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Images of Undergraduate Mathematics Curriculum: A Critical Self-Reflection

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Abstract

Higher education practices in Nepal have been playing an important role to train and develop pre-service school teachers. This paper critically reflects on the curricular and pedagogical practices of mathematics education based on the first author's experiences of learning at the undergraduate level from the perspective of mathematics curriculum images and pedagogical implications. Subscribing to autoethnography as a research methodology, we analysed the first author's experiences as an undergraduate student in one of the public campuses in Nepal which point to two major images of mathematics curriculum: curriculum as a prescription and curriculum as a cultural reproduction. Considering Habermasian Knowledge Constitutive Interest as a theoretical referent, the paper concludes that the transformation of curricular and pedagogical practices in teacher education is essential. The transformative practice in teacher education is insightful to improve pre-service and in-service school teachers' pedagogical and content knowledge in Nepal.

Keywords: *Autoethnography, Mathematics Education, Mathematics Curriculum, Critical Self-Reflection*

Setting the Scene

I (the first author) completed an MPhil research journey examining my past and present experience of learning and teaching mathematics using the lens of transformative learning under the supervision of the second author. This reflective paper is prepared based on my recently completed transformative education research focusing on one of the sections of my dissertation. The critical feedback and comments of the second author played a vital role in shaping this paper. One of the impetuses to bringing this paper out is to visualize the pedagogical practices in higher education (undergraduate level in particular) of Nepal from the perspectives of different mathematics curriculum images. In the context of Nepal, teacher education is taken as one of the most important and precise levels of education to train the pre-service teachers in general and pre-service school mathematics teachers in particular. It is believed that the students of higher education in mathematics education (also called pre-service school mathematics teachers) need to get a lot of exposure and

opportunities such as internships, community service, research activities, and so on during their education journey; so that they can contribute their valuable time to reform the school mathematics curriculum and transform the pedagogical practices of teaching mathematics in both the public as well as institutional schools of Nepal.

Contrarily, I was not happy with my experience as an undergraduate student at a public campus studying mathematics education. It was likely to disempower me to be a transformative mathematics teacher and teacher educator rather than empowering me to be a learner-centric mathematics teacher. Most of the curricular activities promoted the mathematical content through the rote-memorization process, which was decontextualized in nature., Nepali scholars working in the field of transformative education research (Luitel, 2009, 2013; Luitel, 2020; Pant, 2017; Shrestha, 2019, Shrestha et al., 2020) also argue that teaching mathematics in school has been a challenging task for many teachers in Nepal due to the culturally decontextualized mathematics education that rarely includes the cultural capitals of Nepali students. Decontextualized mathematics from school education to higher education is likely to lead mathematics teachers to take the teaching profession as a side job and empower them to be involved in different sectors such as business, agriculture, politics, and so on. Contextualized teaching and learning in general and contextualized teaching and learning mathematics in particular has not been the priority of school education of Nepal (Wagle et al., 2019). One of the reasons behind these is not to get an opportunity to experience as a pre-service school teacher in general and school mathematics teacher in particular during their higher education journey, especially at the undergraduate level.

Purpose and Research Question

The purpose of this paper is to critically reflect on and conceptualize my curricular and pedagogical practices of mathematics based on my experiences as an undergraduate student of mathematics education. For this, two major mathematics curriculum images: curriculum as a prescription and curriculum as a cultural reproduction, are constructed and the associated pedagogical practices are discussed. The research question guiding this paper has been framed as 'how do I conceptualize the pedagogical approaches in mathematics education from the perspective of different mathematics curriculum images through critical self-reflection?'

Theoretical Referents

Knowledge Constitutive Interests (technical, practical, and emancipatory) (Habermas, 1972) is one of the theoretical referents we employed in this paper. The technical interest focuses on structuring and managing the objects and environment, in which learning materials, students, and even the teachers' work are aligned with

the managed environment. One of the purposes of teaching, as per the technical interest, is to train students to follow law-like rules, memorize the facts and theorems, which helps sustain the controlled classroom. The function of the curriculum is to define and control students' learning (Fraser & Bosanquet, 2006). The curriculum is designed in such a way where teachers and students are not allowed to go beyond the controlled and managed curriculum; thereby, pedagogical and assessment practices could be more teacher-centered. Such a curriculum is regarded as 'curriculum as content or subject matter', 'curriculum as the program of planned activities', 'curriculum as the intended learning outcomes', and 'curriculum as the cultural reproduction' as Schubert (1986) mentioned. In this paper, we discuss how technical interest enables me (the first author) to promote unhelpful and discouraging practices in mathematics education in general and curricular and pedagogical practices of mathematics education, particularly during my undergraduate study. The practical interest focuses on human experiences, uncovering meanings, prejudices, and presuppositions (Fraser & Bosanquet, 2006). The students and teachers collaborate and communicate with each other to make sense of the subject matter. The curriculum informed by practical interest is not a means-ends curriculum by which an educational outcome is produced through the action of a teacher upon a group of objectified people, but curriculum design is regarded as a process where teachers and students interact to make meaning of the subject matter (Grundy, 1987). The notion of curriculum as experience, discrete tasks, and concepts, as discussed by Schubert (1986), is aligned with the practical interest. Thus, practical interest enables me to generate communicative knowledge constructed during interaction among myself, others, and the community related to mathematics education.

The emancipatory interest is concerned with empowerment and emancipation to engage in autonomous action arising out of authentic, critical insights into the social construction of human society (Grundy, 1987). It aims to make citizens critical and imaginative so that they can raise their voices on false consensus, taken for granted assumptions, social injustices, etc. There is a dynamic relationship between action and reflection, in which the process of critically reflective practice is incorporated into the process of curriculum development (Fraser & Bosanquet, 2006). The notion of curriculum as *currere,* as mentioned by Schubert (1986), is guided by emancipatory interest. In this paper, we use emancipatory interest to develop an awareness of false consciousness, taken from granted assumptions, which is shaped and rooted in our education system in general and mathematics education in particular because of the hegemonic method of curriculum development.

Autoethnography as Research Methodology

Autoethnography refers to writing the personal and its relationship to culture; thereby, it is an autobiographical genre of writing and research that displays multiple layers of consciousness (Ellis, 2004). For me, autoethnography is the study of self-experience and knowledge gained after interacting or during an interaction between people. Excavating upon self-experiences may be helpful to understand self, others, as well as community, to develop awareness towards rights as well as responsibility. Autoethnography is a qualitative research methodology that offers nuanced and specific knowledge about particular lives, experiences, and relationships rather than general information about large groups of people (Jones et al., 2016). Indeed, the researcher becomes a research participant and expresses their experiences critically and imaginatively as the data text in the autoethnographic research.

In addition to this, autoethnography is considered an insider's methodology in which my personal experiences during undergraduate study become the key basis of inquiry during the research process. In addition to this subscribing to autoethnography as research, the methodology enables me to observe my educational practices in higher education in general and curricular as well as pedagogical practices in particular. Indeed, this becomes a powerful tool to link my past and present experiences and connect with my heart, mind, and soul. In this regard, the autoethnographic exploration of my experiences of mathematics education, mathematics curriculum, and pedagogy in this paper starts from the constructed images of mathematics curriculum as cultural reproduction.

My Own Curriculum of Real Analysis: Canvas of Curriculum as Cultural Reproduction

I still remember the last day's exam of my first year of undergraduate study, where I felt that a thousand kilograms of weight was released from my mind and physical body. It seemed boring to spend around one month on exam. On the other hand, I found those days fruitful because at least a four/five days' gap from one exam to another was quite a good time to prepare for the examination. However, I completed my first year of undergraduate study with an image of mathematics curriculum as an object for consumption (Luitel, 2020), which aligns with the notion of curriculum as a subject matter (Schubert, 1986) – the technical interest of Habermas. Although whatever I conceptualized regarding curricular and pedagogical practices of mathematics during the first year of my undergraduate study, I tried to keep in the back of my mind and got ready for the second year. I was excited about reading Real Analysis, one of the core courses of mathematics taught in the second year of undergraduate study. When I was in my first year of study, senior

students and even teachers often frightened me during our informal sharing about the abstract nature of Real Analysis. It was also said that the one who passed the course' Real Analysis' would easily complete undergraduate study in mathematics education. In contrast, for others, it would be harder than reaching the peak of Mt. Everest. However, the following narrative prepared based on my experience of taking the course' Real Analysis' would become crucial to me becoming more critical. In addition to this, the narrative might be an important reference for the readers to critically reflect on their experiences of teaching and learning in general and teaching and learning mathematics in particular. Critical reflection on teaching and learning experiences enables teachers, teacher educators, and practitioner-researchers to shift their practices from one paradigm to another (Larrivee, 2000).

It was the day of 2012; I was sitting in the class of Real Analysis, looking at the clock hanging on the wall. There was around five minutes time before the class would begin. The number of students in the class was low. Some of my friends were coming and sitting in the classroom and gossiping with each other, some others were already getting ready for the class. As usual, Mr. Theorem entered the class with some pieces of paper in his right hand and a stick of chalk in his left hand. I came to know that we were going to learn Set Theory. Initially, I felt happy because I studied sets during my schooling and I thought it would be easy to learn them again. However, Mr. Theorem started to copy the theorem of the set on the blackboard using the paper and started saying that the theorem and the definition of set theory are very important from the examination point of view. I became alerted and copied it properly. I expressed my difficulties in catching up with the definition and theorem. Mr. Theorem responded that he had also learned those things in the same way. Mr. Theorem's teacher also presented the important definitions and theorems and asked him to memorize them. He said that whatever he prepared as a note for the course Real Analysis during his undergraduate study and graduate study, the same things he transferred to us and asked us to memorize to pass the exam. By showing the notes, Mr. Theorem used to say that, "It is my own curriculum of Real Analysis that I developed; I always teach based on this." Further, he explained, "I have collected some important theorems and definitions, so you must follow me and memorize each accordingly so that you can easily pass this course with a good score."

Accordingly, Mr. Theorem started writing theorems related to Set Theory on the board. I realized that it was easier to remember the solution of ready-made problems, calculations, multiplication tables, procedures, etc. than the meaningless definition and theorem. Those theorems were neither related to the story nor related to the daily activities of my life. But it was a must to follow the previous generation's

work and memorize to pass the exam. On that day, I sat with one of my friends who was a real genius who aimed to become a professor of mathematics. Then, he shared that he also started to make a note in Real Analysis so that he could use the same material during his teaching as our lecturer did. Moreover, Mr. Theorem reinforced again the long-held view that mathematics is always abstract, culture-free, and needs rote-memorization when we requested to use contextual examples whilst defining new concepts, proving theorems, and solving algorithm problems.

Mr. Theorem's word 'my own curriculum' really made me thoughtful and led me to some critical questions such as how did he prepare it? Did the curriculum incorporate students' experiences and prior knowledge? Was this inclusive and contextualized? And so on. I came to know that it was prepared by collecting the so-called important theorems and mathematical problems from the textbook and delivered to us. Indeed, Mr. Theorem was reproducing others' ideas and content from books rather than making it meaningful and contextual. Moreover, Mr. Theorem was busy writing the definition of the open and closed set, union and intersection of the set, and differences and complements of sets. In between that, he said that "…*many students dropped the course with mathematics and chose another course because of the abstract nature of mathematics*". I realized that the pedagogical approach for mathematics in higher education is such because of the hegemonic method of curriculum development, which involves adding more content and theorems in the name of curriculum reform. In this context, I agree with Luitel (2013) as he mentioned that mathematics is taken as a vehicle for enhancing scientific and technological innovation by subscribing to a narrowly conceived notion of curriculum reform as basically adding more content areas. Because of this approach of curriculum development from school to university level, teachers might not be able to bring their own and students' real-life experience to the mathematics classroom. University lecturers have started to acknowledge that, as Luitel (2013) mentioned, they cannot connect mathematical theorems with everyday practices because they never had such orientation during their lives as students. Therefore, mathematics known by university lecturers is all about abstract and mechanical algorithms.

Schubert (1986) highlighted the notion of the curriculum as cultural reproduction and mentioned that the job of schooling is to reproduce salient knowledge and values for the succeeding generation. It means that the teachers' knowledge, ideas, or whatever they knew and learned were transformed into a curriculum that could be transmitted to the students. The same kind of knowledge, teaching pedagogies, and teaching material have been repeated time and again to deliver the content inside the classroom, no matter who the students are, their

experiences, etc. How the teacher learned in their schooling is more important than why and what to teach. This might mislead teachers to choose the same type of student assessment tools that they were evaluated with during their schooling. The teachers seem busy replicating the same ideas which were presented in the previous years.

The highly teacher-centered lecture method, also called 'banking pedagogy' (Freire, 1993), is dominant in such a classroom. The aim of the curriculum seems to control the environment, students, and teachers. This disempowering image of the mathematics curriculum as cultural reproduction inhibits students' creativity as well as prevents them from becoming imaginative thinkers. Shrestha (2019) asserts that the school mathematics curriculum of Nepal is inclined towards upgrading students, rather than improving curriculum knowledge for students, with students taught in a closed monotonous environment for many years, much like animals being trained in a circus. Indeed, these types of curriculum and pedagogical practices are, to some extent, a reflection of the teachers as they have had similar practices as pre-service teachers during their undergraduate and graduate study. The images of the mathematics curriculum as cultural reproduction empower and encourage people to reproduce the culture and tradition with which they are familiar. Mariana (2017) mentioned, "If one intention of mathematics education is to reproduce the culture, then mathematics problems would be enriched by cultural contexts" (p. 47). We agree with this statement because, in our context, it is difficult to change the belief systems that have already shaped society. It seems good to value the common practices which are mathematically rich, but we need to see those practices from different lenses based upon time and context. We need to value, legitimate, and reproduce certain cultural practices that are part of the student's day to day activities which are the positive parts of this curriculum image (Luitel, 2009), and disrupt unhelpful hegemonies, hierarchies, and false consciousness that are the negative aspects of this curriculum image (Apple, 2004, as cited in Luitel, 2009).

One of the important roles of transformative and progressive educators is to change such beliefs and concepts that promote the mathematics curriculum's images as cultural reproduction. D'Ambrosio (1985) also argues that the forms of ethnomathematics and culture might also be changing following cultural movements in society. In this 21st century, changing the culture according to the cultural movements is the main challenge for lecturers. Summative assessment systems, political activities in school education and higher education, teacher-centered pedagogy, less parental participation in educational activities, etc., are the dominant cultures in teaching and learning mathematics education.

Curriculum as Prescription

During my second year of undergraduate level, as I studied Curriculum and Evaluation as a compulsory course, I tried to understand the meaning of curriculum in general and mathematics curriculum in particular. I learned a similar course during my intermediate study but did not get enough understanding of the meaning of the mathematics curriculum. The way of engaging in my second year of undergraduate with the course' Curriculum and Evaluation' was quite similar to the way of engaging on a similar course at my intermediate level. The study was just limited to the coursebook. I was forced to learn the course to pass the exam instead of knowing the curriculum, its development process, its role in the classroom, etc. Thereby, I seemed busy memorizing the definition of curriculum. Philosophers and educationalists have offered many different definitions and descriptions of curriculum over time. Those definitions of curriculum tend to be prescriptive, descriptive, or a combination of both. In this context, my experience reveals that the definitional approach of the mathematics curriculum is one of the traditionalist ways of understanding the mathematics curriculum, and it promotes the prescriptive nature of the mathematics curriculum. Moreover, the definitional approach of knowing mathematics curriculum is dominant in school practices too, which directly affects education in general and mathematics education in particular. The prescriptive nature of definitions provides us with what ought to happen (and not in the form of a plan), and intended program, or some kind of expert opinion about the needs to take place in the course of study (Ellis, 2014).

While doing the Curriculum and Evaluation course, I memorized the definition of the curriculum like a plan, a map, and a prescription to be followed. Such definitions did not enable me to know about the role of teachers, students, and the school during the teaching and learning process. The teacher and learners are bound by the words used in the definition. For that reason, the concept of the curriculum is narrowed down, leading them not to think broadly about the curriculum. I do not want to claim that all the definitions of curriculum restrict learners from thinking about the curriculum from a wider perspective, but in our context, such kinds of definitions are given priority in the teaching and learning process. Also, the definitional approach of knowing curriculum in general and mathematics curriculum, in particular, might encourage learners to narrow down their understanding and view the concepts as fixed as well as rigid. In our context, there is a negative belief that the definition of curriculum is more important than the curriculum itself, which is why the summative assessment system exists from the school level to the university level. There is a culture of asking questions like what is the curriculum? Explain with the definition, or How did Hari define curriculum?

Explain. From the examination point of view, the limiting definitions of curriculum and curriculum elements, namely, objectives, content, teaching/learning process, and evaluation, are very important. These are the things that help students obtain good marks in the exam. In the Curriculum and Evaluation course, our mentor often encouraged me to memorize some definitions of curriculum and elements of the curriculum. Almost all of us memorized the elements of the curriculum with or without understanding the meanings. These activities (especially activities done for the exam, such as rote memorization) became an instrument that controlled the environment and reduced the multiple possibilities of learning. I came to know that such an approach to learning intends to control the classroom's (either schools' or campuses') activity via a set of manageable and instrumental actions.

Instrumentalism promotes teachers to look at school subjects and humans as instruments, as tools or means for reaching another goal or end (Varkøy, 2007). Consequently, society can be an important instrument for giving the impression that mathematics is an unchangeable body of knowledge in which routine mathematical problems are solved using fixed instrumental procedures. Moreover, Mellin-Olsen (1981) mentioned that instrumentalism produces instrumental understanding, which is opposed to relational understanding. Indeed, instrumentalism encourages students and teachers to follow the rules which are already established, manipulated, as well as used. In contrast, relational understanding encourages students and teachers to investigate rules, why, and how those rules work. In the Curriculum and Evaluation course, I did not know about the curriculum elements, and I did not analyze its definition in depth. As I mentioned above, I memorized the curriculum elements (objectives, contents, etc.) from the examination point of view. I moved ahead and prepared for the exam as the mentor instructed me. During my six months of study, I remembered some definitions of curriculum, and I came to know that curriculum is an essential material to the teacher. It is useful to the teacher during the planning, such as an annual plan, unit plan, and lesson plan. In addition, during the six months, I collected question papers with answers from previous years of the course Curriculum and Evaluation to prepare for the exam. On reflection, did my school mathematics teacher and university teacher use the mathematics curriculum during planning and teaching? Did they work out on planning? Were they involved in the curriculum design process? What is my role if I become a teacher?

During the Curriculum and Evaluation course in my undergraduate study, I learned that, in the context of Nepal, the school mathematics curriculum is prepared by the Curriculum Development Centre (CDC), Nepal. After preparation, it is distributed to teachers as a prescribed document. Also, I came to know that the same curriculum is prescribed to all the schools inside the country. After knowing

this, many queries came to my mind. Actually, who is employed in the CDC? How do they prepare the school mathematics curriculum? Why are teachers not involved in the curriculum development process? Does it fit in every school located in different places across Nepal? What may be the in/visible forces that make curriculum prescriptive? The curriculum is the heart of education, and those who make the curriculum need to pay attention to what is happening in other fields that integrate theory and practice (Null, 2011). If the curriculum is prepared based on cultural practices and students' experiences incorporating the current issues and practices, learning becomes more contextual and the curriculum becomes inclusive, and students might be more creative. Curriculum also directs or opens the floor to explore new ideas and knowledge. Thus, the role of the curriculum is not limited to knowledge but to give a platform to explore knowledge and enhance life skills. The education or knowledge and the curriculum may be different things. Null (2011) mentioned that curriculum requires those who discuss it to address what subject matter should be taught, whereas education is frequently discussed without regard to the subject matter, but every discussion of the curriculum must address the subject matter in one way or another. Identifying these differences between curriculum and education helps teachers to become effective teachers and thoughtful curriculum makers. Dealing with the questions as shown in Figure 1 during the curriculum development process is essential to making a learner-centered curriculum. If the tradition of prescription of the curriculum does not end, then it is difficult to make the students locally and globally competitive because the prescriptive nature of the curriculum does not cover the students' experiences, or it may not be able to identify students' previous knowledge as well as teachers' capability. So, teachers are compelled to force students to memorize the facts and theorems. Roman educator Quintilian also argued that forcing students to learn things is just a waste of everyone's time and such learning goes in one ear and out the other (as cited in Ellis, 2014). This made me thoughtful. I remembered my school and campus days

> What is curriculum? What is it for? Who is it for?
>
> Who should make curriculum?
>
> How should these decisions be made?
>
> How curriculum should makes structure the decision-making process?
>
> What should they do to make good curriculum and what should people who specialize in curriculum development do in order to make curriculum better?
>
> What characteristics, or virtues, should these people possess?
>
> Null (2011, p. 5)

Figure 1

when my teachers sometimes scolded me by saying '*eak kann le sunara aarko kan le uduana'*, which might result from the expert-oriented mathematics curriculum. My experiences of teaching and learning mathematics ponder that the school mathematics curriculum in Nepal is still regarded as the collection of expert opinion in which one of the characteristics of that kind of mathematics curriculum is to make teachers force students to learn as experts prescribed or viewed.

Reflecting on Pedagogical Practices

It was a sunny morning in March 2015. I was sitting in my room. I had my laptop in front of me and chapter two of the book 'Pedagogy of the Oppressed' was displayed on the screen. Warm sunlight entering from the window gave me energy in cold weather to read the displayed chapter on the laptop. Suddenly, my eyes were in the third paragraph of the chapter. The author highlighted the characteristics of narrative education, which positions the teacher as the narrator and the student as the receiver, recorder, and memorizer. More specifically, Freire (1993) mentioned that the outstanding characteristic of narrative education, then, is the sonority of words, not their transforming power. "Four times four is sixteen; the capital of Para is Balem." The students record, memorize and repeat these phrases without perceiving what four times four means, or realizing the significance of "capital" in the affirmation "the capital of Para is Balem," that is, what Balem means for Para and what Para means for Brazil (p. 71). The above statement made me thoughtful. It helped me summarize the implications of the above mathematics curriculum images that I constructed after completing my schooling and undergraduate study. Just as four times four is sixteen, and the capital of Para is Balem, there were uncountable theorems and algorithms narrated by the teachers from the textbook and not constructed (as shown in figure 2) and discussed in their application. For instance, $\frac{d}{dx}(sinx) = cosx, \int 1\,dx = x + C, \int cosxdx = sinx + C$, etc. are some dominant formulas. During my undergraduate study, I never understood how such formulas or facts were constructed. The meaning of $\frac{dy}{dx}$ and difficult deadly symbols like $\int$ always troubled my mind. These are some examples only, as there are lots of symbols and facts that I recorded from the narration of the teacher and memorized later to pass the exam. Most interestingly, we, the students, wondered where the capital letter 'C' with the sign of addition (+) came from in $\int cosxdx = sinx + C$, $\int sinxdx = -cosx + C$, *etc.* There was no more discussion about the theorems, algorithms, or formulas. My job was just

> The union of open sets is open.
>
> The intersection of closed set is open.
>
> A set is closed if and only if it contains all its limit points.
>
> (Trench, 2013)

Figure 2

to listen and record in my notebook whatever was narrated by the mentor. Whenever it was necessary, for example, when I had to attend the examination, I had to revise and repeat, with the ultimate goal of memorization. Later, reading critical papers and books related to mathematics curriculum and education forced me to think that if teachers themselves got an opportunity to be involved in the curriculum-making process, students like us may not suffer from the narration 'sick' education system.

However, unless the structure and the education system from school level to university level are changed, students will always suffer from the narration sickness of education which is not treatable by the doctors. Commonly speaking, in our society, thousands of students can 'die' because of one error or being misguided by the teacher, but one patient can die because of one error by a doctor. It does not mean that small errors done by a doctor are fine. It shows how big an impact (positive or negative) a teacher's action can have on students' experience. Now the learning and teaching approaches in mathematics have been changing slowly around the world, in which drill and memorization are being replaced by creativity and problem-solving. For instance, Oers (2002) mentioned that over the past fifty years, the classroom approach to mathematics had changed radically from a drill-and-practice affair to a more insight-based, problem-oriented approach. However, there are still some questions to be raised upon the changed practices of teaching and learning in general and teaching and learning mathematics in particular. Does the changed practice match my context? Is it applicable in the school where I completed my primary, lower-secondary, and secondary schooling? Is current school students' experience of learning mathematics different from mine?

Indeed, in the context of Nepal, a top–top and centralist approach are the present characteristics of the Nepali model of education policymaking (Dhakal, 2019). Thus, the school teachers and the local authorities might not get an opportunity to be involved in the education policy-making activities, curriculum development process, etc. They have been imposed ready-made materials for implementation by the higher authority. However, suppose there is the participation of teachers as well as student representatives in the process of selecting content, or curriculum development process. In that case, the role of the teacher might not be limited to the narration process only. Involving teachers and students during the curriculum-making process creates a dialogic environment that involves negotiating, communicating, and questioning and helps them come up with a better solution. More specifically, it allows teachers and students to be more responsible and accountable.

Learning as recording and memorization focuses on the mastery of an arithmetical operation. The student is positioned as a factory machine or robot, which

needs to function based on the narration of the instructor. Moreover, mathematical knowledge is presented as constituted of fixed objects. It is also believed that the elements of mathematical knowledge can be transmitted to children (Oers, 2002), which portrays that mathematical knowledge is fixed, not changeable, and can be transmitted to the coming generation. Somehow, it can be transmitted as well, but better to transmit after revising and editing. There should be a place for students to invent new mathematical knowledge based on their own experiences. In the context of Nepal, those who are positioned to make a mathematics curriculum might have been guided by pure mathematical knowledge. The policymakers, curriculum developers, or other stakeholders working in mathematics education have played an important role in shaping teachers' beliefs (positive or negative) towards mathematics (Pant, 2015; Luitel, 2019). Such beliefs can in/directly impact the teaching and learning process. For instance, if a teacher's belief is towards pure mathematics, then teaching is more textbook-oriented, focuses on the algorithm, and promotes a memorization approach to learning.

Discussion and Implications

As an auto-ethnographer, I have critically reflected on my experiences as an undergraduate student (2010-2012) of f mathematics education. Being critical does not mean being negative; rather critical educators are committed to the democratic principle, equity, equality, justice, and access (Tutak et al., 2011). In addition to this, critical educators carefully reflect and analyse a specific educative moment of their life to bring some changes in practice. We can call that a transformative practice (Pant, 2019). In the context of Nepal, as I mentioned earlier, the students of undergraduate level mathematics education are considered pre-service school mathematics teachers. In this regard, the curriculum of higher education in general and the curriculum of mathematics education in higher education must be based on learners' experiences and needs to be guided more by practical and emancipatory rather than technical interests.

On the one hand, the teachers in higher education oriented by the practical interest observe their roles as using their judgment in interpreting the curriculum for their students, and making meaning of the program of study and discipline for them, in an environment based on open communication, trust and mutual respect (Fraser & Bosanquet, 2006). On the other hand, in our context of higher education, especially in the class of mathematics education, the program structures exist prior to the arrival of students, and these keep them separate from the learning experiences rather than taking the students an essential part of organizing the program and structure. The curriculum of mathematics education in higher education develops through the dynamic relationship between action and reflection, in which the process of critically

reflective practice is incorporated into the process of curriculum development (Fraser & Bosanquet, 2006), and this is the essence of emancipatory interest.

The higher education of Nepal needs to prepare students as critical and imaginative thinkers, real-life problem solvers, effective communicators, effective collaborators, curriculum designers so that they can transform the school education practice from a traditional approach to a progressive approach. It needs to treat them as pre-service school mathematics teachers rather than as students of pure mathematics. As mentioned by Grundy (1987), content must be selected to assist 'meaning-making and interpretation, and it is likely to be holistically oriented and integrated' (p. 76). So, in this 21st century, if the students of higher education or pre-service mathematics teachers in Nepal got an opportunity to see the connection between mathematics and daily activities, then they can definitely contribute to improving school education in general and mathematics education in particular. Furthermore, it is necessary for pre-service mathematics teachers during their higher study to learn about the curriculum development process of school mathematics in a practical way, rather than by simply memorizing the definition and elements of the curriculum.

Closing Remarks

As an auto-ethnographer, I have critically reflected on the curricular and pedagogical practices of mathematics education in higher education based on my experiences as an undergraduate student at one of the public campuses in Nepal. The paper calls for a transformative practice in higher education; especially during the curricular and pedagogical activities which is to be insightful to improve pre-service as well in-service school mathematics teachers' pedagogical and content knowledge in the context of Nepal. Thus, this paper is likely to be an eye-opener for the higher education policymakers, curriculum designers, lecturers, and teachers. Moreover, it is equally useful for the undergraduate students of mathematics education to unfold their practices, critique the false consensus governed by the hidden forces of society, and set their future goals.

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