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Institutional Setting and Its Influence on the Teaching of Mathematics: Implications to Implementing Reform Vision in Mathematics Education in Ethiopian Schools

Dereje Taye Wondem [1,2,*], Solomon Abedom Tesfamicael [1] and Dawit Asrat Getahun [2]

[1] Department of Teacher Education, Norwegian University of Science and Technology, 7034 Trondheim, Norway
[2] College of Education and Behavioral Sciences, Bahir Dar University, Bahir Dar P.O. Box 79, Ethiopia
* Correspondence: derejetw@ntnu.no

Abstract: Existing initiatives in mathematics education demand establishing a continuous professional development program for teachers in Ethiopian schools. However, implementing such programs first requires an understanding of the school and district environment in which the participating teachers work, as mathematics instruction is in part a function of the environment. In many cases, school and district settings are dynamic, and it is difficult to incorporate unplanned and intervening factors into the change process. This case study attempts to investigate the influences of the school and district settings in promoting reform visions in mathematics education. This study applies the theory of communities of practice as a framework and qualitative coding of data to understand the dynamic school setting and its implications for the teaching practices of mathematics teachers. The findings reveal that the school setting does not adequately promote reform visions, but rather it maintains the practice that is supposed to be changed. The current situation includes an accountability system loosely connected to reform visions, the absence of reform-oriented school leaders and expertise to guide the teachers, and a lack of instructional materials that the teachers can refer to regarding the new reforms. This paper suggests a possible configuration of the school situation to promote an environment that fosters the teaching of mathematics toward reform objectives.

Keywords: professional learning communities; communities of practice; teacher development; mathematics education

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1. Introduction

Like many developing countries, the Ethiopian Ministry of Education (MOE) has been introducing different reforms to improve the low quality of education in the country [1,2]. The reforms set ambitious standards and goals for students' learning [3]. Concerning mathematics education, these reforms entail shifts of focus from mathematical procedures to mathematical reasoning and understanding. These shifts demand that mathematics teachers change their teaching paradigm from a teacher-centered approach to an activity-based and student-centered approach. The Curriculum Framework for Ethiopian Education: KG—Grade 12 [3] clearly articulates that teachers should use a variety of teaching and learning methodologies so that students are given opportunities to question, verify and practice what they learn. Globally, such kinds of changes are complex and demanding for teachers. They require sustained professional support for teachers [4,5]. The case in Ethiopia could even be worse because of several factors that include the teacher-dominated schooling experience of the teachers, poor pre-service teacher education and the absence of sustained professional development opportunities at the school level [6,7].

The pre-service teacher education programs in Ethiopia are characterized by content mismatch with the school curriculum [7,8]; the lack of emphasis on pedagogical content knowledge (PCK) and the separate treatment of content and pedagogy [9,10]; the lack of standardization across training institutions [7] (MOE, 2012); and mismatch between teacher educators' competence and what they are required to do in training student-teachers [9,11]. A recent study has also revealed that pre-service mathematics teachers' knowledge for teaching (MKT) [12] is very poor, and their respective teacher educators have no satisfactory awareness about MKT, which might create a knowledge gap in students' knowledge and in turn make the college of teacher education unable to produce quality and competent primary school mathematics teachers [13].

Addressing such drawbacks in pre-service teacher education programs is one aim of school-based professional development (PD) programs [14,15]. However, global reports indicate that establishing sustainable PD programs that can help to address such gaps and enable schools to respond to dynamic reform demands for teachers, in general [16,17], and for mathematics teachers, in particular, remains challenging [18,19]. PD programs must be context-specific [20,21]. However, in most cases, PD models are implemented without proper adaptation and fail to consider contextual factors and reform dynamics in a given context [22]. In this regard, researchers argue that, besides knowing programs and models of successful PD, it is essential to think about how to contextualize them so that it is possible to build a sustainable and scalable PD for teachers [23]. In connection to this, the ICME-13 Survey and ICMI 25 Study indicated that the research base on the sustainability and scaling-up of successful PD programs for mathematics teachers is not extensive and needs further study [19,24].

In affecting sustainable PD programs that improve teachers' teaching practices and students' learning, among other things, two initial aspects of designing PD programs in a given context are essential: understanding the current instructional practices of teachers, and investigating the institutional setting that constitutes the teaching practices [5,25]. Analysis of these two aspects is critical for the guidance that the findings provide for the design and facilitation of teacher PD programs. Looking at the situation in Ethiopia, where the present study is located, studies on the first aspect (teaching practices of teachers) have shown that the emphasis is on students' acquisition and application of procedures for dealing with mathematical symbols [10,26,27]. However, studies focusing on the latter issue are rare in the Ethiopian context. Therefore, as part of a larger project aiming to design a PD program for middle school mathematics teachers in Ethiopia, the present study focuses on the second aspect: examining the institutional context in which teachers teach mathematics.

In addition to individual teacher competence, a series of studies have shown that what happens in the classroom depends on a large number of situational factors, e.g., the relevant curriculum, adequate resources, reasonable class sizes, a good school leadership and accountability system, community involvement, a supportive policy environment, etc. (e.g., [5,14,28]). According to Cobb et al. [21], however, the institutional setting for how these factors operate in a particular school and how they affect instruction remains complex and difficult to understand. To our knowledge, little research places teachers' instructional practices in a dynamic school and district setting in which they work so that the design of PD programs considers this situation. Previous related studies have been conducted mainly in Europe and the US, where teachers work in highly accountable environments with better infrastructure [5,29,30]. Hence, this study can contribute to the understanding of the actual instructional setting in which mathematics teachers work in less developed countries, such as Ethiopia, which is known for its context of limited resources [31] and a poorly organized education system due to various cultural and political factors [17]. Such an understanding can be useful for designing contextually relevant and sustainable PD programs that ensure continuous improvement in teacher practices as envisioned by curriculum reforms [5,25,32].

The specific research question to be answered in this study is as follows: How does the institutional setting constitute the current practices of mathematics teachers and influence reform visions in mathematics education in Ethiopian schools?

2. Literature Review

Current reforms in mathematics education demand fundamental changes in the instructional practices of mathematics teachers [4,5]. However, studies have yet to adequately answer the question of what constitutes successful teacher support programs that ensure the development of instructional practices in demand [19]. Despite this fact, reports have consistently confirmed some common characteristics of PD programs that are relatively successful [16,31,32]. For instance, Darling-Hammond et al. [16] analyzed the common characteristics of 35 methodologically rigorous studies that have demonstrated a positive link among teacher professional development, teaching practices and student outcomes. A total of 10 of these studies concerned improving mathematics instruction and student learning. The consistent features of these programs included focusing on specific subject matter content and instructional practices, establishing a professional learning community (PLC) that provides teachers the opportunity to collaborate and actively participate, and ongoing and sustainable overtime. Such PD uses authentic artifacts, interactive activities and other strategies that provide thorough and highly contextualized professional learning opportunities. They provide coaching and expert support focused directly on teachers' individual needs, and the support involves sharing expertise about content and evidence-based practices. These characteristics ensure that teachers reflect collaboratively on their learning as they experience effective instructional strategies as learners [32–34].

The consensus about the characteristics of effective PD programs and difficulties replicating such programs are widely apparent [16–18]. Schwille and Dembele [14] put this paradox of PD replicability as " ... knowing what to do but not how to do it ... " (p. 110). A successful PD in one context with a particular community of teachers and students might not work equally well in another context with different teachers and different students. According to Guskey [20], "this is what makes developing examples of truly universal 'best practices' in professional development so difficult. What works depends on where, when, and with whom." Darling-Hammond et al. [16] (p. 462) also pointed out that the educational system within which PD occurs has implications for its effectiveness. They further argue that, specifically, teaching and learning conditions both within schools and at a broader system level can inhibit or foster the effectiveness of PD. This entails the need to be responsive to the specific needs of the target teachers and to the institutional context in which teaching and learning take place in designing PD programs.

Bringing change to the classroom, and consequently to student learning, is the final goal among those facilitating and studying teacher learning in PG programs. However, teachers' classrooms and their practices do not exist in a vacuum. Even when supported by systematically designed opportunities to learn, teachers' development of practice is substantially influenced by the institutional settings they work in—in negative as well as in positive ways [21,35,36]. The institutional setting in which teachers work largely influences how teachers formulate the goals of teaching, the resources they use when preparing for or reflecting on practice, and the degree to which they have and engage in opportunities to learn.

For example, as reviewed by Cobb et al. [21], factors related to teachers' working environments and collegial relationships that are influential on their classroom practice include (1) the instructional materials and associated resources to which teachers have access and that they are expected to use (e.g., teaching guides and curriculum frameworks); (2) what teachers understand themselves to be accountable for based on the professional norms and practices of their school leaders and other teachers in their schools (e.g., principals' expectations for math instruction); and (3) the formal and informal sources of support from which teachers can draw to improve their instructional practices (e.g., school and district PD, and colleagues to whom they can turn for advice about instruction). In this regard, leaders at the school and district level constitute significant aspects of the institutional setting in which teachers work and improve their instructional practices [5,35].

In many teacher development studies, however, researchers consider the institutional context in which teachers work as a background rather than as key support for teachers' developing practices [16,21]. The distinction is critical with respect to what the findings reveal and their contribution to designing and facilitating teacher PD programs somewhere else. In this regard, those who advocate for the critical role of contextual factors for teacher development (e.g., relevant curriculum, adequate resources, reasonable class sizes, the quality of school leadership and the accountability system, community involvement, a supportive policy environment, etc.) advise that, in the course of designing new PD for teachers, the current instructional practices of the target teachers should also be understood in line with the institutional setting in which they perform the practice [30,37,38]. For instance, [38] analyzed the instructional practices of English department teachers in one secondary school in Ontario, Canada, as constituted by the recurrent institutional setting in which teachers work. The study analyzed those institutional factors that constituted the current practices of teachers who were found to be less reform-oriented. These factors included the lack of a jointly developed mission among the teachers; limited mutual engagement in practices addressing issues regarding curriculum, teaching and learning; and an overreliance on externally developed, standardized tools of practice. The underlying institutional factor for these problems is the lack of quality time for teachers to engage in collaborative and substantive learning in and about their practice. As a result, there is a low possibility of creating a learning community where teachers negotiate their perspectives and examine their teaching practices by analyzing critically reified tools of practice and the processes they create, as well as by designing new tools or improving their skill levels in using old ones to improve their practice. This study proposes a variety of configurations of time and space that may create institutional settings that foster learning among teachers.

Cobb and his colleagues [21] also showed that consideration of the ongoing institutional context in which the target teachers work significantly contributes to the ongoing improvement of their PD designs and their effectiveness. Reflecting on their ongoing collaboration with middle school mathematics teachers, they stated that institutional setting analyses would inform plans to support teacher learning. It would also contribute to the PD designers' accounts of teachers' activity in professional development sessions and their classrooms. Institutional analyses can support the formulation of strategies for institutional change that involve the creation of new tools to be shared among those involved in the teaching function and the arrangement of different activities that can engage all those involved in influencing the classroom instruction and PD designers. Moreover, by beginning to work with a group of teachers, documenting the institutional setting of teaching allows PD designers to explicitly negotiate a joint agenda with the teachers that reflects their priorities and interests. In general, compared to the usual practice of assessing the capacity of institutions to implement curricular innovations [28], Cobb and his colleagues argued that documenting the institutional setting of mathematics teaching provides better detail on the current capacity of a school or district to inform not only the implementation of curricular innovations but also the formulation of designs for supporting teachers' learning that are fitted to the local school and district setting.

3. Theoretical Framework

As discussed above, the effectiveness and sustainability of a PD program at the school level is partly a function of the school and district settings in which the participating teachers work. In many cases, the school and district settings are dynamic, and it is difficult to account for unplanned and intervening factors in the process of change [39–41]. In general, teachers' instructional practices are strongly affected by the formal and informal support available to them, the institutional needs they are trying to meet and the materials and resources they use in their teaching practices [37]. This implies the need to apply an interpretive perspective that places teachers' instructional practices in the settings in which they work, that helps to analyze the opportunities and limitations of the schools and districts in which they work and that help to shape the design of PD for the practicing teachers.

In this regard, the analytical approach proposed and used by Cobb and his colleagues (see [21,35,37]) to understand the unobtrusive, recurring and self-evident aspects of school life is worth considering. This approach aims to place the teaching practices of teachers within the institutional context of the schools and districts in which they work. In this analytical approach, Cobb and his colleagues described teaching as a distributed activity by focusing on the functions of teaching and the activities of the individuals who contribute to the fulfillment of those functions. For example, the function of teaching mathematics includes not only classroom interactions with students to support their mathematical understanding but also the following:

- *Organizing mathematics teaching and learning*, for instance, by setting lesson goals and by choosing and adapting teaching and learning activities and other resources.
- *Making mathematics teaching and learning visible*, for instance, by interpreting test results or developing assignments to create a record of students' thinking or reasoning in mathematics.

By analyzing how these functions are actually fulfilled, a number of people in various specific positions within the school and district would be involved in fulfilling them. This can happen through using various tools, such as textbooks, teachers' guides, syllabi, classroom observation forms, reports of test scores, etc. It is important to emphasize that this distributed view on instruction does not necessarily imply that people within a school or district always seamlessly or smoothly coordinate their activities. Rather, the classroom is a place of tension, as people within a school or district often have conflicting agendas. These efforts by members of different communities of practice to achieve sometimes conflicting visions of instruction and to assess the extent to which their visions have been realized in classrooms provide or constitute the immediate institutional setting within which teachers develop and refine their teaching practices.

Cobb and colleagues also followed [42] in developing a viewpoint on school districts and schools as lived organizations that can be described as configurations of *communities of practice* (CoP). This contention differs from the view of schools and school districts as *designed organizations* [28], where their various elements are designed to perform specific tasks or specific functions, such as the teaching of mathematics. They argued that analyzing an organization as complex as a school district solely as a designed organization does not necessarily provide an adequate account of how work is actually organized and performed. On the other hand, analyzing the school or district setting as a *lived organization* does not presuppose the functional organizational units but deals with identifying the CoPs in which work is actually carried out. Through this analytical approach it is also possible to analyze the interconnections among various CoPs within a configuration by focusing on (a) *boundary encounters* where people from different communities participate in activities together, (b) the role of *brokers* who at least include peripheral members of more than one community and (c) the role of *boundary objects* that two or more communities have incorporated into their practices (Figure 1).

In this study, the analytical approach leads to the delineation of CoPs, whose missions or enterprises are concerned with the teaching and learning of mathematics at the school and district levels. This approach adopts three interconnected dimensions that serve to describe a CoP: a mutual relationship, a shared enterprise and a shared repertoire of ways to reason with artifacts and tools. This allows conflicts and tensions between CoPs to be solved regarding the aims and approaches of school mathematics teaching. This context implies that the immediate institutional setting within which teachers develop and refine their teaching practices is constituted while members of different CoPs pursue sometimes-conflicting visions of instruction and assess the extent to which their visions have been realized in classrooms. This analytical approach also provides for the development of testable conjectures to reconfigure the institutional settings in which teachers improve their instruction through reflection on and revision of their teaching practices [21,38]. In general, it is believed that the key constructs of this analytical approach contribute to a general method to understand the specific settings in which particular groups of teachers work.

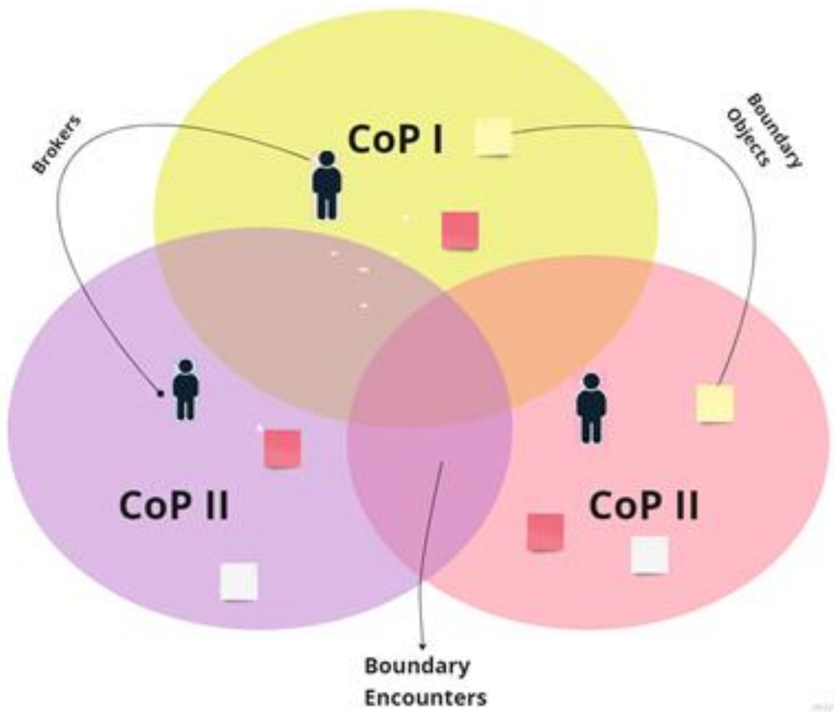

Figure 1. Interconnections among communities of practices, adapted from [42].

4. Method

4.1. Study Site

This study is part of a larger project aiming to institutionalize a new model of professional development for mathematics teachers at four primary schools. The project was launched in 2019, and the data for this study were collected in Spring, 2020. The schools are located in the Municipality of Bahir Dar in Amhara Regional State, Ethiopia. The results of the study will inform the adaptation and implementation of a new PD model in the four schools.

Regarding the background, the Curriculum Framework for Ethiopian Education: KG—Grade 12 [3] was launched by the Federal Ministry of Education. This framework promotes activity-based and student-centered teaching methods implemented across school subjects. Specific to mathematics, it advocates for the shift of focus from mathematical procedures to mathematical reasoning and understanding. This, in turn, entails teachers using a variety of methods that can actively engage students in their learning of mathematics. On the basis of this framework, the Federal Ministry of Education developed a syllabus for each school subject, including mathematics. On the basis of the syllabi, a mandate for the preparation of student textbooks and teachers' teaching guides was given to the regional states. Schools in each regional state are required to use one textbook prepared by the region. In general, districts in each regional state oversee the implementation of the curricula.

4.2. Participants

All mathematics teachers from grades 5 to 8 are the target group of the professional development program in the four schools. The teachers completed a three-year-minimum teacher training course in mathematics for primary schools. Their teaching experience ranges from 12 to 37 years (Table 1). Each teacher teaches four to five sections of students, each having a class size of 50 to 60 students. They teach in a half-day shift system, where they only come to school for one shift. In addition, principals and supervisors from each of the four schools, as well as a district-level education expert, are involved in the study. These participants are the key players influencing the teaching of mathematics in the four schools [21].

Table 1. Teachers' profiles.

No.	Pseudonym	School	Sex	Grade	Years of Teaching
1	Alem	A	F	Fifth and Seventh	32
2	Genet	A	F	Sixth and Eighth	12
3	Hirut	A	F	Fifth	20
4	Emebet	A	F	Sixth	40
5	Dereje	A	M	Seventh and Eighth	38
6	Melkam	C	F	Fifth	20
7	Zewuditu	C	F	Eighth	16
8	Zenu	C	M	Sixth	19
9	Hamelmal	C	F	Seventh	15
10	Halima	B	F	Eighth	21
11	Ababu	B	M	Fifth	31
12	Almaw	B	M	Sixth	32
13	Zelalem	B	M	Seventh	33
14	Degua	D	F	Fifth and Sixth	19
15	Muluwork	D	F	Seventh	14
16	Gubay	D	M	Eighth	16
17	Meseret	D	F	Six and Eighth	9

4.3. Procedures for Data Collection

Methodologically, we used that which [37] applied in a similar case study. In this methodology, Cobb and colleagues used the *snowballing methodology* and the *bottom-up strategy* to identify CoPs within the target school district with enterprises regarding mathematics teaching and learning. This allowed them to understand the school and district setting in which math teachers worked. The first step in this strategy is to undertake semi-structured interviews with target teachers to find individuals in the district who have a significant influence on how math is taught.

More specifically, the interviews with teachers focus on the following:

- Issues about the professional development activities in which they participate;
- Their understanding of the district's policies for mathematics instruction;
- The people to whom they are accountable;
- Their informal professional networks;
- The official sources of assistance on which they can draw.

In the first round of interviews with the target teachers, we did not find any CoP strongly impacting mathematics teaching. The teachers did not consistently identify the people who influence the decisions they make about their teaching activities directly or indirectly. In the second round, in a deductive manner, we looked for people who represent what Wenger [42] called potential CoPs that should influence mathematics teaching in schools. We used the literature on education policies and school organizations and some data from the interviews and documents to locate these individuals at the district and school levels [28]. As a result, we identified and interviewed a cluster principal, the principal and vice principal from each school and two district-level experts.

Interviews with supervisors and principals aimed to understand their agendas related to mathematics instruction and how they attempted to achieve their agendas. Once we obtained the data about these issues, we returned to the teachers and further interviewed them on how the practices of the supervisors, principals and experts influence their practice of teaching mathematics. All interviews were tape-recorded by the first author and then transcribed.

Document analysis and lesson observations were also conducted to supplement the interview data. Documents related to curricula and professional development that we reviewed included syllabi, teachers' guides, students' textbooks, different planning guidelines, student assessment rubrics, teachers' evaluation checklist and one-year department meeting minutes from each of the four schools. Moreover, to corroborate the data obtained from the interviews and the documents and as a baseline for the bigger project, one lesson taught by each teacher was video recorded.

4.4. Data Analysis

Data collection and analysis were performed in an integrated manner [43]. Analyzing interview and document data at the beginning of the study during the first round of interviews, we noticed issues to pursue in our second round. This interaction between data analysis and data collection allowed us to test the working hypotheses that began to emerge from our initial interview analysis. For example, the analysis of our first round of interviews suggested that there are no people at the school and district levels who significantly influence mathematics teachers' day-to-day instructional practices. This discovery led us to look for those people at the school and district levels who should have the potential to influence teachers and constitute potential CoPs [42]. In this round of interviews, we probed further into the hidden link between mathematics teachers and these people. We continually considered the interaction of our data analysis with our data collection. This approach allowed us to clarify what constitutes the institutional settings of mathematics teachers in the selected schools by identifying potential CoPs that would have positive effects if some kind of reconfiguration is made in the settings in which the teachers are working [42,44].

Guided by the conceptual framework, each of the three CoPs were described considering the three interrelated dimensions of a community of practice: a joint enterprise, a mutual relationship and a well-honed repertoire of ways of reasoning with tools and artifacts. Similarly, the three constructs (i.e., boundary encounters, brokers and boundary objects) are the themes that we used to analyze the collected data in the study so as to describe the interrelationships among the CoPs. This approach is in line with the qualitative data analysis methodology guided by pre-determined themes or a priori codes [45]. Moreover, there were continuous discussions and mutual critique among the researchers to reach a common understanding and to confirm the consistency and quality of data interpretations.

4.5. Ethical Considerations

This research received ethical clearance from the NSD–Norwegian Centre for Research Data (Reference no. 734283). Permission to conduct this research was also granted by Amhara Regional Government Bureau of Education. The school principals also approved the conduct of the study. Participants took part in the study voluntarily and were assured of confidentiality. Participants signed informed consent documents and were free to withdraw from the research at any time.

5. Findings of the Study

In this study, attempts are made to identify potential CoPs whose enterprises are related to the improvement of students' learning in mathematics. As depicted in the conceptual framework of this study, CoPs are groups of people who are mutually engaged with each other in joint enterprises that members work towards and who share a common repertoire—sets of routines, tools, symbols, stories and other resources—for engaging in their work. In this particular study, CoPs are those that pursue agenda regarding how mathematics should be taught and learned. Analysis of the interview data and the document review resulted in three CoPs that wereconfigured and influenced the teaching and learning of mathematics. These are the mathematics teachers' community, school leadership community and the district level experts' community. The interconnections or configurations among these CoPs that constitute the institutional settings in which mathematics teachers work are also presented in this section.

5.1. Potential Communities of Practices

5.1.1. Mathematics Teachers' COMMUNITY

Math teachers' CoPs in each school consist of five to six mathematics teachers teaching grades 5 to 8. Each school's math teachers' group works as a community of practice in teaching mathematics. Each group as a CoP has its shared enterprises, a mutual relationship and a well-honed repertoire of reasoning with artifacts and tools. According to the direction given by the school, every year, all teachers are required to set a ten-percentage point improvement for students' scores compared with the previous year. From the interviews with the teachers, it was evident that their enterprise involves improving students' learning achievements by applying what they think are the best teaching methods and by covering textbook content. However, from classroom observations, their teaching methods predominantly focus on students' acquisition and application of procedures for operating on mathematical symbols and learning the definitions of mathematical terms (see Teaching Episode 1). Almost invariably, the teachers demonstrate the procedure for solving a particular type of problem step-by-step and then assign similar problems for the students to solve. Their assessments of students' reasoning are limited to the correctness of answers based on a few students' responses. The adjustments they make when students do not produce correct answers typically involve explaining the procedure for a second time or asking students to check whether they have performed the steps correctly. Because the class size is large (above 50 students), most students do not get the chance to show their answers to the teachers.

Teaching Episode 1

The topic of this lesson is the multiplication of fractions and decimals.
After writing the title of the lesson, the teacher tells the students that they learned about the multiplication of fractions and decimals in grade 5. Some of the students say 'yes' together. Without saying anything about what is new about this topic in grade 6, she moves to the textbook and gives the exercises written under the topic to the students to solve in small groups. The questions are $\frac{3}{4} \times 1/2$, $5/12 \times 6/25$ and 0.2×0.4.

The students immediately start working on the solutions to the exercises. The teacher moves around the room and makes brief visits to the groups. Sometimes, when she sees errors in the students' solutions, she joins the group discussion and asks the students questions about their solutions. After ten minutes, she calls the students' attention to the blackboard and starts solving the exercises being led by the students. She assigns one student for each exercise to tell her the solution with the procedures while she writes the answers on the blackboard. However, during the actual work, other students join the selected student and tell the teacher the procedures up until reaching the final answer. Whenever the teacher feels that what they are telling her is wrong, she gives an instant correction and leads the students with the correct procedure. With this process, she finishes writing the solutions to the three questions on the blackboard. This whole class activity takes around ten minutes.
Next, she writes another round of exercises on the blackboard, and without any wait-time, she randomly selects three students to come and perform the exercises on the blackboard. The exercises are 2.43×1.25, 3.15×0.2 and 5.32×1.2. These students come and start writing the solutions to the three questions in parallel. While these students work on the blackboard, the teacher says to the rest of the class, " ... solve the problems on your exercise books so that you will tell the errors of the three students later." After three minutes, the three students finish their solutions.

The teacher reviews the solutions and asks the class "are they correct?" Some students together respond by saying "no." Without any additional comment on the solutions of the three students, she proceeds to ask for voluntary students to correct the solutions to the three questions. Out of those who raise their hands, the teacher selects three students to come and correct the solutions. The three students come and erase all the work of the previous students, start over again and finish their solutions in less than three minutes.

The teacher reviews the second round of the solutions to the three questions and says, "let me do the questions for you, and you will solve them later." She erases the solutions made by the students and starts doing each question by explaining the procedures. Each of the teacher's movements is accompanied by some students saying each part of the mathematical procedures that she is showing. After solving the second question, the class ends, and she finishes the lesson with that as well.

They all share the view that most students believe that they are not good at mathematics. They further suppose that only a few students in each section has the ability to learn mathematics, and the rest of the students are less likely to have the capacity to improve their learning in mathematics. The following quotes represent their views.

> "The students come to school with the belief that mathematics is difficult to learn [...] they assume that it is only a few who can learn." (Degua)

> "More than 90% of the students in each class are low achievers in mathematics, and that is mainly because most of the students have a negative attitude to the subject." (Zenu)

> "whatever I do to teach math, I know that it is only a few who will perform well in the final exams." (Alem)

Most teachers partly attribute the problem of the low achievement of students in mathematics not only to students' beliefs but also to the grading and promotion system being applied in the schools, as exemplified by the following comments:

> "Since the students get passing marks in other subjects which are easier than mathematics and that lead them to have a passing mark which is an average score of 50 and above, the students are reluctant to exert effort in learning mathematics." (Almaw)

> "Students exert little effort because they get promoted from grade to grade with lower grades in mathematics as their scores in the other relatively easier subjects such as civics, sport, etc...is higher, and they get passing marks on average. (Ababu)

On the other hand, because of the demand from school and district leaders, the teachers differentiate the students into three categories: high, medium and low achievers, based on teacher-made exam scores, and they attempt to provide extra tutorial classes for low achievers. The interview data consistently confirm that, in these tutorial sessions, students who are labeled as low achievers are not interested in attending. Instead, students from the other categories tend to appear in and attend the sessions. This point may corroborate their assertion about students' beliefs and capabilities in the learning of mathematics presented above.

The reviewed documents and the interviews with school principals reveal that each school holds a meeting and elects a department head annually. The election does not follow any set of criteria. Rather, the teachers negotiate regarding some characteristics of teachers and elect one. As the position is not attractive, sometimes, teachers volunteer to be department chairs. The following response regarding the election depicts the situation of the department heads:

> "We get together and nominate a teacher among us whom we think has good personality ... Most of the time, teachers do not have the interest to take the position saying it adds more work load. There is no teaching load reduction for taking the department head position .... Even after taking the position, there are those who try their best to work and there are those who are just careless and not serious about the work." (Hamelmal)

The teachers hold meetings at different times throughout the year under the facilitation of the department head. Reviewing the minutes of the meetings, it was found that their agendas mainly focus on routine administrative matters, such as setting an annual timetable, teaching class assignments, setting times for exams, tutorial and peer supervision, etc. They also conduct monthly and bi-annual meetings to evaluate the performance of teachers based on a checklist forwarded by the school. The teachers also get in pairs and observe each other's teaching once a semester. If both teachers teach at the same grade level, they meet by the end of each semester and evaluate the exam items to be administered for final exams.

According to the interviews with the teachers and document analysis, the student textbook is the main resource that teachers consult daily in preparation for teaching. The teachers use the textbook and the teachers' teaching guide as the main references to prepare their annual and lesson plans. Reviews of these plans, however, showed that they are short (i.e., 2–3-page annual plan and $\frac{1}{2}$—1-page lesson plan) and mainly focus on clarifying the timeline of when textbook contents must be covered (Table 2). Other than that, the plans do not have space to give detailed direction on students' mathematics learning trajectories and instructional practices that support these learning trajectories. The teachers use a 40–60 proportion of continuous assessment results to final exam results, respectively, to report on students' learning for each semester. Textbook exercises are the points of reference that teachers use to evaluate the appropriateness of the items in the final examinations.

Table 2. Excerpt from a one-page lesson plan.

Content	Time	Teacher Activity	Student Activity	Assessment
Divisibility of Integers	10′	- Revise divisibility rules by Q & A - Introduce the topic of the day	- Answer questions - Listen to the introduction	Oral Question
	20′	- Give the Exercises 2.1 from the textbook - Give support to the students while working on the exercises	- Work on the exercise individually - Ask teachers for any clarification	Oral question and Observation
	10′	- Select a difficult exercise from the list and work with the students - Summarize the main point of the lesson	- Follow attentively	What is the use of divisibility rules?

5.1.2. The School Leadership Community

The core members of the school leadership community are the principals and vice principals of each school. The mathematics department head and cluster school supervisors are also peripheral members of this community. The members of this community have 10 to 30 years of experience teaching a school subject that is not necessarily mathematics. They do not have any special training regarding mathematics education reforms and what such reforms entail. The interview data analysis from the principals, supervisors and teachers revealed that the joint enterprise of this community in each school is improving the learning scores of students by assisting teachers in covering the contents of the textbooks and giving tutorial classes to those students who are labeled as low achievers. They set a ten-percentage point improvement target from the previous year's average scores in mathematics learning of students at the school level and impose this on the respective teachers. The following quote is representative of this:

> "in order to achieve the learning target, the school tries to reduce class interruptions by teachers due to non-teaching responsibilities . . . we facilitate classes for tutorials . . . we also account these things in the teacher's performance evaluation" (Principal, School B)

The leaders share the view that students perceive mathematics as a difficult subject, and as a result, they are reluctant to exert more effort in mathematics learning. They also attribute the low performance of students in mathematics to teachers' lack of knowledge in teaching mathematics. In this regard, a principal was quoted saying the following:

> "The students' scores in mathematics subject is the lowest when compared to other school subjects . . . possible reasons for that include the persistent belief of students that mathematics is a difficult subject . . . also the teachers themselves do not expect the students to achieve the expected level . . . other reasons are problems of teachers' teaching methodology and teachers' lack of mastery of mathematics knowledge" (School D).

For school leaders, effective teachers do not miss classes, cover textbook content as planned, conduct additional tutorial sessions for students labeled as 'low achievers' and are positively evaluated as effective teachers by their students. They also mentioned that, during classroom observation, if they see teachers using teaching resources (e.g., charts, colored chalks, etc.) and students participating in answering teachers' questions and discussing in small groups, they are effective teachers. The principals expressed this effectiveness as:

> "Good teachers always invite students to participate by frequently asking questions . . . they differentiate students as 'high,' 'medium,' and 'low' achievers and devote their extra time to give extra tutorial sessions for the 'low' achievers . . . " (School C).
>
> "They use teaching materials . . . and are also loved by their students" (School D).

From the classroom observations for this study, teachers frequently asked questions requiring short answers without explanation.

School leaders prepare the annual improvement plan for the school and communicate it to teachers and the district education office before the beginning of the year. They conduct monthly and bi-annual meetings with department heads to evaluate teachers' performance, mainly considering covering textbook contents against the planned time and whether teachers are giving extra tutorial classes to those identified as low achievers. Community members make classroom observations once each semester to ensure that the textbook contents are being covered, as outlined in the annual plan and to see to what extent students are 'actively participating' in the teaching and learning process. They collect feedback from students, who are labeled as high-achieving in their average scores, regarding each teacher and use it as input to evaluate the teacher's performance. There are checklists that they and students use to evaluate teachers' performance at different times of the year. The checklists are generic across content areas. Concerning making students' learning visible, they collect students' achievement scores out of 100 points from each teacher and analyze them as per the planned target score set at the beginning of the year.

5.1.3. District Experts' Community

The members of this community include teaching–learning experts placed at the district education office level and as cluster school supervisors. Cluster school supervisors are placed at cluster center schools connected to three to four other schools. The supervisors are responsible for following up and supporting the school under the cluster. This group is mandated to lead and oversee the performance of the schools under the district. School principals are also peripheral members of this community. The members of this group have a minimum of 10 years of teaching experience in schools in teaching a school subject that is not necessarily mathematics. They participate in a few workshops, in which selected school mathematics teachers attend active learning and lesson planning training. Besides this information, they have no special training in mathematics education reforms. The district education office sets minimum average scores for students' learning. For instance, we learned from the interviews with experts that the office had set 50% as the minimum score that all students should achieve each semester, and 35% of students in every school should score 75% and above. Their enterprise is to improve the scores of students by following up and supporting schools with resources to differentiate students according to their performances so that each school arranges and provides extra tutorial sessions to low-performing students and so that each school ensures classroom participation by the students. As an example, a district expert explained how they pursued to achieve the learning targets, as follows:

Expert:	We have directives shared to the schools that capitalizes the need for teachers to give special attention to the achievement of the targets ... for instance, at the beginning of the year, the teachers should be able to identify how many students are high, medium or low achievers in the their respective subjects ... then they should arrange extra sessions for the low achievers ... we push the principals to ensure that this is happening in the schools ... we also check the implementation during supervision visits of the schools ...
Interviewer:	Do you mean the main strategy is special support to low achievers?
Expert:	Yes, arranging special support sessions for low achievers is somethingthat we are implementing to achieve our target
Interviewer:	Is it unique to mathematics or common to all
Expert:	It is common to all school subjects

Experts at the district level visit each school at different times (every quarter) in the year. They hold meetings with the leadership community, with the presence of the cluster supervisor, to evaluate the school's performance. While paying a visit to the schools, they also randomly select classrooms and conduct teaching observations. The main focus of their observations is to determine whether the content being discussed in class matches the time specified in the annual plan and whether teachers are properly managing their classrooms and making students 'active' in their learning. For experts, students are actively participating if, as one expert expressed, "they discuss in groups or answer questions being asked by the teachers," regardless of the lesson objective. Cluster supervisors make more frequent visits to each school under their supervision. Their main agenda in visiting schools is to check if they are following the checklists of priority activities prepared by district experts.

The experts set the continuous assessment rubric that teachers are supposed to use to make students' learning visible across the schools in the district. By the end of each semester, they receive students' raw score (out of 100%) in each subject from each school and analyze the score against the minimum performance level set at the beginning of the year. From the interviews with the experts and others, it was revealed that there is no way for the scores to be verified. The following responses from a supervisor and an expert indicated this point:

> "about the scores ... there is no external assessment made to check if the raw scores reported by each school really reveal the actual performance of the students as well as they are in line with the minimum learning competencies set in the school subject syllabi." (Supervisor)

> " ... we always have doubts about the genuineness of the report concerning schools' reports on the students' performances ... " (Expert)

5.2. Interconnections between Communities of Practices

As indicated in the conceptual framework, the institutional setting in which mathematics teachers work constitutes the configuration of the CoPs that share enterprises related to the teaching and learning of mathematics. In this section, the interconnection between the three CoPs and how these interconnections influence the current instructional practices of the teachers are presented. By analyzing how the practices of the three CoPs are aligned and sustained, or how the practices of school leaders and district experts relate to and influence the classroom practices of teachers, one can better understand the situation in which mathematics teachers work. The three types of interconnections that we used to analyze the configurations among the CoPs are boundary encounters, brokers and boundary objects. The data collected for this study reveal that these connections are manifested at different levels and underlay the current instructional practices of mathematics teachers.

5.3. Boundary Encounters

This interconnection occurs when members of different groups engage in activities together as a routine part of their respective practices. In this regard, school leaders hold monthly meetings with department heads to evaluate the progress of each department against the plan, with a focus on content coverage and giving tutorial classes. There are also bi-annual meetings with teachers from the whole school, in which students' scores are presented and discussed based on the targets set at the beginning of the year. The experts from the district visit each school every quarter. They hold meetings with school leaders to discuss the performance of the schools against the checklist that incorporates the priority areas of the district education office. From the list, the only agenda of these meetings pertinent to mathematics teachers' instruction is whether the teachers differentiated students by achievement level and conducted additional tutorial sessions for low achievers. Other than this, the boundary encounters that we observed in the four schools included classroom observations that school leaders and experts conduct once a semester. However, the visits, as confirmed by the teachers, are not regular and do not cover all teachers. One teacher explained this situation saying, " ... over the years. I see these people observing classrooms of different teachers in the school but not me."

All these encounters encourage teachers to focus on content coverage by sticking to textbook contents, differentiating students based on achievement level and giving tutorials to achieve their goals/targets. However, in most cases, as confirmed by the interviews with teachers and principals, the 'low achievers' are not the ones who benefit from these tutorials. A teacher explained the paradox of the tutorial program by saying that, " ... when we arrange tutorial sessions for low achiever students, it is the high achiever that comes to the sessions ... ". This implies that teachers conduct tutorials because school and district leaders demand them. These encounters do not raise issues of classroom practices or provide the opportunity to reflect on their practices vis-à-vis new curriculum reforms. As a result, none of the teachers confirmed that participation in these encounters helps them to refocus their vision for mathematics teaching to reform agendas.

5.4. Brokers

The activities of brokers, who are at least peripheral members of two or more groups, are the second type of interconnection that is important to document to understand the institutional setting in which mathematics teachers work. Brokers can bridge the activities of different groups by facilitating the translation, coordination and alignment of perspectives and meanings [42]. They can therefore play an important role in aligning the enterprises of different groups. As per the data collected from the four schools and the district, the mathematics department head, cluster school supervisors and the principals of each school are somehow visible brokers. The department head attends monthly meetings organized by the school leaders' community to evaluate monthly school performance. The head teacher shares information about teachers' accomplishments with the members of the leadership community during these monthly meetings. In return, the head brings new directions and feedback from the leadership community to the teachers' community. The school supervisor also attends some of the monthly meetings organized by the school leaders. On the other hand, the principal participates in quarterly school performance evaluation meetings organized by the experts' group at the district level.

As reviews of the minutes of these meetings revealed, the extent to which teachers provide extra support to low-performing students is an agenda for mid-semester meetings. The district experts organize end-of-semester meetings, and the row scores of the students are presented by each school and are evaluated as per the targets set at the beginning of the year. The feedback that the principals obtain from these meetings is the basis on which the leaders' community revisits their next plans. Although the supervisors are supposed to provide professional support to the leaders and teachers of each school, the interview data revealed that they are not recognized as experts who can bring new ideas to their work. It was also evident that supervisors do not have the expertise in teaching mathematics, as outlined in the new reform. When asked about the role of supervisors, two teachers responded, saying the following:

> " ... I don't know what exactly he does. I seldom see him meeting department heads and principals." (Degua)

> "I do not see any supervisor or principal role in teaching mathematics. I see them simply writing reports sitting in their offices. Maybe the principals can give us some materials, like papers, if we ask him. Otherwise, I do not see any functional role of the supervisor in supporting the teaching and learning process." (Dereje)

5.5. Boundary Objects

The third type of interconnection, boundary objects, involves reification [42]. Wenger defined reification as "the process of giving form to our experience by producing objects that congeal this experience into 'thingness'" (p. 58). As Wenger noted, reifying objects are relatively transparent carriers of meaning for members of the community or group in which they are created. In contrast, there is the wider possibility that they are used in a new way, taking different meanings if introduced into the practices of other communities or groups. Even in such situations, reifying objects can significantly enable the members of different groups and communities to coordinate their activities.

In this regard, the boundary objects that the three CoPs use in organizing their plans and practices concerning mathematics teaching in schools include the supervision checklist, the student textbook and the student assessment reporting sheet. The supervision checklist prepared by district experts is a dominant boundary object that influences classroom instructional practices in the schools. Concerning mathematics teaching, aspects of the checklist that permeate the practices of each community include its emphasis on content coverage and students' classroom discussion as indicators of teachers' instructional performance, as well as its emphasis on providing additional tutorial sessions, worksheets and abridged notes to students who are labeled as low performers. In turn, as derived from this checklist, the monthly evaluation checklist prepared by the school leaders capitalized on content coverage, tutorials and student participation during class instruction. The classroom observation checklists used by the leaders and the experts also share these characteristics. As a result, teachers seem keen to maintain the timeline regardless of the diversified pace of the students in their classrooms and also conduct tutorial sessions for students labeled as low achievers. As this practice seems to be the norm in schools, the teachers expressed concern that their participation in our project may affect their content coverage plan.

Teachers use the textbook principally to prepare their plans. Syllabi and other references are not used much as resources to prepare annual, semester, unit, weekly or daily lesson plans. The format used by teachers to report students' scores is the only boundary object that the three CoPs use to make mathematics teaching and learning visible. The teachers use a 40–60 proportion of continuous assessment results to final exam scores, respectively, and report the students' total scores out of 100 to the leaders. As the document analysis revealed, the report consists only of scores without any qualitative explanations of the scores. The interviews with the principals and experts showed that the leaders and the district experts use these reports to evaluate the teachers' and the school's general performance against the target scores set by the teachers and the school for students' scores at the beginning of the year. From the interviews with the teachers, it was prevalent that teachers prepare exams to be administered at the end of each semester mainly by adapting the items from textbook exercises. There is no external examination by which students are evaluated. As a result, there is no way of checking that the student scores that teachers report are valid and reliable.

Generally, the data consistently show that the interconnections made by boundary encounters and brokers focus more on reporting routine activities and less on issues of instructional improvement. The consistent agendas that are raised during these interconnections related to the organization of mathematics teaching and learning include content coverage and providing tutorial classes for low-performing students. Moreover, classroom observations are rare, and their focuses are students' group discussions and their participation in Q&A regardless of lesson objectives. From the above discussion, one can also see that boundary objects further strengthen the influences of boundary encounters and brokers. In all encounters, the main reference used to evaluate teachers' instructional practices emanates from the checklist prepared by district experts, which is generic. The student textbook takes a central place in the interactions among the three CoPs, in that content coverage is one priority area of evaluation under the checklist, whereas, concerning making students learning visible, all CoPs rely on the row scores of students reported by teachers.

In general, the data revealed that it is rare that different CoPs have an opportunity to discuss the various interpretations of boundary objects and negotiate the meanings so that the alignment of the enterprises of the different CoPs can be ensured. As a result, teachers and the leaders merely report content coverage, the number of tutorials given and several classroom observations conducted by leaders in order to satisfy the needs of the district education office. This seems paradoxical with the confirmation of all respondents indicating that students' scores reported by the schools are less reliable. The evidence they mentioned was that, when students take the end-of-primary-school regional exam in grade 8, their scores are always far below the scores reported by the schools.

6. Discussion

In Ethiopia, like in many countries in the world, reforms in mathematics education entail shifts of focus of instruction from mathematical procedures to mathematical reasoning and understanding. These shifts again demand that mathematics teachers change their teaching paradigm from teacher-centered to activity-based and student-centered approaches. However, this study reveals that the actual situation or institutional setting in which mathematics teachers work and practice does not promote this reform vision. The findings show that the institutional setting, described as the interconnections among different communities of practice, promotes the learning of procedural knowledge and content coverage. This finding partly coincides with study findings reported in the US and Canada (e.g., [35,38]) but with different causes. For example, the study by Cobb and McClain [35] revealed that, although the US government embarked on ambitious mathematics curriculum reforms that ensure students' learning with conceptual understanding, actual practices in schools seemed to deny that and promote procedural knowledge. This is mainly due to the high-stakes test system for which schools are accountable. School leaders want to see students achieve high in high-stakes tests being administered at the district level. As a result, they encourage teachers to teach according to the tests without flexibly addressing the specific needs of individual students. They promote this practice through encounters such as classroom observations and feedback, professional development programs and preparing specific guidelines for the teachers to follow through.

In the case of schools included in this study, however, no high-stakes test meaningfully influences classroom instruction. Rather, school and district leaders depend on the scores of students on teacher-made tests. The tests are prepared based on textbook exercises that advance procedural knowledge. Moreover, all interconnections that constitute the institutional setting of mathematics teachers' work and practice do not have elements of reform visions. The school leaders and the district experts do not make reform objectives their agendas in their interactions among themselves and with the teachers so that negotiation would have happened and opened up for change in the teachers' practices [42].

The means of improving students' test results also do not coincide with reform objectives. This gap could be related to framing the problem of advancing student learning as instructional management versus instructional improvement [46]. The instructional management approach attributes the low scores of students to inadequate instruction, and the remedy is giving additional instruction to these students. Although the instructional improvement frame entails inadequate instruction, most teachers do not have sufficient skills to promote ambitious instruction in the classroom, and the solution is supporting teachers to bring fundamental changes to their instructional practices through sustained learning opportunities. This study shows that school leaders and experts apply instructional management framing. As a result, they emphasize additional tutorial sessions for low achievers in their supervision visits and reporting formats. This point is in conflict with the findings of studies that strongly argue that instructional improvement is the way to help teachers shift their orientation and practice toward student-centered and inquiry-based learning from the current teacher-dominated practice [4,5].

Unlike the situation in high-performing nations, the institutional setting in which the mathematics teachers work does not constitute people with expertise in mathematics reform agendas. In high-performing nations, it is common to find expertise with different names, such as math coaches, teacher leaders or mathematics experts that collaborate with math teachers and school leaders to promote reform agendas (e.g., [5,16,19]). These experts design and facilitate professional development programs for mathematics teachers. They also develop different curriculum materials that help translate curriculum standards and frameworks into classroom practices. These materials are shared among teacher and school leader communities for negotiation. These encounters, brokering and boundary objects meaningfully influence the institutional setting in which mathematics teachers develop and revise their instructional practices toward evidence-based mathematics teaching [5].

However, the absence of these experts in the school in Ethiopia could deny mathematics teachers the chance to change their practices toward reform [5,42,47].

It is also uncommon to find diversified curriculum materials and guidelines constituting the institutional setting in high-performing nations. However, as this study reveals, the student textbook is the only accessible material to those involved in teaching mathematics. The textbooks, on the other hand, are low-quality and promote the teaching of procedural knowledge [27]. This point could be considered a serious problem because findings from prior research reveal that teachers' use of high-quality instructional materials increases the likelihood that they implement ambitious mathematics instructions that promote students' learning with understanding [5]. This situation, coupled with the absence of expert support, may push teachers to adhere to the common practice of teaching mathematics [47].

The situation, in general, is less restrictive on what teachers do and do not in the classroom. Teachers are free to choose what teaching methods to apply if they cover the content of the textbook and report students' test scores every semester. The classroom observation and feedback system seems simply nominal, as such observations and feedback happen rarely and focus on limited and generic features of the classroom. The instructional plans that teachers prepare and submit to leaders are routine and nominal activities. This situation allows teachers to freely choose teaching activities themselves. This result makes the situation in these schools quite different from schools reported in the other studies. There, teachers' practices are highly supervised and restrict them to sticking to some guidelines in their teaching (increasingly regulated work processes and outcomes) (e.g., [35,38,48]). However, it could be due to the absence of supplementary curriculum materials and reform-informed experts around them, as well as the lack of access to pedagogical resources that they could consult about developing and revising their instructional practices that teachers may see little reason to alter in their routine practices [42,47,49]. This is so because these conditions could deny teachers the chance to challenge their assumptions about their teaching practices and limit their imagination [42,47]. The interconnections among CoPs only allow them to perform routine and administrative activities and mere reporting.

7. Implications

The government of Ethiopia envisions seeing teachers change their current practices to a more inquiry-based and student-centered approach entailed by mathematics education reforms. One way to address this vision is to restructure the institutional setting where teachers work so that the situation reinforces teachers to change their practices toward reform visions [21,30,48]. Designs of any professional development program for teachers should also consider changing the situation as an objective [5,50]. In this regard, the following activities are suggested to consider changing the situation in which mathematics teachers work. First, students' learning goals envisioned by reforms should be clearly articulated and communicated to all stakeholders so that all interconnections among CoPs are aligned. This process also entails aligning the accountability system to adhere to these standards. Second, school leaders and experts should get to acquaint themselves with the mathematics reform objectives and contents. Moreover, they require developing skills in designing and facilitating teacher professional development programs. Third, considerable time should be allocated for teachers to engage in reflecting on their practices vis-à-vis reform demands. Fourth, quality teaching materials that promote and guide teachers to practice ambitious instruction should be available at the school level, including revising the current textbook and preparing additional guides that provide teachers with resources to consult. These materials also serve as a negotiating space among teachers, school leaders and experts, as well as sources of insights for discussion during professional development programs.

This study also contributes to the literature on understanding teachers' teaching practices and the design of PD to improve teachers' teaching practices. The conceptual framework and the research methodology adapted from Cobb and colleagues' works seem promising for investigating the actual institutional settings in which teachers work, which has implications for the design of PD programs for teachers in resource-constrained countries such as Ethiopia. Previous studies that advocate for the critical role of contextual factors for teacher development advise that, in the course of designing new PD for teachers, current instructional practices of the target teachers should be understood in line with the institutional settings in which they perform the practices [30,37,38]. However, as contexts vary from place to place, it is rare to find a comprehensive methodology that can guide an analysis of the actual institutional setting in which teachers work [1,21]. In this regard, the methodology applied in this study gives a potential alternative for PD program designers to investigate the actual situation that teachers are in and consequently to design PD that considers this situation. This study's focus on mathematics teachers' working situation and its implications on reform vision implementation and on their PD in the context of a developing country are another contribution. To the our knowledge, there are few studies that have been conducted on this topic in the context of developing countries (especially in Africa) [24]. Therefore, this study adds a new topic to the body of studies on the contextual analysis of teachers' practices vis-à-vis mathematics education reform and its implementation in Africa.

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