with the other (similar context). Similarly, knowledge construction is a continuous and active process where learners generate knowledge from their day-to-day life activities. They may use their intellectual power and personal experience to construct knowledge by interacting with family, community, and society in a collaborative manner (Mutekwe, 2018). The learners may also learn and construct knowledge from social-cultural norms, values, and critical reflective practices. In this line, Vygotsky (1978) claimed that people must interact in society to learn and to generate knowledge.

Furthermore, he added that learners could build knowledge through social interaction with more knowledgeable others (Breive, 2020). However, mathematics education in Nepal still focuses on a set of rules, symbols, formulas, and procedures for problem-solving by emphasizing reductionist logic (Ministry of Education, 2016). Such practices are dominated by the viewpoint of pure mathematics (Luitel, 2009). The teaching-learning of mathematics in Nepal emphasizes the transfer of mathematics knowledge from teacher to student, embracing the view that mathematical truths as absolute and infallible. Despite several mathematical practices in the local culture, the mathematics incorporated by the school curricula in Nepali schools is different from what one can find in the local context. The mathematics curriculum in Nepal perpetuates value-free and non-empirical knowledge of mathematics. Mathematical knowledge could be constructed through teaching in the mother

language, contextualized ethnomathematics, and teaching mathematics incorporating the local knowledge (Acharya et al., 2021); however, it is not a norm in Nepali school mathematics curriculum and pedagogy.

Critical dialogue in mathematics education should be a norm in generating new ideas and knowledge in the field within and outside the classroom through collaborative and cooperative group dynamics of students and teachers or educators (Webb et al., 2019). Such practices may help teachers and students mutually collaborate for activation, motivation, and a more significant cognitive gain in terms of meaningful learning of mathematics in the classroom (Boheim et al., 2021). Therefore, the dialogue can be regarded as a critical tool for mathematics educators to engage themselves and students in the process of co-generating knowledge of mathematics education in terms of cultural and social agents that drive co-learning and co-development (Abdu et al., 2021). Therefore, mathematics educators' critical conscience on students' construction of mathematical knowledge through culture, communication, collaboration, and context should be emphasized in teacher education and development programs.

Idiographic Pass 2: Discourse, Dedication, Deliberation, and Development (4Ds)

Critical pedagogy is the alternative perspective of banking pedagogy because in critical pedagogy problem-posing process is highly implemented through the process of a dialogue that the students may generate and examine the problems of their everyday life in a collaborative participation to find the possible solutions. In critical pedagogy, the teacher stimulates the students for questioning, not for imposing his/her views on the students (Freire, 1970). The role of the teacher is not to save the learner but to empower them to encounter domination in their world (Freire, 1970). There are three emergent domains in critical pedagogy in mathematics education--ethnomathematics, culturally responsive teaching-learning, and equity in school education (Skovsmose, 1985). In this context, critical mathematics educators should be critical of themselves and foster democratic values and critical consciousness. The following narrative excerpts are participants' views on students' construction of mathematical knowledge through discourse, dedication, deliberation, and development.

> **Prabin.** Through my own experiences in teaching and learning mathematics, I realized that mathematical knowledge could be generated through *critical discourse*; learners are motivated to *interact and participate* in the *debate* about mathematical issues. In critical discourse, learners may argue on possible applications of mathematical knowledge to solve real-life problems. In this *discourse*, teachers *facilitate and support* learners in thinking and sharing their ideas and experiences about the possible problems and their solutions without any hesitation.

> **Rabin.** In my view, mathematical knowledge can be generated through an iterative process in a *critical discourse* among the members in participation. I believe that iterative, recursive, and discursive thinking may develop a culture to construct knowledge in mathematics education that takes less time than the first few attempts in the classroom. This kind of *recursive discourse* as a classroom norm or culture makes students more confident. It also challenges the learners to think out of the box. Students may develop a better understanding of the issues under discussion through connection to prior works, *sustained*

engagement in the discourse through questioning and reasoning, and adding knowledge to build more confidence in mathematics learning.

Indra. A teacher should be a problem solver for solving students' problems in the teaching-learning process. Problems-solving is a natural process for any action of a *new possibility* (*development*). Every classroom should be a laboratory for purposeful experimentation and practice. So, practice or procedure is never permanent but makes perfect. New insights, understandings, and perspectives bring previous decisions up for re-evaluation, and consideration is a *dynamic* way of teaching. Teachers must try to solve issues more *deliberately*, articulating the rationale in their teaching field. A teacher is a problem-solver who involves *synthesizing experiences*, *integrating information* and *feedback*, uncovering *underlying reasons*, and *discovering* new meaning in teaching.

Ray. One of the best ways of generating knowledge in mathematics education is the *discourse or critical discourse* among students, students, and teachers, and among mathematics teachers and educators. There is a quote in Sanskrit; it is said that "[वादे वादे जायते तत्व वोध:] Vādē vādē jāyatē tattva vōdha:" which means that the discussions, discourses or debates help in reaching the truth, that is knowledge. In this context, knowledge is not just information but an understanding of the event or action in a context through *critical discourse*. In the classroom, most of the students keep interested in working in a group. They frequently solve mathematical problems in different alternative ways and discuss themselves. There can be *arguments on problems* that can be solved in this way or why they cannot be solved that way. Moreover, if they are unable to reach a conclusion, students may ask me the right way to solve this problem. Then, I guide them with *some clues* without giving them the solution right away (*deliberation*).

Rasmi. In my view, generating knowledge is not a one-way process. In mathematics education, knowledge is constructed by *discussing a problem or issue* between two or more persons. A person can develop his/her knowledge through a *healthy and logical debate* with others. The debate is the main source of knowledge. While I share my views with others about the same issues, they may have *another (alternative) view*. Then, we may start a *debate on the problem or issue* to construct a common understanding. We should discuss more on issues which may lead us *to better ideas*. This is one of the many ways to construct knowledge by learners in mathematics education.

From the above narrative of the participants, we came to know that the knowledge generation process in mathematics education should be based on critical thinking and critical discourse through iterative dialogues and debates among mathematics learners. In critical discourse, learners are motivated to interact and participate in the debate about mathematical issues. In critical discourse, learners argue about possible applications of mathematical knowledge to solve real-life mathematical problems in alternative ways. In the process of critical discourse, the learners can generate mathematical knowledge challenging the status quo. The knowledge generation process may go through debates and discussions with friends, facilitators, and other knowledgeable persons. This discussion may be dialogical or dialectical, blurring the interface between learners and teachers (Freire, 1970).

Similarly, mathematical knowledge can be constructed through an alternative perspective from experience, clarifying values, solving problems, and addressing challenges in day-to-day life activities. Likewise, another way to construct knowledge in mathematics education is through raising questions to the people on how and why in search of logical solutions. That means students may construct their knowledge through doubting and questioning oppressive elements of society as perpetuating phenomena.

In this line, Deacon (2006) claims that the power in the mathematics classroom is the tool for the construction of reality (ontological object) through discourse (epistemological pathway). Likewise, Foucault (as cited in Abera, 2019) argued that knowledge is power and power is knowledge. Therefore, in generating knowledge by students through critical discourse, teachers should create an environment in which students are liberated in the sense of learning by sharing their views, beliefs, knowledge, skills, and dispositions in mathematics. It may demand a pedagogical change in mathematics education by rethinking identity through reflective practices to generate shared critical knowledge by the students themselves (Walshaw, 2010), by embracing liberating pedagogy against banking pedagogy (Freire, 1970) with the integration of ethnomathematics, culturally responsive teaching, and equity in school education (Skovsmose, 1985). However, it needs to develop and implement academic discourse of mathematics education from school to higher education for questioning, justifying, and arguments on the issues of teaching-learning, problem-solving, curriculum designing, and assessing students' learning (Heller, 2015). Critical discourse in the classroom may help teachers and students learn from each other, open up their deep understanding of the contents, processes, and outcomes, and develop a deep sense of trust amid doubt on mathematical works and procedures (Harkness & Noblitt, 2017). The discourse as a critical pedagogical paradigm in mathematics education can be extended beyond the classroom practices in the professional development of mathematics teachers and educators with higher professional learning goals and priorities (Tytler et al., 2011). Thus, the talks and discourses are accepted as essential parts of students' improvement in mathematical thinking (Norenes & Ludvigsen, 2016). The constructivist learning process facilitates the learners to create meaning through discourse. For this, cultivating learners' habits of mental inquiry consists of acquiring cultural beliefs from claims, opinions, or mere conjecture and developing an open-mindedness to alternative viewpoints of the cultural practices, which is inquired in mathematical pedagogy (Teo, 2019). Imm and Stylianou (2011) also focussed on the discourse in classrooms and mathematical language among teachers and students. Critical discourse adopts critical thinking as the strategy of generating ideas; as discussed by Imm and Styleanou (2011), there is a significant association between cognitively demanding tasks and mathematical conversations. Discourse on the issues among the learners is only the source of creating knowledge. Lo and Wheatley (1994) claimed that the classroom discourse concentrates on purposeful mathematical talk with unpretentious students' engaged interactions. Therefore, mathematics educators' critical conscience on students' construction of mathematical knowledge through discourse, dedication, deliberation, and development should be emphasized in teacher education and development programs.

Idiographic Pass 3: Equity, Engagement, Elaboration, and Extension (4Es)

Conscience is the ability of a person to take appropriate action. Critical conscience in mathematics education is selecting appropriate teaching-learning strategies, and making lesson plans that may bring transformation through equity and social justice. Mathematics education is a discipline that incorporates research, teaching, and learning

of mathematics from schools to higher education institutions. The stakeholders of mathematics education have to act on concrete rules, plans, policies, guidelines, and their inner judgment, known as their conscience. Their judgment is based on their experiences, knowledge, skills, awareness, needs, visions, anticipations, and potential outcomes from their actions. These judgmental elements may have a differential impact on one's decisions based on the individual's conscience. Therefore, conscience is an individual's inner vision about the actions to be taken in a context (Salomone, 2000; Schar, 1973; Sprinkle, 1990). The following narrative excerpts are participants' views on students' construction of mathematical knowledge through equity, engagement, elaboration, and extension.

> **Prabin**. In my experience**, c***onscience* is the *ability of a person* to take *appropriate action* to accomplish a task based on his/ her knowledge and experience. For me, as a mathematics teacher, critical conscience in mathematics education is the *selection of appropriate teaching*-learning strategies and making lesson plans that bring transformation in the mathematics classroom, *promoting equity, access, social justice*, and social *inclusion*. Critical conscience in mathematics education should enable students to *raise their voices* against the social injustices challenging the status quo. For that, critical mathematics education plays a key role.
>
> **Rabin.** My practice of critical conscience depends on the concrete lesson plans based on *equity* and *inclusion* and critical mathematics education by following modern *student-centric teaching approaches* such as collaborative learning, Realistic Mathematics Education approach, Argument-Driven Inquiry approach, and problem-posing and problem-solving strategies. In collaborative learning, mathematical knowledge is generated by *peer discussion and interaction* (Vygotsky's social learning). Students can *generate problems* before, during, and after the solution of a problem. Problem-solving is a process of reaching a solution. When learners have to solve a problem, they have to *examine the data, think and analyze critically* for strategy, and finally carry out the best strategy. Mathematical knowledge is generated during *problem posing*, and *problem-solving* is the sign of the critical conscience of the knowledge generation process.
>
> **Indra.** In my opinion, knowledge construction through critical discourse is an alternative perspective in learning mathematics or the process that involves *developing opinions, clarifying values*, and *taking an informed position*; the learner considers *different ways of looking at issues* and reaching a conclusion. This approach includes consideration of *complementary and competing strategies*, experiences, and world views, facilitating the learner to learn critically. It promotes students' creativity and thinking by *challenging their current knowledge and skills* and informing them of *other opinions*. It promotes open-mindedness and a willingness to consider relevant evidence to support students' arguments in forming beliefs or revising them based on renewed experience and knowledge. Such practice provides *more options for students in problem posing and solving* them, and addressing the ongoing challenges.

Ray. There are various ways of constructing mathematical knowledge in the classroom. To consolidate mathematical knowledge, we have to *introduce new contexts* to mobilize the new concepts and processes. There must be an *intensive discussion* between teachers and students with *local contexts* related to the mathematical concepts for better conceptual knowledge. *Concrete examples* help students understand the concepts. Introducing topics using *multiple representations* is necessary. Logic, observation, cooperation, collaboration, experiment, discussion, comparison, critical reflection, and memorization practice are required for better procedural knowledge. The practices of these all are the *judgment and critical conscience* of mathematical knowledge.

Rasmi. In my opinion, the construction of mathematical knowledge through critical conscience is how teachers and their students *generate ideas and understanding* through *reflection and critical judging*. The generation of mathematical knowledge through critical conscience is a widely accepted form. There are two aspects of mathematical knowledge. The first aspect is conceptual, which is related to the *mental representation* of a mathematical object or idea. Another aspect is procedural, which is related to an *ordered chain of operations* leading to a result.

From the narrative mentioned above, we can conclude that generating the knowledge is basically through learners' inner vision about the actions to be taken in a context and collaboration with each other for equitable learning. From the perspective of critical conscience, knowledge can be created for the selection of an appropriate teaching-learning strategies maintaining equity, democratic access, and social justice through inclusion. Likewise, from the narratives of the participants, mathematical knowledge can be generated through critical conscience from students centric teaching, collaborative learning, applying the realistic mathematics education, argument-driven inquiry, and problem-posing and problem-solving strategies in the mathematics teaching-learning processes. Further, conceptual knowledge can be constructed through discussions and lectures from the textbooks. Memorization and procedural knowledge can be consolidated through observations, discussions, and problem-solving practices. Students' logics, observations, cooperations, collaborations, experiments, discussions, comparisons, critical judging, and reflective writing practices are all required for better conceptual knowledge, which helps in critical conscience for the construction of mathematical knowledge in the process of teaching-learning.

Lithner (2008) argues that imitative reasoning is the one where students use memorized and algorithmic reasoning in solving a problem, whereas if students create themselves a whole or a part of a solution procedure that is novel, flexible, plausible, and mathematically founded. Nonetheless, the contemporary constructivist theories of teaching and learning have acknowledged the importance of problem-posing activities for the students (Silver, 1994). Ayllón et al. (2016) believe that when learners have to solve a problem, they have to examine the data, think and analyze critically for strategy, and finally carry out the best strategy. Silver (1994) claimed that mathematical problem posing is the generation of new problems and the reformulation of given problems. The matter of conscience should be considered as a critical element of mathematics education in the success or failure or quality of actions based on whether they were performed with a clear and good conscience (Sprinkle, 1990). Critical conscience may be interpreted as an expression of dissatisfaction toward the status quo practice seeking alternatives thoughts shifting the process of deconstruction and reconstruction of knowledge in mathematics

education focusing on the empowerment of dominated, suppressed, oppressed, minorities and indigenous groups integrating global and local pedagogical and research issues (Ross & Rivers, 2018).

The critical conscience of mathematics educators should demonstrate their power and privilege to resist the structural hegemony of certain groups and raise the voice of students who are ideologically subjugated by political and policy elites (Rivers, 2018). It requires mathematics educators to pay attention to the problems, challenges, and issues to be connected to their classroom pedagogical and research actions, even when the dominant groups may not want them to go in this direction and "that states may not want to face" (Smyser, 2003, p. 278). It is not just an individual motive to resist injustice and inequity, but it is a social construct to restructure the social functions based on compliance with laws, rules, values, and justice (Holtman, 2012). Therefore, mathematics educators' critical conscience on students' construction of mathematical knowledge through equity, engagement, elaboration, and extension should be emphasized in teacher education and development programs. This way, it may promote holistic construction of mathematical knowledge through affective, cognitive, social, and relational understanding and developing self-awareness in relation to others through consciousness and conscience (Taylor & Cranton, 2012).

Idiographic Pass 4: Formation, Fusion, Frame, and Faculty (4Fs)

Transformative learning is a process that transforms problematic frames of reference, set of fixed assumptions to make them more inclusive, open, reflective, and be able to change and create a democratic environment in the learning process (Mezirow, 2003). Transformation is the change in thoughts, self-awareness, raising consciousness, generating new self-views or perspectives, making meaning through critical self-reflection, and changing the deep-seated values and beliefs (Mezirow, 2003). The phenomenon of transformation in teaching-learning and assessment may challenge the status quo and taken-for-granted structures and practices in education (Hamm, 2016). The following narrative excerpts are participants' views on students' construction of mathematical knowledge through formation, fusion, frame, and faculty.

> **Prabin.** There are different ways of mathematical knowledge construction process. In the *trans/formation*, pedagogical knowledge is constructed after the *internalization*. In my opinion, contextual understanding, critical reflection, and supporting meaning by reasoning are the main aspects of transformative learning. From the social justice perspective, the *transformative dimension* involves a shift in attitude; this means *a change in pre-established mindset*. The transformed person becomes more *inclusive, non-discriminating, open, and emotionally able to participate* in the changing context. The *transformative self* sees everything critically and collaboratively. To be transformed, we need to have emotional maturity, which means awareness, empathy, and control.

> **Rabin.** I have been practicing *both conventional and modern teaching* approaches in teaching mathematics. When the time is limited, and the classroom is congested, then I practice the conventional approach, and when the period is sufficient and the number of students is manageable, I prefer a student-centric modern approach. I involve students in peer work and group work. I just provide the *necessary*

scaffolding, and let them create the solution process themselves. I sit by the side as a guide. I teach some of the chapters using Project-based Learning (PBL) and inquiry-based learning (IBL). I emphasize *contextualization*. Sometimes, I create *a fusion between academic mathematics and ethnomathematics* by taking students into authentic cultures (however possible). I have also started the integration of technology in teaching mathematics. During the Covid- 19, when face-to-face teaching-learning activities had been halted, I had used online teaching tools for mathematics teaching, which were helpful for my students in visualizing the concepts. The *transformation process* avoids the teacher-centric approaches and implements students centric approaches through the use of ICT tools, which was at first confusing to students, and then they *realized the change* in their learning.

Indra. Teachers must practice *questioning the status quo* in the conventional situation in the classroom with their students. It helps to examine the *assumptions of classroom practices*. School *policies and teaching practices* are both *culturally and politically embedded*. So, the changes in the aspects of individual practices are necessary for a collective effort. The *beliefs, assumptions, and expectations* of school policies and classroom procedures are based on questioning the status quo. A teacher and student's roles are to *challenge the status quo*.

Ray. Critical and transformative ideas are in favor of constructing knowledge through critical *self-reflective practices*. The *consciousness* that appears whether discursively or in the way of *thinking of social injustice* people face, it is one way of *developing awareness*, leading them to *change their perspective* and, hence, *social transformation*. Thus, the realization of how to *visualize the phenomena* from an alternative perspective departs them from knowing the world differently. The change in *reference* frames helps them *emancipate* from the domination, suppression, and repression from individuals and social structures.

Rasmi. Underachievement in mathematics is an ongoing issue in schools across Nepal. Many students at the elementary level are *not motivated* in mathematics and *perform poorly*. It may be the reason for this problem due to *negative attitudes* toward mathematics and *less effective teaching strategies* in mathematics. To begin to remedy this problem of less motivation to learn mathematics and achievement, teachers *need to be aware* and implement the *best teaching practices*. The best practices of teaching mathematics are using *games*, *manipulative*, *real-life problems*, *differentiated instruction*, and *integrating technology* into mathematics instructions. Once *aware of the best practices*, teachers could begin to implement them in their classrooms, which will begin to remedy low mathematics motivation and achievement among students throughout Nepal.

From the above participant narratives, we realized that mathematical knowledge is constructed after self-reflection, realization, and interaction among the community of learners. The contextual understanding, critical reflection, and challenging the existing knowledge, and searching for alternatives are rooted in the generation of knowledge in mathematics education through transformative thoughts and actions. Likewise, knowledge in mathematics education can be constructed through group work, peer work, and the use of different forms of ICT

in sharing and interacting during the pedagogical actions. In the same way, knowledge in mathematics education could be created by questioning, debating, challenging the existing situations, and developing self-realization to visualize the phenomena under study.

When mathematics educators become reflective practitioners, they can move beyond the current knowledge base of discrete skills, and they can integrate and modify skills to fit specific contexts and to a point where the skills are internalized, enabling them to invent new strategies (Larrivee, 2000). They develop the necessary sense of self-efficacy to create personal solutions to problems. Likewise, transformation in education brings a change in one's thoughts, self-awareness, consciousness, and creative views (Mezirow, 2003). The root of transformation comes from the individual's self through looking at the ideas and assumptions from a different perspective and challenging the status quo (Hamm, 2016).

Knowledge generation in mathematics education through transformative practice may include five distinct interconnected ways of knowing such as cultural self-knowing, relational knowing, critical knowing, visionary and ethical knowing, and knowing in action (Taylor, 2013). Some scholars have suggested three stages as a framework for developing the practice of critical reflection –forward, backward, and both forward-backward (Larrivee, 2000) while being a reflective practitioner for the knowledge generation process through transformation. In this sense, learning is the process whereby knowledge is created through the transformation of the experience of learners (Kolb, 1984). As an alternative, one can apply imitative reasoning as a way of memorizing rules and using algorithmic reasoning in solving a problem (Lithner, 2008), whereas if students create themselves a whole or a part of a solution to a novel problem that may help in transforming the knowledge in mathematics education (Lithner, 2008) through active engagement of students in the classroom to share and integrate their indigenous knowledge in teaching-learning activities (Rai & Acharya, 2021).

Transformative culture in mathematics education embraces "critical collective consciousness" that may come through challenging the injustice and inequity and taken-for-granted classroom practices that have left many students behind in the subject knowledge, skills, and dispositions (Hughes, 2020, p. 2). Such practices in the classroom and outside should emphasize higher-order thinking with creativity, critical thinking, collaboration, and mutual respect with a greater sense of responsibility (Hughes, 2020). Mathematics educators may develop tasks of "transformative event" through which students abstract their understanding of mathematics in a context through reflection and continuously thinking about their thought processes (Rowlands & Carson, 2006, p. 26). Therefore, mathematics teaching-learning and research practice should be oriented towards deep learning through the profound engagement of teachers and students as co-teachers and co-learners with intrinsic motivation to develop meaningful questioning and reasoning in mathematics education (Howie & Bagnall, 2015). It focuses on practical learning nurturing indigenous culture and languages within its pedagogies. Transformative learning may be illuminated through critical dialogue and discourse in the classroom on socially relevant problems and challenges (Hughes, 2020). Therefore, mathematics educators' critical conscience on students' construction of mathematical knowledge through formation, fusion, frame, and cognitive faculty should be emphasized in teacher education and development programs.

Conclusion

There is not a single way of constructing knowledge in mathematics education. Knowledge in mathematics education could be constructed in various ways, such as through debates, arguments, logics, and reasons. It is believed that mathematical and pedagogical knowledge is constructed in the process of engagement in the lives of people through linguistic communication and persistent observation, reflection, and interaction among the members in a community of knowledge and its business. Another way of knowing the world (in mathematics education) is through the vision of critical reflective practices. The critical view allows people to visualize the phenomena from an art-based knowing as another thought with multiple logics and genres.

Another way to construct mathematical knowledge is through critical conscience. For this process, one may generate knowledge of teaching-learning mathematics by selecting appropriate strategies, making lesson plans that bring transformation in mathematics classrooms, promoting equity, democratic access, social justice, and social inclusion. Critical conscience in mathematics education may enable students to raise their voices against social injustices, challenge the status quo, and through their self-reflection and critical judgment on unfair and oppressive practices. In critical discourse, learners are motivated to interact and participate in debates about mathematical issues. Transformative practice is another way to construct mathematical knowledge and its pedagogical practices. From this process, teachers and students can construct knowledge of academic and cultural mathematics after the internalization of the externally situated objects of knowledge (e.g., artifacts, communicative functions, cultural and social practices). The contextual understanding of the phenomenon of learning, knowing, and applying mathematics in the context through critically reflecting, making meaning, reasoning, and interrelating them conceptually, may support the critical conscience of mathematics education through critical pedagogy, social justice, and transformative education. Nepali mathematics education community has a long way to go in this direction, embracing critical conscience with ethical and moral values of their professional responsibility to keep up their identity as mathematics education scholars. Mathematics educators' critical conscience of culture, communication, collaboration, and context (4Cs); discourse, dedication, deliberation, and development (4Ds); equity, engagement, elaboration, and extension (4Es); and formation, fusion, a frame of reference, and faculty of cognition (4Fs) can promote and empower mathematics teachers and their students in Nepal. While emphasizing critical conscience in the construction of knowledge in mathematics education, there should be an emphasis on both social constructivist (Ernest, 1990) and radical constructivist (von Glasersfeld, 1995) practices to have balanced classroom activities with individual and group roles and responsibilities for students to learn and make sense of what they are learning and constructing their mathematics knowledge.

The study had a major limitation in the sample of the data collection from the five research participants who were mathematics educators in higher education institutions in Kathmandu, Nepal. The findings from these participants might have limited generalizability. Another limitation is the subjectivity of the researchers involved in the data collection, analysis, and interpretation, which might have affected the thematic constructs. The researchers' worldviews, experiences, and biases toward the selection of the research participants might have also limited the potential transferability of the findings to other contexts.

Implications

This study was primarily concerned with the construction of knowledge in mathematics education based on the experiences of mathematics educators who have been teaching mathematics and pedagogical courses for a long period, especially in the Non-Western context.. The outcomes of the study will certainly be beneficial for mathematics educators and students in the areas to be focused on generating deep understanding in the process of teaching-learning mathematics. The results of the study could also be helpful at the policy level to emphasize areas and activities in the mathematics curriculum to enhance students' critical and creative powers. To sum up, we can draw the implications of this study as pedagogical implications, policy implications, and theoretical implications of the four thematic groups of mathematics educators' critical conscience in the construction of knowledge in mathematics education-- culture, communication, collaboration, and context (4Cs); discourse, dedication, deliberation, and development (4Ds); equity, engagement, elaboration, and extension (4Es); and formation, fusion, a frame of reference, and faculty of cognition (4Fs), in the developing context, such as Nepal.

In the pedagogical implications, teachers may use the critical conscience of the 4Cs, 4Ds, 4Es, and 4Fs for teaching-learning strategies for creating a classroom environment for critical discourse and value-laden tasks and activities of mathematics within and outside the classroom. The curriculum as a neutral guideline may promote the status quo, and critical conscience can be used as a pedagogical and research framework to challenge the status quo educational practices. The pedagogical implications are concerned with the methods and strategies of teaching and learning mathematics. Likewise, in the policy implications of the study, policymakers in mathematics education may think of including critical conscience of 4 Cs, Ds, Es, and Fs as a part of pedagogical knowledge, skills, and dispositions in teacher education programs.

Suggestions for Future Studies

The study on critical conscience for the construction of knowledge requires careful analysis of the current practices in mathematics education and renew the vision of transformative mathematics education by planning, organizing, and implementing 21st-century mathematics education visions and values with equity, access, quality, quantity, values, ethics, responsibility, accountability, and morals of education. The outcomes of this study can be helpful for mathematics educators' professional development by integrating the praxis of mathematics education with the process of knowledge construction. Further study in the areas of critical conscience of the four thematic groups of Cs, Ds, Es, and Fs with a large sample with mixed-method design can unveil generalizable findings that can inform and enrich the theory and practice of mathematics education. The future studies of critical conscience for the construction of mathematics knowledge can also include elementary, middle, and high school mathematics teachers and students in order to broaden the scope of the findings and improve the notion of meaningful teaching and learning mathematics.

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