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Does National Curriculum Fit for Working Class Children? A Gap in Math and Science Teaching

Shurendra Ghimire
Tribhuvan University, Birendra Multiple Campus, Bharatpur, Chitwan
ghimireshurendra@gmail.com

Abstract

This paper highlights the issue of imposing middle-class norms of schooling on working-class children and its consequence on low learning achievement and perpetuating socioeconomic differences in learning. A study was carried out to explore the teachers' role in contextualizing teaching in schools where students are from the working class. Math and science subjects teaching of a dozen of teachers were observed, and complemented with interview. Thus generated information was analysed in the background of the school setting, and the teachers' role as mediators between students' concrete experiences and disciplinary formal concepts of textbooks. The study suggested that teachers stressed the transmission of knowledge than mediating students' experience to formal learning; teachers' language use in the classroom is insufficient triggering students thinking and conceptualisation, meanwhile teacher preparation and development are not oriented to the contextualised and integrated teachings. Their teaching was not only problematic to achieving the national objective of education encouraging critical thinking, and developing problem-solving skills but also demanding middle-class habitus, aspirations, resourcefulness, performance, etc. in the working-class children.

Keywords: *Integrated and Contextualised Teaching, Interdisciplinary Math and Science Teaching, Classroom Observation, Working Class Children*

Introduction

Over the 70 years short history of mass education in Nepal a dozen of reform and restructures in the curriculum has been made in addition to regular changes. At the outset, education was taken as a tool of 'national development' (*bikas*) (Pigg, 1992) and recently a tool of developing 'value-oriented citizens' for the "socio-economic transformation of the nation' (Ministry of Education, 2016, p. vi). In the past three decades many reforms were endeavoured- e.g., BPEP I &II: 1992-2004, EFA: 2000-2009, SESP: 2003-09 (Khaniya, 2007), and SSRP: 2009-15 (Ministry of Education, 2009), and SSDP: 2016-23 (Ministry of Education, 2016), meanwhile enough technical support from donor agencies and western consultants was taken to reform subjects of teaching, subject structures, and content under subjects, expected performance/learning objectives, and teaching methods (Madsen & Carney, 2011). Millions of dollars were spent on teachers' training and professional development- e.g., the TPD of SSRP alone has spent 14.82USD (MoE, 2009), but there is no progress in the quality of education (Acharya, 2022).

Education Review Office which assesses the quality of education has reported that "around 50% of students of grade 5 do not have any sense of reading and writing numbers and number operation (Kafle, et al., 2019, p. x)", about 55% of students in all levels (grade-3, 5, 8, &10) are underperforming (ERO, 2020), and the majority of the class is unable to solve Higher Order Thinking items (Kafle et al., 2019). A sequence of similar study reports mentions that there are problems in the teaching-learning strategies, remedial actions, and the role of head teachers and recommends reviewing on curriculum, teaching methods, etc.

(ERO, 2020). Meanwhile, these studies report that the learning gap associated with the student's socioeconomic background is significant (Kafle et al., 2019).

Socioeconomic-based inequality in students learning especially in math and science subjects is not only significant in poor countries like the least developed country Nepal. It is persisting even in developed and rich countries that are included in OECD, the PISA reports have mentioned this problem (European Commission / EACEA / Eurydice, 2022). Recent studies in developed countries have identified parents' education and occupation, and related books available at home as the major predictors (Chmielewski, 2019), and property value is found associated with Math achievement (Ware, 2019). Socioeconomic background and educational inequality are a persisting global problems in a stratified society (Sirin, 2005). Meanwhile, there are allied problems- students perceive math and science as difficult subjects, and achievement is significantly included by socioeconomic background (Khanal et al., 202; Ogunkola et al., 2011; Dweck, 2014). However, mathematical and scientific skills are highly valuable for living in this knowledge society (Atweh et al, 2007; Yee et al., 2006), since, there has been research for over 50 years to find way out to make learning easier.

Kunwar (2020) from an empirical study in Nepal has pointed out that the curriculum structure, school facilities, instructional techniques, teachers' teaching performance, use of tools and technology, and evaluation system are the main causes of mathematics phobia. Panthi et al. (2017) pointed out the gender, language, and equity issues in the mathematics classroom and suggested improving the curriculum, teachers' training, and resourcing the classroom with locally made and new technological tools. A few interventional studies have made recommendations to increase learning achievement and reduce the gap between students of diverse socioeconomic backgrounds. These are-providing extra classes and learning opportunities to low-SES students (Huang, 2015); comprehensive and multi-contextual approaches targeted to families and schools for improving children's exposure to math-relevant experiences (Galindo et al., 2015); offering safe, supportive, and well-structured school environments that allow children to enjoy better and so benefit from their educational experiences (Morgan et al, 2016). This fact indicates that socioeconomic-led learning disparity, though cannot be eliminated in a stratified society, can be reduced to some extent even if applied appropriate intervention, but, appropriateness is very contextual.

There are some economic, social, structural, and cultural constraints to reducing the socioeconomic led gap in students' learning. There is one argument that schools are designed and resourced according to a set of assumptions about the school's social relations and processes informed by middle-class norms (Lupton et al., 2012, p. 15). Nepalese context to similar to it, since, Nepal has practiced elite-oriented school education longer than mass-oriented education (Sharma, 2062BS) and is rooted in feudal culture (Bista, 1991). Moreover, it is also supposed that most of the school teachers hold the 'habitus' (Bourdieu, 2005, p. 43) of middle-class values which may not compatible with working-class children's experience and thinking. A study by Lupton et al., (2012) supports the claim by Bernstein (1970) - "culture of the child must first be in the consciousness of the teacher" for effective pedagogy. It suggests a gap between school curriculum, pedagogy, evaluation, learning hours, teachers, etc., and taking education as an investment, meaning of education, the home environment of eating-earning timetable, material comforts, family languages, expectations, and aspirations, etc., of the working-class people (children). From the gap, a question emerges- 'how these gaps are reflected in classroom teaching?'.

There are some logical and empirical views on restructuring the math and science course, and pedagogy to improve students' learning. Luitel (2013) views that the truth or validity of a mathematical corpus of knowledge depends on its usability in solving daily lives. For him, it is a process of enabling all to use mathematics in their present and future life worlds rather than a body of pure knowledge or a finished product developed by some other and ready to transfer to others by the agent of teachers. Abramovich et al. (2019) proposed two strategies for math teaching- (a) concept motivation: where the teacher challenges students with their daily life problems, which creates curiosity in them, and the teacher by using this curiosity introduced the concept that is applied to solving real problems; (b) action learning: it requires- a real problem, students have to solve it individually, more knowledgeable other to assist where by acting to solve one gets reflection or mathematical learning. Many researches revealed that teachers' pedagogical decisions and activities make a difference in students' mathematics understanding (Berry, et al., 2009, p. 5). Similarly, a meta-synthesis supported "inquiry-based science instruction" in science (Minner et al., 2010). Bernstein (1970) from the British experience discussed curriculum as collection and integration and framed the delivery that indicates a contextual and class-based implication of education.

Considering and employing mathematics as both pure and applied knowledge is the best way of teaching that makes students curiously engage in real-life problems. Asking students to develop mathematical concepts and skills in solving different problems is cross-cutting. Though, we have no integrated or thematic curriculum that helps to acquire and apply concepts by multi-, inter-, and trans-disciplines (Smith, et al., 2000). But it can be applied even in the subject curriculum like our school if teachers are prepared, and developed, and linking between math and science subjects is relevant and easy in the present curriculum structure. Therefore, the study was initiated with the questions of- (a) to what extent teachers have contextulised their pedagogy; (b) what are the major curricular and teacher-related gaps in school; (c) how mathematical concepts are elaborated with their daily life world, and other subjects; and (d) to what extent science and math subjects are taught to complement and supplement the concepts each other. Based on these questions a study was aimed to explore the teachers' role in contextualizing teaching in the school where students are from the working class.

A framework was developed to generate information and analyse based on Vygotsky's theory of teachers' role in mediating students' experiences and formal concepts. Along with conversation, information was generated by observing classrooms teaching math and science subjects in seven community schools and analysed axially by selecting and clustering the information to answer the formulated questions. The study was dominated by Vygotsky's (1978) theory of learning- teacher's mediation for the formal (disciplinary) conceptualisation of students' experiences; language fosters thinking; and interdisciplinary perspective on math teaching (Williams, 2019; Williams et al., 2019) discussion on. The study suggested that teachers stressed transmitting knowledge mentioned in textbooks through routine learning rather than conceptualisation up to problem-solving by contextualisation and interdisciplinary integration. Meanwhile, teachers were found weak-prepared and developed in comparison to envision and assurance of SSDP, 2016-22, and NCF, 2019. This contradiction between expectation and achievement informs and cautions the government, and challenges the rhetoric of quality education in Nepal.

Literature Review

The review has been organised into three different themes a voyage from the nature of mathematics to its ways of teaching.

Interdisciplinary Nature of Mathematics

Schwab (Mann, 1968) opined that any academic discipline entails three layers of structure- 'organisational', 'substantive', and 'syntactical'. The organisational structures of a discipline are related to defining the scope and delineating the border among the different disciplines. It is a position of a particular discipline in the taxonomy of the disciplines that is constituted from organised knowledge. Since, defining the boundary and ordering of disciplines- e.g., defining borders and interactions among mathematics and other disciplines is a difficult, complex, and limitations-pertaining task.

Mathematics is a branch of science that deals with numbers and their operations. It involves calculation, computation, solving problems, etc. (Fatima, 2012). Similarly, statistics is regarded as a branch of math but sometimes "as a science which has its object the classification and analysis of quantitative data the intelligent judgment may be passed upon them (Kenney, 1939, p.1). Therefore, there are many regions of mathematics that are overlapped with the boundary of other disciplines. This overlap makes mathematics conducive to linking with other disciplines and synchronising teaching and learning. Meanwhile, defining its 'boundary' is challenging, always inquiring, and expanding, and since, it is regarded as an 'unfinished process' as suggested by Luintel (2013).

The second layer of a discipline is Substantive structure, it entails sets of assumptions about the variables of interest to a discipline that control the questions asked and inquiries undertaken. Assumptions under this organisation guide inquiry in a discipline, it is the discipline's postulational structure that their removal or alteration would require a total revision of that structure. An instance would be the drastic alterations in geometry that result from altering assumptions about the properties of a plane. The paradigm shift from Euclidian to non-Euclidian geometry brought changes in measuring solid shapes. Quantum physics postulated the route of electrons around orbitals where mathematics could not develop the formula of probability finding the elections in certain locations. Not only in the organisational structure of boundary level but also at the substantive level are interdisciplinary relationships prevalent.

Mathematics in School Curriculum

It is regarded that arithmetic, geometry, astronomy, and harmonics as quadrivium used to be taught in the Pythagorean School around 500 b.c. Plato, after 100 years, also valued mathematics as an essential tool of reasoning and recommended it as the subject of study (Dossey, 1992; Zhmud, 1998; Mueller, 2005). After him, Aristotle valued math as it can capture a small part of the physical world. Math is a branch of abstraction that is dome from the perception of the physical world. Math emerges from the elimination of physical objects- e.g., triangularity conceptualised from a triangle-shaped object (Corkum, 2012). Physical objects such as a group of planets around the sun or seven stars together (as mythical seven seers) are the sources of set theory. The data generated from the repetitive observation of naturally occurring phenomena as well as experiments on the matter, and measuring them are the sources of mathematical calculation and abstraction (Dossey, 1992). Mathematics is ideal, universal, and unchangeable against changeable physical matters. But the former is derived from the latter. But since the 1980s educationists are engaged in arguing mathematical knowledge and learning are contextual.

The USA is a dominant country in curriculum research where the integrated curriculum was practiced. Arithmetic and natural sciences had been included in the school subjects (entrance) at Yale and Harvard University around the 1700s. German philosopher Herbart's concepts of curriculum correlation- i.e., "each subject should be taught in such a way that it refers to and relates to other subjects. Knowledge would then appear to the learner as an integrated system of ideas that form an apperceptive mass the whole of a person's previous experience into which new ideas could be related" (Hunkins et al., 2012) had impacted education in the United States. In the same legacy, the founder of progressive school Dewey (1966) satires the absurdity of- a child and his life is whole, but to prepare her/him to learn and live in this world we teach by dividing the whole into the parts (different subjects).

There is a role in Spencer's (1884) famous essay "What knowledge is of most worth" to accept science as the most practical subject for the survival of the individual and society and to get space in the school curriculum. Teaching math and science formally to the young began in the 'axial age' (Baumard et al., 2015) of human society. The rise of realism which assumes the physical world is governed by natural laws with a basic principle of cause and effect inexorably, placed physics and chemistry, aided by mathematics at the top of the hierarchy of subjects regarding them as objective and reliable than others (Chand et al., 2004).

Basic concepts of mathematics are considered essential for a citizen of modern society. Math and science are supposed as complementary subjects, therefore, these subjects are included or emphasised in assessing and comparing the education quality across the countries- PISA, TIMMS. The PISA aims to measure how the young at age 15, at the end of compulsory schooling, use their knowledge and skills to solve real-life challenges (Yee et al., 2006) whereas TIMSS reflects the curricular goals of participating countries, especially in students' applying and reasoning skills (TIMSS & PIRLS International Study Center, 2019).

Mathematics Teaching Conceptualisation / Contextualisation

Teaching mathematics in Greek tradition was dominated by rationalism-idealisation, and decontextualisation of learning to make pure, sacred, and transcendental knowledge. Church-dominated education up to early modernity in Europe was dominated by teacher-centered controlled and expository methods. The rise of empiricism in the late seventeenth and eighteenth centuries against the ideology of rationalism shifted the value of sensation, experiencing, and contextualising knowledge and teaching (Meyers, 2014). Rousseau's (1712-1778) argued that children possess an inherent instinct or impulse of learning by observing, doing, and experimenting with the things around them (Rousseau, 1889). He stressed natural objects to initiate teaching, and thus said- "You will not be the child's master unless you are master of everything around him, and this authority will not suffice unless founded on esteem for virtue (p. 59)". Thus, Emile not only stressed the idea of a child-centered curriculum and teaching but also encouraged the creation individual curricula. As a result, Froebel (1782-1852) began a method of teaching mathematics implicitly to the kinder garden students where students develop geometrical shapes-e.g., spheres, cubes, and circles from physical substances- e.g., clay, sand, cardboard. Along with mathematics shapes children can learn the nature of construction materials, and engage in playful activities such as building castles and mountains, running, and otherwise exercise (Wiebé, 1869). Herbert (1776-1841), a German pedagogue developed a five steps model of a lesson plan that emphasised-… (3) *association*, which refers to linking the new concepts with what students have studied earlier; (4) *systemisation,* which refers to the use of examples to illustrate the principles or generalisations to be mastered by the students; and (5) *application,* refers to the testing of new ideas or the materials of the new lesson to determine ifstudents have understood and mastered them (Hunkins et al., 2012). Dewey, learning and inspired by this movement, initiated a progressive education that entails problem-based courses. During the progressive era, instead of the ordinary course, how the eight different mathematical concepts were embedded in the process of problem-solving have been discussed by Hartung (1939).

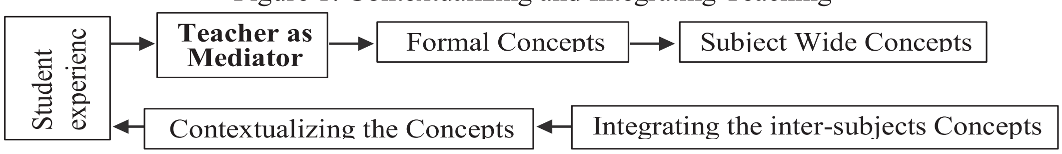
While Dewey (1858-1952) was practicing a progressive school in the USA by defining the role of teachers as a facilitator of developing problem-solving skills for students, Vygotsky (1896-1934) was exploring the role of teachers as a 'mediator' to conceptualise students from their problem-solving activities in USSR. Vygotsky explained human cognition and learning as social and cultural rather than individual phenomena. He stood with knowledge as concept formation against knowledge as information, and a teacher as a mediator between knowledge and students instead of a role model or a source of knowledge (Kozulin et al., 2003). His theory is continuously elevating toward popularity since the 1920s. Teacher as 'mediators' help students to transform their experiences into the formal concept which is the heart of mathematics, but the rigorous deduction and formal logic which is dominantly used in math teaching are not the right paths to conceptual genesis (Schmittau, 2003).

Students of working-class families have a lot of daily life experiences because they engage in earning activities to support their families. In this process, they encountered different scientific and mathematical phenomena. Their teachers as mediators can help them to develop formal concepts from their concrete and perceptual experiences.

Conceptual Framework

The paragraphs above suggest that a teacher as a mediator helps students to develop formal concepts from their daily lives. Students develop many formal concepts, and teachers help students to categorise these concepts into different subjects in their courses. Meanwhile, teachers give students some social issues or their daily problems and students learn to mix the disciplinary concepts into the whole while solving the problems. Such inductive and deductive is an effective ways of math teaching to the children of the working class who are experienced and rich. This effective way has been presented in figurative form. Figure 1 suggests that the study revolved around how teachers engage to explain subject-wide (disciplinary) formal concepts to the students' experiences- language, tools, signs, etc., and how students are encouraged and helped to generate abstract concepts from their concrete experiences of daily lives. Thus, the role of a teacher is a mediator of both inductive and deductive radical and socially constructive learning.

Figure 1: Contextualizing and Integrating Teaching



Research Methodology

As the study aimed to explore the teachers' role in contexualising teaching in working-class students. Therefore schools, where the children of the working class read, were selected, purposively. The community schools of Nepali medium are the place where the children of the lowest social class use to read (Ghimire et al., 2019). These schools were located around six km in a municipality. To assess classroom practice in two subjects- math and science, the purpose of the study was communicated to head teachers and the subject teachers. Among the studied six, five schools were elementary (grades 1-8) and one was secondary (1-10), in the secondary school math teacher of 7/8th grade refused to be observed. Classroom teachings of a total of 13 teachers were observed in June and July 2022. Table 1 details the description of the participating teachers. The unit of study was classroom interaction; the school settings including students were purposively selected were the children of the working class but the teacher's qualifications were unknown while selecting the schools.

In addition, I initiated a discussion in staffrooms especially engaging the observed teachers about students' learning, community, parents' participation, course structure, etc., to reveal their opinions, understandings, knowledge, values, attitudes, etc., Attitude is a broad 'trait' or construct of a person composed of cognition, feeling, and action (Morgan, 1977). Math and science teachers' attitudes toward teaching are composed of their understanding of effective or quality teaching, feelings or motivation for teaching, and action or teaching activities. The students who come are these six schools are from similar communities if not the same; though they are of diverse caste- Tamang, Chepang, Tharu, Dalit, and 1 to 2 percent of Brahim-Khshatriya, their economic status is the same. The setting of the six public schools is similar, many cases of teachers were taken to capture the diverse academic, schooling, teaching experience, and socio-cultural backgrounds and to include all the schools of the community(es). Meanwhile, the study engaged to understand how the teachers' (or curriculum deliverers') actions and experiences are generated by their social worlds, in turn, how these teachers are generating a social setting for their students like a 'critical ethnographer' (Madison, 2020).

As an inhabitant of the community, and as a teacher-researcher frequently involved with the schools and interacted with the parents, I carried this study in ethnographic design. It is the best approach to capture this social and complex reality and presented the truth subjectively. Meanwhile, the studied (or to some extent assessed) teachers shared the purpose and rationale of the study of finding ways of improving teaching, and strengthening the issue of working-class children, and requested voluntary participation in the study at first, and only willing teachers were included, their motivation and knowledge of integrated teaching, and opinions of the current curriculum was informally excavated in a non-threatening situation by maintaining ethical balance. Facts and observations were theory-laden and value-laden, and the findings are fallible (Cohen et al., 2018). The findings or conclusions as an assertion made in this study are accepted as an open matter of "examining or testing the assertion itself as well as its consequences as suggested by Popper (2014, p. 27)." Methodology entailed a combination of individual talking (qualitative interview); observation of their classroom teaching; group talking in staff rooms; living (observing) with the community, talking with students, etc.

Table 1
Description of Observed Classrooms

Schools	Teachers	Sub	Course gained	Experience
1.	Dev Chaudhari	Math	BEd (MA-Soc.)	14 years
	Hari Adhikari	Math	BEd	5 years (6 months)
	Bina Dhakal	Science	ISc (BEd Pop.)	6 years (3 years)
2.	Neel Bhandari	Science	SLC	31years (10yrs)
	Jeevan Lamichane	Math	BEd (Math)	5 years (6 months)
3.	Binod Aryal	Science	ISc (BBS)	14 years (3 yrs.)
	Saroj Khanal	Math	IEd Math (BEd Pop.)	14 years (3yrs)
4.	Sweeti Pokhrel	Math	MEd (Math)	5yrs. (6 months)
	Sweeti Pokhrel	Science	MEd (Math)	5yrs. (6 months)
5.	Alina Tiwari	Science	MSc (Zoology)	1yrs
	Sailaja Pokhrel	Science	MEd(Chem.)	1yrs.
6.	Nita Shah	Math	BEd (M)	3yrs (6 months)
	Hema Kandel	Sc	BSc/ BEd	3 yrs.

Source: field visit, 2022, June, and July *(pseudonyms are used)*

Most information is concentrated on teachers' classroom activities. Guided by 'researcher as a tool of information generation and collection', I sat on the last bench of the class and observed "classroom interaction" during the whole period. I noted the all activities committed by teachers and students. It is said that pre-established theory-guided analysis in ethnography is chided for weakening the analytic power, curtailing new insights with the research, and undue favour to the imported theory (Julius et al., 2010). However, I ventured into 'focused coding' than 'open coding' (Emerson et al., 2011, p. 143). Thus generated codes were categorised. Thus, developed categories were further searched, and examined by revolving around information like 'axial analysis' (Williams et al., 2019) of exploring the teachers' role as a 'mediator' between the formal concepts of the course and the experiences of the students (Vygotsky, 1978) in the contextualisation of the formal concepts of the text, and abstraction of formal conceptualisation from the daily experiences of the students.

Analysis and Findings

The 'half-baked' selective information has been presented to depict the classroom interaction at first, and themes as findings have been generated in the second form of the explicit information of the first stage and implicit information of the researcher.

Curtailing Senses Learning and Understanding the Concept

Due to the gradual course changes the same content about the nervous system is allocated in grades tenth and ninth. The MSc in zoology held the book by folding the course pages and reciting the lines one by one. She neither showed the chart of the nervous system nor made the figure of brain structure on board. She sometimes asked students to read the paragraphs, and sometimes ask to recite by reading herself every sentence and asking a question from the same sentence e.g., - "if the big brain (cerebrum) is injured, the person goes into the coma; what happens if the big brain is injured? The students answer in the chorus- the injured goes into a coma." The teacher who is MEd Chemistry agreed to invite me to the class after 2 hours and went secretly to the class to ask them to be obedient in front of me. After teaching them the nervous system, she divided the class into three groups and asked them to read the cerebrum, cerebellum, and medulla for each group, and summarise them by the group leader. Students were obeying her for "one-day pretending" instead of participating as usual. Both teachers did not talk about the shape of a skull, or the size of the brain in cc, explaining this unit, calculating the percentage of the mass of each of the parts that would help to understand the brain with mathematical concepts (shape, size, percentage) and understand the math in the applied form beyond learning for the sake of learning.

Two of the science teachers were unqualified and ad hoc, they hold the textbook and read line by line, and they were unknown of some of the concepts mentioned in books. One teacher who is a BSc, BEd and has 3 years of teaching experience taught viruses, bacteria, and fungi in a single period. She just wrote the topic in the Nepali language (Devanagari script) but did not write even these terms in English. She did not mention the lactobacillus as an example of beneficial bacteria, it was the most familiar in this context. She did not explain the shape and size (measuring units) of viruses and bacteria. These natural shapes (Dutta, 2022) would help to remind and conceptualise the hypothetically drawing shapes in geometry. She could show animated photos and videos with help of a projector and laptop that were available in the school.

Another science teacher who is ISc, BEd (Pop.) taught the separation of a mixture. She mentioned vegetables, mutton, tea, etc. as some examples of the mixture. Then wrote the topic distillation process in the Nepali language. She called one student to draw a figure on board, and the boy copied the figure from the textbook and took 15 minutes to draw. The figure was very poor in comparison to the textbook in the students' hands. The figure was labeled but the teacher did not explain and describe how the- apparatus fitting works. All the naming of the figure in the text were in Nepali language (Devanagari script of English pronunciation), and she neither wrote the technical terms such as cork, round bottom flask, condenser, distillation, burner, wire gauge, etc. in English language in board nor introduce their functions in a science lab. She neither thought the lesson of fractional distillation nor gave the example of a local brewery (most of them are familiar with/engage in liquor making in their homes). That example would make their conceptualisation of fractional distillation impressionistic.

There was a male head teacher qualified as ISc, BBS, and 23 years of experience in science teaching from grades 4 to 10 in different schools. In my observation, he was teaching energy in fifth grade. There were only six students in a class with a capacity of 40. There was CC camera surveillance, a hanging projector, and a desktop computer in the classroom. The teacher wrote eight different types (actually it was formed) of energy on board in the English language from a textbook of private publication and told examples of each. Students were asked to read, recite and remember. He was a very active teacher- describing the text, asking from his description, and asking students to read the text loudly; but the students were passive listeners and followers of his commands.

There were materials laptops, projectors, internet in schools. Teachers could make teaching effective by presenting the contents- e.g., parts of the brain; distillation process via multimedia (Abdulrahaman, et al, 2020). Meanwhile, they could ask students to add examples of viruses, bacteria, and fungi, forms of energy (Clough, 2007). They could demonstrate the process or fitting of distillation with apparatuses. Teachers agreed that they are taught that learning by observation, doing, and participation is more effective than mere reading text or listening to lectures. They argued that they are on the one hand not supported or encouraged to do so by higher authorities- head teacher, school management, municipality office, etc., and on the other hand, if they consume their time in such activities they won't complete the course in time. Teachers value course completion rather than developing a scientific attitude or applying scientific knowledge/skills in problem-solving which is worthy indeed (Gauld, 1982). Teachers are losing the opportunity for technology-aided and context-aided science teaching (Zulirfan et al., 2018, but they are unaware of this fact.

Math Teaching: following the Rules or Solving the Problem

A math teacher having a degree in BEd math and MA in sociology and experience teaching for 17 years in this school taught alternative and vertically opposite angles to 8th grade. He asked for remembering the definitions from the board. Then he gave them a problem to solve- find the value of x^0 and y^0 from the exercise in the textbook. Among the 14 students only one who was of around 18 years, once dropped and rejoined, solve the problems. After his answer and the other students' silence, the teacher solved the exercise. Students were not taught to make the equation of x +60=180 (sum of adjacent angles, and so on), think over it, guide and challenge them, etc., The third problem was solved by 4 more students but they applied only the concept of adjacent angle whereas applying vertical-opposite angle was one step shorter than they could not.

The next teacher was BEd and seven years of teaching experience who taught ratio and conversion of the unit in fifth grade: (a) rupees to paisa; (b) foot to the inch; (c) km to meters to cm. There were a total of 15 students in the classroom, four of them were ignored "because they were seldom comers." The class was asked to make a ratio of 750 m to 1 km. Only three of the students knew about 1km equal to 1000 m. Students were not taught where the feet, inches, and paisa are used and needed to know their amount and convert from others. Nowadays students do not see the coins of the 25 or 50 paisa. Though the teacher has not explicitly provided them with the route, implicitly calculating a ratio entails four concepts- (a) conversion into the same unit; (b) arranging them into fraction form; (c) calculating the LCM between numerator and denominator, and removing it, and (d) finally presenting the remaining factors in fractional form. Operating the concepts in a sequence makes a rule.

Another teacher who has IEd Math and BEd Population, and 15 years of math teaching experience taught students a set of model questions in 8th grade for the coming test. He wrote the question on the board and as long as solved but he did not- ask students to try, supported from the side, and make them able to solve. Though, there were (are) only 13 students in the class, he applies the techniques of a large class in this small class. He was teaching them to find the value of 8√3- 5√3, I asked to let them solve, and students were unable to identify √3 as an analogy x or y. He asked students to convert decimal digits 0.00037 into scientific notation. He taught as 0.00037= (37/100000) = $(3.7*10^1/10^5)$ = $3.7*10^1*10^{-5}$ = $3.7*10^{-4}$. He did not let them think over it, and rather said-"remember the rule and process while solving other problems." I asked them- how can we write 1 for the decimal while converting a decimal into a fraction; are decimals and one the same? I again asked to take the decimal sign from this position to the right side of any natural number (here is 3), and how many steps the point should go to the right side. They counted- "there are four steps." If we push any number toward 'the left-hand side from the 'reference point' (i.e., decimal), it is negative or positive? Two of them replied negatively. I said- "now we can put -4 to the power of 10." These two students said yes it is $3.7*10^{-4}$. I asked- if we can give the right answer by counting through a shorter path why do we follow the fractional path? They ponder over it. The teacher taught converting 101011_2 into X_{10}; then I asked them- how do you write 101011_2 in scientific notation? Students looked at their teacher.

Another teacher who was MEd in math and has experience of 3 years of teaching. The class was filled with 36 students, and all of them use to participate in a little bit of earning or supporting activities at home. I observed that she was teaching calculating the area of different geometrical planes. Three days ago she had asked students to remember all the formulae to apply while solving the problems of exercise. She asked the formula for the class for each of the shapes copied on the board from the textbook, but none answered. She solved by saying- if you do not recite, how can help you? I will solve one of each formula, and if you cannot solve it yourself it is not my responsibility. Students were harshly copying the solutions without understanding. After class, she said- "I have never seen such weak, irregular, any study at home, and reckless students, how can I help them?"

A teacher was teaching drawing the angles of 30^0 and 60^0 with the help of a compass. There were seven students in the class. She was drawing on the board with the sign pen, where the compass point and pen were sliding. Since she was teaching students individually. One of them was without instruments, and he was pretending as if he is learning by observing his friends. Another had the instrument but the compass was loose. She chided them as troubling students, coming to school without having requirements, and irregular (absentee). One of them had already drawn with the help of his brother at home. Two of them showed by drawing.

The description of the above paragraphs suggests the following points.

a) Teachers Stressed on Transmission of Knowledge than Mediator of Experience-learning

The role of the teacher in the whole process of teaching seems like a server. Teachers take the course content as a collection of knowledge (information) that students require to grasp and store in their minds. They should solve the all given problems in exercises in the textbook and similar other problems. This attitude indicates teacher is a mediator of knowledge transferring like a food server transfers from the kitchen to consumers (clients). Since it can be a metaphor for curriculum developers as cooks; teachers as a server (waiters) and students as a consumer. Thought, the role of the teacher must a mediator, as an agent to help students make a formal concept from their experiences not by imposing without understanding. Teachers do not wait even a minute for students to brainstorm; if students cannot initiate any ideas then the teacher can lead them toward the answer by Socratic questioning. In the case of teaching calculating area of geometrical planes- the teacher could let them identify the shape of the figure; discuss with them which formal fits to calculate instead of demanding ready at the tip of the tongue- and then showing them inferior and solving herself immediately as it is emergency to solve now. Especially, her class was one way, disengaged, discouraging, embarrassing, and almost nonsense because no one was understanding- what the problem is; what are the concepts to solve the problem; and what is the method (process) of solving essential in learning mathematical skills and developing cognitive abilities (Tambychik et al., 2010). Similarly, the teacher taught ratio through Skinnerian reduction rather than developing concept maps with daily lives. Unless students develop a concept, they cannot apply it to solve their daily problems (Lessani et al., 2016).

b) Classroom Language Use is Insufficient for Thinking and Conceptualisation

Terminologies are special vocabularies of a particular discipline. The terminology carries a specific meaning and concept. A teacher's use of more, clear, and formal terminologies gives likely more chances of learning concepts from the students. Meanwhile, linking the terminologies with the informal, local or contextual, and native-language terms makes students more chances of understanding concepts.

Observation of both math and science class suggests that teachers write just the topic and sub-topic in the Nepali language. The science teachers, irony, though, MSc and Med did not write the English terms of *snayu pranali* (nervous system), neither written on board nor pronounce while teaching. They wrote, pronounce, and taught *thulo mastiskha* – big brain for Cerebrum, *sano mastiska*- small brain for the cerebellum, and edulla in Nepal word for Medulla Oblongata. Unless the students are familiar with every word of their study in English how can they search for further meaning on the internet, how do they link it to their higher study, and how do provoke their thinking? Similarly, the geometry teacher said- "make this size of chap in your compass, and draw like a protractor shape, then from the same 'chap' cut the previously drawn figure from one end. She did not introduce students to the English meaning of Nepali 'chap' is an arc.

If the students got vocabulary (language), they seek- to think over it, ask others or search in printed books or digital sources for the meaning of the terms. Students who get opportunities for interaction with the teacher in their language or ground terms would help abstract their experiences, as per Vygotsky's theory of "More Knowledgeable Other" (Kozulin, 2003). Students acquiring a language or terminology or formal concept gives them control over their mental processes: the ability to guide their thinking, direct attention, and formulate mental plans (Gentner et al., 2002).

c) Teacher Preparation and Development are Insufficient for Contextualised and Integrated Teaching

The locality of the schools is a municipality of inner Terai, and the public schools were selected as a destination for working-class children. Schools were approved for primary level (1-5) and extended to (6-8) as proposed. Especially science and math teachers are supplied on either a contract basis or a locally managed source for salary. Thus, appointed teachers always seek better opportunities since the turnover rate is high. Table 1 tells that the teachers who are primary level permanent have a longer time of experience but the bachelor's and master's degree owners have shorter and low payment. Almost teachers are either novices or underqualified. Qualified teachers are prepared in teachers' college with theoretical knowledge as well as practical skills in the content of their teaching subjects, subject-specific and general pedagogy, child development and learning, and managing learning environment (CDC, 2019); and the qualified teacher is developed in a school setting by supervision, mentoring, collaboration, researching, reflection, etc. (Tsui, 2011), and the continuous development is identified and succeeded by promotion, and thus, motivated (MoE, 2016). Most of the math and science teachers are underpaid, tenure-based, and unstable, on the one hand, and there are no other teachers MKO to supervise, mentor, collaborate with, etc. for their development, on the other.

d) Middle-class School Norm for Working-Class Children

The studied teachers have a notion of students come to school with a neat and clean uniform, text and practice books; writing, drawing, and graphs papers; instrument box, tiffin, ready for educational travel or one-night camping/hiking; doing homework with the help of parents/siblings or tuition, attending coaching and co and extra-curricular activities if any, etc., They also expect that students be disciplined, obedient, studious to secure the grades of C to A in 8th or 10th grade to following science or management, or technical streams in upward. It is because they were expected the same in their schooling, they expected the same from their kin and relatives, and they had the same practice in previous (private) schools. As Marxist psychology claims (Packer, 2008), their social world constructed them (them means their notion, values, beliefs, etc.); and they are trying to shape the school family or students.

Since, that led them to a 'metal set' bias (Ciccarelli et al., 2012, p. 262) and they try to teach students from their prior experiences. The curriculum receivers' livelihoods, values, notions, and expectations are different. Students in these schools after and before school time are involved in household chores, fodder and firewood collection, and labor work. Shortage of school materials (books, copies, geometry boxes, etc.), going to school on an empty stomach, school absences, no homework, etc., are the very common problems in these schools. Additional problems are the lacking of learning motivation, future aspiration, autonomous learning, support while doing homework, etc. The teaching schedules, teachers' attitudes to students/ and teaching in these schools, teachers' apathy to the low quality, etc. indicate that teachers are prepared for middle-class children rather than addressing the need and flexibility of working-class children.

Conclusion

Half a dozen of plans over thirty years since the 1990s in Nepal were implemented with millions of dollars to ensure the quality of education, but several assessment studies since 2011 report no significant progress. Many studies recommended reviewing curriculum, teaching methods, and evaluations, to solve the problem of low average achievement, especially in math and science, and reduce the socioeconomic effect on learning. Over the last, fifty years educational theorists have raised the issues of classification of knowledge and its contextualization (Bernstein, 1970), education keeps the children of working-class in the working class (Bowles at el., 1976), and school produces docile workers than liberate human (Freire, 1970; Reimer, 1971; Illich, 1972), politics of national curriculum (Apple, 2012), determination of 'official knowledge' (Apple, 2019), etc. Therefore, to examine these contradictions ethnographically in the Nepalese context, a study was carried out to explore the teachers' role in contextualizing teaching in the school where students are from the working class.

Thematic analysis of the information generated from observing classroom teaching of math and science subjects along with qualitative interviews suggested significant gaps among the 'written', 'taught', and 'learned' curricula (Glatthorn et al., 2019). The findings regarding teachers' knowledge about teaching, motivation of teaching, and activities of teachers show a huge lacking gap in the mediator of conceptualising their concrete experiences; contextualising the content by interdisciplinary methods; and encouraging their thinking through language, signs, and tools as suggested by Vygotsky (1978).
Teachers in public schools where most students are from working-class communities are almost unqualified and inexperienced. These teachers instead of encouraging thinking, and developing problem-solving skills stressed on route learning of content. It is a sarcastic claim about developing innovative and critical thinkers in such inactive, dull, and discouraging classroom environments. However, the finding and conclusions were drawn from the information generated from an indicative field study, accidentally selected teachers and their classrooms (but natural thus free form infliction of 'fake good'), and analysed by a researcher in curriculum studies. Endeavoring to school working-class children but imposing the national curriculum and demanding middle-class habitus and aspirations from them is unjust.

More rigorous and prolonged interventional research is recommended to examine the effectiveness of either pedagogical or curricular renovation in these classrooms to empower the students or ensure quality education. Nevertheless, this study advocate for interdisciplinary, technology-aided, inquiry-based teaching approaches in math and science subjects. Moreover, it raises the issue of tailoring schooling for working-class children instead of imposing middle-class values, norms, and attitudes.

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