Collaborative learning in virtual space and learning in the physical workplace: The case of in-service public-school teachers in India

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Abstract

The existing approach to in-service teachers' professional development in the Indian public-school education system has often been criticized on grounds of ineffectiveness. In recent years, peer-driven, technology-mediated online communities of government school teachers built around their common interests have emerged as an alternative avenue to engage with peers. In these communities, teachers themselves drive their learning and professional development in a bottom-up manner by focusing on finding solutions to problems specific to their contexts.

In this study, the emergence of such decentralized, peer-driven, technology-mediated communities of learners was examined. The focus was on understanding the ways in which teachers learn within these congregations, and how they 're-contextualize' the knowledge thus gained to reflect the realities of their physical workplaces for implementation within classrooms. Another question concerned the nature of communities that emerged when these teachers from geographically distributed schools came together in virtual spaces.

The interpretive case study was used as the primary methodological approach. Data from three different virtual groups of teachers was analyzed and seventeen teachers belonging to these groups were interviewed in order to understand their experiences in the virtual groups, as well as the utility of the groups for discharging their responsibilities as a teacher. The respondents for the study were selected through purposive and snowball sampling.

The data revealed that the virtual groups acted more as problem-solving or information sharing platforms and in-depth discussions were absent. The physical communities played a significant role in lives of teachers despite the wide prevalence of and participation in virtual groups. Broader social factors influenced the opportunities, as well as the nature of participation in the virtual and physical groups. These factors are delineated, and their impact on participation and learning are explicated. The 'recontextualization' of learning for application in physical context was not found to be a separate activity but an inherent part of the teacher's participation in virtual spaces.

The implications for policy and practice, as well as for the existing understanding of learning of teachers within virtual spaces in a situation where the community members (in-service teachers) are located within geographically distributed workplaces are discussed.

Acknowledgments

A thesis bears the name of a single person, but in reality, its successful completion is made possible only with the contribution of several individuals. Though it is impossible to name everyone who has helped me in my journey, I would like to take this opportunity to thank some people whose contributions were direct and significant.

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Chapter 1: Introduction

The phenomenon of interest

Professional development in the public elementary education system in India has relied on top-down, institution-based training (Azim Premji Foundation, 2010)that has been criticized on the grounds of inadequate coverage, high cost, and questionable effectiveness (Chudgar, 2013; NCTE, 2009; Ramachandran et al., 2016). At the same time, the emergence of information technology as a factor in shaping professional practice and development is evidenced in the attempts of many teachers in the public system to create informal professional development networks (see Appendix 1 for a list of some of these initiatives). Edusafar, Education Innovation (EI) Bank[1], or other teacher-driven newsletters, blogs, YouTube channels, and Facebook and Whatsapp groups are all examples of this phenomenon of self-driven attempts to create technology-mediated forums for professional sharing and professional enhancement. These examples of technology-mediated forums are built around a common point of interest, for instance sharing of innovative experiments, or meeting administrative and professional needs of the teachers, or helping them prepare for promotion-related examinations. This emergent phenomenon of 'Government (Public) School teachers voluntarily coming together in virtual spaces for learning purposes by using technology-based platforms', either organically, or with the aid of a peer or an external, non-departmental actor, is the broader phenomenon that is being studied.

The relevance of the phenomenon

Peer-driven networks of learners within the public education system are important because:

(1) they contrast the traditional model of professional development (Macià & García, 2016) which is based on an expert-driven model of instruction, is built around the teacher as a passive recipient of knowledge, and is driven by a curriculum that is based on theoretically derived understandings of what is worth knowing;

(2) they place 'practice' at the centre of knowledge that is worth knowing; assign an agency role to the teacher as both producer and consumer of knowledge, thus illustrating the phenomenon of "*prosumption*" (Ritzer, 2010); and focus on innovative experiments of the practitioners that are considered worth sharing.

In other words, they afford the possibility of complementing formal professional development practice with a decentralized peer-driven approach to learning that (a) privileges the voice of the practitioner, (b) valorizes the contextualized practice of the practitioner, (c) derives its curriculum from learning at the workplace, (d) is conscious of efficiency of delivery in terms of cost and reach, (e) and aims at developing a community of learners that can share its practice-based knowledge and work collectively so that classroom or school practice can improve.

The context of the study

The states of Gujarat and Maharashtra have seen the rise of several technology-mediated forums of government school teachers built around a common point of interest. One of these, 'Teachers as

[1] Education Innovations (EI) Bank is a clearing house for the practice-based, context-specific innovations of the Government Primary School teachers. These teachers largely depend upon their own creativity and resourcefulness to transform the socio-economic constraints to schooling. These innovations are categorized and hosted at http://www.inshodh.org/about/history . Ravi J. Matthai Centre for Educational Innovation (RJMCEI) at Indian Institute of Management Ahmedabad coordinates the project.

Transformers' (TAT)[2], is a network of more than 6000 innovative teachers from government schools in the states of Gujarat and Maharashtra (India). This network emerged from a physical network that was initiated in the early 2000s and was driven by a group of teachers under the guidance of a higher education academic institution for about a decade. The move to a technology-mediated platform was initiated in 2012, in two locations, Solapur in Maharashtra, and in Gujarat, the latter through the initiative of Ravi J. Matthai Centre for Education Innovations (RJMCEI) at IIM Ahmedabad. The innovations that are shared by the members are not R&D based but are practice-based innovations (PBI) (Ellström & Nilsen, 2014). PBI can be defined as a 'modification' in workplace operations as a result of conscious efforts of employees involved, leading to some 'improvement' (in efficiency, effectiveness, or outcomes) in the work practices. This modification is made possible by the 'learning' that happens during the work and gets manifest in the conversion of 'implicit' knowledge that gets generated during work into 'explicit' knowledge, thus making the change visible (Ellström, 2010). Through these innovations, the teachers solve the context-specific problems that they face in their schools and classrooms. Not all the teachers in the TAT network are innovators in the classic sense of the term[3] (Ellström, 2010; Jensen, Johnson, Lorenz, & Lundvall, 2007). While some innovate actively and create something novel, others modify these innovations to suit their specific context. Several teachers are a part of the network but do not share or discuss anything in public, and it may be difficult to identify the benefits that they derive from being part of the network.

RJMCEI has been documenting the work of these teachers for several years. A website (http://www.inshodh.org) systematically collates and presents all the innovations done by these teachers. The repository is famous as Education Innovation (EI) Bank and for this study, I use this name instead of TAT A Facebook (FB) group of these teachers (and a separate Facebook group of women teachers) act as the primary public platform where these teachers can share or discuss their work. These teachers are geographically spread across the two states, and most of them have never met each other physically. It is only through these virtual spaces (website and FB group) that they come together to share their work, discuss and comment on others' work, or to clarify the doubts they may be having about various issues related to the activities of the group or its members. The InShodh website acts as a central repository where no discussions happen, but all innovations shared by the teachers are systematically listed. Thus, it gets referred to frequently by the individual teachers. In their day-to-day lives, it is the FB group that makes the continuous existence of this community possible by bringing members together. It is the participation of teachers in this virtual community that makes the existence of this network 'real' and gives significance to it. Hence, EI Bank network can be considered as a virtual entity.

Beyond EI Bank, there are several geography or interest specific technology-mediated forums (including websites, blogs, Facebook or Whatsapp groups, and mobile applications) in Gujarat and Maharashtra. These have been created 'by teachers' and 'for teachers.' Their focus could vary from sharing administrative information, to creating and sharing content for professional development (e.g. departmental promotion examination material; administrative hacks) or for improving classroom effectiveness (e.g. grade and subject specific questions or activities). While some groups have a membership in hundreds, others could have more than several thousand individuals accessing the content. It is these virtual networks of teachers and the way members participate within these virtual networks to enhance their learning that is the focus of this study.

[2] Appendix-2 contains the list of all the abbreviations used in this document.

[3] See Jensen, Johnson, Lorenz, & Lundvall (2007) for the contrast between classic way of defining innovations (Science, Technology, and Innovation mode) as opposed Doing, Using, and Interacting (DUI) mode, and see Ellström (2010) for a definition of practice-based innovations.

Virtual Communities of Interest (COI) within the context of Computer-supported Collaborative Learning at Workplace (CSCL@Work)

The learning that happens in groups with the help of computer-mediation (including online) is studied under the label of Computer-supported Collaborative Learning (CSCL) (Stahl, 2006). The focus of CSCL has primarily been the learning that happens within academic contexts. Within the workplace, Computer-Supported Collaborative Work (CSCW) has been the label used to describe studies which examine computer-mediated collaboration to achieve efficiency and effectiveness in work, that is, knowledge management and not learning. Goggins and Jahnke (2013) suggest that there is a need to study the CSCL that happens in the workplace owing to the possibilities of collaboration via social networking and terms this area of study as CSCL@Work (Computer-supported Collaborative Learning at Workplace). The focus, according to them, should be *"on making collaborative learning in the workplace explicit through social media and other collaborative technologies integrated into workplaces"* (p.1). Workplace learning scholars (e.g. Brown & Duguid, 2001; Eraut, 2011; Eraut & Hirsh, 2010; Hager, 2011) have engaged with practice-based, context embedded learning within workplace, much of which happens outside formal learning spaces and events. The present study aims to explore this area and study the way learning emerges specifically within virtual public discursive spaces (Pfister and Knowolton, 2010) when individuals from physical workplaces come together online.

The virtual collective for learning that forms the unit of study under CSCL@Work can be identified using the typology suggested by Henri and Pudelko (2003): a collective that can be either strong or weak on intentionality and high or low on degree of cohesion. A collective with weak intentionality and low degree of cohesion is called a Community of Interest (COI). The "interest" is defined by the desire to solve problems, usually complex problems, that can benefit from the diverse perspectives, experiences, and expertise of the collective's members (Fischer, 2001; Henri & Pudelko, 2003). In contrast, collectives with strong intentionality and high degree of cohesion are termed Communities of Practice (COP) (Wenger, 1998; Wenger et al., 2002). In COP, members are involved in a single 'practice' and are part of a single 'knowledge system' (Henri and Pudelko, 2003; Fischer, 2001). In this study, we adopt the COI as the unit which engages in computer-supported collaborative learning at work. The justification for this approach is provided by Chand (2012), who notes in a background note prepared for a project to network teachers that in the public education contexts of developing countries characterized by strong hierarchies and deference to authority, loose networks of teachers focusing on just sharing of work in a non-threatening environment, would facilitate the emergence of a socio-educational entrepreneurial identity for the group. However, the artifacts developed by the members of the collectives and their physical workplace contexts play a key role in the creation and sharing of knowledge. Thus, we also use socio-material perspective (Fenwick, 2009) to understand the processes that happen within this community with the mediation of learning by artifacts in the workplace.

The participation in one virtual group does not rule out the participation in other similar groups. The teachers create their own Personal Learning Networks (PLN) with an aim to learn (Nikolaou & Tsolakidis, 2013) and the participation in different groups may vary from being a silent spectator to being active. The learning also depends on other factors including the individual's disposition, affordances offered by the workplace, and the teacher's agency (Billett, 2001, 2011).

Because of diverse participation in multiple groups, the relationships within these different groups may vary. Additionally, the teachers remain embedded within their physical workplaces and the boundaries between the physical and virtual remain permeable (Shumar & Renninger, 2002). The participation in virtual groups impacts the interactions and relationships within physical spaces (Wellman, 2000). The possibilities offered by virtual spaces for democratic participation has been argued as a way to overcome the limitations of the physical interactions. These virtual discursive spaces (Pfister & Knowolton, 2010) have been assumed to free the individual of the constraints of

the physical spaces including the power and hierarchy structures within the organization. In this study, the interactions in virtual spaces are also analyzed to understand the nature of community that emerges.

Studies focusing on digital workplace learning and how such technologies can bridge formal and informal learning at the workplace are scarce (Ifenthaler, 2018, p.4). In the field of education, according to Burhan-Horasanli and Ortaçtepe (2016), most studies that explored use of ICT for promoting learning through reflective practice have looked at only pre-service teachers, or at best, novice teachers. Only one study (Bean and Stevens, 2002) compared trainees (pre-service teachers) with experienced practitioners (in-service teachers). These authors found a significant difference between these two groups in terms of *"how the former drew more on their personal belief systems and text references and shied away from referring to local contexts, while the latter also discussed their pedagogical decisions with more emphasis on local references"* (as cited in Burhan-Horasanlı & Ortaçtepe, 2016, p.373). Similarly, studies on teachers' informal online collaborations for professional development (PD) are rare (Macià & García, 2016). Even when studied, the focus of these researchers has been the networks and communities specifically created for research purposes, and usually within university environments (Macià & García, 2016).

Thus, it makes sense to look at workplace collaborative learning as separate from the collaborative learning in academic settings. It can be expected that the situated experiences of the in-service teachers within the local context of their physical workplaces will remain salient in the learning that takes place as opposed to the abstract, theoretical knowledge in academic settings. The present study addresses this missing link by studying the way in-service teachers (experienced practitioners) come together in virtual spaces to learn while being embedded within their physical workplaces and how their learning gets impacted as a result of this collaboration in the virtual space.

Research questions

In the context of the present study, the Government Primary Schools (GPS) in the state of Gujarat are the workplaces for the teachers. Traditionally, there has been an assumption of absent or negligible virtual interactions among the teachers, especially with the specific aim of learning. When the teachers (employees) in this geographically distributed traditional organization voluntarily come together in a virtual social-network with an aim to learn from others, the opportunities for interaction and learning increase substantially. We are building on the premise that when teachers come together in virtual spaces and interact, learning happens. Owing to its geographically distributed nature, computer (or ICT) mediated communication is what makes learning feasible in this group and hence, it can be seen as computer-supported collaborative learning at workplace (CSCL@Work) (Goggins & Jahnke, 2013). Fischer (2013) created a conceptual framework for CSCL@Work to explain the learning that happens in this situation. Distributed cognition; integration of problem framing and problem solving (PF-PS); domain-oriented programmable design environments (DoPDE); and communities of interest (CoI) are the four key components of this framework. The purpose of the framework is to facilitate the empirical work to capture learning within CSCL@Work context, but it does not help us understand the way this learning happens. Thus, we ask the first question:

Q.1: *How does learning happen for teachers when they come together in a virtual social network?*

In the context of spatially (geographically) distributed traditional workplaces, the opportunities for conscious and selective interaction increases substantially with the introduction of computer-mediated communication. When employees come together in online communities to interact and learn, a clear demarcation between the interactions happening in the virtual and the physical spaces cannot be done. All the network members have simultaneous virtual and physical presence, and the nature and intensity of their social interactions and activities in the two spaces may vary. Membership in virtual communities allows individuals to connect with people through 'conscious'

and ‘selective’ participation in multiple communities simultaneously based on their common interests (**Figure 1**). Virtuality makes it easy to join or leave a group, though the membership in physical communities is likely to be more stable and permanent. As a result, a dynamic and temporal view of community membership is required.

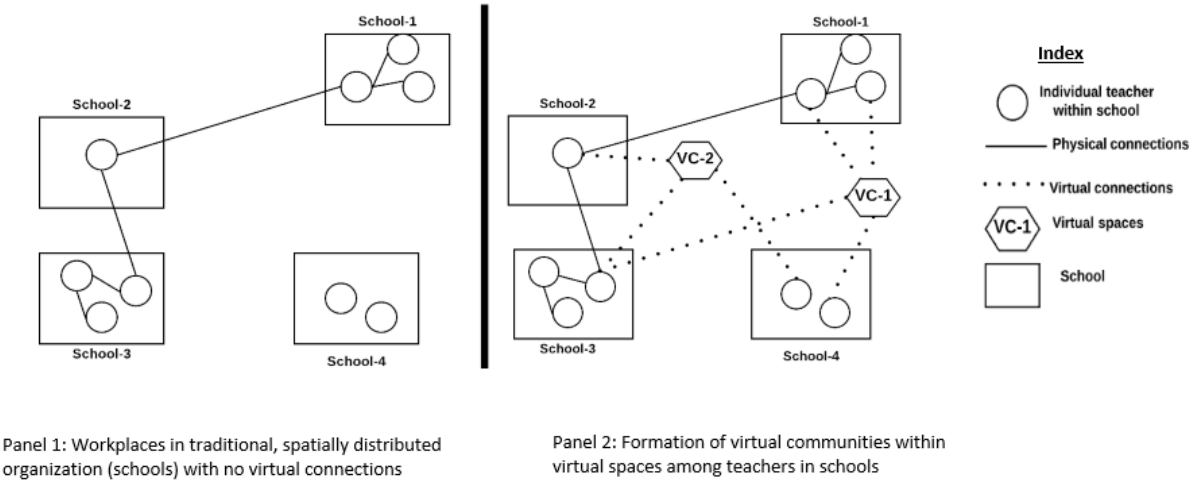

Figure 1. Physical and virtual interactions among members in a traditional, spatially distributed organization

It is this simultaneous presence in physical and virtual spaces, and the opportunities for diverse interactions that shapes the nature of the ‘emergent’ community.

In workplaces, learning and knowledge creation does not happen in isolation from work-practices (Brown & Duguid, 2001). It is a result of an *“ongoing interaction of problem setting and problem-solving”* (Dougherty, 2004, p.46) leading to workplace learning (WPL) for the people involved. Also, the interactions among the people involved (employees), their context, their relationships (with the task, and with each other), and the task itself (Schatzki, 2001; Price et al., 2012) are critical for the evolution of this learning. The traditional ‘situated’ nature of the work does not change despite participation in virtual communities and the ‘action’ will always happen in the physical workplace which requires application of ‘context specific’ knowledge. We hope to understand the ways in which the learning from virtual spaces gets contextualized by teachers to make it useful for application in physical workplaces. This is the focus of the second question:

Q.2: ***How does the learning acquired by the teachers through their participation in the virtual communities get re-contextualized for application in the physical workplace?***

We expect that owing to the possibilities afforded by the medium of interaction, the nature of the communities that emerges in this scenario will be significantly different from the communities existing without virtual connections. The glue binding teachers, the nature of their interactions, and the nature of content discusses in virtual spaces is unlikely to be the same as for the physical groups, but both kind of communities will co-exist. Thus, we need to understand the nature of these new communities and their relation to the older communities. For this, we ask the following questions:

Q.3: What is the ‘nature of the community’ that emerges when the practitioners (in-service teachers) from a traditional, geographically distributed organization come together in a virtual social network to learn from each-other?

Finally, we explore the impact of the participation of teachers in virtual communities on the interactions that happen in the physical communities that they are a part of.

Q.4: ***How does the participation in virtual communities impact the nature and extent of interactions (e.g. vigor, diversity, focus) that happen in physical communities?***

Methodology

To study the phenomenon, the interpretive case studies approach (Stake, 1995, 2006) was used. As a method, it allows the researcher to interact directly with the research participants and engage intimately with them to gain an understanding of the phenomenon of interests. I chose the virtual groups and the physical groups that its members are associated with as the tentative cases. Three virtual groups of teachers were selected (purposive sampling) for this study (EI Bank, North-4 Taluka Social Science Teachers' Group, and Central-3 District ICT Group). Of these, two were initiated by the teachers of a specific geographical area while the third (EI Bank) was started by RJMCEI as a platform to allow teachers to share and access innovations happening within the context of government primary schools. The posts and chat history of these groups were analyzed to understand the nature of content and interactions. Further, seventeen teachers from these three virtual groups (VG) were interviewed to understand their participation in these VG and how it connected with and impacted their participation and learning within the physical groups (PG) that were salient for them. The inductive content analysis (Elo and Kyngas, 2007) was used to analyze the data. Intragroup analysis was followed by intergroup (cross-case) analysis (Stake, 2006). While analyzing the VG data and during the interviews with the teachers, several artifacts that mediated the interactions or were created by the teachers were also analyzed to understand their role in the groups, as well as in teacher's learning and its application within the classroom.

Organization of the thesis

The next section (chapter-2) presents the existing research on the phenomenon of interest. In chapter-3, I describe in detail the research methodology used to select sample and collect and analyze data. Chapter-4 presents the detailed data analysis including the individual and the cross-case analysis. Finally, in chapter-5 I discuss the findings arising from the data analysis, situate these within the existing literature, and draw conclusions to extend the theory of CSCL@Work. Further, implications of the findings for the practitioners are discussed, along with limitations of the study and possible future avenues that researchers can explore to better understand the phenomenon.

Chapter 2: Literature review

The existing status of teacher professional development in India

The quality of education in schools is significantly influenced by the capabilities of the educators. In the Indian context, teacher shortage (Ramachandran et al., 2016) and absenteeism (Muralidharan, Das, Holla, & Mohpal (2017) found 23% teachers absent in rural India) is a major issue. Beteille (2009) showed how political interference results in teachers seeking political patronage for administrative works like transfers. Even when the teachers are present, teacher quality remains a big concern (Chudgar, 2013). Teacher effectiveness (measured through impact on student outcomes) vary widely even in private English-medium schools (Azam & Kingdon, 2015). The poor quality of pre-service teacher education has been highlighted by several actors including National Council for Teacher Education (NCTE), the agency responsible for governing the teacher education institutions within India (e.g. Deswal, 2017; NCTE, 2009; Srinivasan, 2015). Thus, the teachers join school unprepared for the task they are expected to perform.

Within schools, the roles and responsibilities of the teachers are shaped by guidance framework documents like National Curriculum Framework-2005 or the Right of Children to Free and Compulsory Education Act-2010. These require teachers to have an "*adequate understanding of curriculum, subject-content and pedagogy"* but they are also expected to engage with the community and school structures and management (NCTE, 2009, P.2). Bhattacharjea, Wadhwa, & Banerji (2011) found no correlation between specific teacher characteristics (years of experience, gender, age, educational or professional qualifications) and students' learning outcomes. Azam & Kingdon (2015) found similar results with one exception. In their study, the only significant teacher characteristic was a postgraduate (or above) qualification. In a scenario with non-existent, insufficient, or ineffective in-service training, such findings are not surprising. Since the present study concerns in-service teachers, I will now briefly discuss the mechanism and the state of professional development for in-service government school teachers in India[4].

The hierarchy of in-service teacher training institutions

In India, school education is the collective responsibility[5] of the states and the union government. The states have their own administrative structures to govern the schools and teachers (including their training)[6]. While NCERT (National Council for Education, Research, and Training) is the principal organization governing school education, each state has its own SCERT (State Council for Education, Research, and Training) responsible for administration of public schools. The major funding for establishment of the two institutions for in-service teacher training (Institutes of Advance Studies in Education (IASE) at the state level and the District Institute of Education and Training (DIET) at the district level) was provided by the Union government (Ramachandran et al., 2016). Together with the SCERTs, these two institutions were provided the specific mandate to focus on in-service teacher training (NCTE, 2009). Block (Taluka) Resource Centres (BRC) and Cluster Resource Centres (CRC) were established to provide regular in-service training to the teachers, as well as provide school-based support to them (NCTE, 2009). There are subject-specific experts at the block level called

[4] For a detailed history and policy perspective of teacher quality and teacher education in India, see NCTE, 2009.

[5] Education is a part of concurrent list of the constitutions which means that both the state governments and the union government have power to legislate on the subject. The laws passed by the parliament are usually taken as model acts but the states have the freedom to remove or modify the provisions of the central act. Both, the state and the union government share the responsibility to provide finances for education.

[6] Only certain category of government schools like Kendriya Vidyalayas (Central Schools) and Jawahar Navodaya Vidyalayas are directly governed by the central government.

Block Resource Persons (BRP) and each cluster has a Cluster Resource Centre Coordinator (CRCC) who are expected to act as frontline resource persons, provide pedagogical support, and act as mentors for the teachers. The elementary school teachers are expected to undergo at least twenty days of training. The teachers themselves are provided opportunity to work as resource person or teacher-trainer in the cluster or block level trainings. Thus, the policy provisions have been made for professional development of the school teachers.

The performance of in-service teacher professional development efforts

Ramachandran et al. (2016) prepared a report on the basis of a nine-state research to understand the status of teachers within India. They found that none of the states in this study had an effective in-service training policy for teachers. Much of the training happened in an ad hoc manner, and was almost exclusively funded by the money flowing from Sarv Shiksha Abhiyaan (SSA) and Rashtriya Madhyamik Shiksha Abhiyaan (RMSA), both Centrally Sponsored Schemes. Even then, most states did not utilize the funds made available for the purpose. For example, in 2012-13, only 50% of the funds were utilized, although the exact utilization varied from 80% (for Maharashtra) to 3% (for Bihar). At a national level, only 35.7% teachers received training. At school level, 60% of the schools had less than 10% of their teachers receiving training while only 30% schools had 90% of their teachers trained at least once (Ramachandran et al., 2016, p. 147). Even when trainings happen, their effectiveness is questionable. For example, there are formal teacher evaluation processes in several states on paper but in practice, they are non-existent (Ramachandran et al., 2016, p.149). It is in this context that the efforts of the teachers to voluntarily come together in virtual spaces need to be considered[7].

Despite all provisions, the institutions responsible for the teacher professional development have failed to perform their mandated function (NCTE, 2009) in most of the states. The state of these institutions was so bad that the Planning Commission had made funding to them contingent on their review, restructuring, and reorganization(Akai & Sarangapani, 2017). The non-availability of qualified faculty was identified as a key challenge for DIETs, with the trainers themselves being unqualified and/or inexperienced. The infrastructure (including library resources and facilities for accommodation of teachers arriving for training) is inadequate, while research is sporadic or non-existent (Azim Premji Foundation, 2010; NCTE, 2009). The institutions lack leadership, are governed in top-down manner, and are often poorly managed (Azim Premji Foundation, 2010). Even when the trainings happen, the interactions are usually unidirectional and teachers' voice is not heard (ibid). Aiyar & Bhattacharya (2016) found similar observations for interactions between the Block Officials and the CRCC, as well as CRCC and teachers where the interactions were purely transactional and lacked any hint of mentorship.

The situation on-ground

The insufficiently trained teachers are faced with a situation where they are expected to discharge their academic and administrative responsibilities but are not provided with requisite capacity-building opportunities. The actors responsible for the capacity building of teachers and mentor them (BEO, BRP, CRCC) are themselves incapable of performing these functions. Aiyar & Bhattacharya

[7] Since the concern of the present study is the state of Gujarat, it is worth mentioning that no study or report is available that directly concerns the in-service training of the teachers in the state. On parameters like fund utilization and number of teachers trained for which data is available, Gujarat is one of the top performers (Ramachandran et al., 2016). The Gujarat Council of Elementary Education (2016) had also uploaded a tentative 8-day schedule of Block level teacher training for FY 2016-17 on its website, although no similar schedule is available for 2017-18 and 2018-19. Yet, several challenges remain. For example, the Block Education Officers are expected to visit each school in Block at least once every year, but they often are responsible for more than 300-400 schools and the target is impossible to accomplish.

(2016) found that these functionaries (including teachers) blamed all factors outside their control for poor learning levels (e.g. poor policy, ineffective administrators, lack of support from parents etc.) but their own roles were never considered as crucial to outcomes. These actors see themselves as powerless cogs in the wheels with little agency; individuals who are expected to implement orders received from the top. Aiyar, Dongre, & Davis (2015) argue that the organizational culture and management practices need to change if any change is to happen on ground. This will also require a change in the cognitive maps (Mehta & Walton, 2012, as cited in Aiyar & Bhattacharya, 2016, p.62) and attitudes of the administrators and last-mile actors. In addition, the line agents (teachers, cluster, and block-level officials) will also require *"the time and tools to enable deliberation, reflection on information and feel confident in their authority to respond [to the needs of the situation]"* (Aiyar & Bhattacharya, 2016, p.69).

Given the situation described above, it is no wonder that the efforts for teachers' PD fail to serve their purpose. It is in this context of policy and practice that the role of alternatives to the traditional PD mechanism needs to be considered. I will now analyze the existing research on learning in the workplace, the nature of schools as a workplace, put the teachers' learning in schools within this context, followed by the nature of computer-mediated learning in workplace. Further, I look at the research on teachers within virtual networks, the nature of communities that arise in such situations, and the factors that shape these communities.

The nature of work, workplace, and learning in workplaces

Workplaces as networked spaces

Today, the access to internet via affordable smartphones and other devices has allowed employees to stay connected with others within and outside their organizations with ease. Outside the arena of the formal communication platforms used by certain organizations for intra-organization communication, the social media platforms like Facebook, Twitter, and the internet-based messengers like Whatsapp are being widely used by employees. These are free and allow huge flexibility in sharing a variety of media including text, images, documents, audio, video, etc. In the state of Gujarat, in recent years, public school teachers are shifting to smartphones since Whatsapp is now being used not just for informal but also for formal communication across the hierarchy. In addition, very recently, even official professional development has moved online[8], encouraging the teachers to have smartphones as an easier alternative to school-based computer connectivity. Thus, I am basing my literature review for this study on this assumption that the employees today are a part of the networked society described above.

In several organizations (e.g. IT companies), a lot of work is definitely being performed remotely, but a significant chunk of 'work' in most organizations is still performed in the physical workplaces. For example, while the teachers are part of virtual networks, their work is still primarily located in their physical workplaces, i.e. schools. The students come to school to study and the content is still delivered inside the physical classroom.' Same is true for other organizations like hospitals, manufacturing industries, or even service industry (e.g. barbers or restaurants).

While the employees can collaborate and learn from each other irrespective of the boundaries of their workplace, certain portion of the work gets performed within physical spaces by physically collocated workers. It is therefore pertinent to consider the nature of work, learning of employees, and the link between the two separately, as well as in conjunction.

[8] The training is being provided through project Samarth (http://samarth.inshodh.org/), a collaboration of SSA Gujarat and RJMCEI, IIM Ahmedabad.

School as a workplace

In this thesis, I am concerned with the school as a workplace. Educational institutions (including schools) have been referred to as loosely coupled organizations (LCO) (Weick, 1976). In LCO, the parts are coupled with each other in the sense that one is responsive to the happenings in other parts, but they also preserve their own identity and have logical and/or physical separateness. "Their attachment may be circumscribed, infrequent, weak in its mutual affects, unimportant, and/or slow to respond" (Weick, 1976, p.3). For example, the teacher inside a classroom has the flexibility to experiment independent of other teachers doing it, and this will not impact the working of the organization. Similarly, each school can be considered as being loosely coupled within the education system. Yet, in certain aspects, there are restrictions. For example, schools are tied together by standard curriculum and evaluations and bureaucratic control. The social organization of power arising from a range of institutional mechanisms constrain and control the work of teachers in schools (Ingersoll, 1991).

In addition, the schools are spatially (geographically) distributed organizations. In a large country like India, the law (The Right to Education Act, 2009) mandates the government to ensure that children have access to schools within safe and accessible distance from their habitations. This 'accessibility' is defined as less than 1km for children in pre-primary classes (grade 1-5) and 3km for upper-primary classes (grade 6-8) (RighttoEducation.in, n.d.). Consequently, there are schools with no more than two teachers teaching thirty children across grades 1-5 in schools located in remote, rural areas[9]. They may therefore not have easy physical access to their peers from other schools (e.g. the nearest Mathematics teacher may at least be some kilometers away). The nearest bureaucrats of the education department are usually located at the block/taluka[10] headquarter. This remoteness allows the teachers within schools a certain leeway to operate, but also has implications arising from minimal face-to-face communication and the bureaucratic nature of organization. As a geographically distributed organization, schools also have the limitation of not offering a continuous support group to such teachers. In addition, this geographically distributed nature of organization leads to the creation of very diverse socio-cultural contexts so that individuals are practically left to tackle the 'localized' challenges on their own, especially in an era where internet was not accessible. Because schools are LCO, online communities provide a good opportunity for the individual teachers to learn from people outside physically co-located groups and implement their learning without being restricted by other teachers in the school.

Since the focus of my research is on teacher's' learning, I also want to briefly mention about schools as learning spaces at the outset. Teachers are part of schools and education departments where the end goal is 'student learning outcomes.' Consequently, schools are geared to act as learning spaces for students but not explicitly for teachers. The problem is accentuated by scarcity of resources which further pushes teachers' professional development to a lower pedestal, and as a result, their own learning suffers (Hodkinson & Hodkinson, 2005).

The nature of teachers' work in schools

The primary role of a teacher is to focus on the academic learning of her students in the classroom. Besides, a teacher is expected to work on the non-cognitive development of the students. Government schools in developing countries like India are understaffed (with high pupil-teacher

[9] The policy considers pupil-teacher ratio as an important parameter. Yet, the budgetary constraints result in allocation of teachers based on total enrollment thus resulting in multi-grade teaching.

[10] In India, a state is divided into districts, which is further divided into blocks or talukas, which are the sub-district headquarters for a cluster of villages. Gujarat state, where the fieldwork for this study was carried out, has a population of over 60 million. The state is spread over 196,000 sq. km and is divided into 33 districts of varying sizes. Dang is the smallest district with an area of 1,766 square km and has three blocks constituting more than 300 villages. Kutch is the largest district with an area of 45,674 square km and has 10 blocks constituting more than 600 villages.

ratios) (DISE, 2017; Ramachandran et al., 2016), resource constrained (poor infrastructure, insufficient teaching-learning aids, insufficient funds for maintenance), and there is hardly any support staff (e.g. clerks, peons, data entry operators) available for non-academic tasks (NCERT, 2017). Thus, the teacher's job responsibilities go well beyond academics. In India, teachers are responsible for all the clerical work, student enrolment (by visiting all families in the village), monitoring the preparation and distribution of mid-day-meals[11], administration of other state or central schemes for students, and the maintenance of the school premises. The teachers are frequently roped in by the government to help with welfare scheme implementation and other administrative tasks like conducting population census, cattle census, voter registration, collecting health statistics, enrolment of villagers for various government schemes, etc. (Jhunjhunwala, 2014; Sharma, 2018b). In addition, their in-class performance of work is also linked to context specific challenges. The students in government schools come from the weakest socio-economic backgrounds (Majumdar, 2004) with poor access to economic, social and cultural capital (Bourdieu, 2011). At times, they work in physically inhospitable terrain and leaky or nonexistent classrooms, and face insensitive bureaucrats (e.g. Pande (2018)). Thus, the teachers need to perform work that is well beyond their standard job description, and also ensure that the students learn inside classrooms. On the one hand, the teachers face harsh circumstances but are targeted by the media and governments for the poor learning outcomes in their classrooms (Ramachandran, 2018). On the other hand, the issue of teacher absenteeism (Muralidharan et al., 2017), the interference by teacher unions and politicization of teacher administration (Beteille, 2009), and incompetence of teachers teaching in government schools (NCTE, 2009; Ramachandran et al., 2016) cannot be denied. Both these aspects need to be understood if one is to get a holistic picture of the landscape in which teachers work. The structure of Indian school system and the context-specific challenges are further discussed in research context in chapter-3.

Teachers' position in the hierarchy of educational bureaucracy has implications for the agency that they have in their classroom, school, and within organization. Kumar (2011) calls the teacher a 'meek dictator' with some semblance of 'control' over children but no choice in curriculum planning, selection of teaching materials, or any other tasks which are totally governed by administrators. While new opportunities are created for a teacher's learning and professional development (and consequently for her self-image and motivation) through social networking, the phenomenon is layered and complex. These virtual groups and the interactions within them are not independent of the teacher's position in the organization, as well as the institutional character of school within education department, and these need to be problematized.

In the preceding paragraphs in this section, I have tried to set the context of the study, describing the nature of work, worker, and workplace that are of concern to this study. I will now discuss the research in workplace learning with a specific focus on how it gets impacted by availability of computer support in networked workspaces. I will also discuss the learning of teachers and make an attempt to integrate it with the existing literature on computer-supported workplace learning.

Learning in a workplace

In the context of the workplace, I am concerned with the learning of adults (employees) which happens outside any formal institutions of education or formal learning (including in-service training programs). With its focus on solving the practical contextual problems, learning in the workplace is very different from learning that happens within academic settings (Resnick, 1987).

[11] All the students in the government and government-aided primary schools (grade I-VII) across India are provided with cooked meals for a minimum of 200 days in a year with 300 calories and 12 grams protein (700 calories and 20 g protein for children in upper primary classes). It is a centrally sponsored scheme and usually, the school teachers are responsible for its administration and management. More details available at http://mdm.nic.in/mdm_website/

Since the focus is on teachers' learning, and the workplace for teachers is school which is a formal institution of learning, a clarification is necessary here. The teachers are responsible for learning of children, and this learning is 'academic' in nature and imparted within 'formal' learning institution (school). The teachers perform the 'work of teaching' (alongside other work as discussed above). Their own learning that happens in the context of the performance of this work as they try to solve practical contextual problems (as suggested by Resnick) is what I call workplace learning (WPL). This adult learning is different from a child's learning in another way. Cairns & Malloch (2011) argue that Vygotsky's idea of learning happening by expansion of the zone of proximal development (ZPD) through scaffolding is a feature of children's learning. Adults learners may act as *"self-scaffolders, and even [learn] without any necessary scaffolding"* (p.8). It is in this context of learning of adults (teachers) within their workplaces (school) that this review of literature is located.

Work, workplace, and learning

Workplace is the arena of action where individuals interact with each other and act, either individually or in groups, to produce desired work outcomes. Work is an *"intentional or purposive act [requiring] application of effort [t]o initiate an activity or respond to an issue or problem in a range of situations for some perceived (by the worker) productive end"* (Cairns & Malloch, 2011, p.6). It is not just the outcome but also the continuous flow of activities leading to that outcome (Dougherty, 2004) and ''is carried out through 'work-practices' (Brown & Duguid, 2001) which are contextual and dynamic, thus demanding ongoing learning.

While the work may take place within a physical space, the learning may not be thus bounded. Traditionally, the '*learning spaces*' have been considered as physical spaces where individuals work with peers, and in the process develop their skills and learn (Kersh, 2015). The association of employees within virtual networks has brought '*virtual learning spaces*' into focus and here, the learning could be inter-personal (social interactions), or intra-personal (cognition and reflection) in nature (Cairns & Malloch, 2011). Solomon et al. (2006) argue that the 'everyday learning at work' happens within '*third spaces*' which are *"neither fully personal/social, nor completely workspace, but something in between."* For example, employees in a canteen during lunch break or teachers in a staff-room in a free period. This 'on' and 'off' the job learning happens in hybrid spaces where *"social and work overlap in terms of time and space"* (as cited in Cairns & Malloch, 2011, p.19). Murray, McNamara, & Jones (2014) see third spaces as allowing employees to engage in high quality learning through *"critical inquiry about their own and colleagues' professional practices, in relation to the social, political, and cultural contexts within which [the practice] is embedded"* (p.310).

Nature of workplace learning

According to Evans, Hodkinson, Rainbird, & Unwin (2006), **learning** may be conceived as *"the process by which human capacities are expanded"* and **workplace learning** as the process by which human capacities are expanded *"in, for, and through the workplace"* (p.15). This expansion of capacities can be understood as *"a systematic change in the behavior [and gaining of new] knowledge informed by experience"* and gets manifested in form of new skills and higher expertise (Cairns & Malloch, 2011, p.15).

In the context of the workplace, most learning is informal in nature and happens in the workplace itself because of challenges of the work or through collaboration and consultation with others while performing work (Eraut et al., 2000, as cited in Eraut & Hirsh, 2010, p.25). ""By definition, all the learning that happens in workplace outside the 'clearly defined formal learning situations' can be considered as informal learning. Eraut (2011) found that more than 70 percent of learning in the workplaces he studied was non-formal. Much of it is incidental, unconscious, idiosyncratic, serendipitous, and unplanned, and is driven by the needs and motivation of people involved. It may happen as a consequence of networking, mentoring, coaching, or trial and error, or even as self-directed learning (Marsick and Watkins, 1990, as cited in Le Clus, 2011, p.361).

The process of learning involves listening and observing, reflecting, seeking or giving feedback, locating resourceful colleagues, and mediating artifacts play a critical role in it. It takes place in social situation in the spaces where people congregate for activities, events, or discussions, and can be considered as "complementary to learning from everyday experience" (Le Clus, 2011, p.361). According to Eraut & Hirsh (2010), WPL can be impacted by several factors including the challenge and value of the work for the learner, the support and trust available from others, learning environment (which can vary from restrictive to expansive (Fuller & Unwin, 2004)), organizational culture, and individual-level factors like motivation, self-efficacy, personal agency, and relationships.

Work practices as the fulcrum of WPL

Brown & Duguid (2001) see workplace practice as the 'know-how of the employee to put her know-what into practice to produce work', i.e. having knowledge and ability to use skills to produce desired work outcomes via action. The 'practice' is not just the task but involves an interaction between the worker, her context, relationships, and the task (Schatzki, 2001). It includes *"the practical wisdom people rely on, and the rich, socially embedded clinical know-how that encompasses perceptual skills, transitional understandings across time, and understanding of the particular in relation to the general"* (Dougherty, 2004, p.37). The practices are always mutually connected, nested with each-other, and always in dynamic interaction with each other (Gherardi, 2006).

This practice is also not just problem-solving done to produce outcomes. According to Schön (1983), it also involves setting the problem, which involves figuring out the context specific requirements, the decisions to be made, ends to be achieved, and means available to achieve those ends. Practice is thus problem setting's ongoing interactions with problem solving (Fischer (2013) calls this as problem framing-problem solving). It is through these work-practices that work gets accomplished, and in process, workplace learning happens. Such learning is temporally inseparable from work-practices: *"learning is a feature of practice, and without practices, there can be no learning"* (Hager, 2012, as cited in Hopwood, 2014, p.352).

The nature of knowledge in workplace learning

Learning enables acquisition of knowledge. Eraut & Hirsh (2010) argue that in the narrowest sense, knowledge gets defined as '**codified knowledge**' that has been externalized in the form of books, documents, SOP etc. Performance of work requires both *codified* (generic and specialized) and ***practical* knowledge** which is usually tacit. Nilsen & Ellström (2011) refer to these as research-based knowledge (RBK) and practice-based knowledge (PBK) respectively. Such formal, explicit knowledge is unusable unless it is accompanied by a *"cloud of tacit knowledge"* and the social capital that individuals develop through relationships and networks makes this task easier (Eraut & Hirsh, 2010, p.61). ''"The **practice-based approaches** focus not on *knowledge* but ***knowing***. Rather than cognitive, it becomes performative: "*knowledge is not something that people possess in their heads, but rather something that people do together*" (Gergen, 1991, as cited in Gherardi, 2006, p.1). ""

The above argument tries to avoid fragmentation and take a holistic view of knowledge, and the evidence for this will come not from documents but actual observation of the performance of work. Knowledge and skills are thus practical concerns and are inseparable in the workplace. For example, the knowledge for riding a bicycle or swimming will be useless without the skill to perform these tasks. It is only a knowing-in-practice. Learning thus becomes the process of gaining more experience (and exposure) and an ability to apply it to solve practical problems at workplace. Another implication is that individuals at a similar level in hierarchy and who are part of the same team will not have the same learning trajectories (Eraut & Hirsh, 2010).

Approaches to workplace learning in research

Hager (2011) provides a historical evolution of theories of learning in the workplace. For this section, I draw primarily on his work but also bring other researchers to provide a perspective on WPL theories. Hager suggests that WPL theorist have followed three major approaches: individual, social, and sociomaterial or postmodern.

According to Hager (2011), the initial focus of WPL theories was on the individual's learning (psychological and cognitive theories). Argyris & Schön (1974, 1978) introduced single and double loop learning, with reflection as a key component that helps in dealing with dynamic situations. This led to an understanding of practitioners' *theories-in-use* as different from their *espoused theories*. Schön's work (1983, 1987) brought the reflective practitioner to the center of learning, with *reflection-in-action* and *reflection-on-action* leading to *knowing-in-action*. ""In this approach, the focus is on the individual learner, learning is not problematized and considered as a 'product' (acquisition and transfer metaphors for knowledge), and role of context is underestimated.

Slowly, the researchers started shifting focus from individual to the social, with some researchers focusing primarily on the social (e.g. situated learning: Lave & Wenger, 1991), and others on interaction of human actors with the social. The assumption in socio-cultural theories is that learning is social in nature (Brown & Duguid, 2001) and happens within a social context through 'participation' in social activities along with other social actors (e.g. cultural-historical activity theory: Engeström, 1999, 2001). Knowledge, instead of being externalized as documents, gets created and exchanged "*as work problems get solved by interdisciplinary teams*" and is ""shaped by the social, cultural, organizational, and other context-specific factors. This learning is seen as happening across an *expansive-restrictive continuum* (Fuller & Unwin, 2003, 2004) and has tacit dimensions. Lave and Wenger (1991) provided an influential perspective on learning within organizations which they called as 'situated learning' that happens through 'legitimate peripheral participation' (LPP) in the workplace. The 'situated learning' is "an integral and inseparable aspect of social practice" (ibid, p.31) and is located in the processes of co-participation (i.e. interactions of individuals), not in the heads of individuals (ibid, p.13). Thus, the locus of learning is not the individual mind (which tries to internalize and manipulate the structures) but a community of co-participants.

These theories consider workplace learning and performance as an embodied phenomenon and reject mind-body dualism. Billett (2001, 2004) problematized the individual's position and vagueness of the 'participation' metaphor in these theories. He posited that learning occurs in *"relational interdependency between the individual and social agency, between engagement of the worker and affordances of the workplace"* (as cited in Hager, 2011, p.26). Hodkinson & Hodkinson (2004) agree with Billett on the role of individual's life history, their dispositions, and agency but they also question whether the clear separation of the agent and the social is desirable, or even possible. These theories thus present a more complex picture of learning and expand the dimensions of the concept of learning (Hager, 2011).

""""""""

Difficulty of separating the individual and the social

Hodkinson & Hodkinson (2003) argue that much of workplace learning literature, especially that focused on the 'participation' perspective, tend to focus on the workplace itself. In the process, it neglects the role of individual's dispositions (to work, life, learning etc.) and 'learning careers' (based on their life histories, a significant part of which lies outside their organizations and prior to it). *"Individuals are conceptually acknowledged, while their individual, personalized, and detailed perspectives are downplayed"* (p.5). For example, even in Wenger's (1998) work, the individual's role is acknowledged but underdeveloped and under-theorized. Lave & Wenger (1991) posit that

'participation' always involves "*situated negotiation and renegotiation of meaning in the world*" (p.51). They see the notion of participation as *"dissolving the dichotomies between cerebral and embodied activity, between contemplation and involvement, between abstraction and experience"* (p.52). Although 'meaning' is arrived at collectively via 'interaction', this does not rule out the possibility of the role played by the individual's knowledge and personal history. Learning ultimately happens 'within' the individual and hence, one cannot neglect the individual even when talking of workplace learning. Illeris (2003) also question Lave & Wenger's conception of situated learning devoid of the individual aspects. He argued that learning needs to be understood "both as an individual and a social process" simultaneously: to understand learning is to simultaneously focus on the human-psychological mechanisms, as well as the external environment where this process is happening. Thus, there is a need to relate the *"learner as a human being, […] as a member of the society, and […] as a specific individual with a personal life history and situation"* (p.169).

Continuing with this line of argumentation, Hodkinson & Hodkinson (2003) outline the need for looking simultaneously at the embeddedness, as well as separation of the individual and the workplace, and position of the individual within wider social structures. Going further, they explicate the idea of 'context' and argue for a need to move beyond 'workplace' as the only context. Wider socio-political, cultural, and economic factors, as well as the policy environment, that have a bearing on learning within workplace should also be considered as a part of 'context'. They provide as an example Lave & Wenger's (1991) work which points out that 'power relationships' shape 'access' within workplaces, though this issue was not addressed in detail in their work. In the specific case of teachers' learning research, workplace context is usually underplayed. Phillips (2016) argues that when talking of context, researchers have usually included "*the factors inside the four walls of classroom (e.g. school environment, physical features, availability of technology, demographic characteristics of students, teacher's prior experiences with technology etc.)"*. He argues for expanding this scope by also including *"the broader sociopolitical conditions that exist within the school workplaces"* (Phillips, 2013, 2014) as well as "*the systemic conditions associated with pre-service teacher preparation* (Albion et al. 2010)" (as cited in Phillips, 2016, p.18). Cox (2008) suggests that including context will make TPACK *"unique, temporary, situated, idiosyncratic, adaptive, and specific"* that will be considered differently by each teacher in their unique situations (Phillips, 2016, p.17).

The role of non-human elements in WPL

The (postmodern) theories (e.g. see actor network theory: Latour (2005); sociomaterial perspective: Fenwick (2010); complexity theory: Stacey (2005); Tsoukas (2005)) in the third strand described by Hager (2011) have moved beyond human actors to bring material (non-human elements) to the foreground.

Socio-material perspective in workplace learning

Fenwick (2010) argues that in their preoccupation with understanding 'human activity and meaning-making', researchers fail to realize adequately that *"work life is fully entangled with material practices, technologies, […] nature and objects of all kinds"* (p.105). As a consequence, work-practices (including learning at work) get conceptualized only in terms of the social relations and cultural forces: "the notions of participation (get) confined to human interactions, [and] the ways in which humans 'use' tools or move through '*contexts*'". This results in the very processes of materialization that makes these interactions possible becoming obscured (Fenwick, 2010, p.107). The socio-material perspective counters this by treating 'matter' as a "critical force in the constitution and recognition of all entities, their relations, and the ways they change (or 'learn')" (Fenwick, 2010, p.107).

The socio-material perspective is a part of the broader domain of practice-based (PB) studies. The basic premise of PB approaches is that 'organizational knowing' is produced in 'action' which is always 'materially embedded'. It is always rooted in the context of interactions between humans and materials and is "acquired through some form of participation" (Svabo, 2009, p.361). In PB approaches, 'knowledge' is not an 'external' product that exists out there and can be acquired. Rather, it is produced locally, is emergent, is always "situated and activity and practice bound" (Blackler et al., 1993; Wenger, 1998, as cited in Svabo, 2009, p.362). This knowledge gets negotiated, consolidated, and transmitted through the mediation of artifacts (Miettinen et al., 2008). Thus, "knowing […] is basically about doing work" (Svabo, 2009, p.361). Consequently, the challenge for researchers in this (sociomaterial) stream is to develop "ways of thinking and talking about the social and material worlds as inseparable, as constitutively entangled" (Orlikowski & Scott, 2008, p.463).

These PB approaches are useful, for they enable us to talk about knowing, learning, and organizing as socially and historically embedded 'processes' (and not end-products) which are materially mediated, and are always emergent and situated (Nicolini et al., 2003, as cited in Svabo, 2009, p.360) rather than being objective and permanent. 'Material', instead of just being in background as the 'context', becomes an active character in PB stories (Svabo, 2009) and the technical and the social get inextricably fused together (Orlikowski & Scott, 2008, p.463). Practice and learning get understood as complex, non-linear, unpredictable, and emergent. Learning is an "increasing capacity to act in a flexible, constructive, and innovative ways [to face unpredictable] challenges. [It is] strongly emergent [as it] grows out of continuous and non-linear interactions" that cannot be predicted in advance (Hager, 2011, p.28). Even the notion that we can segregate learning from other life activities gets challenged by postmodern theorists like Usher and Edwards (2007):

> *"Learning is a socio-culturally embedded set of practices [that are] neither invariant, nor unchanging. [In this] postmodern world, [a]ny activity can be valorized as learning, [and] the boundaries between leisure, entertainment and learning are increasingly blurred (p.30). [W]hen, for example, someone is learning music and when they are actually playing it? When is work learning? […] Who, then has the authority and power to rename practices as learning?" (p.167).*

Thus, the assumption that any *"decidable and predictable system [of learning] can be designed or implemented"* if conditions that support or enhance workplace learning are understood (Hager, 2011, p.27) gets challenged. Hager (2011) argues that there is a danger of simplification of complex phenomenon when generic label of 'workplace learning' gets applied. There is a need to recognize the diversity represented by this concept and engage with *"particular types of workplace learning"* (p.28) at the level of individual, group, and community of practitioners.

The role of artifacts

The sociomaterial perspective questions the binaries of subject-object, individual-organization and knower-known, and also challenges the *"given-ness of fundamental distinctions between human and non-human"* (Fenwick, 2010, p.107). Fenwick (2010) calls these as 'sociomaterial perspectives' as these take *"whole system as the unit of analysis; […] trace interactions among human and non-human parts of the system; […] and understand human knowledge and learning as embedded in material action and inter-action (or intra-action)"* (p.111).

For Engeström et al. (1999), all knowledge in an activity is mediated through artifacts. Within his activity theory, the 'object of an activity' is something towards which all activities are directed, and it may be material or immaterial. This 'object' is 'partly given, partly emergent'. The individuals' relation with the 'objects of their activities' gets mediated through concepts and technologies. While

'division of labour' mediates this overall object at the community level, the 'rules and procedures' mediate relations among individuals and communities that they are part of. Thus, the bricolage of 'tools, rules, and division of labour' mediate activities (Svabo, 2009, p.364).

The 'material' artifacts are *"objects for meaningful action"* (Svabo, 2009, p.365). 'Material' here is defined widely to include *"tools, technologies, bodies, actions, and objects"* and not as something that is inherently distinct from humans who use them (Fenwick, 2010, p.104). 'Materials' (or materiality) is constituted by 'objects' (only material) and 'artifacts' (material, as well as immaterial). Artifacts are 'constitutive' parts of the communities and may embody (and communicate) its history, values, beliefs and values. They support the communication and cooperation among individuals in the community. *"An artifact embodies human meaning in its physical form [and] its meaning has been designed into its form by a community for whom that artifact is part of their culture"* (Stahl, 2006, p.312). Meanings that get attached to the *"signs, symbols, terms, phrases"* get formed through use by a community (ibid, p.311). Artifacts are not only physical but could also be symbolic, digital, or linguistic. Cahalane, Finnegan, & Feller (2011) also add the distinction between external (material and semiotic; e.g. signs or symbols) and internal artifacts (e.g. ideas and plans). For them, tools and symbols (external artifacts) "mediate self-reflection, [and also] the behavior of others, talk about self, as well as behavior of self within objective oriented activities" while internal artifacts (plans and ideas) get materialized in the form of instrumental and semiotic artifacts. Stahl calls the internal artifacts as 'cognitive artifacts': *"the artifact that has been transformed into a mental process"* through a process of 'internalization' (Hutchins, 1999; Norman, 1991, as cited in Stahl, 2006, p.310). In a community of practice (or other collaborative acts), internalization is followed by 'exteriorization' (Kaptelinin, 1996) or 'externalization' that helps sediment in language the meaning embodied in artifacts. In this process, shared artifacts (e.g. speech, drawings) are created that make the internal cognitive artifacts accessible to others (as cited in Cahalane et al., 2011, p.3). Beyond language and acts, artifacts also refer to the 'spaces' where action and interaction happens, and the 'objects' to which words refer and acts engage. This is a very broad definition and thus, one cannot talk about action, learning, reflection, and practices in workplaces without reference to the material that is involved in these (Svabo, 2009, p.364).

The construction of artifacts invariably has a 'social' element (Berger and Luckmann, 1966, as cited in Pratt and Rafaeli, 2006, p.282). They are not just an 'outcome' of some action but can also trigger new actions. It is not just people who 'make things' but even 'things make people': *"objects mediate social relationships, and [they have] a form of agency of their own"* (Pratt and Rafaeli, 2006; Strati, 2006, as cited in Svabo, 2009, p.362). An artifact's construction happens through *"words, actions, and more tangible materials"* (ibid, p.280) and it can be situated on a continuum from being ephemeral (e.g. words, unless captured in a repeating medium like script, play, etc.) to being more-or-less permanent (e.g. forts or pyramids). Some meaning is intended by the creators (sense-givers) of the artifacts, but that is not necessarily interpreted as such by the sense-makers. Thus, instead of being a monologue, interpreting an artifact always involves a dialogue (which can be synchronous as well as asynchronous) (ibid, p.286), which is basically a trialogue as suggested by Hakkarainen et al. (2013).

Research on teachers' learning in the workplace

In my research, I am not concerned with the learning of pre-service teachers but of in-service teachers, with primary focus being their informal learning outside the formal programs. Further, the focus is not the workplace learning of teacher educators but of teachers who teach students in schools.

In contrast to student learning which is based on 'thinking activities', the learning of teachers is based on 'doing activities' in the workplace. Meirink, Meijer, Verloop, & Bergen (2009) cite **five key learning activities** of teachers identified across multiple studies: doing; experimenting; reflecting on

experiences; learning from others without interaction; and learning from others with interaction (p.210). In-service teachers require time and space *"to engage in, reflect on, and analyze the range of learning affordances and opportunities in the workplace"* (Murray et al., 2014, p.300). Their learning is not limited to their workplace (schools) but also extends to formal learning spaces (e.g. university), cross-professional territories, as well as virtual spaces created by new technologies (Murray et al., 2014). The participation or membership in virtual communities *"helps teachers enlarge their professional community, share resources, and reflect on teaching practices"* (Wesley, 2013) which allows them to create new understanding of their experiences and practices (Davis, 2015) (as cited in Macià & García, 2016, p.301).

While pre-service education plays a role, Flores (2003) argues that workplace norms and values, school culture, leadership, and above all, the day-to-day experiences and the students' reactions within the classroom matter more for teacher's learning. Despite this, teachers, especially at the beginning of their careers, see learning as an individual act that happens through reflection on own actions in the classroom (Flores, 2003). Even policymakers, teacher-educators, and researchers have often taken an uncritical perspective of teachers' workplace learning:

> *"Teachers and their learning have been positioned as mere cogs in an educational machine, driven relentlessly by a set of practices centered on 'raising pupil learning outcomes' often through narrow and measurable exam targets. They have been subjected to performance management and appraisal processes, which often start from a deficit model of teaching defined as performance and then proceed to define and measure the 'worth' of teachers against narrow productivity measures." (Murray et al., 2014, p.299)*

The focus on teachers' learning thus gets diminished. Their motivations and sense of agency are neglected, and their voice in their own professional development is not heard. This is visible in the policies related to teacher's professional development and learning which have primarily been prescriptive and deterministic in nature with a one-size-fits-all approach.

Nature of teacher's knowledge: PCK, TPACK, and its critique

The nature of a teacher's knowledge is different from the knowledge required in other professions, and this differentiation has been recognized by researchers for a long time (Phillips, 2016). Teachers require 'practical classroom knowledge' but it is neither objectivist, nor pre-existing, ready to be acquired. It is oriented to practice but is simultaneously personal, value-laden, and experiential (Clandinin, 1985, as cited in Phillips, 2016, p.10). At a minimum, it will include:

> *"knowledge of content, curriculum (materials and programmes that serve as 'tools of the trade' for teachers), pedagogical knowledge (general, as well as tools, pedagogical content knowledge which is an amalgam of content and pedagogy that is special form of teacher's professional understanding), knowledge of learners and their characteristics, knowledge of educational contexts […], and knowledge of the educational ends, purposes, and values, and their philosophical and historical grounds" (Shulman 1987, as cited in Phillips, 2016, p.10).*

Shulman phrased the term 'Pedagogical Content Knowledge' (PCK) for such professional knowledge of teachers. The PCK framework differentiates expert teachers (e.g. a Physics teacher, who requires a blend of PK and CK) from content experts (e.g. a Physicist, whose sole focus is CK) (Phillips, 2016, p.10).

With the proliferation of digital technologies, technological knowledge (TK) is now considered inseparable from teacher's work and her knowledge. Pierson (2001) argued that the intersection of or technological-pedagogical-content knowledge will define effective technology integration (as

cited in Phillips, 2016). Subsequently, researchers have suggested ICT-related PCK (Angeli and Valanides 2005) or technology-enhanced PCK (Niess 2005) as critical for effective teaching (ibid). The integration of TK with PK and CK has been termed as TPACK (Technological, Pedagogical, and Content Knowledge) by Koehler & Mishra (2005). Through this addition of TK to PCK framework, they were trying to address two questions. One, "what do teachers need to know about technology?" And two, "how can teachers acquire this knowledge?"

The TPACK framework was represented by Mishra & Koehler (2006) as three overlapping circles (like a Venn diagram), with each circle representing TK, PK, and CK of a teacher's professional knowledge. Consequently, *"seven potential forms of teachers' professional knowledge with the aspirational TPACK positioned at the nexus of these circles"* emerge from this framework, and all these are bounded within the context in which teachers *"acquire and exhibit"* this knowledge (as cited in Phillips, 201, p.11-12). There is a critical role of 'context-specific' understanding while utilizing TPACK framework to focus on of teacher knowledge and their usage of technology within classroom: *"there is no single technological solution that applies for every teacher, every course, or every view of teaching"* (Mishra & Koehler, 2006, as cited in Phillips, 2016, p.17).

Critique of TPACK framework

After its proposal, the TPACK framework has been utilized widely in several studies that examined teachers' professional knowledge (Graham, 2011, as cited in Phillips, 2016, p.12). Yet, it has been critiqued by others, who have highlighted its shortcomings and problems with its assumptions.

Parr, Bellis, & Bulfin (2013) claim that the TPACK framework 'compartmentalizes' professional knowledge (e.g. subject teaching and ICT knowledge) which is problematic. Further, they problematize the TPACK assumption that the expertise for CK and PK is derived from two distinct and separate communities. (Phillips argues that this critique is unfair, for the authors built on PCK framework in which Shulman had considered PK and CK not as separate but "*in amalgamation that is uniquely the province of teachers, their own special form of professional understanding*" (p.14)). In addition, considering CK as uncontested and well-accepted is problematic: "*the notion of a discrete set of CK 'drawn from outside the [teaching] profession [which] is neatly bounded, unchanging and widely agreed upon by a homogenous academy […] is a fundamental flaw in TPACK logic*" (Parr et al., 2013, as cited in Phillips, 2016, p.13-14). Cox (2008), Kelly (2010), Rosenberg & Koehler (2015) have all raised concerns about the absence of 'context' from the research on teacher's knowledge utilizing TPACK framework (Phillips, 2016, p.17). Further, the role of language and dialogicality in generation, interpretation, and negotiation of knowledge is not explicitly acknowledged (ibid). Also, this framework is silent about the *"complex, situated, and socially mediated negotiations that shape collective knowledge and practice"* (Phillips, 2016, p.17). Teacher's' knowledge gets portrayed as an individual attribute and not as a collective accomplishment. In conclusion, the compartmentalization of different kinds of knowledge, considering knowledge itself as unproblematic, underplay of impact of context, and failure to account for the social attributes of the process of knowledge acquisition and the content of knowledge itself are the major critiques of the TPACK framework.

The social nature of teacher's learning

The critiques mentioned above are specific to the learning of teachers as suggested by one of the frameworks, but these are in sync with the WPL theorists' arguments who similarly problematize knowledge content and acquisition/creation processes and neglect of contextual factors. This critique becomes salient when one understands the practice of teaching as essentially social. For example, Wenger's (1998) conceptualization of 'participation' as a fundamentally social activity makes teachers' practice a social act. Henderson (2007) illustrates this through a simple example. While the lesson plan may be developed in isolation by a teacher, it is always bounded by the (explicit and implicit) norms and rules of the institution. It is driven by needs of the students, and there is an unsaid need for 'approval' from colleagues. Thus, "*what appears to be a solitary pursuit is actually a socially negotiated practice*" (as cited in Phillips, 2016, p.49-50). Teachers' learning,

therefore, needs to be looked not as an individual accomplishment, nor as an institutional characteristic. It involves both, and more expansive features of workplace environment better support this learning (Hodkinson & Hodkinson, 2005).

Theories of learning with computer mediation

How does the workplace learning get impacted by the introduction of computer-mediation?

As a consequence of access to computer-mediated communication (CMC) technologies, the scope for collaboration and learning in workplace has increased and it is no more limited to physical workplaces. According to Cairns and Malloch (2011), in the context of learning and cognition in the workplace, the 'place' where such learning happens is definitely not limited to physical space. It can include intra-personal (cognitive) spaces, as well as inter-personal (including virtual) spaces where social interaction happens. WPL is not even limited by organizational boundaries. Because of web2.0[12], people can work collaboratively, and it is this technology that also creates the possibility of learning together. How does this change of medium of communication impact workplace-based learning?

Computer-mediated communication (CMC) has potential to support learning communities because they create a possibility of social interactions and allow creation of authentic learning tasks that was otherwise not possible (Bruckman, 2006). Digital tools allow individuals to construct their own learning environments, as well as create and share artifacts. They have unique (technological) affordances that facilitate creation of learning communities: ability to 'transmit information' and 'connect people'. These two affordances are not independent but intricately linked: information originates from humans directly or indirectly, and the credibility of source has direct implication for credibility of information. Thus, combined, these affordances can be called 'distribution of situated information' (Bruckman, 2006, p.466).

Egloffstein & Ifenthaler (2017) point out that the digital learning technologies are being used in the workplace for formal learning environment implementation, but a huge opportunity exists for these to support informal workplace learning (as cited in Ifenthaler, 2018, p.4). Networked devices can reduce the communication gaps within and among teams by facilitating peer-to-peer and peer-to-group discussions without need of a dedicated coordinator or facilitator. "*These [technologies] can support the collaborative building of knowledge that is not restricted to the skills, memories and efforts of individuals*." (Stahl, 2006, p.149). Although the potential exists, the disjuncture between the rhetoric (state-of-the-art) and the reality (state-of-the-actual) is huge: "*we have been on brink of transformation through learning technologies for some decades now"* (Laurillard, 2008, as cited in Phillips, 2016, p.6).

From a research perspective, studies focusing on digital workplace learning and how such technologies can bridge formal and informal learning at the workplace are scarce (Ifenthaler, 2018, p.4). Fischer, Goller, Brinkmann, & Harteis (2018) focus on empirical investigation on the views and experiences of workers on digitalization of their workplace and its potential for learning. They argue that empirical investigations into this aspect of workplace digitalization's impact on worker's learning and their experiences of such digitalization is missing (p.228). Similarly, informal learning and online collaborations are widely studied, but studies focused on teachers' informal online

[12] Techopedia suggests that Web 1.0 refers to the first stage in the World Wide Web, which was entirely made up of web pages connected by hyperlinks. It was a set of static websites that were not yet providing interactive content. In contrast, Web 2.0, applications allow users to interact and collaborate with each-other in virtual spaces. Social media, web-based communities, user-generated content are key features of this phase of web.,

collaborations for professional development (PD) are rare. Macià & García (2016) found 23 empirical studies conducted since 2009 that were focused on in-service teachers' participation in online networks or communities with a focus on PD. Even when this phenomenon has been studied, the networks and communities were specifically created for research purposes, and usually in university environments (Macià & García, 2016). It is worth noting that the authors discarded eight studies from their sample that *"corresponded to face-to-face experiences (not online)"* (p.295) but few studies have looked at 'embedded' online communities (e.g. Matzar, 2010). Tour (2017) argues that despite acknowledging the opportunities provided by online spaces for self-initiated and spontaneous learning, *"little attention has been paid to teachers' self-initiated professional learning"* (p.11). She further found that despite work on out-of-school spontaneous and self-initiated learning in digital spaces, much needs to be understood about these forms of learning. In the present study, I have attempted to contribute to such understanding. I have considered both, face-to-face interactions (physical communities) and virtual communities that are focused on in-service teachers' professional development through participation in such communities.

The nature of virtual collaboration

Learning within virtual networks is characterized by use of ICT (information and communication technologies) to promote connections among individuals, learning communities, and learning resources. These interactions happen in shared workspaces and can be synchronous and/or asynchronous, and happen through text, graphics, audio or video. It is thus social in nature and involves '*interaction with and mediation through humans and technological tools*' as a key component contributing to the learning, and goes beyond simply accessing online materials (Jones, 2015).

The nature of online collaborative spaces is different from face-to-face settings. In the physical workplace, usually manual work is combined with cognitive work, and though individuals may work in isolation, they also necessarily collaborate and communicate with others. In a spatially distributed group, it may not be possible to personally know every individual. While implicit reflection does take place during work, the process can be made explicit during communication with others (Prilla, Hermann, & Degeling, 2013). When collaborators are physically and temporally distributed, for example, in online spaces working synchronously or asynchronously, communication becomes critical and is seen as a precondition for collaboration (Kienle, 2013). It also becomes difficult to directly point to an artifact or show its use as can be done in physically co-located groups. The principles and processes from physical collaborative learning situations thus cannot be expected to be directly applicable to virtual collaborative learning situations.

Computer-support in workplace learning: CSCL, CSCW, and CSCL@Work

In contrast to the other social learning theories, the computer-supported collaborative learning (CSCL) researchers make the link between learning and ICT clear and explicit. They try to understand the ways in which ICT tools, in several cases custom-designed to enhance learning, can be used collaboratively by learners to achieve their goals (i.e. learn). This often involves face-to face interactions but through computer-mediation (e.g. joint construction or exploration of a simulation) (Stahl, Koschmann, & Suthers, 2006). CSCL is a multidisciplinary field *"concerned with promoting computer-mediated collaborative learning that takes place in small groups or classrooms of students"* (Stahl, 2011c, p.4). It is different from e-learning where the focus is on digital content but not necessarily 'group' and 'collaboration'. According to Stahl, Koschmann and Suthers (2006), CSCL involves: (i) *"[inter-subjective] meaning making (social constructivism as opposed to positivist realism), (ii) examination at the group unit of analysis (rather than exclusive focus on or reduction to the individual mind) and (iii) investigation of group processes (instead of just measuring pre/post learning outcomes)"* (as cited in Stahl et al., 2014, p.239). CSCL research has primarily, but not exclusively, focused on the academic context (i.e. schools and universities) and on how students'

understanding is enhanced (Goggins & Jahnke, 2013b). As already discussed, the nature of academic learning is very different from WPL. Thus, CSCL is not ideally located to study collaborative learning at the workplace.

In the context of the workplace, a related research field has been Computer Support for Coordinated/Cooperative Work (CSCW) (usually driven by organization). It is an interdisciplinary field of research with a focus on using computing technologies to enhance effectiveness and efficiency of employees to perform work (Schmidt and Bannon, 2013). The classic CSCW field developed with a focus on "*modelling and executing organizational procedures"* in the workplace with the help of collaborative computing technologies (ibid, p.347) and the scope broadened with the advent of the internet that allowed cross-platform communication and interaction. The 'second generation' of CSCW studies has focused on 'knowledge sharing' and 'expertise sharing' (Ackerman et al., 2013) as opposed to simply the 'artifact-centered' repository model focus in the 'first generation' studies. These studies broadly focus on knowledge management (KM) and not on collaborative learning.

A key distinction between CSCL and CSCW is the way in which the expert-novice relationship is considered. The focus in CSCL is on *"helping novices learn—mainly knowledge that already exists in the world and in specific disciplines"* (Goggins & Jahnke, 2013, p.5). CSCW, in contrast, is focused on *"helping experts learn, sharing what others know, what is known elsewhere in the world, or what will be new knowledge in the world"* (p.6). Although the social media and other technological platforms that make collaborative learning possible are available, they are not being used explicitly to foster learning in the workplace. CSCL researchers have focused primarily on academic context, while CSCW researchers focus on sharing and diffusion of (already existing explicit and implicit) information, knowledge and expertise. The CSCW community, argue Goggins & Jahnke, *"has been too timid with regards to considering the application of learning approaches in studies of cooperative work"* (2013, p.7). What has been missed is an understating of *"how organizations create the knowledge they require when that knowledge is not already known within the organization"* (Goggins & Jahnke, 2013, p.1). Studies under the rubric of 'Computer-supported Collaborative Learning at Workplace' (CSCL@Work) examine such computer-mediated collaborative workplace learning.

There does exist some work connecting the two domains (for example, Fisher, Rohde and Wulf, 2007; and COP work by Wenger et al., 2002) but here, the focus is on the apprentice model, and learning among domain experts, with the expertise being seen as distributed across practitioners and not centralized, is not considered. In conclusion, what Goggins & Jahnke (2013) argue is that CSCL@Work research needs to integrate CSCL and CSCW research and find a middle ground where the focus is on continuous, collaborative learning in the workplace with a focus on problems for which the solution is not yet known. In CSCL@Work, collaborative learning involves active 'construction of new knowledge' and not merely 'acquisition of existing knowledge'.

CSCL@Work

CSCL@Work, according to Goggins & Jahnke (2013) *"frames a new area of inquiry, focused on making collaborative learning in the workplace explicit through social media and other collaborative technologies integrated into workplaces"* (p.1). Being online, learning is not restricted by organizational boundaries. Here, *"unstructured connections between employees' work, personal networks, and collaborative reflections that emerge in social media (online space) are critical for knowledge construction"* (p.14). Next, they suggest that feedback from 'diverse' sources that lie outside established organizational boundaries is critical for collaborative learning in workplace. These sources could be from the personal network or from networks on social media. The diversity in such sources could play a key role in realizing the learning potential of collaborative learning in the workplace (p.14). Gurzick and White (2013) also suggest that in contrast to the old workplaces, with respect to decision-making hierarchies, the 'new' workplaces empower employees. It is in such a

workplace that they can use online personal networks to exchange ideas and knowledge or offer encouragement and support to each other. The field, thus, will need to analyze "the movement of informal, socially constructed practices into formal, institutionalized practices over time" (Goggins and Jahnke, 2013, p.3). Consequently, CSCL@Work researchers need to see learning as a part of the work and as integrated into the daily work-practices, not as some isolated activity.

Conceptual framework suggested for CSCL@Work

Fischer (2013) suggests a conceptual framework for CSCL@Work which comprises four components: distributed cognition; integration of problem framing and problem solving (PF-PS); domain-oriented programmable design environments (DoPDE); and communities of interest (CoI). In distributed cognition, the cognitive processes are considered to be *"socially distributed among members of a group, […] and emerge in social interactions, as well as (embodied) interactions between people and structure in their environment"* (Hollan et al., 2000, p.177). The boundaries of the system that encompasses such cognition are not individuals but 'groups of individuals' situated within their socio-technical environments and interacting with each other through dialogues or materials via practices to accomplish certain functions.

Fischer recommends the distributed cognition framework, for knowledge is not a product of individual mind but is created in social practices and mediated by 'artifacts'. One of the key features of such knowledge is its 'externalization' that moves it outside the realm of 'mind' into the world where it "represents situations which can talk back to us, [be] critiqued, and negotiated" (p.29). The problems are not externally defined in a static manner but framed and reframed by people who are in the thick of action (practitioners), and problem solving is integrated with problem framing. Fischer looks at learning in CSCL@Work as neither fully self-directed (without any guidance/support), nor completely controlled (tightly defined with extensive guidance). Ideally, it should be somewhere in between, and allow "control, expressiveness, assistance, modifiability, […] contextualization, and […] collaboration" (p.30).

Fischer sees domain-oriented programmable design environments (DoPDE) which are flexible enough to allow modifications and experimentation as suitable for enabling such learning. DoPDE are better compared to open learning systems that support self-directed learning but without any guidance and support, and intelligent tutoring systems that provide all support but may be irrelevant for dynamic workplace problems. DoPDE allow *"learner control, expressiveness, assistance, modifiability, domain-oriented descriptions, [..] contextualization of information, and collaboration between users"* (Fischer, 2013, p.30).

Finally, he posits that LPP (legitimate peripheral participation) in COP (Lave and Wenger, 1991; Wenger, 1998) is not the true representation of the kind of challenges that are faced in CSCL@Work scenarios. COI (Communities of Interest) (Fischer, 2005) better represent the group that collectively tackles problems in such environments. These include people brought in from multiple COP. They have similar interests, diverse skills, and come together to work on complex design problems, and disperse after the problem is solved (p.30).

Through a narrative, Fischer (2013) explains the conceptual framework that he suggests for researching CSCL@work. Fischer argues that a chapter written by him as a single author is actually more than his effort, and it can be understood through distributed cognition perspective. The ideas and arguments presented were developed in direct collaboration with several of his colleagues and students over years, and with indirect collaboration with several other researchers by engaging with their articles and research. The ideas presented were not completely novel but built upon his own previous work. In addition, this work was not an accomplishment of an individual human mind or human-human collaboration but involved tools like Microsoft Word and Endnote. This work was developed and refined through criticism and feedback from a community of interest (CoI) consisting

of peers, reviewers, editors, etc. Each subsequent input presented an opportunity for the author to reflect more deeply about the issue at hand, and this process was facilitated through collaborative writing tools. The final article was not a solution to the problem statement defined in the beginning, but the problem to be solved was itself reframed and refined. Thus, the solution that emerged at the end was not known in the beginning and represented working and learning through collaborating with other human and non-human actors.

Thus, the four elements represent the situated and social character of learning with a key role posited for the artifacts; dynamic interaction of problem framing and solving; the need for a technological medium that allows these interactions; and a specific kind of community (COI) that is focused on problem solving.

Understanding the Community of Interest

One of the research questions guiding this study involve nature of communities that emerge when teachers come together in virtual spaces. Consequently, I will focus on the nature of virtual communities in some detail.

Networks and communities

In the context of group interactions, the terms 'network' and 'community' are often used interchangeably but these are distinct concepts, albeit with no single agreed-upon definition. Wenger, Trayner, and de Laat (2011) provide a distinction between a network and a community. While a network is defined as "*the set of relationships, personal interactions, and connections among participants who have personal reasons to connect*", a community is defined as "*the development of a shared identity around a topic or set of challenges*" (p.9, as cited in Macià & García, 2016, p.293). Communities are dynamic entities and depend upon the interactions of and contributions from its members (Elkordy & Zumpano, 2018). A virtual community is a more close-knit, identifiable part of a virtual network. All communities represent networks, but not all networks can be called communities (Wenger et al., 2011).

Jones (2015) considers networks and communities as two distinct aspects of social structures where learning takes place. A community's focus is on learning. This focus arises from a shared domain that is nurtured by "a common history of learning, shared practices and the commitment to negotiate, learn and develop ideas and resources together". In contrast, a network is more information oriented and less tightly structured. It provides access to "a wide range of information flows that can be useful for obtaining resources, finding solutions or establishing dialogues in targeted or untargeted searches" (Wenger et al., 2011). Higher the number of connections with peers, higher is the possibility of access to information. A community thus demands higher, sustained engagement from its members, while participation in a network is usually more spontaneous, unpredictable and serendipitous (as cited in Macià & García, 2016, p.293).

Wittel (2001) also contrasts network's sociality with the community. The networks represent relationships and interactions among actors as sets of nodes and links. The affordance for learning within a network comes from its structure that allows information flows and creates opportunities for joint problems solving (possibly) leading to new knowledge creation. These actors connect with others in the network for diverse personal reasons. The social relations in a network are informational, based primarily on exchange of data, and not on a shared history or mutual experiences that leads to 'belongingness'. Communities, on the other hand, represent the 'collective intention' of actors, however tacit and distributed, leading to development of a 'shared identity' around some common challenge or interest (Wenger et al., 2011, as cited in Jones, 2015, p. 58). "Community entails stability, coherence, embeddedness and belonging. It involves strong and long-lasting ties, proximity and a common history or narrative of the collective" (Wittel, 2001, p.51, as cited in Jones, 2015, p.90).

Nature of virtual communities

Virtual communities are a critical part of modern work life and they play a 'socialization' role just like physical communities do. Consequently, even in virtual communities, learning and identity construction can be seen as an outcome of 'participation' as in Wenger's (1998) social learning theory (Henri & Pudelko, 2003). It is the 'participation' of people in these virtual communities that makes the existence of these virtual entities 'real' and gives significance to them. Just like physical communities, participation involves not just membership of social communities but also active involvement in the social enterprise. 'Reification' process gives form to this social experience by producing 'products' that can be shared with others (Henri and Pudelko, 2003). It is this combination of participation and reification that is involved in negotiation of meaning even in virtual communities.

Henri and Pudelko (2003) have identified three major components of the social context of the activities of virtual communities (p.476):
a. the emergence of intention (goals of the community),
b. the methods of initial group creation, and
c. The temporal evolution of both the goals and the methods of group creation

The creation and evolution of the virtual communities is co-determined by the 'intentionality' of group creation and the 'nature' of the group. Here, 'intentionality' represents "the '*will*' of the group members to create a strong social bond and to undertake an activity with a learning goal" (Henri and Pudelko, 2003, p.476), and it can vary from weak to strong. The 'nature' of group represents the strength of the social bond that group members are able to create (and sustain) during group formation (and evolution) and it could vary from being a simple gathering to a highly cohesive group (p.477).

The emergence of intention: Within virtual spaces, the emergence of community needs to be followed by increasing the awareness about its existence and this gets concretized by "declaration of intention of existence, […] and the definition of a goal" (Henri and Pudelko, 2003, p.477). This is formalized by "listing its members, choosing tools of communication, creating an environment offering various types of resources, […] and by adopting rules of operation" (ibid).

Type of group/gathering: To exist as a meaningful social entity that is capable of realizing its goals, virtual communities need "conscious membership of its adherents" (ibid). The kind of gathering impacts the degree of cohesion (the feeling of belonging to the group) and engagement (in the activities) that the group is able to achieve.

Evolution of intention and gathering: "The type of gathering; the degree of explicitness of the intention justifying the collective action; and the participants' degree of awareness of forming a social learning entity" determines the way activities are performed by the group (ibid, p.477).

Based on the dimensions of intentionality and social cohesion, Henri and Pudelko suggest the existence of four different kinds of virtual communities: Community of interest (COI); Goal-oriented community of interest; Learner's community; and Community of Practice (COP).

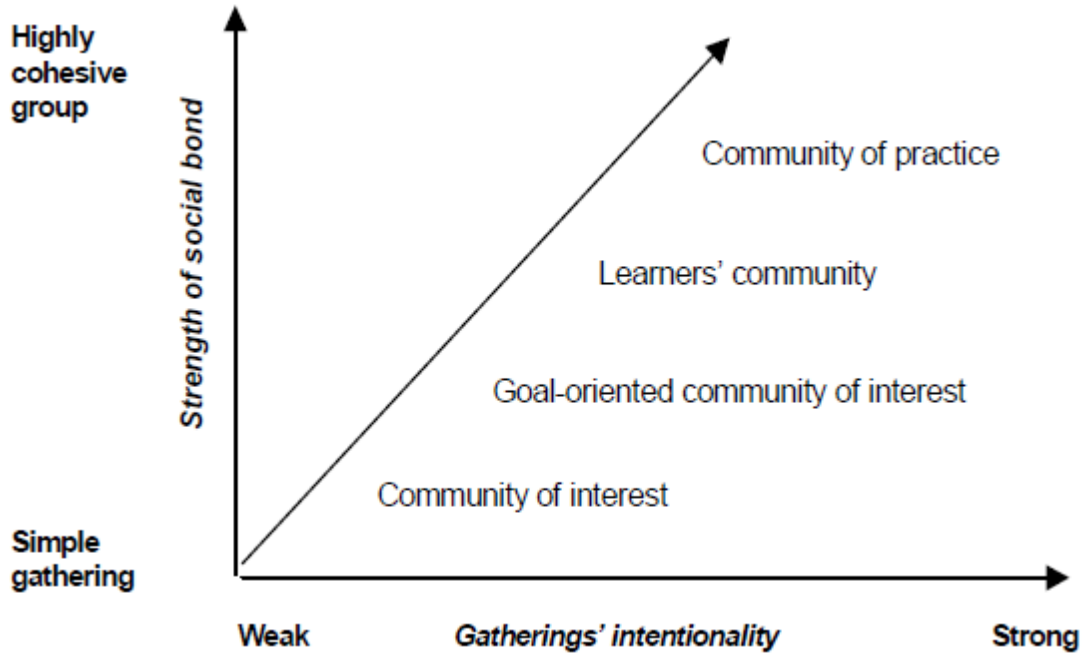

Figure 2: Different forms of virtual communities based on their context of emergence

(adapted from Henri and Pudelko, 2003, p.476)

The classification of the communities into the four categories and their specific characteristics can be assumed to be idealistic and in the real world, one can expect to find groups and subgroups that cannot be classified as a 'pure' community of a certain type. Instead of being 'discrete' categories of communities, these four can be placed along a continuum.

According to Fischer (2001), COPs are '*homogenous design communities*' that are characterized by their specific domain and similarity of work (practice) that happens in this domain. The knowledge systems of a COP are domain oriented which makes possible 'effective and efficient communication' within the community, but it makes it difficult for the non-participants to communicate with the participants (about the practice). In contrast, COI are '*heterogeneous design communities*' that bring together stakeholders from different COPs (Fischer, 2001) and their activities do not represent a 'collective field' or 'area of work' (Henri and Pudelko (2003). This bringing together of multiple COPs creates opportunity for emergence of 'social creativity' that can help transcend individual perspectives (Fischer, 2001). In context of CSCL@Work, Fischer (2013) and Goggins & Jahnke (2013) argue that the nature of groups of participants is closer to 'communities of interest' (COI). The key challenge for COI is to incrementally and collaboratively build a 'shared understanding' of the problem. This requires an ability to communicate with members who may have different perspectives and to learn from them (G. Fischer, 2001).

Learning within Communities of Interest

Fischer (2001) uses the type of problems that the members in the congregation tackle as a way to place COI in relation to other types of congregations. A key characteristic is that in COI, the participants frame and solve complex problems that require diverse perspectives, expertise, and experience. The members in CoI attempt to solve a complex problem that cannot be fully defined apriori. The knowledge that becomes the basis of finding the solution to these complex problems is usually "distributed tacitly among various stakeholders, each of whom possess an important and yet incomplete understanding of the problem" (p.2). Consequently, the ability of members to communicate and learn from each other becomes the key to (re)framing and resolving these problems. It is the 'problems of common interest' that get the members energized and excited, and

in the process of finding a solution, they push each-other's mental boundaries which helps them gain new knowledge. This newly gained knowledge is not restricted to the group and is frequently shared with members outside the COI, thus creating impact beyond the explicit membership (Briad and Carter, 2013, p.9).

Within COI, learning requires 'externalization' of understanding (knowledge) gained by individuals in the form of external 'artifacts' (boundary objects) (Fischer, 2001). It is through such externalization that meaning gets "shared across the boundaries of individual knowledge systems" (Fischer, 2001, p.4). Macià & García's review (2016) found evidence for teachers re-phrasing their knowledge and adapting it according to communication tools like blogs, Wikis, instant messaging etc. (Cranefield & Yoon, 2009).

The participants in a COI require both, an 'action space', and a 'reflection space' (Schön, 1987) and the participants need to coordinate and manage the content, as well as the process of content creation (Fischer, 2001). Henri and Pudelko (2003) suggest that in order to analyze the activity of a virtual community, there is a need to take into account the "process of participation (communication and action) and the process of reification (use and production of intermediary objects)" simultaneously (p.485).

Teachers' networked learning: Personal Learning Networks and Professional Learning Communities

In the workplace, an individual acquires the requisite knowledge and expertise by tapping into their trusted networks of current and former colleagues that they have nurtured over time. These have also been referred to as Personal Learning Networks (PLNs). Such networks can easily extend beyond boundaries of the organization, especially in the era of social media (Milligan et al., 2014, p.1).

Several studies (e.g. Campana, 2014; de Laat & Schreurs, 2013; Eraut, 2011) have pointed out that "*professionals spend several hours per week informally learning with peers*" (Macià & García, 2016, p.292). Macià & García (2016) argue that such bottom-up, informal online communities and networks of teachers allow the teachers to engage in shared learning and reflecting, as well as receiving emotional support. Whenever accessible, this 'outside-school' peer support is critical for their professional development. The online networks make the 'collective intelligence' of the group accessible to the individual members. Besides, an opportunity is created where they can connect with other members to find solution to their specific problems (Lieberman & Mace, 2010, as cited in Macià & García, 2016, p.292).

Milligan et al. (2014) argue that these learning networks are loosely bound, and connections among participants strengthen when they are able to identify other individuals with common goals. They have identified four learning behaviors that are observed in these PLNs: consumption of knowledge available through network, creation of knowledge by authoring or extending existing knowledge, connecting to people and resources in the network, and contributing new knowledge back to the networks (p.4). They argue that these are most effective when performed in public interactions (openness) as it maximizes potential benefits.

Professional Learning Communities (PLCs) have been recognized as another way to look at the congregation of professionals (e.g. teachers) who come together to *"share and critically interrogate their practice in an ongoing, reflective, collaborative, inclusive, learning-oriented, growth-promoting* way (Mitchell & Sackney, 2000; Toole & Louis, 2002) *and operate as a collective enterprise* (King & Newmann, 2001)" (as cited in Stoll, Bolam, McMahon, Wallace, & Thomas, 2006, p.223). In the context of schools, such communities involve teachers and administrators who "*continuously seek and share learning, and act on their learning […] to enhance their effectiveness as professionals for the students' benefit"* (Stoll et al., 2006, p.223).

Not all communities of professionals are focused on learning or improvement and hence, the concept of PLC needs careful application. Further, for becoming a community (as discussed earlier also), there needs to be *"shared beliefs and understandings; interaction and participation; interdependence; concern for individual and minority views; and meaningful relationships"* among members (Westheimer, 1999, as cited in Stoll et al., 2006, p.225). PLCs are a particular type of community that share the following common features: shared values and vision, collective responsibility, reflective professional inquiry, collaboration, and a focus on individual and group learning (Hord, 2004, Louis et al., 1995, as cited in Stoll et al., 2006, p.226-227).

Toole's (2019) review suggests that benefits of participation in such virtual communities have been established but these cannot be expected to arise simply from participation. Besides, looking closely at Toole's review provides a hint that the focus is on the affordances provided by the technology but the context where these network members are embedded is not takes as a natural dimension to be explored. This is true for PLNs also. While some researchers (e.g. Kleon, 2014) have considered the internet to be a great equalizer ("*the internet has no bouncer, no gatekeeper, and no barrier to entering the scenes*"), participation in PLNs is essentially a political process. Technology is neither determining, nor neutral. It is politically charged and part of a contested process. "*Technology is not a destiny but a scene of struggle. It is a social battlefield*" (Feenberg, 1991, p.14) and an "*outcome of political processes*" (Winner, 1986, as cited in Jones, 2015, p.25). Thus, there is a reason to be skeptical about technology enabling PLNs or PLCs and looking at it in merely essentialist and instrumental terms. When the idea of learning is considered as unproblematic, the researchers fail to engage with the political and sociocultural contexts that it is embedded in, and there is no consideration of learner's agency, and the interaction of humans and material (Jones, 2015). One needs to consider the issues like power relations, hierarchies, the fear of cyber bullying, and other factors that hinder free expression and participation as envisaged by idealists like Kleon.

Problematizing Networked Learning

Role of social media in networked learning

Digital networks are necessary, but not sufficient for a network society. In a networked society, *"the core social activities and structures are organized via electronically processed information networks"* (Jones, 2015). Web 2.0 applications including social media, observed Jahnke (2009), transform the social systems (i.e. social groups) into socio-technical systems, with the social and technical interwoven (as cited in Jones, 2015, p.79). These informal networks allow learning to happen across organisational boundaries and include "not just co-workers, but also ex-colleagues and, contacts made through professional bodies." (Milligan et al., 2014, p.2). This frees knowledge from personal or intra-organizational silos. *"Each person throughout this network serves personal learning needs, which are not limited by collective goals"* (Nikolaou and Tsolakidis, 2013, p.78). As a result, a common field of knowledge or interest is also not necessary, and a PLN may represent either a few or many of the interests of each individual. PLC researchers suggest shared vision and collective responsibility to be the driving factors (e.g. Stoll et al., 2016) but the flexibility to focus on personalized needs definitely remains.

Toole's (2019) review of PLCs suggest that benefits of participation in such virtual communities have been established but these cannot be expected to arise simply from participation. In such networks, "***competence*** *[is gained]* ***from forming connections*** *[…] and the* ***capacity to know more*** *is more critical than what is currently known"* (as cited in Anderson, 2016, p.43). When learners are situated in real-world settings as opposed to a classroom, and if they are allowed to focus on their authentic problems, then, a much deeper understanding of the content being discussed is achieved (Bruckman, 2006). This is exactly what happens in virtual groups in workplaces: the problems are

authentic, the implications of learning are real, and the issues and solutions are discussed in a bottom-up manner as opposed to top-down approach in training sessions.

Looking closely at Toole's review provides a hint that the focus is on the affordances provided by the technology but the context where these network members are embedded is not taken as a natural dimension to be explored. This is true for PLNs also. While some researchers (e.g. Kleon, 2014) have considered the internet to be a great equalizer ("*the internet has no bouncer, no gatekeeper, and no barrier to entering the scenes*"), participation in PLNs is essentially a political process. Technology is neither determining, nor neutral. It is politically charged and part of a contested process. "*Technology is not a destiny but a scene of struggle. It is a social battlefield*" (Feenberg, 1991, p.14) and an "*outcome of political processes*" (Winner, 1986, as cited in Jones, 2015, p.25). Thus, there is a reason to be skeptical about technology enabling PLNs or PLCs and looking at it in merely essentialist and instrumental terms. When the idea of learning is considered as unproblematic, the researchers fail to engage with the political and sociocultural contexts that it is embedded in, and there is no consideration of learner's agency, and the interaction of humans and material (Jones, 2015). One needs to consider the issues like power relations, hierarchies, the fear of cyber bullying, and other factors that hinder free expression and participation as envisaged by idealists like Kleon.

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Other factors critical for teachers' workplace practice and learning

While it is important to consider the nature of teacher's knowledge and practice, one cannot neglect the issues of teacher's life history, dispositions, agency, identity, and affordances of workplace and technology. These need to be considered not in isolation but as factors that are intertwined with the teacher's practice, context, and learning. I have already discussed these factors in previous sections, either explicitly (as separate sub-sections) or as part of general discussion. I will now briefly expand on issues of agency and affordances in context of teachers (agents) situated within schools (workplaces). The issue of identity will be dealt separately when I address the nature of communities in the workplaces.

Dispositions, agency, and workplace affordances

From a learning perspective, all engagements are not equally valuable. Degree of novelty of a situation, activity, or practice varies for each individual. The efforts that they are allowed to put in (agency), the efforts that they put in (intentionality), and the scope provided to them to engage with these activities (workplace affordances) will shape the nature and scope of their learning (Billett, 2001, 2011). The intensity of an individual's engagement in different workplace practices is a resultant of their values, beliefs, and socio-cultural backgrounds (Billett, 2011).

The way teachers understand and engage with the different facets of their work is impacted by their personal dispositions and life histories including the opportunities afforded (and utilized) for learning (Hodkinson & Hodkinson, 2004). They also differ in their learning styles and strategies. For example, Hodkinson & Hodkinson (2004) studied two teachers, one of which learned "*through 'hot action', backed up by cold [deliberation] about problems encountered, and [his] learning seemed largely unacknowledged*". The other "*also learned through own teaching but [this learning] was more deliberative [and included] anticipatory learning activity. [He] engaged in collaborative learning [by] consciously watching the way others taught and modeling [them in his own practice]*" (p.176). They argue that these learning styles were a consequence of their life histories, as well as position in (departmental and school) hierarchy and power relations (which further shaped their self-image and school experiences).

Billett (2011) highlights the role of self and personal agency in theorizing of workplace learning. There is a relational interdependence between human actors and their social environments and both are enmeshed. "*Individual teachers' actions and dispositions help structure the learning environment they work in. They are part of it. It is not just external to them*"(Hodkinson & Hodkinson, 2005). The social world is actively remade and transformed by the practices of human actors, and in turn, it (the social) provides human actors "*access to knowledge that is sourced in history, cultural practices (i.e. occupations), and manifested in particular instances of practices of the work*" (Billett, 2011, p.61). Billett's (2011) idea that individual subjectivity and agency are the key to understand learning in and through work is premised on the following:

1. Without intentional exercise of personal agency, it is difficult to change the cultural practices of workplace necessitated by the need for responding to the dynamic challenges.
2. Individual construal of meaning is shaped by their personal life histories (ontogenies), and how they engage with new experiences is also shaped by their personally unique experiences.
3. The individual and social world are always in a dialectic, and personal agency and social suggestions are always relational.

Meaning is actively constructed by individual actors in negotiation with others within the social, and is dependent on their previous histories. Thinking, acting, and learning are not separate but occur simultaneously, and lead to formation of working identities and [individual] subjectivities (Lave & Wenger, 1991).

Affordances: workplace and technological

The term 'affordance' refers to "the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used" (Norman 1988, p.9, as cited in Jones, 2015, p.37). While Norman considers affordances as a fundamental property of objects, it also has been seen as relational, and in conjunction with 'constraints', and both emerge from the interaction among different elements of that are part of the assemblage. What role does the perception, needs, and capabilities of the human actors play in defining affordances and constraints? "The object offers what it does because it is what it is" (Gibson, 1986/1979 as cited in Jones, 2015, p.28). Thus, even when relational, affordances and constraints are also real. These may not be perceived, but they do exist: functionality constitutes 'real' affordances, but the way these get identified and accessed depend on 'perceived' affordances (Norman, 1999).

Billett (2001) defines workplace affordances as "the readiness of the workplace to afford opportunities for individuals to participate in work activities (support or inhibit) and access (or deny) direct and indirect support" (p.209). Such 'readiness' also includes norms and work-practices that allow and motivate the individuals to participate in the work and learn through it (ibid). These affordances, though, are not rigid but quite elastic, especially in the case of a loosely coupled organization like a school.

Workplaces afford certain possibilities, and individuals make use of these affordances through applying their 'agency'. The affordances that an individual has depends on several factors including the position in hierarchy, caste, class, perception about level of expertise, personal relations, and workplace affiliations, etc. (Billett, 2001, p.210). Despite similar affordances, individuals can choose to engage differently with the work based on their motivation, which itself may result from their values, beliefs, understandings, and capabilities. Thus, the learning that they derive from engaging in work practices may differ. In a culture that supports learning and where mutual trust exists, an 'expansive learning environment' increases 'affordances' (Billett, 2001b) for learning at work, as well as the opportunities for the utilization of these by the employees (Hodkinson & Hodkinson, 2005).

In the context of a technology, affordances can be visible or hidden, and the degree of affordance can vary from less accessible to more accessible (for the user). In practice, the affordances available are unlikely to arise in isolation from a single tool, since most tools and technologies in education and learning are present as aggregates (assemblages). One deals not with a single mediator but a web of mediators (assemblages) that collectively create the affordances.

Jones (2015) argues that the technology and its affordances need to be considered separately. Technology (and also objects and artifacts) possess properties that are real and these properties exist independent of their use or perception by a human actor. Technological affordances, on the other hand, are relational. The technological properties become affordances based on their perception and use by the human actor. These properties are likely to be many and varied, but definitely not infinite, and these define the possible range of affordances available to a user. Human capabilities for creative manipulation can stretch the affordances and shrink the constraints built in by the designers of the technology/tools, but there is a limit to which the objects can be stretched. "Technological affordances are second-order phenomena and for human actors and assemblages of humans and machines [...] can be dependent on culture and history" (p.228). Consequently, technologies cannot be considered in isolation from human interactions and social relations, and need to be seen as "composite sociotechnical systems involving a complex interaction of humans and machines" (p.228).

In a sense, although emergent and dynamic, the actual affordances that get utilized depend on human perception and capabilities (skills), as well as the cultures and institutions in which these opportunities are available. Thus, while these technological affordances are necessary, there is a need to also consider the socio-cultural affordances available to the individuals. If collective problem solving or use of calculators is deemed as cheating by the institution (school), the affordances offered by group cognition (owing to the presence of several individuals simultaneously working on same problem in same space) get diminished. Similarly, when social media is seen as a distractor by the management and access to certain websites is curtailed, the opportunities afforded by the technology remain unutilized.

Factors shaping nature of community

The idealized notions of communities

The general imagination of community involves seeing them as an ideal, something that has been lost to modernity. These imaginations, Cohen (1985) argues, are sociologists' fiction (Shumar & Renninger, 2002, p.3). Anderson (1991) contends that *"all communities - with the possible exception of foraging bands - are imagined*" and the modern imagination holding traditional communities as *"loving, close knit families"* is nothing but a modern myth (as cited in Shumar and Renninger, 2002, p.4). Shumar & Renninger warn against depending on such traditional Tonniesan notions of communities (*Gemeinschaft*) for understanding the virtual communities. The normative and fictional character of such imagery impacts *"how we are positioned to think about building virtual communities. […] The definitions of community, [after all], informs the image held, the words used to describe community, and the set of expectations concerning what community can be"* (Shumar & Renninger, 2002, p.4). Such assumptions about an essential set of criteria for defining communities and social interactions within them become unnecessarily limiting and "*may keep us from recognizing forces that structure social relationships and […] the forms of social relationships that are being enacted" in virtual communities* (Shumar & Renninger, 2002, p.5). It thus becomes important to understand the nature of virtual communities, their connection to physical communities, and the factors that shape these communities.

Problematizing 'community'

The word '*community*' has been widely misused in research and practice. It is often used uncritically and is frequently associated with positive overtones. Cox (2005), for example, has critiqued Wenger's (1998) use of this word to describe a community of practice. Citing Brown & Duguid (2001), he argues that 'commune' or 'cadre' could be better, more neutral alternatives and Baumann (2000) also highlights this tendency to see community as a homogenous and harmonious entity (as cited in Phillips, 2016, p.44)). Anderson (1991) argues that even the traditional communities were more conflictual than consensual, with power as the organizing force, and church, kingship, and kinship often acted brutally (as cited in Shumar & Renninger, 2002, p.4). Thus, there is a need to problematize the term 'community' and look closely at the interactions among group members to understand the true nature of the collective.

Physical and virtual communities

Whether physical or virtual, the community is shaped by images held by its members and the ideas enacted by them. There is a tendency to assume physical communities to be more organic, existing in contiguous space, and temporally synchronous. As opposed to this, virtual communities have a **greater need for intentionality,** and the spatial and temporal boundaries are symbolic (Shumar & Renninger, 2002). Barth (1981) has pointed to anthropologists' tendency to see groups as bounded within clear boundaries and having homogeneous cultures, but these boundaries are in fact symbolic and "*may be understood in different ways by its participants […] depending on circumstances"* (Shumar & Renninger, 2002, p.7). Thus, the boundaries in social groupings, whether physical or virtual, are imagined, fluid, and may have non-homogeneous cultures.

The complexity of virtual communities

As opposed to a physical community, a virtual community allows certain reciprocity since archived exchanges and information remains available and useful over time. Instead of geographical proximity, *"what we do with others"* and the *"social networks we maintain"* is more crucial for defining even a physical community (Wellman, 1999, as cited in Haythornthwaite, 2002, p.159). There is a complexity of discourse in virtual spaces since participants can build on previous discussions, have concurrent discussions, and link multiple sites and resources; possibilities not available within physical communities (Shumar & Renninger, 2002). To define a virtual community needs an acceptance of such complexity and multidimensionality. These need to be understood from the participants' perspectives *"what it means to them, what it offers, what it affords its participants, and what its boundaries for them"* (Shumar & Renninger, 2002, p.7).

Linkage between physical and virtual communities

The participants' connections to virtual community are 'cognitive and affective', and not 'spatial or temporal' and relationships are shaped by shared interests of individuals - *"class of objects, ideas, or events"* (Shumar & Renninger, 2002, p.6). Yet, despite being liberated from geography, *"community depends on creating and sustaining strong interpersonal ties, those based on multiple exchanges that include social and emotional content, intimacy, and self-disclosure"* (Granovetter, 1973, 1982; Walker et al., 1994, as cited in Haythornthwaite, 2002, p.161). Thus, the physical and virtual communities share some common aspects: *"adherence to common goals, membership requirements, hierarchy and roles, shared history, common meeting place, social construction of rules and behaviors, and enactment of rituals"* (Haythornthwaite, 2002, p.163).

Pointing to the permeability of boundaries between the virtual and physical communities, Shumar & Renninger (2002) argue that it is very difficult to conceptualize the two as completely separate entities. The relations between the two can often be quite explicit, but they can also be implicit, with

an option available to the individual participant to engage with different groups in the two spaces. The boundaries, then, can be made and unmade in virtual spaces based on the social imagination of its participants. An active participation in virtual communities along with physical communities does not mean that the relationships with those in physical groups become weak. In fact, Chmielewski & Wellman (2000) suggest that *"long-term users of the Internet are more likely to maintain contact with those they are close to, including those in close physical proximity"* (as cited in Shumar & Renninger, 2002, p.10). The permeability between the two thus also impacts those who are not participants in the virtual communities.

Virtual spaces as public discursive spaces

Public deliberation and reciprocal dialogues among different social actors have been considered as critical elements of any democratic society. These have been linked to an expanded public sphere through constant reasoning and disputation (Habermas, 1989, as cited in Ho & McLeod, 2008, p.190). The potential of computer-mediated communication (CMC) in the expansion of the public sphere has been discussed widely by researchers. The argument involves the possibility of remaining anonymous, and lesser or no use of observable social cues relative to face-to-face interactions since the expression happens through writing. Such online 'discursive spaces' are considered to be democratic spaces (Pfister & Knowolton, 2010) and *"have the potential to create an environment conducive for public deliberation by attenuating the effects of the undesirable social-psychological influences on opinion expression"* (Ho & McLeod, 2008, p.191). The participants, it is assumed, are free to share, discuss, and contribute to the group activities without any barriers since the bureaucracy does not control this platform or define its rules.

What hinders free expression in CMC?

Anonymity in CMC and the reliance on written text were expected to pave way for more egalitarian participation, greater idea generation, and more diversity in participation (Ho & McLeod, 2008). In reality, the discussions in virtual communities are not along expected lines and the active participation is difficult to achieve. With the popularity of social media platforms like Facebook and Whatsapp, the anonymity assumed as a part of CMC is difficult to maintain. This is more so in case of groups with participants from the same organization. Additionally, the use of emoticons, emojis, images and even videos for communication brings back several aspects of face-to-face communication (Ho & McLeod, 2008).

There have been several attempts to understand the reasons for people's reluctance to share their honest opinions with others (in social context). The theory of '*Spiral of Silence'* (SoS) (Noelle-Neumann, 1993) has been widely used to understand public opinion expression. Empirical research has corroborated the SoS theory and its findings were also replicated in the online spaces (for example, see Matthes, Knoll, and von Sikorski (2018) for a meta-analysis of SoS studies in physical and online context) (Chun & Lee, 2017). The theory argues that individuals measure the (majority) public opinion and if they perceive it to be unaligned with their own views, they are likely to remain silent due to fear of isolation.

Chun and Lee (2017) attempted to find *"factors that make people [empowered to] speak out and share their opinions"* in a social media environment (p.121). Thus, instead of the focus on the individual and the fear of isolation, they shifted the focus to group dynamics. They found that *"simply perceiving opinion congruency with others' comments on social media does not increase perceived sense of power/control, but it can be increased when people perceive social support from the comments themselves" (p.127).* The impact was higher when sharing opinions within own personal social networks (a close group of people) compared to a wider social network. Finally, the expressed willingness to comment was strongly correlated with the actual commenting behavior, thus validating their findings. Others have come to a similar conclusion that the general perception

of majority opinion and the fear of isolation mattered less than the expressed opinion of the members through comments in the virtual group (Ho & McLeod, 2008).

Power relations in virtual communities

Defining a community involves defining its terrain and boundaries which are both shaped by the power differences among individuals. It is a discursive process (Shumar & Renninger, 2002). Thus, there is a need to recognize power as part of all interactions. The 'social structure' and 'norms' are also reflected in the interaction that happen among participants within the social spaces (physical and virtual) (Shumar & Renninger, 2002). Though not addressed in detail in their work, Lave & Wenger (1991) also suggested that 'power relationships' shape access within workplaces and thus, they have a bearing on participation in communities (of practice).

Ideally, the virtual spaces allow the individual to overcome hierarchies in physical spaces. They can exit these virtual social fields without others being aware of it. Thus, there is an opportunity to diffuse hierarchies. Tour (2017) suggests that in technology-mediated learning spaces, *"traditional markers of status and authority do not exist"* (p.12). Yet, Van Wijk, Van den Bosch, & Volberda (2011) have pointed out that in networks, power issues create barriers for knowledge transfer and learning. There is thus a need to identify the ways in which power relations impact interactions implicitly or explicitly.

Role of trust in virtual spaces

Trust is a crucial element of successful teams and extensive research exists to establish the role it plays in enabling productive interactions and transactions. It is an implicit belief that the other party will not get involved in opportunistic behavior to take advantage of the vulnerability of the trustor (Ridings, Gefen, & Arinze, 2002). Although no definition of trust in literature is unproblematic, it can be defined as *"the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party."* (Mayer et al. 1995, as cited in Zejda, 2011, p.531).

Some researchers (e.g. Dwyer, Hiltz, and Passerini, 2007) believe that online interactions can be considered as a technical extension of real-world interactions and thus, the general characteristics of trust within virtual interactions remain same. This is not an uncontested position and the very nature of online interactions (absence of facial cues and physical contact) is seen as a roadblock in trust development (Ridings et al., 2002). Gallenkamp, Korsgaard, Assmann, Welpe, & Picot (2011) quote Handy's (1995) famous statement that *"trust needs touch"* to highlight this position. Yet, there is agreement that trust is important for virtual communities but it is relatively more difficult to achieve than within physical settings (Jarvenpaa, Kantu, & Lim, 2017).

Trust, virtual spaces, and relations in physical spaces

The importance of trust in physical interactions is well accepted for long. Blau (1964), for example, found that *"people in traditional communities work better with others they trust, while actively avoiding contact with those they do not trust"* (as cited in Ridings et al., 2002, p.275). In virtual spaces, in absence of any workable rules, trust acts as basis for acceptable behavior of members, especially in the initial phases (Ridings et al., 2002). Slowly, repeated interactions within public domain may help evolution of trust between the individual and the group of strangers. Trust was found to be an important predictor of a member's intention to exchange information in virtual communities (Ridings et al., 2002), a vital element in online interactions.

Even when working in blended teams, effective communication requires trust: technology alone is not enough (Handy, 1995). The content, frequency, and process of formal and informal communications within virtual spaces help construct trust relationships (Hanson & Gobes-Ryan,

2015). Higher perceived responsiveness shown through replying quickly and often to others' messages has been linked to higher levels of trust (Ridings, Gefen, and Arinze, 2002). Moreover, trust increases when people know something personal about each-other. Such knowledge-based trust (Robert, Denis, and Hung, 2009) develops when enough information is available about the other person to enable one to predict her behavior, expectations, and norms (as cited in Hanson & Gobes-Ryan, 2015, p.2124). This could prove crucial in situations where individuals interacting in virtual spaces have opportunity to meet physically, or in virtual spaces outside the task-focused groups.

The nature of trust

Trust is usually understood as a psychological state while trustworthiness gets perceived as a characteristic of the person (trustee) (Rotter, 1971, as cited in Hanson & Gobbes-Ryan, 2015, p.2123). This view considers trust to be a property of the individual but others (e.g. Lewis & Weigert, 1985) consider that it could be seen as a property of interacting parties thus making it a social phenomenon (Junglas, Johnson, Steel, Abraham, & MacLoughlin, 2007). In virtual spaces, since the posts are usually addressed to a general audience, trust exists at a generalized, collective level (Ridings et al., 2002).

In the context of virtual groups, trust can be based on *"roles (skills implied from designated position in team); rules (structure and norms attached to a team); third-party recommendations (input from other coworkers who have engaged with same people or been in similar situations); dispositions; and social-markers (cultural or identity based stereotypes)"* (Robert et al., 2009, as cited in Hanson & Gobes-Ryan, 2015, p.2124). It is a complex, multidimensional construct that is also linked to context-specific elements. Paul and McDaniel (2004, as cited in Hanson & Gobes-Ryan, 2015, p.2123) argue that interpersonal trust has three parts: calculative (cost-benefit of interacting with others), competence (belief that abilities are in congruence with designated role), and relational (reciprocal, involving emotional ties and shared identities as team members). Ability, benevolence, and integrity have been considered as three dimensions of trust but within virtual communities, Ridings et al. (2002) argue that benevolence and integrity lead to same behavior—reciprocity. The ability or competence dimensions suggest that trust is contextual. For example, despite high generalized trust, we do not depend on a close friend to diagnose or treat a disease but call on a qualified doctor.

Golbeck and Hendler (2006) argue that trust is transitive, i.e. "we may follow trust relations to infer trust between those who do not trust each other yet or who even do not know each other" (as cited in Zejda, 2011, p.532). It is also asymmetric and directed, and trust by one party may not be reciprocated to equal extent. Finally, trust is not static but dynamic, and the level of trust is emergent. It can be absent, gained over time, lowered, or even lost (Zejda, 2011). It must be developed, maintained, and nurtured, and unexpected or counterproductive acts can lead to deterioration of trust.

Trust and Power

Hanson and Gobes-Ryan (2015) argue that power is an important contextual factor that impacts trust, and in the context of virtual groups, it needs to be considered. Power creates unilateral dependencies or unbalanced relationships. Bachmann (2001) suggests that "*trust and power together are the means of coordinating organizational relationships at the interpersonal and the structural levels*" (as cited in Hanson & Gobes-Ryan, 2015, p.2123). Thus, these have a bearing on trust among team members, between individuals and leaders, and between teams and organization.

Identity, practice, participation, and learning

In the general context of virtual environments, an ability to hide and change identity has been considered as crucial for participants in virtual worlds (Junglas et al., 2007). This possibility arises from the fact that the *"corporeal body is separated from the interactions over the internet"* (Hu,

Zhao, & Huang, 2015, p.466). Thus, the individuals can detach from the social norms governing them in physical spaces and express themselves more freely. Such a disjunction between the physical and virtual identity is difficult to achieve in the context of workplace virtual groups where members often know each other even when they do not work together physically. Anonymity is difficult to maintain in context-specific discussions that happen in virtual groups involving peers from workplace. Social media platforms like Whatsapp further make maintenance of such dual identities impossible since each account is connected to a mobile number which is mapped to real people.

Identity-practice-learning

In the context of workplaces, work practices matter and often drives participation in virtual groups. The popularity of Wenger's (1998) conceptualization of communities of practice can be considered as a testimony to this linkage. An institution can impose rules and procedures, but it cannot define the practices of its employees. These practices are an outcome of negotiated meanings among community members (Henderson, 2006). Similarly, job descriptions cannot define identities of workers which are built through negotiations within the communities. Practice and identity, thus, cannot be defined externally (Henderson, 2006).

"Practice is more than what we do. It is how we perceive our environment and how we interact with what goes on around us. At the same time, our identity which frames how we perceive ourselves and what is important to us, shapes and is shaped by our practices." (Wenger, 1998, as cited in Henderson, 2006, p.10). *"The issues of identity are an integral aspect of a social theory of learning and are thus inseparable from the issues of practice, community and meaning"* (Wenger, 1998, p.145). Learning is an outcome of participation in a community. So, learning, practice, and identity are intricately linked.

Social nature of participation

Wenger (1998) sees identity not as an object but a 'constant becoming' (p.154). He argues that our identities are constantly changing (temporal), moving in a trajectory that ties both the past and the future. In this way, we identify ourselves as much by where we have come from and where we believe we are going as by our current competence as members of the community (of practice). The participation is crucial for identity formation, but it is not an individual act. Participation is essentially a social activity even when a member is alone (Wenger, 1998). As Henderson (2007) points out, a teacher may develop his or her lesson plan in isolation but will constantly be making decisions based on his or her understanding of his or her students' needs as well as a sense of what is acceptable according to the institution's expectations and a need for his or her colleagues' approval. What appears to be a solitary pursuit is actually a socially negotiated practice (Phillips, 2016). This has implications for the nature of participation in a virtual group. The contributions of members within these spaces is skewed and lurkers are more common than in physical communities. While one may appear a non-contributor, these lurkers could be *"potentially productive participants, not ready to make a contribution yet, […] and may be in different stages of legitimate peripheral participation (LPP)"* (Shumar & Renninger, 2002).

Group Cohesion

Casey-Campbell & Martens (2009) have defined cohesion as the *"group members' inclinations to forge social bonds, resulting in the group sticking together and remaining united"*, though there is no accepted definition. There are differences in conceptualization of cohesion, with disagreement even over it being unidimensional or multidimensional construct. Is the concept applicable to teams, individuals within teams, or to both levels, is another issue with no accepted answer. Besides, cohesion is temporal and emerges over time (Salas et al., 2015). Team cohesion has been considered as critical for team success and has been linked to team performance (Salas, Grossman, Hughes, & Coultas, 2015). It is for this reason that cohesion has been used as a dimension to define the virtual

communities. For example, Henri & Pudelko (2003) created a typology of virtual communities with Communities of Interest (CoI) being low on cohesion and high on intentionality, while Communities of Practice (CoP) were considered as low on intentionality and high on cohesion.

While task cohesion has been given due importance, social cohesion outside task domain has also been considered. Besides task and social cohesion, belongingness, group pride, and morale have also been considered as the dimensions of cohesion (Salas et al., 2015). Wenger (1998) has argued that a community's cohesion is dependent on *"the extent to which practice and identity are invested in mutual engagement (doing things together), joint enterprise (responding together to the organization's needs and goals), and shared repertoire (resolving problems together)"* (Henderson, 2006, p.10).

The mutual engagement is more than performing tasks together to achieve task-related goals and involves skills beyond task-related skills *"It provides the social environment in which communities can form and in which practice and identity can be negotiated"* (Henderson, 2006). Thus, the group participants must have opportunities to do things together. Such situated, purposeful engagement is crucial in shaping their identity and practices and helps sustain the community despite external pressure (Henderson, 2006).

Summarizing the literature review

The review started with the existing status of teacher professional development in India. Capability of educator is important in ensuring learning outcomes of students. At present the poor pre-service training has created a situation where the teachers themselves are not capable to teach students effectively. Poor infrastructure, highly hierarchical organisation, insufficient support staff, and involvement in administrative and non-academic work further creates challenges. In addition, these GPS teachers serve students coming from the poorest socioeconomic backgrounds which make it more challenging. The issues of low teacher motivation, high absenteeism, etc. are also well documented as contributing to current state of public schools. The government primary schools are often situated in isolated, remote rural areas and some schools have only one teacher for each subject, thus accentuating isolation from their peers. It is in this context that the virtual communities have come up as a source of overcoming teachers isolation and providing them an opportunity to engage with peers for their own professional development.

The literature review started by considering 'school as the workplace', a loosely coupled organisation (Weick, 1976) but the practices within this institution are governed by State Education Department. This, despite being loosely coupled, the teachers do not have much leeway in operating within classroom (Kumar, 2011). It is in this context that the learning of teachers needs to be understood. The next part of the literature focused on learning within workplaces. The focus of practitioners is on solving practical, contextual problems (Resnick, 1987) and hence, the nature of learning that happens within workplaces different from the learning that happens within academic institutions. In addition, these are adult learners who can learn without external scaffolding. Learning in workplaces is a natural part of the process and happens *"in, for, and through"* (Evans et al, 2006) leading to expansion of capacities of individual to engage in work. WPL is mostly informal in nature and involves practice-based knowledge (Ellström, 2010).

Next, I looked at the three broad approaches to workplace learning: individual, sociocultural, and socio-material (postmodern) (Hager, 2011). The focus of individual approaches was on workers reflection-in-action and reflection-on-action (Argyris & Schön, 1978; Schön, 1983).Learning was considered as a product and not problematized. Sociocultural researcher of workplace learning (Brown & Duguid, 2001; Lave & Wenger, 1991) saw learning as being social in nature and considered knowledge as being created in collaborative practices as work problems got solved by

interdisciplinary teams. These theories did not explicitly consider context-specific factors that impacted learning. Billett (2001, 2004) problematized the position of individual within these theories as being ambiguous and Hodkinson & Hodkinson (2003) considered separation of the individual from the social as impossible. Thus, there is a need to look simultaneously at the isolation as well as embeddedness of the individual within the social (workplace and society). Socio-material (postmodern) theorists (e.g. Fenwick, 2010; Orlikowski & Scott, 2008) further highlighted the role played by artefacts in learning and how it has been relegated to background by the workplace learning theories. They argued that organisational knowing is produced in action which is always materially embedded. These practice-based approaches enable us to talk about knowing, learning, doing, and organizing as socially and historically embedded process and not as an end product, which is always materially mediated and is emergent and situated (Nicolini et al., 2003).

The next section focused on learning of teachers within the workplace (i.e. school). Teachers' learning has been considered as part of in-service teacher training or professional development programs. They need time and space to engage in, reflect on, and analyze their practices (Murray et al., 2014). Virtual community participation allows these teachers to enlarge their peer group, and share and reflect on their practices with people outside the boundaries of their organisation (school) (Macià & García, 2016). The review further looked at the nature of teachers learning and how it has been looked at primarily through focus on pedagogical and curricular issues in conjunction with technology (e.g. Koehler & Mishra's (2005) TPACK framework). Such a view has been primarily criticized for absence of a role for language and dialogicality in the generation, interpretation and negotiation of knowledge (Phillips, 2016). The absence of context and considering knowledge as individual product 9and not collective attribute) in this stream of research has also been a major critique.

This was followed by considering the ways in which teachers learning get impacted by introduction of computer mediated communication and ICT tools. These tools allow affordances for social interaction and for teachers to engage in authentic learning tasks. The teachers can create their own personalized learning environment. Ifenthaler (2018) found that studies focusing on digital workplace learning and how such technologies can bridge the formal and informal learning gaps in the workplace as scarce. Further, studies focusing on informal collaboration of teachers for the purpose of learning and PD are rare. While reviewing empirical studies on teachers' virtual learning, Macià & García (2016) found that most of studies on in-service teachers look at groups and communities specifically created for the purpose of professional development and these are situated within formal learning spaces (i.e. these are not bottom up). Interestingly, they decided to remove studies involving face-to-face interactions. The significance of this exclusion will become clear in the context of present study. Hence, these researchers argue that little attention has been paid to teachers self-initiated learning within virtual spaces (Tour, 2017), a gap that the present study tries to address.

I also looked at the nature of collaboration that happens within virtual spaces for the purpose of learning. CSCL studies have focused on this phenomenon but most of these studies are located within formal Institutions of learning (schools and Universities). CSCW studies focus on work places but they do not look at learning practitioners. Goggins & Jahnke (2013) and Fischer (2013) highlighted this gap and suggest the there is a need to look at collaborative learning that happens within workplaces with the help of computer mediation. This was followed by looking closely at the way networks and communities have been understood by various researchers including the classification of virtual communities by Henry and Pudelko (2013) based on the two dimensions of intentionality and group cohesion. Fisher (2013) argues that the community which develops in such situation is a community of interest (CoI) which is focused on problem solving. I highlight the ways in which there are contestations on the definitions of the classification.

The review further looked at the teachers' Personal Learning Network (PLN) and how they are part of multiple virtual communities; actively engaged in some and peripheral members in others. The literature on professional learning communities (PLC) consider congregation of professionals coming together to share and critically interrogate their practices in order to improve them. The literature also highlights that this benefit cannot be considered as emerging automatically from my participation in the groups. The participation in such virtual communities has been seen as a political process where technology is seen as a social battlefield. Thus, there is a need to problematize the nature of participation and learning that happens within these communities and to explicitly consider the political and social context in which these communities are embedded. The learners' agency, disposition, personal histories, as well as the material aspects of interactions are also critical to consider as learning gets shaped by these all factors.

Finally review looked at the factors that have been considered as shaping the nature of community. The idealized notion of community as 'loving and close knit' has been challenged as a modern myth (Anderson, 1991). Thus, there is a need to problematize the idea of community and look closely at the interactions that happen among the group members to understand the true nature of the collective. Virtual communities require greater intentionality from members and the boundaries for these communities are more symbolic than real and the relationships are shaped by the shared interests of individuals (Shumar & Renninger, 2002). The virtual spaces have been considered as public discursive spaces but this notion is also challenged (Pfister & Knowolton, 2010) and the factors that hinder free expression within CMC have been explained (e.g. by Noell-Neumann's (1993) Spiral of silence theory). Power relationships among individuals and the social structure and norms also get reflected in the interactions (Van Wijk, Van den Bosch, & Volberda, 2011) and create barrier for knowledge transfer and learning in virtual spaces. The literature further looks at the role of trust in virtual spaces and how it is more difficult to build trust as compared to physical spaces due to lack of face to face interaction. Finally, I look that the issues of identity creation and how it shapes practice. Learning is an outcome of participation in communities so practice. Learning and identity are intricately linked and need to be considered when discussing learning within virtual spaces and workplaces.

Chapter 3: Research design and methods

The phenomenon of interest for the study

The central goal of this study was to understand the ways in which learning manifested for the primary school teachers of public schools when they participated in virtual communities with their peers. In addition, I also tried to understand the nature of communities that emerged in these cases. In last few years, teachers of the Gujarat Government Primary Schools came together in several 'unofficial' Whatsapp or Facebook groups. The groups were initiated primarily by the individual teachers (or a group of teachers). In some cases, an external, non-departmental entity also created the groups that focused on sharing content created by the GPS teachers. These groups are now hubs of diverse activities including sharing academic or administrative information, innovative ideas, questions from peers, sharing school activities, or coordinating official tasks etc.

Before the access to such technology-mediated platforms, periodic physical training[13] provided the only official avenue for the teachers to discuss the academic, pedagogical, or other issues with the administrators or their peers outside school. The agenda for these trainings is pre-determined by the state level functionaries and conveyed through circulars to the concerned administrative functionaries (including teacher-trainers) and the teacher trainees. Thus, within the formal space and time, the teachers have little scope to drive the agenda of their own learning. Even if the challenges faced by the teachers arise from local contexts, the top-driven trainings fail to recognize this and provide little scope for focusing on such issues. Besides, the frequency (approximately 2 cluster and one block level training every two months) is fixed.

The idea of 'access to peers', and specifically to those who are teaching the same subject to same grades becomes highly relevant in the Indian public-school context. According to DISE (2017) data, the lower primary schools (up to grade 5) in Gujarat have an average of less than 3 teachers, but the number is likely to be lower in the remote rural schools. Even in upper primary schools (up to grade 8), the average number of teachers is less than six, and usually, there is no overlap in the grades or subjects they teach. Thus, the teachers are left to face their challenges on their own if they cannot physically access their peers teaching same grades and subjects. The challenge can be expected to be even more for the trainee-teachers joining as Vidyasahayaks or who get transferred to schools located in different socio-cultural context.

The virtual groups have created a possibility of building informal networks that the teacher could access to share their ideas and problems and learn from each other. It was this phenomenon of teachers organizing themselves into a community for learning with help of peers by using technology-based platforms that was the primary focus of my study. This learning from virtual groups ultimately needs to be utilized for achieving outcomes in the physical workplace (i.e. classroom and school). Hence, I also wanted to understand the ways in which teachers are able to utilize the learning from virtual groups within the physical workplace.

The teachers stay in the same school for several years. In Gujarat, eight to ten schools in proximity are officially designated as part of a 'cluster' which acts as an administrative unit, especially with

[13] The teachers are expected to undergo 20-days of formal in-service training every year. Of these, twelve cluster-level meetings are scheduled for first Saturday of every month. A separate calendar for eight-day Block-level training is shared. (See http://gujarat-education.gov.in/ssa/annual_report.htm for Annual reports that mention the data on training schedules and achievements). See the tentative calendar for Block level 8-day in-service teacher training for FY 2016-17 uploaded by the State Education Department. The trainings are general, subject-specific, or grade-specific. (http://gujarat-education.gov.in/ssa/Images/SSA_2016-17_TALIM_CALENDER_08082016.pdf)

regards to the routine professional development activities. Consequently, these physical 'communities' (school and cluster) have been an integral part of teacher's professional lives. Alongside these physical communities, 'virtual communities' have become salient for the teachers. I wanted to understand the nature of the communities that emerged when teachers came together in virtual groups, and how the participation in these new (virtual) communities impacted the interactions in the old (physical) communities. This became the secondary focus of the study.

Research questions

The primary focus of the study was on teacher's learning in virtual spaces, and secondary focus was on nature of communities. To understand the phenomenon of 'public school teachers voluntarily organizing themselves into a virtual community for their own learning, so that their students can benefit', four research questions were formulated.

> Q.1: How does learning happen for teachers when they come together in a virtual social network?
>
> Q.2: How does the learning acquired by the teachers through their participation in the virtual communities get re-contextualized for application in physical workplace?
>
> Q.3: What is the 'nature of the community' that emerges when the practitioners (in-service teachers) from a traditional, geographically distributed organization come together in a virtual social network to learn from each-other?
>
> Q.4: How does the participation in virtual communities impact the nature and extent of interactions (e.g. vigor, diversity, focus) that happen in physical communities?

These four questions guided my study and kept me focused during the data collection, as well as data analysis stages. The major concerns of the study, the nature of learning and the nature of communities, also shaped the choices that I made about positioning the study in a certain paradigm, and the methodological choices arising from that.

Ontological and epistemological assumptions

Ontology concerns the *"claims and assumptions made about the nature of social reality (what exists, what it looks like, what units make it up, and how these units interact with each other"* (Blaikie, 2000, as cited in Adam, 2014, p.4). Epistemology, according to Blaikie (2000), is "the possible ways of gaining knowledge of social reality" (as cited in ibid). It is concerned with the process of gathering knowledge about the social reality that we identified based on our ontological position. These ontological and epistemological positions then dictate the modes available to the researcher (methodology) for acquiring knowledge about the phenomenon. Thus, the research design and the analytical strategies that are utilized within a research project (techniques/procedures used to collect and analyze data) are guided by the answers to the ontological, epistemological, and methodological questions which together constitute the 'research paradigm' (Guba and Lincoln, 1994). From the reader's perspective, a clear articulation of these choices provides the justification of the approaches adopted in the study (ibid).

I set out to investigate the nature of 'learning' and 'communities' arising from participation in peer-driven virtual groups. Before I could start, I needed to place my study within a particular research paradigm to clarify my ontological and epistemological positions so that I could select the appropriate methodology and methods to gain this knowledge. I placed this study within an

interpretivist paradigm where the reality is understood as a social construction. Individuals interact 'in' and 'with' the world, and it is through these interactions that meaning gets constructed 'intersubjectively'. *"[All] knowledge resides within the meanings people make of it and is gained through people talking about their meanings. It is laced with personal biases and values, stated in a personal, up-close manner, evolves, emerges, and is inextricably tied to the context in which it is studied"* (Creswell, 1998, as cited in Wyss-Flamm, 2002, p.81).

To access the socially and intersubjectively constructed meaning, the interpretivist researcher needs to depend on *"language, consciousness, shared meanings, documents, tools, and other artifacts"* (Klein & Myers, 1999, p.69). Since the meaning is assigned by the people (either individually or as a group), the researcher needs to access these people in order to understand the phenomenon (i.e., socially constructed reality). She needs to *"engage in the social setting [being] investigated and learn how the interaction takes place from the participants' perspective"* (Adam, 2014). Field studies that allow researchers to engage with the participants in the real social setting, Orlikowski & Baroudi (1991) argue, would be more suitable for generating such interpretive knowledge.

Interpretive case study as the research methodology

After positioning the study within the interpretivist paradigm, I chose to utilize field studies as suggested above to access the teachers' understanding of learning and community as they engaged with their peers in virtual groups. 'Interpretive case studies' (Stake, 1995, 2006) seemed a reasonable choice as the primary tool of investigation. These allowed me to interact directly with the teachers who were intimately engaged in the phenomenon of interest. Case studies allow one to discover how [people] *"function in their ordinary pursuits and milieus"* (Stake, 1995, p.1). They allow generation of rich data embedded within context (Wyss-Flamm, 2002) to allow in-depth investigation of the phenomenon. Case studies are useful when the purpose is *"[in-depth] understanding, extension of experience, and increase in conviction in that which is [to be] known"* as opposed to *"explanation, [generation of] propositional knowledge, and [general] laws"* (Stake, 1978, p.6). Thus, case studies are useful to produce analytical generalization and not statistical generalization (Yin, 2012). Stake (1978, 1995) also argue similarly and contends that the latter is not even the goal of the method.

The interpretive case study, according to Stake (1995), is an attempt to study the particularity and complexity of a single case. Each case is 'specific' and 'bounded', and represents a *"specific, complex, functioning thing"* (p.2). Attending to the question of 'what can be this bounded case', Stake (1978) suggests that *"whatever is of interest: [an] institution, a program, a responsibility, a collection, or a population"* can be the case (p.7). While attending to the case-in-focus, the purpose is not to produce generalization but particularization; to search for patterns and consistencies. *"We take a particular case and come to know it well, not primarily as to how it is different from others but what it is, what it does. There is an emphasis on uniqueness, and that implies knowledge of others that the case is different from, but the first emphasis on understanding the case itself"* (Stake, 1995, p.8). This is often achieved by studying unusual cases.

While Stake (1995) dealt with understanding derived from a 'single' case, Stake (2006) extended the use of 'multiple' interpretive case studies *"to examine something that has a lots of cases, parts, or members"* (p.vi). The 'whole' that constitutes these 'cases, parts, or members' is referred to as the 'quintain' by Stake: *"The quintain can be an organization, and we study its different parts. The quintain can be a campaign, and we study its instances"* (p.vi). The quintain is something that the researcher is interested in understanding more thoroughly and employs multi-case study for the purpose. Drawing from Geertz (1973) and Simons (1980), Stake (2006) argues that while *"it is*

important to examine the common characteristics of the phenomenon, […] it is also important to examine situational uniqueness, especially [in its] complexity and interaction with the background conditions" (p.ix). The purpose is to work with a set of case studies that can collectively illuminate the phenomenon (quintain) in an effective manner.

Justification for using interpretive case-studies

For this study, I utilized this 'interpretive' multi-case study approach to understand my 'quintain'. The virtual group (VG) in focus, and the physical groups (PG) that its members are associated with became the tentative cases. The 'specificity' and 'boundedness' of these cases promised me a glimpse into the activities of the teachers in the virtual groups, and their interactions with their peers from VG and PG. I expected the multiple case-study to prove useful for understanding the phenomenon (nature of learning and communities) closely.

Using 'interpretive' case studies as the research methodology provided me two benefits. One, this was in sync with my ontological assumption of the reality being socially constructed (social constructivist view). Two, it allowed me to enter the field without an apriori theoretical framework, which is a dominant way to conduct the case study research in the positivist paradigm (e.g. Yin; Eisenhardt).

Much if the existing research on the participation of teachers in virtual spaces (discusses in chapter-2) is focused on either on pre-service teachers, or on projects initiated by education administrators or universities with a specific focus on teacher's learning through collaboration. Thus, these virtual communities are not bottom-up. In addition, such studies focus on either virtual connections, or physical spaces. The behavior and interactions of individuals in VG were likely to be different in the context where I was planning to explore the phenomenon (i.e. Government primary school teachers in India). A good look at the several public Facebook groups of these teachers showed a low engagement but talking to some of the teachers from these groups painted a different picture. The engagement was higher in physical spaces, or at peer-to-peer level and not in virtual 'public' spaces. Thus, entering the field without any a-priori theoretical framework looked more reasonable. With no existing study on the phenomenon in India and little information on the groups themselves made interpretive case studies a better choice. Of course, taking seriously Maxwell's (2013) advice that *"any component of the [qualitative research] design may need to be reconsidered or modified during the study in response to new developments"* (p.2), I was prepared for any such eventuality. The choice of interpretive case studies seemed to be a good fit for my needs.

Expanding on research design

In this chapter, I briefly introduced the phenomenon of interest and the research questions that guided my study. I then delved into the ontological and epistemological assumptions of the study, thus positioning my study within the interpretive research paradigm. This was followed by explaining the choice of methodology (interpretive case-study) arising from these assumptions. Last, I provided the justification for choosing this methodology for investigation of the phenomenon.

Next, I will detail the research design and my rationale for the choices that I make. This will include details of the research context, the sampling decisions, and the data collection strategy used for the study. Next, I will delve into my data analysis strategy. I will also elaborate on the way in which ethical issues arising from the study were addressed. Last, I will present the criteria to evaluate the study, the limitations of the study, and close the section with concluding thoughts.

Research design

The context of the research

Spread over 196,000 sq. km, the state of Gujarat (India), where this study was done, has a population of more than 60 million. Gujarati is the official language, as well as the primary language of communication. There are more than 44,500 schools in the state of which 75% are government schools; 70% schools are in rural areas. More than 94% of these schools are primary or upper primary (i.e. up to grade 8). More than 5.6 million students study in these government schools (4.7 million in rural areas). There are 205,848 teachers across government schools in the state. For this study, the teachers from the primary schools (both lower and upper primary) are of concern (DISE data 2016-17).

The teachers from these government primary schools are a vital part of the Indian education system. Those who can afford, send their children to private schools. The government school teachers thus teach students from the most vulnerable sections of society, those who are low on social, cultural, and economic capital in Pierre Bourdieu's (1985) words. They face criticism from the government and society when their students are unable to perform well on three-Rs (reading, writing, and arithmetic). In Gujarat, although the average student-teacher ratio in the government primary schools is 27.5, there are almost 900 schools with a single teacher (DISE, 2017). Besides shortage of teachers, there is also acute shortage of infrastructure. Several school buildings are dilapidated, and some become non-operational for days during monsoons due to water logging or water dripping in the classroom from the roof or broken windows. Besides the lack of physical infrastructure, the teachers face professional development challenges. The in-service teacher training has been criticized for not being effective enough (Kidwai et al., 2013; NCERT, 2005).

It is in this challenging context that the teachers have initiated peer-driven, technology-mediated forums to share and access ideas, innovations, documents etc. with the ultimate focus on creating positive outcomes for their students. One of these, 'Teachers as Transformers' (TAT), is a network of more than 6000 innovative teachers from government schools in the states of Gujarat and Maharashtra (India). This network emerged from a physical network that was initiated in the early 2000s and was driven by a group of teachers with support from an academic institution for about a decade. The move to a technology-mediated platform was initiated in 2012, in two locations, Solapur in Maharashtra, and in Gujarat state, the latter through the initiative of Ravi J. Matthai Centre for Education Innovations (RJMCEI) at IIM Ahmedabad. It was through the teachers involved in TAT (EI Bank) that I came to know of the existence of the other virtual groups initiated by the teachers. These geography or interest specific technology-mediated forums (including websites, blogs, FB groups, and mobile applications) in Gujarat have been created 'by teachers' and 'for teachers'. Their focus could vary from sharing administrative information, to creating and sharing content for professional development (e.g. departmental promotion examination material; administrative hacks) or for improving classroom effectiveness (e.g. grade and subject specific questions or activities). While some groups have a membership in hundreds, others could have more than several thousand individuals accessing the content. It is these virtual networks of teachers and the way members participate within these virtual networks to enhance their learning that is the focus of this study. The rationale for selecting specific groups for this study will be provided in the sampling plan.

The organizational context of research sites

The focus of the present study was the virtual and physical groups of the teachers teaching at the public primary schools in Gujarat. The state has more than 44,500 schools[14], of which 75% (33800) are public schools. More than 99% of the government schools are either lower primary (grade 1-5) or primary (grade 1-8), and only a handful (less than 0.1%) are only upper primary schools (grade 6-8). In this study, these are collectively referred as 'government primary schools' (GPS). Of the total government primary schools, more than 90% are located in rural areas. These GPS have more than 5.6 million students (84% in rural GPS) and 0.2 million teachers. Consequently, the average Pupil-teacher ratio (PTR) for the GPS is 27.5 but 41% schools in the state have PTR above 40 (DISE, 2017).

Situating teachers within the organization

The teachers are a part of the state education department's Primary Education wing, which is a highly bureaucratic organization with the teachers at the bottom of the hierarchy. **Figure 3** provides the organizational structure of the department.

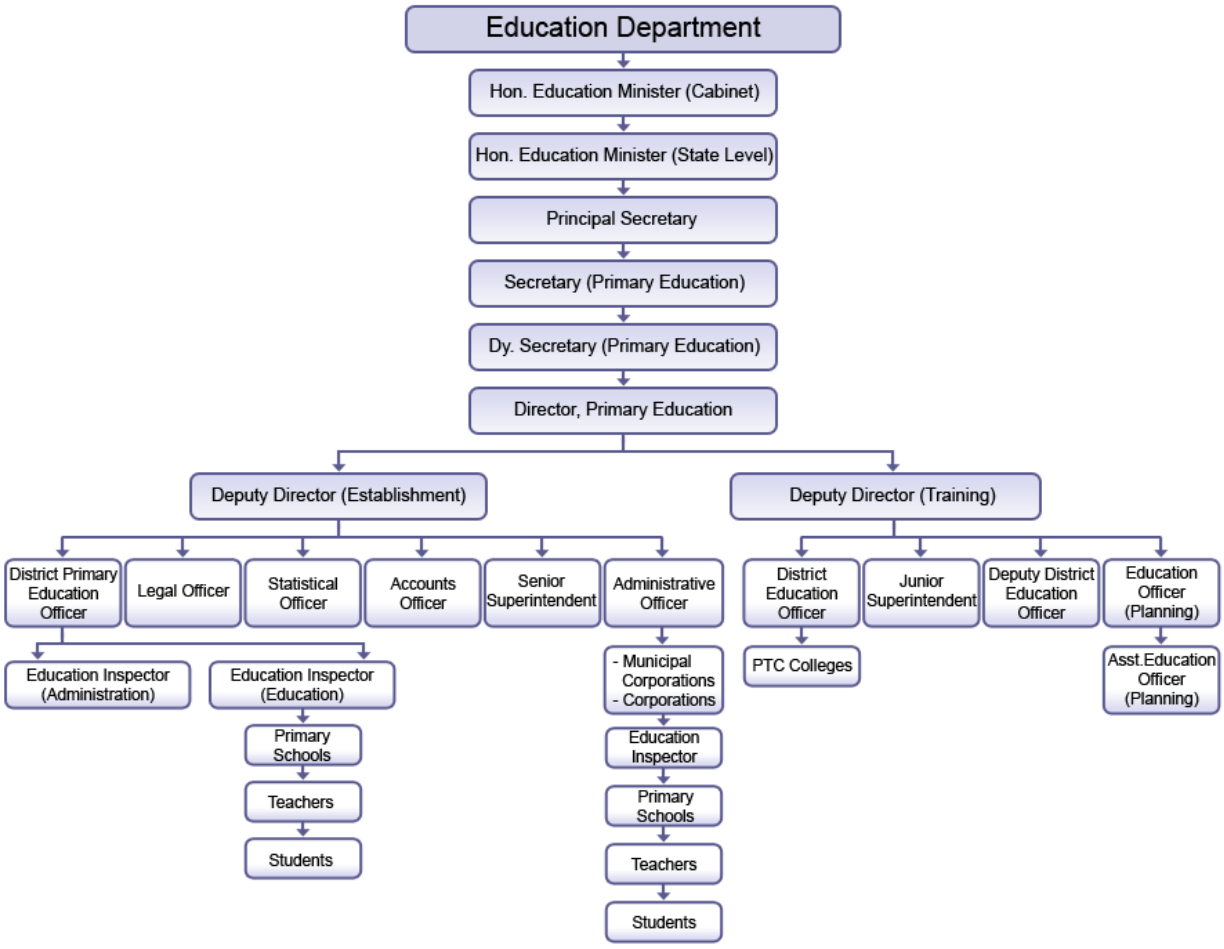

Figure 3: Administrative structure of the primary education department[15]

[14] All statistics regarding the schools in Gujarat state are sourced from 2016-17 DISE Data (DISE, 2017) unless stated otherwise.

[15] Image Source: http://gujarat-education.gov.in/primary/about_department/vahivati-madkhu-eng.htm

The teachers report to the school principal (Head Teacher), who further reports to the Taluka Primary Education Officer (TPEO) and the District Primary Education Officer (DPEO). A group of 8-10 schools located in geographical proximity form a cluster with a designated CRCC (Cluster Resource Centre Coordinator) responsible for this administrative unit. This CRCC reports to the TPEO and is responsible for the teacher training and the administrative coordination with the schools in the cluster. Each district has one District Institute of Education and Training (DIET) that is responsible for organizing the regular in-service training for the teachers. One resource person is assigned for each subject at the Taluka level (called the Block Resource Person-BRP) to help teachers in the taluka with subject-related issues. The hierarchy governs the relationship between the teacher and the officials; and the teacher rarely gets an opportunity to interact directly with the district or state level officials. A major portion of communication is top-down (primarily through circulars). The teachers find it difficult to openly challenge the state officials or the policies and any such challenge, if noted, is considered as an act of indiscipline and receives a reprimand. (For example, see Express News Service (2018); Pande (2018); and Roytalukdar (2018)).

The social milieu of schools

Over years, there has been a migration of students from government to private schools. Between 2010-11 and 2015-16, the enrolment went down by 13 million in the government schools in 20 biggest states of India, while it increased by 17.5 million for private schools (Kingdon, 2017). Even after this, 65% of the school-going children go to government schools, and the proportion is higher in the state of Gujarat with only 7.7% children in rural areas and 24.8% in urban areas (15.4% overall) going to private schools that receive no government grants (Kingdon, 2017). The proportion is even higher in upper primary classes, with 86% of the students in the age group of 11-14 years enrolled in government schools (ASER, 2017a; Saha, 2017).

Those who can afford to send their children to private schools do so, and the government schools are thus left with children from the poorest sections of society (Kingdon, 2017). The caste and class intersection among Indian population results in "the disadvantaged [social] groups [being] heavily concentrated in the lower economic class category" (Nandwani, 2016, p.135). The proportion of Scheduled Caste and Scheduled Tribes[16], the most socioeconomically backward communities in the state, is 6.7% and 14.8% respectively. Yet, 7.7% and 21.7% students in lower primary classes and 9.4% and 21.7% students in upper primary classes in Gujarat government schools belong to the SC and ST communities respectively (DISE, 2017). Consequently, the students in the government schools are not just from the poorest but also from the most socially disadvantaged caste groups.

As discussed, the students in government schools come from the poorest sections of society, with several students living below or close to poverty line (monthly family income less than INR 5000). In contrast, the salary of the GPS teachers is very high. In Gujarat[17], the teachers initially join as a Vidya Sahayak (Teaching Assistant) and earn INR 19950 per month. After five years, they are appointed as a teacher and get a monthly salary of more than INR 26000 plus other allowances[18]. The teachers teaching for more than a decade get more than INR 40,000 per month and those near retirement

[16] The constitution of India recognizes four broad segregations for affirmative action. The tribal population is categorized as Scheduled Tribes (ST), the lowest of the castes that face maximum social discrimination are clubbed under Scheduled Castes (SC). These two groups have been receiving reservation in admission to institutions of higher education and government jobs since 1950, while other socially backward classes (OBC) were extended benefits of affirmative action in early 1990s. Those who do not form part of these three groups are collectively labelled as 'unreserved' or 'General category'.

[17] The salary data for Vidhyasahayaks was based on recruitment notification for the posts for FY 2018-19 available from http://bit.ly/2Sog11Q. The teacher salary data was based on inputs from the teachers interviewed for the study. Since it is a government job, the data is not confidential and the starting salaries, as well as the annual revisions, can be predicted with ease.

[18] The situation is similar across states. Kingdon's (2017) analysis shows that a junior Primary school teacher in another state (Uttara Pradesh) gets more than INR 38,000 as salary.

age may be drawing a monthly salary of 60 to 80 thousand rupees. Besides the economic chasm, there is difference in the educational qualifications of the students' parents and teachers, with several students being first generation learners.

Since the GPS are physically located within communities from where the students come, they are influenced by the socio-cultural milieu of the local community. The teachers usually stay in these schools for several years[19] and are required to interact with the local community owing to the non-academic tasks (e.g. election duties, census data collection, health surveys etc.) assigned to them by the department. Thus, these teachers become a significant part of the local community, especially when the schools are located in remote, rural areas. While the students mostly walk or cycle to the school, most teachers in rural schools stay at the district or taluka headquarters and travel to school by their own vehicles.

Resource constraint: A constant reality

The resources of the department are spread thin, with one BRP or TPEO responsible for as many as 250-300 schools. The National Achievement Survey (NAS) 2017 reports that schools in Gujarat face severe resource constraints, with as many as 18% of the school buildings in the state requiring urgent repairs. 37% schools have shortage of teaching staff, 20% reported scarcity of teaching instruction materials, 55% had inadequate support staff (NCERT, 2017), and several schools do not have Principals (Express News Service, 2017). These issues arising from administrative inefficiencies impact the academic activities within schools and may have consequences for teacher morale.

Poor learning levels and the pressure to perform

Not surprisingly, the academic achievement of the students in the GPS is a matter of concern. The National Achievement Survey 2017, a national level survey with a sample size of 2.2 million students found a consistent decline in learning levels across grades with a large percentage performing below the grade level. In the state, 41% of grade-VIII students failed to read and write numbers up to 999; 53% could not solve problems on daily life situations involving addition and subtraction of fractions and decimals, and 69% could not calculate the surface area and volume of a cuboidal and cylindrical object (NCERT, 2017). The situation is equally dismal across other subjects and is confirmed by ASER[20] (2017) report. It found 25% of 8th graders unable to read a grade-II level text and 79% students in class-III incapable of reading grade-II level text. The corresponding numbers for Gujarat were 23% and 78%.

Taking cognizance of the problem, the education department launched several programs to improve the learning levels. Gunotsav[21] (literally, celebrating quality) was started in 2009 as an annual assessment exercise that grades schools and children, and teachers according to the performance of their students. Mission Vidya was launched to provide remedial classes to help the students below grade level to 'catch up'. The teachers have been trying to improve the learning outcomes but with little success (as visible in recent NAS and ASER reports). Understaffed schools and overworked and undertrained teachers also implement the government directives regarding non-academic tasks, "*from conducting cattle census, election duties, pulse polio work to ration card verification.*" They spend barely 19.1% of working hours[22] in core teaching activities in the classroom, found a recent study conducted by National Institute of Education Policy and Administration (Puppala, 2018). NV,

[19] All the teachers I interviewed (except two) had been in their present school for more than six years, and several had been in the same school for over a decade.

[20] Annual Status of Education Report (ASER) is an annual, large scale survey conducted by Pratham since 2005 to gauge the reading, writing, and arithmetic proficiency of school students. Instead of being school-based, it is a household based-survey and is widely recognized as providing a good picture of learning levels of school students.

[21] http://www.gunotsav.org/aboutus.html

[22] The study utilized self-report measures and hence, the data must be interpreted with caveats associated with such methodologies in mind.

one of the participants of this study shared his experience: *"We get a lot of [non-academic] work. […] There are national, state, local body or village elections. In 5 years, at least 3-4 times we go for election duties. Even that is fine, but primary schoolteachers are roped in for all kinds of work. […] The government should stop this. When we will be allowed to focus on teaching, only then [positive] results will come"* (NV: 87-88). Given the hierarchical nature of the organization and their position within the hierarchy, the teachers rarely get an opportunity to raise their voice to provide feedback to the higher ups in hierarchy (for an exception, see Sharma (2018b)). Yet, they are blamed for the poor results despite the time and resource constraints.

It is within this organizational and social context that the cases of interest for the present study were located. During the analysis, I will further build on this context and the ways in which it interacts with and shapes the phenomenon of interest.

Bounding the phenomenon

This study was consciously limited to the exploration of teacher's learning in the virtual spaces for context-specific application in their physical workplace (i.e. school or classroom). The aim was not to look for the implementation of ideas originating as a result of this learning in the classroom, or its implication for the learning of students in the classroom. Consequently, classroom observations or interviews with students were not part of the study.[23]

Sampling plan

Walsham (2006) points that *"all fieldwork is context-dependent and requires difficult choices to be made"* (p.321). Careful selection of cases is crucial, for the sample is usually small. As already discussed, the goal in interpretive multi-case study is not to search for statistical generalization but analytical generalization. In fact, each case should be analyzed for 'particularization' or 'uniqueness', to search for patterns and consistencies.

Providing a guidance on how to choose cases, Stake (2006) argues for selecting cases "that most enhance our understanding than to pick the most typical cases" (p.vii). He calls these 'instrumental' cases: "Case study here is instrumental to [accomplish] something other than understanding this particular [individual or program]. [W]e may get insight into the [research] question by studying a particular case" (Stake, 1995, p.3). A group of such case studies focused on answering the same research question(s) is termed as 'collective case study'. In particular, Stake (2006, p.23) provides three criteria:

a. Is the case relevant to the quintain?
b. Do the cases provide diversity across contexts?
c. Do the cases provide good opportunities to learn about the complexity and contexts?

[23] Though classroom observations were not part of the research plan, during the interviews, the teachers showed the way they used the ideas and artifacts that were shared within VG (either created by themselves or shared by others in VG) through videos or images stored in their mobile phones. During the course of the research, I got opportunity to visit classrooms of three teachers (RR, BB, and VD). These classroom observations did not add much value in terms of understanding the utilization of ideas from VG, for the sessions were not necessarily built around these ideas. Still, the classroom observations proved useful from the perspective of understanding the workplace realities of the teachers.

The sample selection for the study involved the following steps. Initially, I defined the various virtual groups of the government primary school teachers as the population[24] from which I had to select my sample. Next, I had to select few virtual groups (VG) from this population that could help me understand the quintain. From these groups, I had to identify the teachers who could act as the key informants about the VG. In addition, I had to identify the physical groups (PG) that these teachers were part of, select those that were relevant for my study, and select some teachers from these PG to understand their interactions in the group. Stake (2006) states that purposive sampling is usually a better choice for qualitative fieldwork, for it allows "to build in variety and create opportunities for intensive study" (p.24). While step-1 required purposive sampling, step-2 necessitated a mix of purposive and snowball sampling. Step-3 had to be completely snowball sampling.

For selecting the VG, I chose the following criteria. One, the groups should involve voluntary participation of teachers, i.e. it should not be mandated by the education department. Two, there should be evidence of interactions with reasonably high frequency. Three, the participation must be diverse, and it should not be that only few teachers post frequently in the VG and everyone else remains a silent spectator. Of course, this was not easy to establish, for prior access to such groups was not possible, especially when they were Whatsapp groups. The last criterion was about the focus of the group. Some groups focused on a particular subject, while others had a broader focus on any academic subject related discussions. Some were focused on sharing administrative information to keep members informed. Others were geography-specific (e.g. school cluster, block, school, district etc.) and some were concerned with use of information-technology in classroom.

Sampling virtual groups

Stake (2006) argues that in interpretive case studies, "the [sample] selection process regularly begins with the cases already at least partially identified" (p.22). This was true for this study also. While selecting VG (step 1 – purposive sampling), I consciously decided to shun those groups that focused only on administrative issues (like sharing circulars) or that were formed on basis of geographic affiliations but had no specific focus. The goal of the study was to understand 'learning' that happened in these groups, and it was not difficult to imagine that the two types of groups I just described are unlikely to be good sites to study it. The past field research at RJMCEI had led to creation of a repository of several such virtual groups. I requested the staff at RJMCEI to talk to some active teachers in the EI Bank network to find if there were any new groups that were not already part of the repository.

One obvious candidate was the Teachers as Transformers (EI Bank) network that was operational since 2000 and had a virtual group since 2012. It was a large group with more than 6000 teachers, and the teachers were active in its Facebook page and several Whatsapp groups. They were spread across the state, and innovations created by several of them were regularly shared in the groups either by the innovators themselves, their peers, or by the group administrators. Several of these were also added to the repository of the Education Innovation Bank (www.inshodh.org). This became the first group of my sample. Although it was not initiated by a teacher but an external, non-departmental actor (RJMCEI), the content in the group was all created by the teachers even when the administrators shared it. Thus, it was selected as the first case.

While EI Bank was a broad-spectrum group focused on sharing and accessing innovations from all academic subjects and even school or community related innovations, the second group [North-4 Taluka S.Sc. Teachers Group) was subject focused. It was a Whatsapp group created more than four

[24] It was not possible to determine objectively with any accuracy the population size because these are informal groups which are not freely available on the web (e.g. Whatsapp groups). Only prior contact or word-of-mouth could be the way to reach these groups. Only groups about which prior information was available, or could be obtained were considered as the population. The list of some of these groups is provided in Appendix-1.

years ago by teachers engaged in teaching Social Science and mostly had teachers from one particular taluka in North-4 district. It had more than 60 members. As opposed to the broad focus of EI Bank, the S.Sc. teachers group was sharply focused on one subject.

The third Whatsapp group (C-3 ICT VG) chosen was created only recently. It was created by a few tech-savvy teachers to support their peers in the taluka in implementation of an ICT project (Gyankunj) recently started by the state government in selected schools. This group was even more focused (on a single project), a narrow spectrum group. Thus, the three groups were focused on different themes and range of issues.

In terms of geography[25], the members in EI Bank were from across the state, while S.SC. Teachers' group was limited to a remote taluka in a tribal district in North Gujarat. The C-3 ICT VG had teachers from Central-3 district (non-tribal) but most were from a single taluka (66 out of 82 schools chosen for Gyankunj project in C-3 district were in single taluka). In terms of focus, the groups were idea focused (innovations), subject focused (Social Science), and project/technology focused (Gyankunj/ICT). I hoped that these three diverse cases would be able to provide me insights to understand the phenomenon in-depth. Stake (2006) also argues for keeping the cases 'embraceable', i.e. they should not be too large or too diverse to know experientially. I had chosen three VG, but I also had to study the PG associated with the teachers in these VG. Thus, only three groups were chosen.

Characteristics of the three virtual groups chosen for the study					
	Type	Membership	Focus	Geography	Operational
EI Bank	Two Facebook Groups: IWT TI	IWT: 2900 TI: 3000	Broad (Curriculum; pedagogy; administration; community)	State-wide	5+ years
N-4 S.Sc.	Whatsapp and Facebook Group	60+ for WA; 400+ for FB	Single subject (Social Science)	N-4 Taluka	4+ years
C-3 ICT	Whatsapp Group	230+	Single Project (Gyankunj)	C-3 district	< 6 months

Table 1: Characteristics of the three virtual groups chosen for the study

Sampling teachers within virtual groups

Once VG were selected, at the next level, I had to choose teachers who could be my key informants. Knowing teachers in EI Bank group[26] was made easier by their close association with RJMCEI. I had enough information about several teachers, their work, and their engagement with the VG. I initially chose three teachers who were innovators and were from different districts. Two of them were females, while one was male.

For C-3 ICT group, the choice was easy since I only knew one teacher who was also the group administrator. Being a Whatsapp group, I could not remotely find any information about the members of the group or the activities therein. So, I decided to pick teachers from this group through snowball sampling after meeting the group administrator.

[25] See Appendix-4 location of various physical groups, and Appendix-5 for the abbreviations used for the locations (districts/talukas).

[26] I had initially selected only three virtual groups as the cases. During interviews, one teacher from TAT informed me about another VG (which I call N-5 Taluka VG) where he was the administrator. This VG had several teachers from his taluka as members, Since I had to select the PG relevant to this teacher, I also decided to look into the N-5 Taluka VG (a Whatsapp group). The teacher was kind enough to email me the group chats.

For the S.Sc. Teachers group, I selected the Cluster Resource Centre Coordinator (CRCC) who was part of this group and was located in North-4 taluka whose teachers were part of this group. I selected another teacher from this group as a participant for the study since he had a reputation as an innovative Social Science teacher and was passionately involved in teaching in a remote tribal school of North-4 district. The remaining teachers (from VG and PG) were selected after meeting these informants selected in the first phase. I describe the VG, the teachers interviewed from each VG, the PG salient for these teachers, and the teachers from each PG who were interviewed briefly in sample description below (and in detail in the next chapter).

For this study, the focus was on understanding the nature of 'learning' and 'communities' that arise as a consequence of teachers' participation in VG. I had a choice to create a new VG for the purpose of this study, recruit teachers for the study, and then look at the interactions that happen. I decided to against this option because it would have removed the key element of the group serving some need of the teachers that they had identified themselves, and that was being served by their engagement with their peers in a VG. Such a group would have been removed from being a naturalistic phenomenon. My presence in the group could also have impacted the way teachers interacted with each other. It was for this reason that I also did not attempt to join the Whasapp groups that I studied and depended on teachers/administrators to provide me with the chat transcripts if they wished to do so.

Teachers interviewed for the study

Seventeen teachers were interviewed for the study. Of these, five were part of the EI Bank VG, three of Central-3 ICT group, four were part of North-4 Taluka S.Sc. Teacher's group. Four teachers belonged to North-5 Taluka virtual group. Two teachers (PM and RR) were part of more than one of these VG, while one (BS) was not part of any VG studied but she belonged to the N-4 Taluka PG. PT was part of none of these four VG but was interviewed since she belonged to N-4 PG and was part of ICT VG of her taluka which had similar agenda as C-3 ICT group but in a different location.

In this section, I will discuss separately the physical context where the teachers from each VG are situated. The critical role of the physical groups in the professional lives of the teachers is discussed later.

A brief note on the profile of teachers

The state education department recruits the lower and upper primary school teachers for the Government Primary Schools centrally. For teaching lower grades, a teacher is required to have completed a Primary Teacher Certificate course (also called Diploma in Elementary Education), while an upper primary teacher is required to have a B.Ed. (Bachelor of Education) degree, but several teachers also have M.Ed. (Masters in Education) degree. A single teacher usually stays with the lower grades for the whole day, while the upper grades have different subject teachers. For upper primary grades (VI-VII-VIII), teachers are recruited for teaching specific subjects. Usually, the students are taught four languages: Gujarati, English, Sanskrit, and Hindi. Each school has one or two language teachers (depending on student enrolment) to teach these four subjects[27]. In addition, there are subject teachers for Mathematics, Social Science, and Science. At times, if the batch size is small, a single teacher teaches Mathematics and Science.

In 2011-12, based on recommendations of NCTE (2009), the department introduced a new rule according to which the teachers in upper primary classes could only teach subjects that they had studied during their under-graduation degree. Consequently, several teachers had to change the subjects that they were teaching (sometimes for decades) or had to shift to lower primary classes if they did not have a B.Ed. degree. This resulted in a major reshuffle in the lives of teachers who had

[27] Although this is true as a general rule, the subjects can change depending on contingent requirements like teacher being on leave, or a vacancy arising due to a teacher's retirement.

to change their subjects, while some of those moved to lower grades due to their academic qualifications considered it as a demotion.

Teachers interviewed from Central-3 ICT VG

Three teachers (PM, BS, and NV) from ICT VG were interviewed for the study. While PM was selected through purposive sampling, BS and NV were selected based on inputs from PM. Two of these (BS and PM) belonged to the same school (S6), while NV's school (S7) was located less than 5-km from BS and PM's school. Both these schools were selected for the initial phase of Gyankunj project and had received the requisite hardware and software. Being part of the same taluka, both these schools were receiving project-related technical support from the same service-provider and were under the jurisdiction of the same District MIS (Management Information System) Officer. PM and BS were utilizing the Gyankunj project infrastructure in their teaching while NV was actively involved in its implementation in his school as the Head Teacher. I could not interview the teacher in NV's school who was directly responsible for the project's implementation in school S7. BS had more than 10 years' experience while NV and PM had been in the state education department for more than 15 years.

Table 2: **Profile of teachers interviewed for C-3 ICT VG and associated PG**

S.No.	Teacher	Gender	Location	School No.	Position	Wing	Experience	Part of C-3 ICT VG
1	PM	M	Central-3	S6	Teacher - S.Sc.	Upper Primary	15+	Yes
2	BS	F	Central-3	S6	Teacher - Language	Upper Primary	10+	Yes
3	NV	M	Central-3	S7	Head Teacher	Administrative	15+	Yes
4	PT	F	North-4	S8	Teacher - Language	Upper Primary	20+	No

In addition to the individuals concerned with the C-3 ICT VG, I interviewed PT, who was a language teacher at an upper primary school located within the Taluka headquarter boundaries of North-4 taluka. Her school was chosen for Gyankunj project implementation and she was using the project infrastructure for her classroom teaching. She was also a part of the official project-related WA group created by the district MIS Officer for the North-5 district. While interviewing the teachers from North-5 taluka S.Sc. teachers' VG, I requested her to meet for a chat about the Gyankunj project and the related WA group. This allowed me to access information about a project-related VG that was official in nature unlike the C-3 ICT group. Also, in the process, I visited a school that did not face the physical barriers faced by the remotely located S-6 and S-7 schools in Central-3 district. This provided a good opportunity to compare and contrast the official vs unofficial, and the remotely located centrally located schools in a scenario where the physical delivery of service was dependent on location of the schools.

Teachers interviewed from EI Bank VG and North-5 taluka VG

Of the seventeen teachers interviewed, four (VN, SC, GP, and VD) were part of EI Bank VG (See figure 4 for network of teachers). One (RR) was the administrator of the N-5 Taluka WA group and a member of the EI Bank VG). Although PM was selected for being a part of C-3 ICT VG, he also turned out to be an active participant in EI Bank VG. My interaction with him was primarily focused on C-3 ICT and hence, his role in EI-Bank VG and associated PG were less relevant for the analysis concerning present section. RR, on the other hand, was primarily interviewed for his participation in EI Bank VG. During the interview, N-5 Taluka VG turned out to be a critical part of his work life and some parts of the interview provided more information on that group. Thus, RR's physical groups

and his situatedness within EI Bank VG are crucial for my analysis in the present section. As a result, although N-5 Taluka WA group has been analyzed as a separate group, I have included RS, CA, and MN from this VG as part of PG associated with the EI Bank VG.

Thus, in the context of EI Bank VG, four teachers were relevant, while three were interviewed for their role in N-4 taluka VG and one was common to both the groups. Their profile and relevant details are provided in the **Table 3** below. Purposive sampling was used to select all the participants in EI Bank VG. They were selected based on their active participation in the EI Bank VG (through their innovation submissions, as well as their responses to the 'Prashna Manch' questions). Snowball sampling was used for selecting teachers belonging to the N-5 taluka VG.

The eight teachers interviewed belonged to three different districts and five different schools. Their experience ranged from 8 years to more than 30 years. All the teachers had been posted in their present school for more than six years except VN who had been transferred less than a year back. Some of the teachers had been posted in the same school for all their career (e.g. RS, MN). Thus, the '*school as a physical group*' had relatively stable membership for the teachers in the sample.

Profile of teachers interviewed for EI Bank VG and associated PG								
S.No.	**Teacher**	**Gender**	**Location**	**School**	**Position**	**Wing**	**Experience**	**Primary VG**
1	VN	F	Central-1	S10	Teacher - English	Upper Primary	15+	EI Bank
2	RR	M	North-5	S4	Teacher - Grade-1,2	Lower Primary	15+	EI Bank; N-4
3	CA	M	North-5	S4	Teacher - Science	Upper Primary	8+	N-4
4	MN	M	North-5	S5	Teacher - Language	Upper Primary	15+	N-4
5	RS	M	North-5	S5	Teacher - Science	Upper Primary	15+	N-4
6	SC	F	Central-2	S1	Teacher - Language	Upper Primary	30+	EI Bank
7	VD	F	Central-2	S9	Teacher - Grade-3,4	Lower Primary	25+	EI Bank
8	GP	F	Central-2	S9	Principal	Administrative	18+	EI Bank

Table 3: Profile of teachers interviewed for EI Bank VG and associated PG

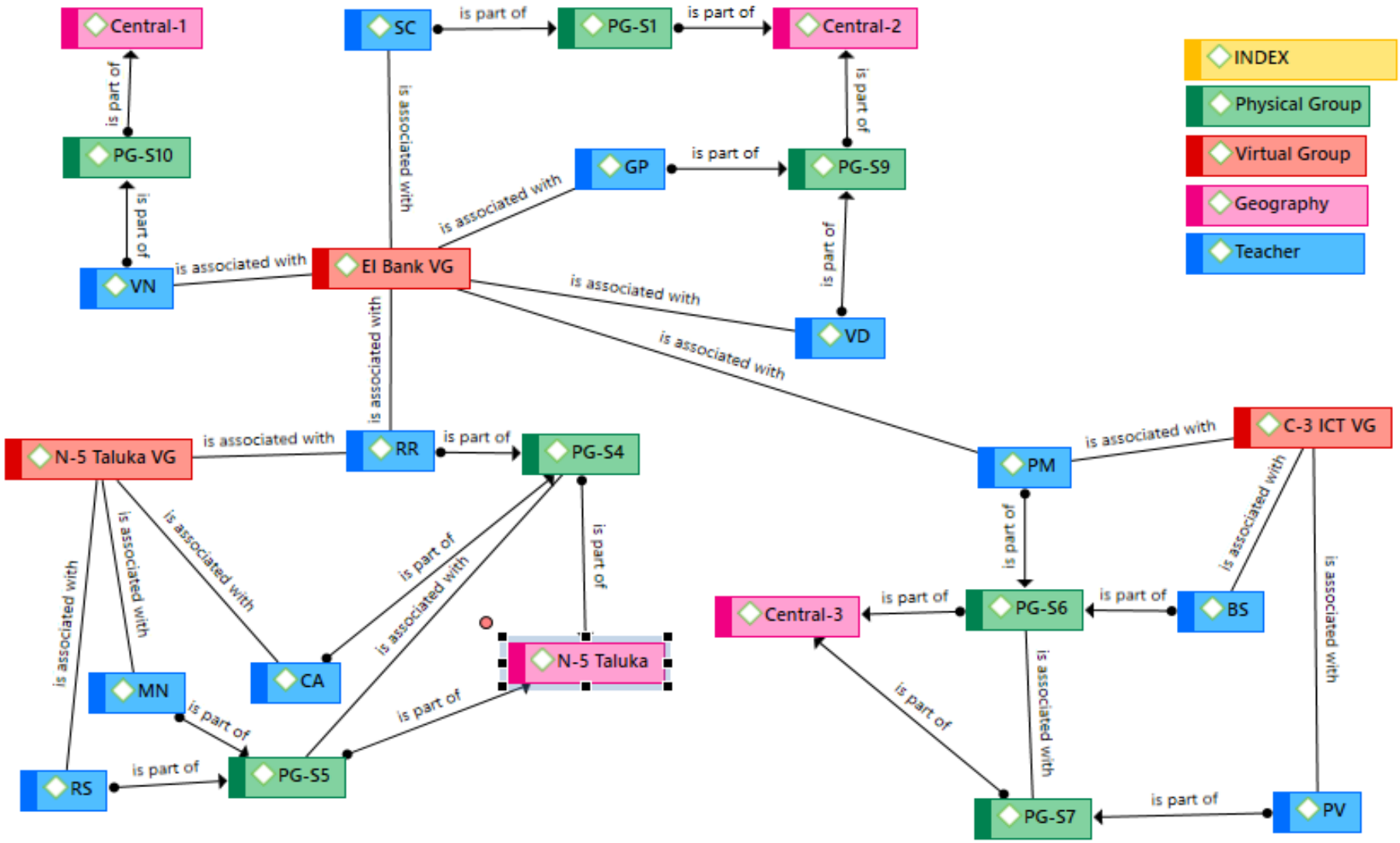

Figure 4: Network of teachers interviewed from EI-Bank and C-3 ICT VG

Teachers interviewed from North-4 Taluka PG

The administrator of the North-4 taluka S.Sc. Teachers' VG (JK) was also the initiator of the group. He was the Block Resource Person (BRP) for the North-4 taluka. As a BRP, he was responsible for the activities (including the teacher training and innovative content development and sharing) concerning his subject of expertise, i.e. Social Science. Consequently, he was chosen through purposive sampling for the interview. Along with him, one teacher (BB) who actively participates in the VG as well as the associated activities in the PG was also selected through snowball sampling after interview with JK. JP was selected for interview based on information available with RJMCEI about his active role as a CRCC in motivating teachers in his cluster to use innovative teaching methods. I met CS through a chance encounter during my visit to the Block Education Office (BEO) where I had gone to meet JK and JP. CRCC and BRP operate from the BEO and they were interviewed in their office. BRP has included CRCCs in his group to allow for dissemination of the knowledge across the multiple clusters that fall under the jurisdiction of his taluka, although JP and CS were not Social Science teachers before taking the role of CRCC.

In addition to these four individuals, I also interviewed BR who was recognized as an innovator in the taluka. She was an English teacher in a remote school in the N-4 taluka and I decided to interview her to understand the perspective of a young female teacher in a remote school in a tribal district. The VG and PG connections of teachers in North-4 Taluka are shown in Figure **5**5.

Profile of teachers interviewed for N-4 Taluka S.Sc. Teachers' VG and associated PG								
S.No.	**Teacher**	**Gender**	**Location**	**School No.**	**Position**	**Wing**	**Experience**	**Part of N-4 S.Sc. VG**
1	BB	M	North-4	S2	Teacher - S.Sc.	Upper Primary	25+	Yes
2	BR	F	North-4	S3	Teacher - English	Upper Primary	8+	No
3	PT	F	North-4	S8	Teacher - Language	Upper Primary	20+	No
4	CS	M	North-4	A1	CRCC	Administrative	11+	Yes
5	JK	M	North-4	A1	BRP	Administrative	10+	Yes
6	JP	M	North-4	A1	CRCC	Administrative	5+	Yes

Table 4: Profile of teachers interviewed for N-4 Taluka S.Sc. Teachers' VG and associated PG

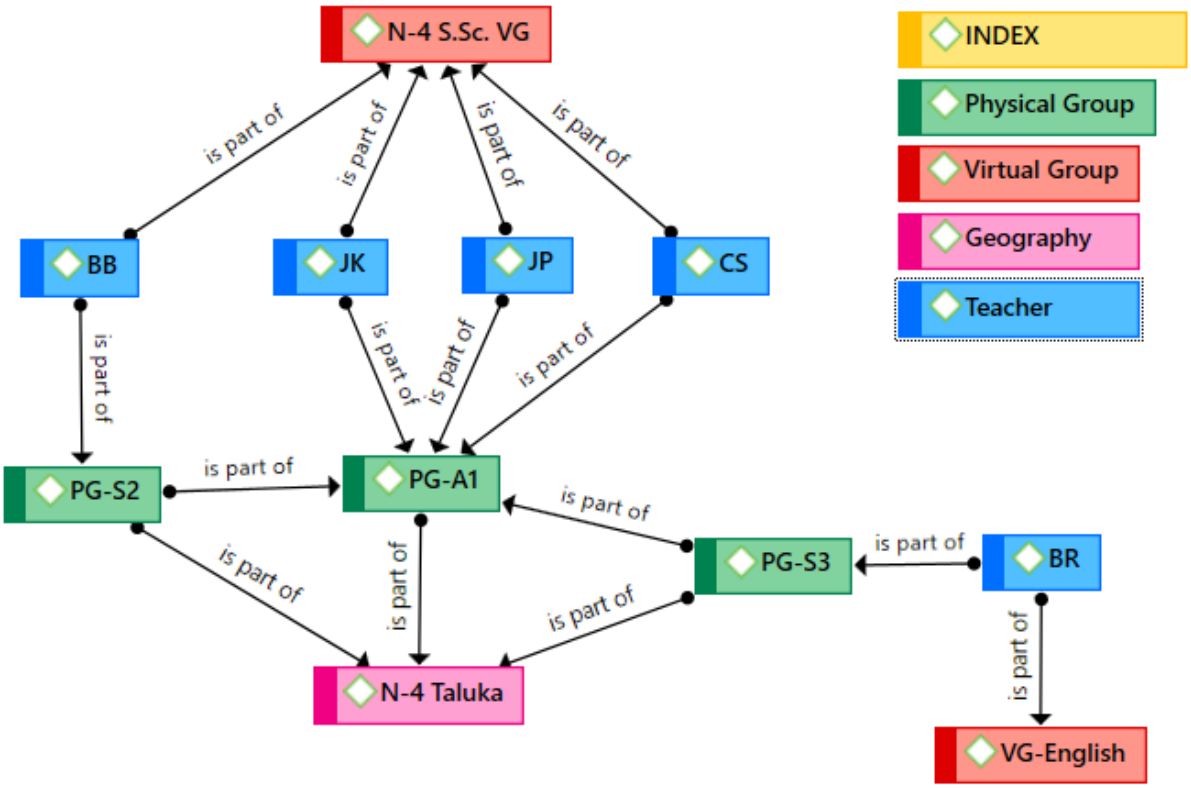

Figure 5: Network of teachers interviewed from North-4 Taluka

Role of physical groups (PG) in lives of teachers

Public schools are physical spaces embedded within the local community and mostly serve the underprivileged sections of the society. Owing to long association with their schools, the teachers often meet frequently and become well acquainted with their peers from nearby schools. These interactions are primarily informal. Officially, eight to twelve schools form part of the cluster. A Cluster Resource Center Coordinator (CRCC[28]) formally coordinates the training and administrative activities for all these schools. The subject teachers from the cluster meet almost 15-17 times a year for formal trainings. Owing to physical proximity (usually a radius of 15-20 km) and relatively frequent meetings, the cluster is the most accessible subject-specific group for a teacher, especially in remote rural areas. Besides, occasional training sessions are organized at the taluka (BRC), district (DIET), and state level, but owing to large group size, these meetings are strictly agenda (decided in a top-down manner) driven and leave little space for informal interaction among teachers.

The village or the local neighborhood where the students live and the school is located become a crucial part of the lives of the teachers. Formally, the school management committees (SMC) mandated by the law requires involvement of the parents of some students as well as the local residents. The students are impacted due to their embeddedness in the community and this reflects in their classroom experiences. Consequently, besides teachers, the local community is another physical entity that matters for the teachers.

[28] The department conducts an internal examination of 'interested' teachers who apply for the post of CRCC. Thus, all CRCC are former teachers and it changes the nature of their work from primarily pedagogical to primarily administrative.

Which Physical Groups matter the most to teachers?

Which physical groups matter the most to the teachers? 'The teachers from one's own school' may be considered as a natural answer to this question, but this was not always the case. VD found the principal (GP) and a few other staff members of S9 to be very supportive and enthusiastic about trying or implementing new ideas. The school thus became a center of activity and discussions for her. Similar was the case of RR, whose peers from school (S4), especially CA, were part of the PG that he was embedded in. RS and MN were part of same school (S5) and this school was barely 3 km from S4. All these teachers (RR, CA, MN, RS), owing to physical proximity of their schools as well as residences, frequently met each other informally. This informal PG thus became a crucial part of their professional lives. The experience of SC was different. Her peers in school (S1) were not very enthusiastic about trying new ideas in teaching. Consequently, she found the Innovative Teachers' group constituted by the district administration as more conducive for interactions along with some other teachers from her cluster (CRC) who shared her interests. Similarly, VN was recently transferred to her present school and it was not this but teachers from her previous school and CRC who formed part of the PG that was salient to her. Figure 6 presents these teachers connected within EI Bank VG, and their respective schools.

The challenges of selecting physical groups relevant for study

Except one teacher (BR) and one CRCC (CS), all the individuals interviewed are mapped clearly to at least one VG or PG that is of most salience to them and has other teachers from the sample as part of that group. BR was a part of the cluster with another participant (JP) and block (JK), but during the interview, it turned out that both these PG were not of much salience to her. She described her school to be the most salient PG and an English Teacher's WA group as the most relevant VG that she is part of. CS, who is principal of a school, as well as a CRCC, was present in the Block Education Office when I interviewed JK and JP. Hence, he became one of the participants. JP is a CRCC and part of JK's S.Sc. Teachers group but being an English teacher till nine months before the study, the groups that is most salient for him is the group of English Teachers besides the CRC WA group that he is officially in charge of.

Thus, there is a clear mapping of individuals to the VG, the mapping to PG was less straightforward. The challenge is primarily an outcome of the nature of participation in VG. There are several teachers who are the only participant in a VG from their school, or even CRC. SC is a case in point. No other teacher from her school was motivated enough to innovate or discuss about innovative ideas shared in EI Bank VG. It was only recently that SC could motivate one teacher from her CRC to join the EI Bank VG. Otherwise, even from the larger PG that is of concern to her, no one was a part of the VG. In case of BR, though she was part of school and CRC WA groups, the groups that was most salient to her was the English Teachers' WA group, and this group had nine teachers from different talukas and districts. Given the administrative structure of schools in the state, there is no other English teacher in BR's school, and her CRC, the PG that has other English teachers, is not very salient for BR.

Another difficulty in demarcating groups and boundaries comes from the difference in the official 'job description' and the actual 'job responsibilities' of the teachers. BR is an English teacher, but she conceptualized and organized an activity to help students understand the process of voting during elections in India. This was made possible because all the government school teachers are required to act as Polling Booth Officers by the Election Commission of India during any district, state or national level elections. In terms of curriculum, this topic is part of Social Science, and not English. Thus, in this scenario, she crossed her role boundaries, mobilized her school teachers, and created a video of the whole process that was widely shared in several VG. Her identity as a 'teacher' became more salient than the identity of a 'subject teacher'. It is such a flux in identities that keeps shifting the PG or VG that hold salience for the individuals at a particular point in time, thus making it tough

for any researcher to clearly pinpoint the target of study.

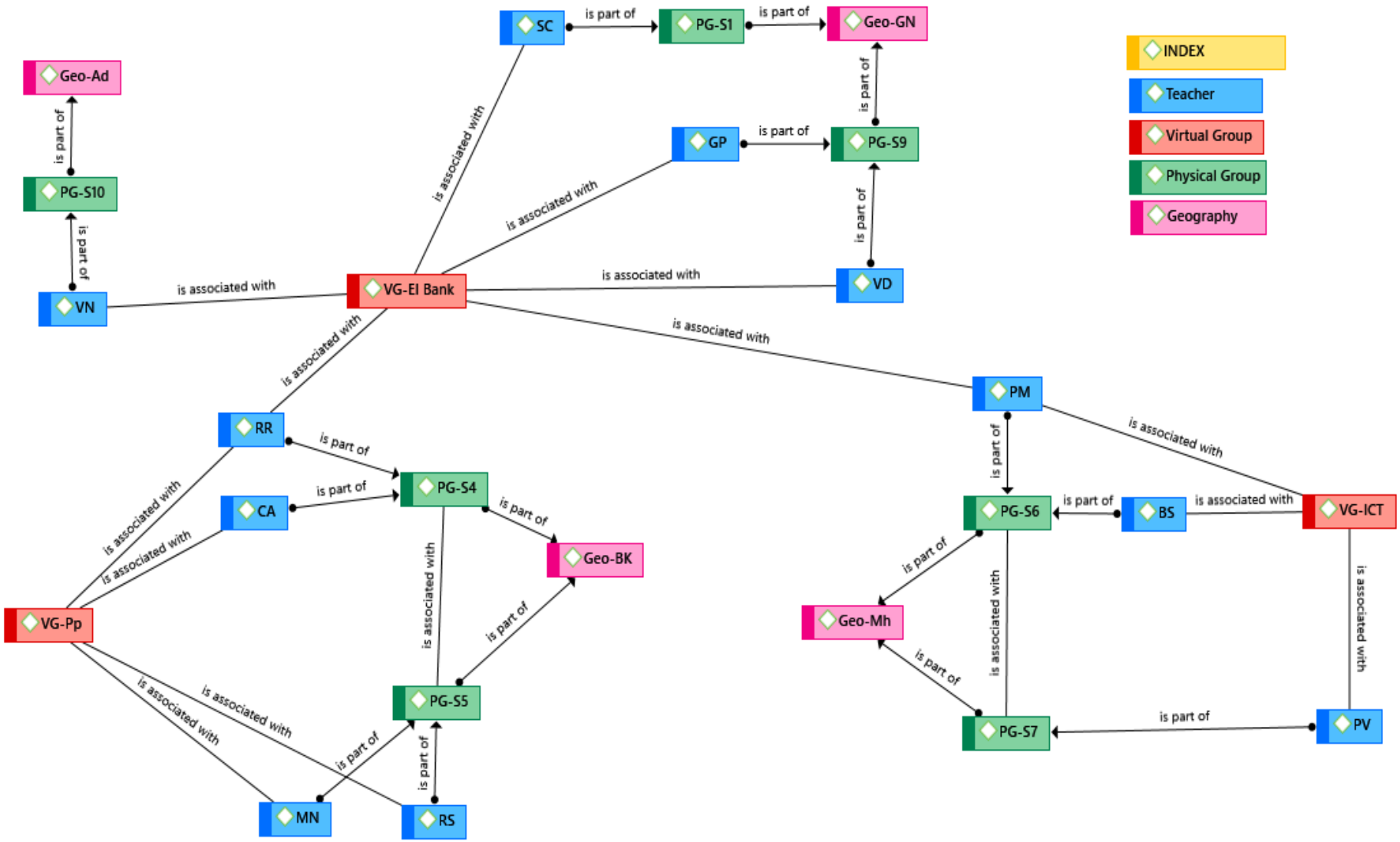

Figure 6: Teachers interviewed from EI Bank VG and C-3 ICT VG, and their PG linkages

Drawing boundaries around the cases

Stake (1995) asks researchers to *"develop the boundaries of the cases as they appear in advance, [to] anticipate key problems, events, attributes, spaces, persons, [and] vital signs"* (p.52). I could identify certain issues in advance, for example, the need to focus on key PG and identify other possible members from the VG. Then there were attributes that I could not identify. Naively, I had also hoped to be able to draw clear boundaries around cases, and even between PG and VG. In the field, I found it difficult to do. What I faced were complex, discontinuous (one may engage with certain PG very irregularly and infrequently), and recursive (PG could impact VG engagement) interactions. The experiences in VG and PG were more interwoven that I would have wanted, and it was difficult to segregate the learning that was happening in the two sites. I will discuss this in detail during my analysis, but from sample selection perspective, it forced me to engage with virtual groups that were not part of the original plan. I later decided to include the data from some YouTube channels, blogs, or Facebook groups of the teachers I interviewed. These provided me with additional information on the ways in which these participants engaged with other virtual spaces and mediums. I provide brief information about these sources in the sample description. As qualitative researchers like Lincoln & Guba (1994), Stake (1995, 2006), Agee (2009) argue, this is not uncommon in this kind of research, and the interpretive case studies allowed me the flexibility to make these choices.

Data collection strategy

Field visit and semi-structured interviews

An interpretive case study primarily aims to obtain the description and capture the interpretation of others. Interviews become the "main road to [these] multiple realities" (Stake, 1995, p.64) by looking for "description of an episode, a linkage, an explanation" (p.65). They are "a highly efficient way to gather rich, empirical data" (Eisenhardt & Graebner, 2007, p.28). They allow the researcher to enter into a conversation, flush out the meanings that the participant makes of the phenomenon, and engage in inter-subjective meaning making along with the participant. Yet, it is not easy to get a true picture because research participants know more than they can say, the aspect that Polanyi (1967) referred to as tacit knowledge. The focus of the observations and conversations with participants is on "asking participants what certain things mean and then ask follow up questions to help the participants bring forth into the public knowledge greater detail and perspectives" (Chenail, 2012, p.501) so that their tacit knowledge becomes explicit, and is available to the researcher for further analysis. Another challenge, Eisenhardt & Graebner (2007) argue, may arise from the possibility of a biased perspective when the participants attempt impression management, and because the sense-making is happening retrospectively. To overcome this, they suggest "using numerous and highly knowledgeable informants [including organizational actors from different hierarchical levels, functional areas, groups, and geographies] who view the focal phenomena from diverse perspectives" (p.28).

Access and permission

Maintaining good access to the organizations and participants is critical for an interpretive researcher (Walsham, 2006). I approached the teachers initially identified in step-2 in sampling plan described and introduced myself as a research scholar at RJMCEI at IIM Ahmedabad. The goodwill of the RJMCEI and IIM name among teachers ensured that the access and permissions were readily granted. In all cases, I had contacted the teacher and they informed their school's principal about my visit and received permission to facilitate my visit. Upon meeting the teachers, I assured them of the confidentiality of the conversations and I ensured this by not identifying the teachers or their schools by name.

While my association with IIM made access easy, it also had implications for my research. I will deal with this briefly in the section on role of the researcher and the researched, and later during analysis also.

Interviews

I conducted seventeen in-depth, semi-structured interviews with the teachers belonging to the three VG and their associated PG. Stake (1995) posits 'issue(s)' as the major focus of case study research: these issue questions allow focus on the complexity and contextuality of the case. These issues are "not simple and clean, but intricately wired to political, social, historical, and especially personal contexts. [..] Issues draw us towards observing, even teasing out, the problems of the case, the conflictual outpourings, the complex backgrounds of human concern" (p.17). I started with an interview protocol to guide the conversations. It was revised after each of the interviews to take into account the emerging issues (Stake calls these as emic issues (emic means inside)). Gender, for example, emerged as one such emic issue in my study. These issues necessitated reformulation of interview questions and my research strategies (e.g. including blog data or exploring a new Whatsapp group that was not part of sample). Sample questions used as part of the interview protocol are given in appendix-3.

Most interviews were conducted in the schools of the respective teachers. I needed to engage participants from the VG, as well as PG to tell about their experiences in a safe and open environment. In one case, I met the teacher at her home. It was for the sake of convenience since she lived close by while her school was in outskirts of the city. Another female teacher was interviewed at her home initially since she was on leave for a few days when I contacted her, but I visited her in school also for a second round of interview. I met three individuals (once Block Resource Person and two Cluster Resource Centre Coordinators) in the Block Education office, which was the base location for them, and travelled with one of them to meet other teachers who were part of his cluster and the VG I had chosen. Other interviews were conducted in respective schools.

The conversations with teachers were not always in the form of face-to-face interviews. In some cases, I interacted with the individuals in classic, one-to-one interview setting with 30 to 90 minute long conversations. In other cases, I spent a few hours with the teacher during school time, sat through their class, attended the school morning assembly, and I was given a tour of the school. We had one-to-one interactions intermittently, at times for 20-30 minutes at a stretch, and at other times, interrupted by the visitors (parents, students, other teachers) or we were even joined by other teachers in the conversation. In one instance, the full interview was conducted with two teachers simultaneously, while in another instance, I interviewed two teachers individually but there was also an overlapping period of 20 minutes when all three of us were having a conversation. I had conversations with teachers over lunch, and then travelled back to my hotel on their motorcycle after school got over, had conversations on the way and even in the hotel room. Frequently, I was riding as a pillion on the motorcycles of my research participants to meet other teachers. On the way, we struck long conversations about topics governing their professional lives. In some cases, I got the most intriguing and honest perspectives during these on-road conversations compared to the formal interview with these teachers. After going through the interview transcripts, I called a few teachers when I wanted a clarification or some extra information. They were gracious enough to entertain me again.

The interviews provided detailed accounts of teachers' experiences within VG and PG and they showed me the conversations happening in the VG in their mobile phones (except EI Bank for which I already had access to FB posts). After analyzing the VG chats, I again called the teachers to clarify doubts or ask new questions. Such telephonic conversations lasted from brief 10-minutes in one case to 40-45 minutes in two cases. In three cases (PM, SC, and VD), I met the teachers again and interacted

with them for almost one hour. In case of JP and RR, besides the interviews, the informal chats also acted as a source of information, and these were followed by mobile calls.

With the permission of the participants, I recorded our conversations on a digital voice recorder and these were later transcribed in full for analysis. Except in one case, all participants gave the permission readily. For the one participant who did not allow recording, I noted down the key points in our conversations after the interview was complete. It was difficult to manage the data that was being generated in the non-formal situations (e.g. while touring the school). Hence, I resorted to taking voice notes on my voice recorder immediately after the conversation finished. I also utilized it to record my impressions of the physical location (school or village) that formed part of the context during the analysis phase.

A note on field visits

A major part of the phenomenon that I set out to study was located in the virtual world, i.e. in respective virtual groups. If the focus was not on the interactions in the PG, it may be theoretically argued that the researcher could have done without visiting the school. I started with a similar belief, but when I visited the different schools, I was better able to understand the reasons for the choices that the teachers were making in their engagement with their peers in VG. For example, one of the teachers was forced to remake TLM (Teaching-Learning Materials) for his class because the dilapidated roof of the school resulted in water leakage and destroyed several TLMs. Also, travelling from the taluka to a remote school, or from one school to another allowed me a peek into the circumstances that forge certain networks and make others difficult. Another reason I found the field visits to be relevant was because of the context of 'workplace': for being useful, whatever was learnt in VG or PG had to be implemented in the classroom. Although the implementation of learning was not my focus in this study as already detailed earlier while defining boundaries of the case, my visits to these schools and classrooms allowed me to appreciate the context in which these teachers engaged in the VG and asked certain kinds of questions. Moreover, these were necessary to interact with the teachers from the PG or other teachers from VG who were chosen through snowball sampling.

Data to supplement interviews

In the case of virtual communities, the interview data of research participants can be supplemented with collection of data from other sources like news articles or other publications about the participants, the organization, or its sectoral context (Walsham, 2006), or online activities of group members. This data is *"abundant in online environments, [and] the information can be located and archived from the Internet without [any] need for the [researcher] to participate within the environment and reflect upon the experiential insights of being immersed in the community"* (Evans, 2010, p.11). Stake (1995) mentions another benefit: *"[these] documents serve as substitutes for records of activity that the researcher could not observe directly"* (p.68). I used this data to triangulate the perspective emerging from the interviews, and to deepen my understanding of the context.

Data from online activities of participants: Group chats and posts

While the FB posts for the EI Bank group (Education Innovation Bank Facebook page) were readily accessible, the availability of chat history of other two virtual groups (Whatsapp chats) was dependent on group administrators. Even if these were available, I received only partial information since these chats did not capture the peer-to-peer discussions, or could never reveal instances when a teacher wanted to post something but refrained from doing so.

"The participants in interpretive studies provide specific illustrations of their practices and internal perspectives and meanings. [Thus] the data [needs to be] collected through interactions between the researcher, participants, and the research setting using words" (Miller, 2017, p.35). My interest was

in the learning of the teachers and their communities. Defining what was being learnt or how they viewed these VG and their role in their lives and their physical groups would have been difficult without talking to the teachers themselves. Learning or the feelings of camaraderie with other group members, after all, cannot be objectively defined or measured. For example, what one learns from a post depends on their existing knowledge about the subject, but also on their interest in the issue that the post addresses. Such complex phenomenon could not be captured in the chat histories of any VG. Besides, I also wanted to find the way this participation in VG was linked to participation and action in PG. Consequently, to understand my quintain, I required an in-depth investigation. I thus chose to engage with the teachers through in-depth interviews as my primary tool for investigation.

Group chats and posts, whenever available, were to become a supporting tool. I could get the Whatsapp chat histories of all the three VG that were being investigated, although the duration for which these histories were available varied (from less than one month for N-4 S.Sc. VG to almost six months for C-3 ICT VG). One teacher (RR) who was administrator of one of the VG (N-5 Taluka) that was not in my original sample also agreed to share the chat history of this group. It was very useful because three other teachers from his PG (whom I interviewed) were also part of this VG. It was difficult to access media files (images and videos) for two reasons. One, the teachers sent me the chat records using the 'email chat history' option in Whatsapp without attaching media files due to internet bandwidth constraints. Two, teachers frequently delete these files from their devices to clear disc space and hence, it became impossible to access these files. To compensate, I asked the teachers to forward me the posts containing images, videos, or documents from past few days (whatever was available) and these were used as a proxy to understand the files that get shared. Fortunately, YouTube channels or blogs of teachers host several files that get shared, and I could access these from there.

In addition, I also accessed the chat history of FB group created by the S.Sc. Teachers VG's administrator, and the FB group of EI Bank. This acted as a rich source of data for the study.

Newspaper articles

During the field work and even after that, I came across a few newspaper articles that concerned the teachers or the state of education in Gujarat. Some of these helped me understand the larger issues impacting teachers' actions and others provided a new dimension to my understanding of the context in which the teachers work. Some were even directly concerned with my phenomenon of interest, i.e. virtual communities of teachers. With a heightened consciousness about the issues concerning teachers and education bureaucracy, I could locate some articles from other states that were relevant for my study, and I utilized these to enrich my analysis.

Other sources of data

While it was not the part of the initial plan, I also looked at the blogs of the teachers whom I interviewed, or who were part of their VG or PG. I also used the data from the YouTube channels created by these teachers to supplement my data. It takes a lot of effort to create new content, or even collate data from various sources. Thus, these alternative sources allowed me to understand the themes and issues that are relevant for the individuals who own the blog/YouTube channel, or their audience (i.e. other teachers).

Artifacts

One feature of VG participation is sharing of artifacts like images, digital documents (e.g. PDF), web links, videos, etc. In addition, the visit to schools provided me access to physical artifacts in the classroom (teaching learning materials-TLMs, or teacher records), which I captured using camera (as videos or pictures). As already discussed, abundant data archive is also available in online environments. I scanned the Facebook groups, YouTube channels, and blogs associated with

teachers from VG to collect the digital artifacts, as well as the associated discussions (comments and replies to these).

Justification against observations in PG

Observations allow the researcher to generate a better understanding. While it would be ideal if all data could be generated through firsthand observation, "often, we have too little time and have to rely on what others have seen", argued Stake (1995, p.67). I have already provided the rationale for not creating a new VG so that interactions could be observed. The second site where observations could have been used for collecting data was the interactions in the physical groups, i.e. schools and Cluster Resource Centre meetings. I decided to get the data about these PG interactions through interviews because it was implausible to believe that a day's worth observations in school could provide me any relevant information. As already discussed, even the 'relevant' PG and the 'boundaries' of such PG were difficult to establish clearly. In addition, whether the PG interactions on any particular day will involve any discussion around the chats in VG was unpredictable. In such cases, I would have to rely on the teachers for data (i.e. finding ways in which VG data impacts PG interactions). Thus, I decided not to focus on PG observations.

Further, CRC meetings are very infrequent (there were none between November 2017 and February 2018, the four months where most of my fieldwork was spread. Also, even if there was a possibility of attending one such meeting, presence of an external observer known to just one or two teachers in the group (and that too through a formal meeting for an interview) would have impacted the natural flow of interactions. If observations were to serve a purpose, only ethnographic observations over the long-term while being fully embedded in the physical space could have been useful. This would have completely changed the nature of my study, and hence, I decided to not include observations as a tool to gather data. This remains a limitation of my study and PG observations deserve a separate study in itself. Even in such a case, the researcher will need to define a combined VG-PG criterion (e.g. teachers in a school or cluster who also actively interact and share in a WA group). None of the VG selected for this study meet this criterion.

I got access to full data from Whatsapp and Facebook groups for a few months, and that was akin to being a silent observer in this space. As already mentioned, I used observations to capture the physical context of the teachers' workplace (i.e. school, classroom, and sometimes the village).

Language barriers during interactions

I am a native Hindi speaker. While the teachers were all native Gujarati speakers, they were all able to understand Hindi very well and express themselves in the language. Still, they sometimes shifted to Gujarati mid-sentence. I did not interrupt the teachers when they switched from Hindi to Gujarati in order to facilitate the teachers in a free expression of their views. I found myself capable of understanding Gujarati that was being spoken intermittently, for it was a very context-specific discussion. When I did not follow something, or when the teacher did not switch back to Hindi, only then I stopped her and clarified about what was just said. Only in one interview, I faced a challenge in transcribing since there were long, continuous stretches which were in Gujarati. I required help of a native Gujarati speaker to translate that interview. All others transcriptions were done by me. Even for that interview, once I received the transcript, I re-listened to the audio and corrected for mistakes and added context specific information.

A note on the role of the researcher and the researched, and their relationship

There is a need to be mindful of the relation between the researcher and the researched in a research study that adopts an interpretivist stance. Interpretive research demands the researcher to be conscious of her relationship with the research participants, and how it impacted their conversations and interactions. I was an outsider for the teachers because they knew of my position as a doctoral student who was not connected to the departmental bureaucracy. I felt that this allowed them to open up relatively easily with me, especially when the conversations were one-to-one without the presence of a third person (or even in presence of a trusted individual).

I also observed the impact of my affiliation to IIM, a well-respected institution. In a society where the incidences of Ph.D. degree holders regularly applying for low-level government jobs get high publicity, the degree itself is looked upon with suspicion. On the other hand, an affiliation to certain institutions (IITs and IIMs) is seen as a proxy for quality. My institutional affiliation allowed creation of trust about my academic credentials and I was considered a serious researcher. I was ascribed this institutional identity immediately: "*He is from IIMA. He is doing his Ph.D. on education innovations (my department) and doing research on teacher's Whatsapp groups*" was the way I was introduced by my participants to others. In fact, I also introduced myself in a similar manner. This allowed me easier (psychological and physical) access to teachers. The principals were also willing to allow the participants to engage with me during school hours. In addition, the work done by RJMCEI with Gujarat GPS teachers in collaboration with GCERT over past two decades has created a goodwill among the teacher community, which has been further strengthened by the positive experiences of teachers with previous field researchers from the RJMCEI. Thus, I felt that I was treated well by the teachers and my visit was not seen as an unwanted interruption in their already busy schedules.

On the flip side, there was a danger that my academic degree (Ph.D.) could have created a barrier, for though some of the participants had a B.Ed. degree, some did not have that (i.e. several lower primary grade teachers). I was aware of this possibility and actively tried to bridge that gap by being honest, understanding, valuing their opinion and not sharing or doing anything that could make them think that I considered myself as superior. I sat with them on floor, even though they specially arranged for a chair for me. I ate the mid-day meal prepared for the students if the teachers were having it and washed the plate myself. These acts allowed formation of trust, and I usually found the teachers to be franker during or after lunch. In one case, I was with a CRCC for two days. He was my point of contact and was taking me around on his scooter to different schools. I interviewed him immediately after meeting him, and I could sense the 'calculated' responses from him. On second day, the situation transformed, and while travelling from one school to another, he brought up critical issues and provided his views on them. This included questioning some of the basic ideas like curriculum, and even a criticism of 'theoretical research' done by academicians like me leading to neglect of certain important questions. I had an opportunity to have lengthy conversations with five teachers (face-to face in three cases – VD, PM, and SC; and over mobile in two cases – RR and JK) after the first interview with them. This provided me an opportunity to probe deeper, clarify, and ask questions that they had skirted in the first meeting. I consider their agreement for a second interaction with me (despite having a clear option of saying no) as an evidence of a positive repo between us.

During my interaction with BR, JP and other teachers were also present in the room and were constantly talking to each other. I perceived this as making BR uncomfortable and also creating interruptions in our interactions. I requested them to keep their voices low so that I could talk to BR. Instead, they got up and went outside the room. Now, should I have done that? If I had not done that, may be BR would not have been able to express herself as freely. At that moment, I was relieved to see them move out since I felt that they were intruding in 'our' space. Yet, was this a correct interpretation? Was it 'our space' and not 'theirs' also? I was just a visitor, while they were

the permanent inhabitants of that space. Probably, in those moments, we required some silence, which they thankfully granted us but was I transgressing into their space? That question still bothers me. In a similar situation in BB's school, there were several teachers and officials present in his classroom when I was interviewing him. I realized that it could have hindered BB from expressing himself freely. Therefore, when I went for the next interview (with BR), I tried to ensure that this was not repeated. My position of privilege was visible, for I was granted my wish to have conversations in a silent space whenever I demanded. Did this position also lead the participants to respond to my questions in a certain way? While I cannot be fully certain, the change in JP's attitude on the second day and the long conversations in the second interaction with a few teachers give me some confidence that I was able to get honest responses in most cases. In addition, I have collected other evidence to triangulate the teachers' responses from the interviews.

I could also sense my privileged position from observing the way I was treated by the teachers and the schools. In two of the schools, I was asked to come in the assembly where I was introduced and presented a shawl, usually offered to guests with high prestige as a token of respect. Two, several teachers addressed me as 'Sir', although I was probably younger than them. In addition, there was the issue of gender. Being a male, was I trusted enough by the female participants to reveal their true feelings on sensitive issues like prevalence of sexual harassment or patriarchal mindset within workplace (including virtual spaces)? I think I succeeded in at least some cases (VN and VD), while I found participants hesitating in other cases (BR, BS). Probably, a female researcher would have elicited different responses. Yet, the availability of VG data and my understanding of the cultural norms in the state allowed me to be aware of the inconsistencies in the responses and locate more evidence to reach a valid conclusion. For example, age of the female participants made a difference to their perception of prevalence of gender-based discrimination in the groups.

Reflecting on these issues and responses, I adapted my questions and modes of inquiry. For example, I dropped the formal interview setting and depended more on informal conversations as the study progressed. I tried to talk informally to people who were not teachers but who had observed and worked with teachers for a long time. I sometimes got answers that were in contradiction to what the teachers said. This was especially the case with their observations about the CRC meetings. The teachers told me that in CRC meetings, they were forced to stick to the agenda imposed on them by the GCERT. In addition, there was so much to cover in these meetings that they barely got time to discuss other issues. On the other hand, I was informed during informal interactions that in these meetings, the teachers were very open with each other and discussed anything under the sun. "*A lot beyond the agenda gets discussed even if that happens during lunch and tea breaks, or after the meeting*", I was told. Whose response presents a true picture? I cannot say for sure. The longer I stayed with the teacher, the more open responses I could get from them. I have already mentioned my experience with JP. Similar was my experience with PM who explained the nuances of teachers' official feedback to the department on curriculum or other issues, and how this is discussed in smaller groups of teachers later on. Instead of simply depending on teacher's responses, I have also attempted to triangulate their claims using the data from VG, asking same questions from other members of their PG, and by asking the same question differently from them.

A reflection on teachers' education, their views on teaching, and my (possible) biases

During my interactions with the teachers, I had an opportunity to understand the way teachers think about the education system and their role within it. I found certain consistent themes like a focus on teaching of facts in ways that the students can remember them, an attempt to give them 'opportunities available only to children in private schools', and a heavy focus on curriculum to the neglect of the world outside the boundaries of the school even when it was impacting their students' lives.

While travelling for the last set of interviews, I encountered the news of violence in the state. There were protests against a movie (a historical drama) that was about to release, and certain members

of one community found the script objectionable. The night before I was travelling for the interviews, the roads were blocked, and a few vehicles burnt by the protestors. These violent incidents in the state during the period of my study triggered the thought that these should be crucial part of the social life of students, as well as the teachers. A large section of students belonged to the scheduled castes and scheduled tribes, the two groups at the receiving end of other kinds of violence over the years. Several teachers belong to Other Backward Classes, which included the community that was at the centre of the ongoing agitations and violence. Incidentally, the teachers that I was going to interview were part of the Social Science VG. Thus, I was intrigued and asked questions about such social issues, and how they impacted their work as educators.

In my view, such incidents of social unrest provided an opportunity for teachers to discuss these issues with their students and analyze them critically. Their responses led me to think about the absence of 'critical thinking' in the schools that I visited. While I considered the absence of critical thought and discussions in the classroom as a gap, the teachers were not very concerned about this. Upon reflection, I realized that my idea of 'critical thinking' as a goal of education originated in my own experiences, especially during the last 5-6 years including my journey as a doctoral student. In this period, I formed certain notions about the nature and purpose of education. The ability to think critically is one such aspect. The teachers whom I was interviewing perhaps did not share my beliefs. Reflecting on this, I realized that such ideas were not even part of their own education or pre-service teacher training. A system that considers all that happens in the world as less valuable (or even meaningless) compared to the content of the textbooks is bound to produce people who do not value critical reflection. The teachers were a product of this very system, and they would possibly transmit the same attitude to their students. This was also visible in the attitude of teachers towards reflective writing. Even when the teachers create their own blogs, or FB groups, most posts created or shared were in form of images. There was hardly any text, and there was almost no opinion piece or commentaries. This may be an outcome of their training within an education system where 'writing' is neglected, and reflective writing is almost absent. Volitional writing gets considered as unnecessary and avoidable. The students write only when someone dictates to them (either in a classroom, or in a teacher training). Otherwise, the writing is a way to convey answers to the questions asked at the end of the chapter, or in examination by someone else. None of the teachers I interviewed was involved in writing about their experiences or thoughts. Even when VD was encouraging her students to write and improve their writing skills, she herself did not create any blog or platform where she shared her thoughts. The only pieces of writing were the official reports she had to file describing her innovation to EI Bank, or to state education department. The absence of any discussion in EI Bank VG, then, is no surprise. I find it important to mention this aspect of their lives because their existing knowledge, behaviors and attitudes are an outcome of their life histories and experiences, as well as the present social and organizational structures that they are part of. This reflection has allowed me to engage better with their responses to my interview questions by clarifying the context of the responses.

Data analysis strategy

The data analyzed for the study was primarily in three forms. One, data from virtual groups (Facebook posts or Whatsapp group chat history); two, transcripts of interview with the teachers; and three, the artifacts (in form of pictures, videos, or documents) either provided by the teachers or downloaded from FB posts. The data was analyzed first for each case (intra-case analysis), followed by cross case analysis (inter-case analysis). The focus during intra-case analysis was on identifying themes specific to each case, and during inter-case analysis, these themes were used to answer the four research questions.

Intragroup analysis

The VG data was analyzed separately, categorizing each post in a Microsoft Excel spreadsheet and noting the nature of its content, the date and time of posting, identity of the teacher who posted

(sometimes, only mobile numbers were available as identifier in the WA chats), and the response received by the post (Like, comments, replies, or no response). The posts that initiated discussions were specifically analyzed for the nature of discussions. Based on the information thus collated, an understanding of the nature of posts and nature of interactions for each VG was analyzed. During this stage, the artifacts associated with each post were also analyzed to understand their nature (created by whom, the content, purpose, and where it was hosted (blog, YouTube channel, or simply forwarded within group). For WA groups, data shared by the group administrators varied from the previous 22 days' chats to more than six months. For FB groups, posts shared in the previous one month was analyzed but I also scanned the previous six-month posts in the group to find any unique content or interaction that was not captured in one-month data. These posts were then added to the spreadsheet for analysis.

For analyzing interviews, the audio recordings were transcribed in full. While some interviews were brief (BS-30 minutes), others were more than 1.5 hours long (JK; VD). Some interviews were completed in a single session (e.g. JK, BS, CS), while others were done in parts (e.g. CA; RR) during day-long stays at the schools. All data related to a single teacher was noted in one file (Microsoft Word document). The audio notes that were recorded by me to capture my reflections, comments on the experiences in schools, or sometimes to capture the summary of conversations with other teachers from the schools visited were also transcribed and merged with the transcribed interviews wherever relevant. All audio notes were in English and I took help of a professional in transcribing most of these notes. Except one interview (NV) that had long excerpts in Gujarati, all other interviews were transcribed by me. For transcribing NV's interview, I took help of a professional transcriber who translated the transcript to Hindi. I listened again to NV's interview to remove any discrepancies in the transcript. In all, the interview transcripts had almost 80,000 words, while including the field audio notes, the total data was more than 100,000 words.

For the first few transcriptions, I directly translated the content (Hindi interspersed with few Gujarati words) into English. This was followed by an analysis with help of Atlas.ti, a qualitative data analysis software. Upon the initial analysis of the first three interviews (one from each VG), I found it more useful to transliterate the audio recordings instead of translating them to English. The essence of several words used by the teachers was lost in translation to English since I did not know the exact equivalent words for these. Thus, I decided to use transliterated text of interviews for assigning codes in Atlas.ti and translated only those excerpts that were used as quotations in the thesis draft.

For analyzing the interview data, The Coding Manual for Qualitative Researchers (Saldaña, 2013) was used as a guide. Accordingly, first cycle coding was done for first three interviews (one from each VG), initially on printed text in the margins of paper, and later in Atlas.ti. The data was analyzed inductively with a focus on the meaning and perspectives of the participants and without any reference to existing literature. This allowed me to stay immersed in the data. The analysis refined slowly as I became more familiar with the data. After analyzing six interviews from the three cases, I revised the list of codes, merging some and deleting others (recoding and recategorizing, Saldaña, 2013), and started coding afresh in Atlas.ti. In the second round, I coded all the interviews with these new codes, and there were only minor changes in the codes in the second round. As I moved forward and created new codes, I scanned the previous text also to find text that I may have missed which could be coded with the newly created code.

Memos feature in Atlas.ti was used to write analytical memos to comment on codes, emerging themes, and their linkage to interviews already analyzed. These memos also helped me in capturing the flow of my own ideas (and sometimes emotions) as I went through each interview. The memos were revised and linked to other memos, codes or quotations as the analysis proceeded, thus creating a dense picture of themes that came handy during writing of the analysis. I also used the *network* and *code family* features of the software to use codes to create themes. These later helped me answer the research questions and build on the theory.

Each participant's transcript formed the participant level analysis but more important for my research was to employ these individual interviews to create the narrative to understand the respective cases. The query tool of the software, along with the memos helped me retrieve relevant information during the writing phase. In addition, I used Microsoft OneNote to create individual pages for each emerging theme and organized relevant quotations or memos that were relevant for these themes. This helped me with my writing later. During the writing of intragroup analysis, I used the quotations from the interviews extensively to give voice to the teachers in explaining the phenomenon and their situated experiences.

In the final stage of intragroup analysis, I combined the narrative emerging from interviews and VG to present a holistic view of the case with teachers situated within the VG and their respective PG. I kept going back to the quotations and memos associated with the codes salient for the theme being described to see if these provided any additional perspective. When I observed repetitions, I considered it as a form of 'saturation' (as suggested by Glaser & Strauss, 1967). Then I moved to the next case, drawing from the previous cases (compare and contrast), and trying to find any novel themes. In this way, the intragroup analysis for all the three cases was completed.

Intergroup analysis

The cross-case analysis was specifically focused on answering the four research questions that were guiding my study. I built on the intragroup analysis to generalize from them and find answer to each question. Here, I also engaged with the literature review (chapter 2 of the thesis) and compared the emerging generalizations with what was already established in the existing research. It thus allowed me to see how my empirical data fitted the existing theories, and what unexplained findings could contribute to further these theories. During the analysis, I sometimes called the participants to check my interpretations for accuracy.

Closing thoughts

In this chapter, I have tried to explain in brief the steps undertaken to conduct this study. Besides explaining the data collection and analysis strategy, I have also tried to present a justification for choosing these specific methods. There were emergent elements in all steps of the process, and I modified my strategies (course correction) to access and analyze the data. Overall, a combination of research tools and methods were used with a focus to answer the research questions that were guiding this study.

I have also presented the organizational context where these groups and individuals are situated. I tried to situate the teachers – who were interviewed, as well as those who were not interviewed but form part of the VG or PG that were of concern in this study— within their physical context. I also provided a thick description of some of the schools that I visited. This was an attempt to make concrete the context of the study for the reader. In addition, the thick description also allowed me to bring out the physical context of some of the interactions that I had with the teachers interviewed. This will probably aid the reader in making sense of my reflections on these interactions as I proceed to data analysis in chapter-four. As an interpretive researcher, I cannot neglect the relationship that I had (and developed) with the research participants. My reflections on this aspect were an attempt to bring out the tensions and possible conflicts that shaped these interactions. In the next chapter, I will present the analysis of the data, followed by the conclusion in chapter five.

Chapter 4: Data analysis

Individual case analysis

For the present study, I have chosen three different virtual groups (EI Bank, Central-3 ICT Whatsapp group, and North-4 Taluka Social Science Teacher's Whatsapp group). The reasons for choosing these virtual groups (VG) have been articulated in chapter three. Besides looking at the content shared in these virtual groups, I also interviewed a few teachers who were part of the VG, or the physical groups (PG) associated with these VG. All the VG, the associated PG, and the teachers interviewed were a part of a larger entity: the public schools in the state of Gujarat (India), and more specifically, these were primary schools catering to the educational needs of the students up to grade-VIII.

I will first focus on the three case narratives (intragroup analysis) followed by intergroup analysis to conclude the chapter. In intragroup analysis, within each narrative, I will first try to put together a collage based on the analysis of VG data. Since the central phenomenon of interest in this study is the virtual group, I consider it critical to capture the activities in this space. Alongside, I will try to sew together the data from the interviews of the teachers associated with the respective VG or their associated PG. This will be the research participants' view of their VG and PG. In this, I will also try to stitch together the VG data with the interview data to provide an overall picture of the teachers' participation in PG and VG, as well as understand their understanding of activities in VG.

In intergroup analysis, the focus will be on finding the patterns visible across the cases. This analysis will be direct attempt to understand the two broad research questions at the centre of the study (i.e. nature of learning and nature of communities). I will attempt to generalize across the cases with an aim to move towards building theory inductively. This will also involve an engagement with the existing literature on the phenomenon of interest. The possibility that some themes may be unique to the cases cannot be neglected and these will help in fine-tuning the emergent theory.

Case narratives: The intragroup analysis

I will draw an intragroup narrative to answer the four research questions of this study. This narrative will weave in the activities in the VG (discussed above) with the data from the interviews (including the artifacts accessed). From a case study perspective, these narratives will include the individual case study analysis. I will build on teacher's' perspectives followed by positioning these teachers within the VG and PG for intra case analysis. The teachers in a VG are not necessarily part of the same PG, and even when they are part of such a PG, it may not be the most salient PG from their perspective. Consequently, the individual teacher level analysis followed by a combined VG-PG level analysis becomes necessary as opposed to a combined VG-PG level analysis only. A cross-case analysis (intergroup analysis) will follow the intragroup analysis.

1. The C-3 ICT VG and associated physical groups

Located at the edge of a narrow road, School-6 (S-6) was situated in the midst of lush green fields. Right in front of the school's main gate, the road took a 90-degree turn and vanished into the fields. There were no other buildings nearby except a few huts with thatched roofs or isolated rooms made of bricks for storing agricultural implements or providing shelter to the farmer from rains or in night. The nearest school (S-7) was located 5 km from S-6, although two villages were located at 2-3 km distance. These villages were the catchment area for the school and all students belonged to these two villages. The all-weather metalled road was constructed only about three years ago and before that, reaching school during monsoon was a humongous task. The teachers stay in city (at the taluka or the district headquarter) and travel daily to school by their cars or two-wheelers. Children come to school on foot or on bicycles. It was in this remote school that PM taught Social Science and BS taught language (primarily English and Gujarati) to the upper primary students (grade 6-7-8). The school itself was not very big; there were only enough rooms for the eight classes and a Principal's office and an extra room. It was this extra room which served as the staff room and the Gyankunj project paraphernalia was installed here. NV worked as the head teacher of S-7, the school closest to S-6. S-7 was located in the middle of the village and was not very far from the main road connecting the village to the taluka headquarter.

PM taught Social Science to upper primary grades and he was the one responsible for ensuring that his school was chosen as one of the sites for Gyankunj Project despite not meeting the eligibility criterion.

> "I was the first one to apply for the project from our Taluka, but our school was not selected. [District MIS[29] Officer] said that [a] minimum enrolment is required and your school does not qualify. I talked to him and [convinced] him [to add our school to the list]" *(PM: 110-124).*

While PM was actively involved in getting the project for his school, BS was only a user, utilizing the project hardware and associated digital content to teach her students. PM had also motivated and guided NV (the Principal of S-7) to apply for the project.

The Gyankunj project

Gyankunj Project[30] (GK project) was implemented across 3,173 classrooms in 1609 schools across the state in first phase. A laptop, projector, white board, speakers, a smart touch pen, and an infrared camera were provided to 1-2 classroom in the selected schools in this initiative. The infrared camera converted the white board into a smart touch board that could be operated using the touch

[29] Management Information System

[30] http://www.gyankunj.org/Home/AboutGyankunj

pen. The state education department had created e-content for grade seven and eigth. This content was preloaded on the laptops, and the teachers could use it for their classroom teaching.

The project implementation and VG formation

82 schools from the C-3 district were chosen for GK project. Of these, 49 were from PM's Taluka. The teachers who had to use the GK project paraphernalia for teaching students were not IT literate in most cases and received training (if any) only for a few hours by the state education department. The organization that won the bid to provide the hardware had to provide one technical support staff per taluka to resolve any technical issues. The 49 schools in C-3 Taluka selected for implementation of this project were scattered across the block and several were in remote locations. Thus, it was very difficult to meet the requirements of all these schools by one support staff. PM explained:

> *"The government [contracted] a 3rd party vendor to provide training & support [to all selected schools in taluka]. This company hired employees for the project at INR 7000 per month per taluka. This contract was for 3 months to provide training but the company's staff was ill-trained. The technician came to our school and told me that he knew nothing about [using] the project [hardware or software]." (PM: 43-52, 63-67)*

To accentuate the challenge, the state education department appointed PM as a Master Trainer. *"I had to train other teachers without getting any training myself. On Friday, Gyankunj was setup in my school, and I had to give a training on Monday (in 3 days)"* (PM: 56-61).

The situation was not very different in several other schools in the taluka (and even beyond). Two teachers (SaC and PiP)[31] from the district contacted PM and MaS and proposed the creation of a VG for troubleshooting the problems being faced by the teachers during GK project implementation, followed by physical workshops to train teachers. When the teachers considered the project as beneficial for their students (they had self-nominated their school for project implementation), they took initiative to solve the project-related challenges instead of blaming the administration. The **prior reputation** of PM and MaS in the physical network as *tech savvy* was the crucial element that made SaC and PiP contact them as collaborators on the project. The identity from the PG thus got carried to the VG. "*We [four] met at Central-3 [district] and discussed [our ideas]. We decided and sent a message [over Whatsapp] that whosoever is interested may join. More than 200 teachers joined. […] Even [teachers] from other districts [joined].*" (PM: 172-177). Thus, the VG was created. "*It was [an] unofficial [group] started by four of us who were tech savvy […] with an aim to help the teachers [who were not conversant with the technology]. We responded to the queries during lunch break, or as soon as we could*" (PM: 14-16).

Capturing the activity in the Central-3 ICT WhatsApp Group

I requested PM, one of the group administrators to share the chats in the group. It turned out to be a 105-page document with more than 21,000 words and had chats from October 23, 2017 to May 11, 2018. Thus, I had access to data for 200 days. Of these, on 143 days, at least one post was shared. 65 days saw more than 5 posts shared, with maximum posts in a day was 50 (average and median number of posts per day being 8 and 5 respectively). Consequently, the group could be considered as reasonably active.

[31] The names of the teachers who have been interviewed for the study are identified in the document with two letters (e.g. RR, RS, SC), and those who were part of the VG but not interviewed for the study have been identified with three letters (e.g. PiP, SaC).

Nature of posts

1127 posts were shared in 200 days, of which 870 included text messages (including posts where web link to a blog post or YouTube video was shared) while 257 included only media files (images, PDF documents, videos). Of more than 240 members, 106 members posted at least once in the seven months, with 42 members sharing more than 5 times. Only 8 members posted more than 30 times, of which 5 were the group administrators, and one was the district MIS officer responsible for the Gyankunj project implementation. The posts from administrators were mostly text. PM shared 134 posts, of which 96 were text messages. Three other administrators shared 58, 56, and 56 posts, of which 51, 52, and 52 posts included text messages respectively.

There was diversity in the posts and several unique themes appeared across the seven months. Therefore, I scanned the document from beginning to end and categorized the posts for analysis. In the initial days, the group administrators tried to respond to the teachers' queries in real time, or as quickly as possible. Over time, other group members also started helping in resolving queries. The core team, in a way, had expanded with active participation of other group members.

As the project matured, most teachers had overcome the initial technical hurdles. Consequently, the posts related to troubleshooting decreased, and the posts concerning diversified and creative use of the hardware, exploring different features of the software, and application of other ICT tools in the classrooms increased. In next phase, the teachers started creating different applications and content that could be delivered using GK project infrastructure. This included quiz, flash videos, QR code-based content etc. Later, the teachers started sharing videos of the diverse ways in which they were implementing the project in their school. The nature of the posts shared in the group is described below in detail.

Directly related to Gyankunj

Troubleshooting

Solution

Several posts were related to finding solutions to the hardware or software related problems or accessing support. The common problems included hardware or software malfunction (e.g. Infrared pen (eyeris) not working, no sound in speaker, laptop starting very slowly, trouble with setting projector).

"*The touch function in manual mode of eyeris (Infrared Pen) is not working properly. What shall I do?*" asked one teacher. A teacher responded by asking her to try the auto-mode, while another teacher shared a video explaining the possible solutions. A third teacher asked, "*I am not getting any sound from projector*". "*The sound does not come from projector. It comes from speaker. Check the voice menu at the edge of the laptop. Select 'speaker out' from the speaker menu*", came the reply from another group member. This question and its answer are a testimony to the [dis]comfort of the teachers with technology, and the insufficiency of the training provided by the department.

One teacher (RjB[32]) was unable to use the touch pen and he asked for a solution. PiP suggested manual calibration of pen, and if that does not work, he suggested auto calibration, providing steps to do so ("*remove the USB cable, shut down, re-plug the cable back, and then restart. If pen is not working, there is no other option but to recalibrate. Also check the position of Infrared camera*."). A third teacher (MhB) asked RjB to reinstall the software and suggested to contact the technical support person from the taluka. When DiD asked a similar question three days later, PiP replied with even more nuanced troubleshooting steps: "*If you press the front portion of the pen, and it shows*

[32] Since I received the transcript of Whatsapp chat from PM, the names of the teachers in PM's mobile contact list were visible. I have anonymized their names. For other teachers who were not in PM's contact list but were part of the VG, only mobile numbers were visible and I refer to them as generic 'teacher' in the analysis.

red light, that means it is charged. For touch related issues, do re-calibration. If you are facing the problem with pen repeatedly, please check the fitting of camera. And as last option, uninstall the eyeris software and re-install, either from the CD, or download the latest version from Cybernatix support website". Such troubleshooting information is usually available in the manual or at the online support portals of the manufacturers. Due to discomfort with the technology, as well as the language of support (English), the teachers turned to their peers in C-3 WA group to provide solution in their language in simple steps.

"*I have tried to start the software twice, but it fails to load. Please share customer care number of Gyankunj support team*", came a question. To this, two teachers responded. One of the group administrators (PM) shared a video explaining step-by-step process to log a complaint for any technical problems with project hardware or software. Another teacher shared a mobile number to log complaint. To this, PM replied, "*The complaint resolution is quicker when complaint is logged online*." Thus, even for the most basic challenges like logging a complaint, several teachers were dependent on their peers, and the WA group proved functional in providing solution to their problems. Within two months, the VG members had created hundreds of videos explaining different aspects of the project, software, and hardware. The teachers, instead of posing a question, started asking directly for the link to relevant video for their specific problem. Three months after creation of the group, a teacher asked, "*How do I use dustbin in Intellispace? Please share the video*". Thus, they had started expecting that a video for all these issues will now be available.

Clarification

The teachers used the group to know specific details about the rules governing the project and sought suggestions based on experiences of other teachers. One teacher asked, "w*hich internet service provider will provide the internet connection for GK project?*" One of the group administrators replied, "*The government has released a grant of INR 10,000 for internet connection. Whichever internet service provider (ISP) promises to provide good speed and service, you can choose that. If there is already an internet connection, you can get its speed upgraded. Else, take a new connection.*" Another teacher provided contact details of one ISP in that area. When a similar query was posted a month later, the response was more specific. The teachers from a particular geographic location responded with the contact details of the best ISP vendor, and the internet speed and plans that were available.

Suggestion

Based on the understanding of the challenges being faced concerning the GK, the teachers voluntarily shared suggestions with others in the group. A common pain point for the teachers was the software. Every time it was started, the GK software took more than 12-13 minutes to start. Without anyone specifically asking this questions, PiP suggested a way out in his post. He asked the teachers to avoid shutting down the laptop every day but use hibernation mode. He explained its benefits, and the difference between shut down and hibernation. In the end, he assured the teachers that "*this option is completely safe and there is no chance that your application (software) or saved files will get corrupt*". A few teachers appreciated this suggestion in their response to the posts.

Official communication

While the WA group was informal, the initiative was widely successful. Instead of forcing the teachers to join the official district-level WA group for the project, the district MIS Officer, who is the official in-charge of the project for the district, joined this WA group. He shared all official communication (intended for teachers or principals) related to the project in the WA group. For example, in one post, he shared the instructions to fill a form: "*About NAS OMR Class wise: For filling up medium of school, please refer to the guidebook and fill code for Gujarati or English or whichever language is right for your school. Basic details of children for NAS School are also available in block login of Aadhar enable DISE. The Block (office) can provide it*". Since a district level official was

present in the group, at times, information from the state authority (SSA) was directly shared in the group with the concerned teachers bypassing the traditional route from DPEO to TPEO to BRC to CRC to Principal and finally reaching the teachers. Thus, the possibilities afforded by VG were fully utilized but it was also a consequence of the bureaucrat's openness to share with the teachers.

Feedback and evaluation of project

The MIS Officer also shared a post informing the group about the plan of the department to conduct assessment of the Gyankunj project through an independent third-party. He provided details (date, mode of evaluation, selection process of schools shortlisted for evaluation). On the next day, he shared a letter sent by Special Projects Director, Sarva Shiksha Abhiyaan (a state level bureaucrat of education department) for Principals and teachers involved in this assessment. The tone of the letter was very instructive:

> *"Dear Principals and Teachers,*
>
> *Honorable CM has directed the planning Department to conduct a third party evaluation of Gyankunj Project in all the districts. As per hon CM's directions, planning department has devised an evaluation proforma which they will fill in by visiting the schools on 6th and 7th of this month.*
>
> *All of you are **directed to prepare** for the survey, fill up the information in the software by logging in, and **give your best**. The emphasis of survey would be on how the teachers are using the system in more interactive way, whether teachers are using the textbooks for evaluating the students after the content is explained through Gyankunj system or not, how the students r responding to the new method of classroom teaching etc. **It's our challenge and responsibility to give a very good review to the government of the most talked about project of education department.** All the best to you all, **may you all come out with flying colors**. Good Luck"*

The above letter suggests that the bureaucrats in the department were taking the 'evaluation' as an 'examination'. The phrase, "*may you come out with flying colors*" is also a typical statement used by the principals across schools in India to motivate students in morning assemblies just before the final examination. The expectations are clear for the teachers: they need '*to give a very good review*' (perhaps not honest review) of the most talked about project (of the present government). The teachers were '*directed to prepare*' for the test, and '*give their best*'.

An interesting aspect of this evaluation was a different view presented by PM, one of the group administrators, in his post the next day where he motivated the teachers to provide an 'honest feedback' to the department:

> *"Dear Teacher friends. Today, an evaluation of the Gyankunj project will be carried out in schools. […] Please give an accurate feedback to highlight any burning issues to make this project a success".*

This was in the background of dissatisfaction with the hardware made available for the project.

Unraveling the different aspects of Gyankunj

While several teachers in the C-3 ICT WA group were IT novices, a few put in extra efforts to support their peers in making maximum use of the GK project. One teacher (YoV) created a series of videos explaining the different features of the Gyankunj software (e.g. shape tools, colors and width, line tools, geometric tools, other widgets etc.) and uploaded them on his YouTube channel. He then shared these links in a series of posts in WA group. One of the administrators shared a post that explained the internet protocol, and how different devices that teachers have access to (mobile,

laptop, tablets) can be connected to each other. Rather than being a generic post, it was drafted to explain the idea within the context of Gyankunj project hardware.

> *"Our e-content is in laptops. It works on web [based] technologies, and information can be obtained from the Internet Protocol IP address. (This IP address means the address of that computer, mobile, etc. For example, 192.168.0.4) A web browser is used to view it. To get this e-content in mobiles, there should be a connection between mobile and laptop. For connection between mobile and laptop, [explains multiple ways of connecting two devices] […] When we turn e-content into a laptop in school, it starts at 127.0.0.1 IP (also known as localhost). We can only see it on the same laptop. To get this e-content on a mobile, tablet or other computer it has to be shared on the network. We have given the router to the school, with it we can create an offline WiFi network".*

Further detailed steps follow this. The teachers handling Gyankunj were neither comfortable with English, nor with IT devices. Therefore, such posts explaining the technical issues in local language proved highly valuable resources for them.

Extending the boundaries of Gyankunj project: ICT-related activities

The WA group was created specifically for serving the needs of teachers concerning GK project. Once the project related challenges subsided, the teachers started experimenting to utilize the project hardware for broader purposes. They frequently shared the content they created or third-party applications or software they used, often with a video demonstrating its usage in the classroom. The teachers built on each other's ideas, and further extended the boundaries of the possible utilization of the software.

Academic activities

One of the teachers (PM) found a free software that allowed creation of multiple-choice question (MCQ) tests online. He used it to create tests for all chapters of the VI-VII-VIII grade books for his subject (Social Science) and shared the links to these tests in the WA group. Any student who had access to these links could take these tests. The teachers in other WA groups shared these links widely and more than 23,000 students across the state accessed and attempted these tests within a few months.

Taking the online quiz initiative a step further, PM generated QR codes for each quiz. These were then printed, labelled, and pasted on a wall in the school. Students in a few schools (including PM's school) had access to Android devices (mobiles or tablets). They directly scanned the QR code and attempted the quiz individually, or in groups. Several schools followed this model. Another teacher (KpS) created a YouTube video explaining how he was using the QR codes in his classroom. He also provided the link to his blog where he had posted QR codes for each chapter in the syllabus for Mathematics. This post received appreciation from fellow teachers, as well as the MIS Officer. Another teacher asked for QR codes for Social Science chapters, to which PM replied that they are available on his blog.

Another teacher (DiD) used a free mobile application (Plickers) to conduct quizzes as a part of the formative assessment. The application allowed real time evaluation and further extended the online quiz experiment. He shared a link of YouTube video of this activity in the WA group uploaded on his channel. This video had been viewed more than 170 times (as on May 22, 2018). PM created a video that demonstrated the use of augmented reality (AR) in classroom. This video had been viewed more than 300 times (as on May 22, 2018).

KpS shared a post in the WA group explaining how they have used Google Forms in classroom for teaching students. He shared a video link that captured the whole process. Other teachers

appreciated the idea. One of the group administrators (PiP) applauded the effort and conveyed his joy that the learning from the last workshop was finding way into the classroom. MhS shared the link of interactive tests in mathematics and science that could be administered using the Gyankunj hardware, and also shared a video that demonstrated how it could be used. Some other teachers also shared similar links to different tests that they had created. PM documented several of his experiments concerning use of GK project hardware and ICT in a virtual flip-book and shared this with the group. This contained all the links and information of his efforts in a single document. It was visible that he had gathered inputs from the C-3 ICT WA group and used them in his context either directly, or with some improvisation.

Teacher Professional Development

The C-3 ICT WA group was formed after four teachers came together to organize a physical meeting of teachers interested in learning about GK project implementation in schools. After thde initial meeting, once the WA group was established, a small team of teachers initiated 'unofficial' physical training workshops for teachers on Sundays in one of the schools in the taluka. These moved beyond the immediate focus on GK project and covered wider ICT application in education. Two such workshops were organized in the first three months of 2018. The registration link for these workshops was shared in the WA groups, and the workshop details were repeatedly shared in the group to encourage participation. The agenda of all the workshops was shared in advance. For example, the workshop held on January 1, 2018 dealt with "Gyankunj e-content, creating QR codes, creating and administering online quiz, using Gyankunj website effectively, live telecast feature of YouTube, live conferencing, using Plickers app for real-time formative assessment, and use of Augmented and Virtual reality technology in classroom". For the next workshop, "creating animated videos for use in classroom, and converting PowerPoint to videos" was added to the agenda. Despite being unofficial events, these events received enthusiastic support from the officials in the district, though the teachers did not take any financial support and contributed money to cover the expenses of the workshop.

Several of the teachers who are part of the WA group and attended the physical workshops were novices in using internet and laptops. They were not even aware of ways to find troubleshooting steps, and most of such help is available on internet in English. Some motivated teachers took initiative to learn about the various tools mentioned above and created a Gujarati language troubleshooting guides for common troubles. These resources were also collated in spaces like blogs and YouTube channels. MhS shared a link to his blog where he had uploaded videos that provided troubleshooting steps for several of issues like disk cleanup, removing temporary files, pushing content from mobile screen to laptop screen etc. This content was initiation of several teachers into usage of ICT in classroom, a task usually delegated to official training programs. Thus, the WA group and associated activities in the physical spaces supported the professional development of these teachers. Besides, links to admission notifications for getting relevant qualifications (e.g. Diploma in Elementary Education) were also shared.

Unrelated posts

Unrelated academic posts

While the teachers usually received response to all their queries related to ICT and GK project, an interesting case in the WA group was a post related to academic matter, but unrelated to ICT. A teacher inquired about links from where he could download National Talent Search Examination (NTSE[33]) study material. This post received no response. Intrigued, I called this teacher to ask if he ever got the requisite information. He had shared the same query in all four WA groups of teachers that he was a part of, and none could provide him this information. There are blogs and YouTube

[33] NTSE is a prestigious pan-India scholarship examination for school students. Upon qualification, the student is awarded a scholarship for pursuing courses in science and social science up to doctoral level and in professional courses like medicine and engineering up to second-degree level subject.

channels dedicated to sharing MCQ and other content that can help students (and even teachers appearing for government jobs or intra-departmental promotion examinations) to 'remember' facts. This contents is widely shared in several WA groups of teachers (including N-4 Taluka and N-5 Taluka WA groups]. NTSE is highly competitive with a focus on higher order thinking skills compared to the several entrance and promotion examinations that focus on reproducing facts. There is a huge 'coaching industry' dedicated to preparing students for NTSE, and private schools advertise the success of their students in such examinations. Thus, it is highly prestigious, but also demand an extensive preparation. This WA post provided a glimpse into the aspirations of government primary school teachers for their students. This is also a peek into the realities of life of the education in these schools where the focus is on 'preventing dropouts' and not on preparing Scientists, Sociologists, Engineers etc.

Other unrelated posts

Usually, in WA groups of teachers, the boundaries of 'what is allowed' remains hazy owing to the wide range of work that teachers are involved in. The C-3 ICT WA group administrators made efforts to draw and highlight these boundaries and as a result, posts outside the 'group objectives' were rare.

Just two weeks after the creation of the group, one teacher shared a long post about a political issue (Patidar agitation) and it received a rebuke from the group administrator. Circulars from the department, which are a ubiquitous part of a teacher's life, were absent from this group except on one occasion. A sensational fake news about cosmic rays was shared and it received a brutal censure. Rarely, pleasantries or wishes on festivals were shared but the administrators made their *locus standi* clear on such posts.

Nature of interactions

Likes and comments

The initial focus of C-3 ICT was on troubleshooting problems faced during implementation of the GK project. Consequently, since beginning, all posts with a query received a response. This trend continued later also where teachers provided feedback (usually appreciation or 'Like' emoticons) on several posts but no 'critical' feedback was provided publicly in the group.

Absence of discussions

There were no discussions in the group, but only comments related to the posts that were shared. Since the posts were restricted within the boundaries defined by group administrators, anything related to the wider issues in education was considered a breach. No teacher expressed their ideas or opinions in the group and no post touched any sensitive issue. There was no problematization of use of ICT in classroom, and no one challenged the objectives of the GK project and its real value for the teachers or students. There were no posts that were critical of any government policy decision, or that highlighted the plight and real state of schools and education in the schools. The group remained sharply focused on the technical aspects of the project, and in using technology to enhance teaching in classrooms.

There was only one occasion where the MIS asked the teachers to provide 'good' feedback about the GK project to showcase the success of the 'most talked-about project of the present government' while PM requested them to provide an 'honest' feedback about the project. There were no discussions even on this post, or after the third-party evaluation teams visited the schools for feedback on the project.

Reactions to unrelated content

Posts that got a reprimand

The group was intolerant to posts that were outside the defined boundaries of its objectives. The administrators, and even group members responded strongly to posts that breached these

boundaries. In the initial phase, a teacher shared a political post in the group. He was warned and then removed from the group. No other 'political' post was shared again. The administrators pointed to the content that was not acceptable and reiterated the group rules every time an unrelated post was shared. Circulars from the department are a ubiquitous part of a teacher's life, and these are shared widely in several WA groups of teachers. The boundaries of the group usually remain blurred around this issue. One teacher shared a circular in the group and the conversation that followed was instructive:

> *Teacher 1: (Shared a circular from education department)*
>
> *PM (one of the group administrators): "Please. No circulars in this group".*
>
> *Teacher 2: "That's right. No circulars please."*
>
> *Teacher 3: [justifying Teacher-1's post] "Brother, (sharing) these circulars is not harmful. They are related to education."*
>
> *PM: "We are getting circulars through other (WA) groups also. So many new circulars come every day. If we start sharing them, then what will happen? If there is some circular directly concerning the Gyankunj (project), then it is fine. Therefore, it is very important to keep in mind the purpose for which this group has been created. This is my request to all group members."*
>
> *Teacher 3: "I agree" (shares a 'Like' symbol).*

Still, some unrelated posts were shared intermittently and even members (and not just administrators) were blunt in highlighting the inappropriateness of such posts. One teacher forwarded a WA message. It was a fake news about cosmic radiation and completely unrelated to Gyankunj. It received a harsh response from another teacher: "*Talk about something sensible and do not try to make a fool out of people. Talk about Gyankunj only*". This direct and explicit contestation is rare in WA groups of teachers. NhS shared a post related to Christmas on the eve of the festival. After a few hours, one of the group administrators (PM) pointed out the group policy in clear words: "*This group is for sharing posts related to Gyankunj, or innovative ideas that are in line with Gyankunj (i.e. ICT). Please refrain from posting anything else.*" While such posts became very infrequent over time, this message was repeated almost every time when any unrelated post appeared in the group. As a result, there were no more than one or two pleasantries shared even on the eve of New Year or big Indian festivals like Holi, Uttarayan, or even Indian Republic Day.

Posts that were tolerated

The off-topic posts were rare in this group, but not every off-topic post got a reprimand. Such posts were occasionally tolerated if they were not political or religious in nature.

MhS shared a video about a historical place, Rani ki Vav, in the group. This video was created by him and hosted on his own YouTube channel. These posts were ignored by the administrators. PiP shared a post related to activities done in school on the eve of Republic Day. Although unrelated to Gyankunj project, this post did not receive any reprimand directly, probably because it was related to education, and probably because of the reputation of the teacher who shared it (PiP was a major contributor to the group and one of the group administrators).

A teacher (KpS) from the group was selected for writing school textbooks by the department. He shared this information with the group members, and they responded by congratulating him. Thus, there was tolerance for certain posts unrelated to GK project or ICT, and occasionally, completely unrelated posts (historical place video) were also ignored.

Gendered nature of participation

The participation of female teachers in C-3 ICT WA group was visible. Several female teachers were members of the group and also posted their queries about the project implementation. Yet, three aspects stand out. One, none of the five group administrators was a female. Two, except in rare cases, the females were always asking for solutions and not providing the solutions. Three, several teachers had created YouTube channels and blogs to host the videos related to ICT and GK project to showcase the use of these tools in their classrooms or work life. All of these teachers were males. Thus, while the participation of females was visible, it was substantially different from that of male teachers. The female teachers were mostly content consumers and very rarely producers of any content. The participation of females in the WA groups mirrored their participation in the physical groups, as well as the wider society. I will discuss this linkage in detail while analyzing the interviews of the teachers associated with this VG, as well as in the cross-case analysis.

Concluding thoughts on C-3 ICT VG

The C-3 ICT group was abuzz with activity, and the administrators maintained a sharp focus on objectives of the group by articulating and reiterating these, as well as reprimanding anyone who posted outside the defined boundaries. While the initial focus was on project, the group evolved with time. Specific and detailed responses to the queries from teachers were provided (unlike EI Bank, N-4 Taluka, or N-5 Taluka Facebook or WA groups). As project related issues subsided, the group members made attempt to learn new tools and utilize the project hardware in more ways than the GK project envisaged. Physical meetings provided the initial understanding of the basic tools to the teachers, and a motivation to learn and experiment triggered their learning. There were many comments on posts but discussions were absent. Initially, the administrators, and later, the members also worked hard to ensure that the posts did not deviate from the group objectives. The group had several female members, but they were primarily content consumers and not producers. Still, overall, the WA group and the associated physical interactions created a community of learners that experimented and shared their experiences which other teachers found useful.

Situating C-3 ICT within the lives of three teachers

PM, BS, and NV were the three members of C-3 ICT interviewed for the present study. While PM and BS were teachers in the same school (S6), NV was principal of S7 located a few kilometers from S6. Despite being part of the same VG and PG (including the school), PM and BS had very different experiences of these spaces.

BS was not part of any other VG but C-3 ICT. PM, besides being the group originator and administrator, also contributed maximum number of posts to the group. PM was active in several unofficial (and one official) WA groups: one related to his subject (Social Science), another related to innovative teachers (he started this group), a third group of his cluster, and he was also part of IIM's Prashna Manch[34] WA group (besides EI Bank and Teachers Innovation Facebook groups).

NV, besides C-3 ICT, was a part of several other WA groups of teachers or principals. Two of these WA groups (Paycentre and CRC) were official and being principal of a school, he was required to join these groups. One was an informal WA group of teachers from the Taluka.

[34] Prashna Manch (translates to Question Forum in English) was a regular feature of Education Innovation (EI) Bank VG. The group administrator shared three questions every month in groups which teachers can reply through Google Forms. The questions usually require teaches to reflect on the situation and explain how they handle it in their classroom. A sample of 'good' answers is shared back in the VG by administrator.

Experiences of BS

BS was part of C-3 ICT VG but she never shared a post. She was a novice in using ICT and had to deal with the GK project paraphernalia. C-3 ICT WA group could have been useful for her, but she chose to ask the expert (PM) who was present in her school (BS: 52-55):

> *D[35]: What benefits did you get by getting associated with the C-3 ICT WA group?*
>
> *BS: Whatever difficulties I face, I get answer from the group. For example, this [smart] pen has stopped working, then what shall I do? […] I did not know about this in the initial days.*
>
> *D: Is there no manual provided with the hardware that contains all this information?*
>
> *BS: No. And even if it (the manual) is there, when I need immediate solution, I can ask in the [WA] group. [But] in my case, PM knows answer to all my questions. I [directly] ask him. […] All my queries are resolved here [in school by PM]. So, I never posted in the group.*

She was part of another WA group with only female language teachers (mostly from CRC or nearby schools) but she considered it dispensable despite its usefulness: "*we used to discuss [whatever] difficult questions we faced in teaching language […]. And beside this [WA] group, even when we used to go for CRC meetings, we kept discussing these kind of questions"* (BS: 21; 33). She changed her mobile sim card and thus was removed from the group, but she did not join back. Intrigued by her response, I asked her more questions about this group:

> *D: Why did you not join [the WA group of female language teachers] again?*
>
> *BS: I will*
>
> *D: But did you get any benefit from being a member of this group?*
>
> *BS: Yes. I used to get answer to the questions that I found tough.*
>
> *D: And how do you do this (difficult questions) now when you are not part of this group?*
>
> *BS: I will join. This semester has started. When I reach those chapter or topics where I face challenge, I will join.*
>
> *D: And in the time since you quit this group, have you faced any challenges?*
>
> *BS: No.*

For BS, the WA groups served a purely instrumental function. It was a means to ask questions when she did not know the answers, but she did not feel obligated to help other teachers in the group. With little investment in the group and its activities, BS never initiated a discussion in the language teachers WA group, though she sometimes answered questions of other teachers.

For BS, the internet was not an infinite source of knowledge. She limited her browsing mostly to the blogs or websites of 'trusted sources': her fellow teachers (like PuG, ViV, or AkP) from Gujarat GPS who had created a name for themselves in the local teachers' community. *"Whatever I need, I download from their websites",* said BS (88), but she neither commented on the website nor called these teachers. Similarly, the physical interactions were also a source to access new materials. *"We*

[35] In text quoted from interviews with teachers, 'D' represents the interviewer (researcher).

teach tenses in English. A [fellow] teacher had compiled some wonderful [study] material on tenses and had given it shape of a book. I took that book from him [at our CRC meeting]" (BS: 90-93). Intrigued, I asked if she talked to this teacher about her experiences of using his material. "*No. Whenever we meet for CRC training, only then we have a chat. Otherwise, I have never called him [in the intervening period]*", said BS. As opposed to the mandatory 16-17 CRC meetings per year, there were barely 3-4 meetings in the previous academic year. This curtailed the opportunities for physical interactions. In such cases, the support from close network or school peers becomes crucial. *"If there is some problem in Gujarati, say in idioms, if I cannot understand something, I ask from teachers in school. Everyone knows Gujarati. [For English], our school principal was an English teacher. He holds a B.Ed. degree in English. I talk to him and I get answer to my questions"* (BS: 128-129).

Living in a patriarchal society and working in institutions dominated by patriarchal mindsets, being a female presents certain challenges to BS. PM, her colleague, is very active in different virtual groups and he motivates other teachers to join these groups. "*There is so much scarcity of time. I have children [to look after]. Then there is household work [that I need to do]. [After school], as I reach home, that [household] work begins. I cannot get as much time as them [the male teachers]*" (BS: 103-105). The social situation of the female teachers partly explains the gendered nature of C-3 ICT VG and the possible reason for the differences in the frequency and nature of posts compared to their male colleagues.

Experiences of NV

NV joined the C-3 ICT group after attending the first training workshop organized by the group administrators. Being the principal of a GPS, he was a part of a few official virtual groups (all Whatsapp). In addition, he had also joined some unofficial groups of teachers or principals. In total, he was member of more than 10 such WA groups. "*These groups make the administrative work easy by improving the speed of information dissemination*" (NV: 13). C-3 ICT, on the other hand, was different: *"We went to the training session on a Sunday. It was voluntary. So, there was no official circular [requiring us to attend the workshop]. I joined the group that day. […] The [official] training that was supposed to happen for the GK project has not happened even now. […] So, it (workshop) helped us understand how the project works"* (NV: 21-25).

Except C-3 ICT, all other WA groups that NV is a part of are devoid of any discussion and the focus is on sharing information. Even this is not specific to a subject or theme: *"No [other] group is focused on one thing. [It is not like] if it is geography, then it will be only geography, or only Mathematics. If there is one [that exists], at least I am not a part of it"* (NV: 54-56). Why then NV is part of several such groups? Non-academic work is a major part of teachers and more so for principals. Since they cannot control the work assigned to them, they find ways to bring efficiency to such work and VG serve the purpose: *"If we go on calling teachers [on their mobiles], it takes a lot of time. At times, their mobiles are out of coverage area. VG helps in bringing speed to the process"* (NV: 11-13). His experience of C-3 ICT was different: *"In this group, I do ask questions. Whenever teachers [in my school] face a problem [concerning GK project], I post in the group seeking a solution. […] Our projector keeps giving us trouble repeatedly. I kept requesting for repair, but it did not happen. […] Our screwdriver was not matching [its screws]. […] Now I did not know that the tool needed [for its repair] was called Allen key (Hex key). I posted on group and someone told the name. I got the whole set from the market [and the problem was solved]"* (NV: 31-39). Thus, in a situation where the provisions made by the state proved insufficient, such 'focused' VG with members having technical expertise came handy.

Although VG are more prevalent, the physical interactions and networks play a crucial role in life of NV. He draws inspiration from the teachers and schools in his vicinity: *"I nudged the villagers to donate one projector to my school. How did I get this idea? In PM's school, there were 2-3 projectors. When I visited his school, I could see how it [projector] was able to capture the imagination of students. […] Then PM and another school's teacher also shared videos of classroom activities [using*

IT tools] on WA group of Taluka teachers. That inspired me to get projector [for my school]" (NV: 102).

Even when discussions are rare in VG, the teachers, desperate to find solutions to their problems, do sometimes seek suggestions from peers in these groups. Poor attendance was a constant problem in NV's school and some teachers in Taluka Teachers' VG suggested that a projector could help him solve it. *"I had raised this issue of some 20-30 students from my school staying absent in the WA group. 2-3 teachers asked me to contact parents, while some suggested that I should get a projector and entice students to come to school to watch movie. […] I liked this idea and implemented it. […] It worked. The attendance has definitely improved"* (NV: 104-106; 138). While NV found solution to a nagging problem (of high absenteeism) from a VG, he did not feel obligated to share the feedback or the success of another of his experiment with the teachers in this VG. He was able to increase enrolment in his school by convincing parents to shift their children from private to government school. *"I did share this with teachers verbally, but I never shared it in WA groups. […] During a BRC meeting, or when I meet teachers otherwise, there I have shared this, but not in VG"* (NV: 139-144).

Experiences of PM

PM was one of the central figures of C-3 ICT as an administrator and founder of the WA group. Along with three other teachers, he was also the organizer and trainer for the physical workshops related to the Gyankunj project conducted for the teachers in the taluka. He describes this core team as a '*group of tech-savvy teachers*', teachers who have interest in using technology in classroom. Compared to BS who a silent spectator in the VG, and NV who asked some questions that troubled his staff, PM replied to the queries posted in VG and created and shared new content. His status was of 'expert' in the community, but this was a consequence of his interest and motivation to learn. PM and his colleagues crossed their role boundaries and filled a gap left by the education bureaucracy. When asked to train teachers after 3 days of the project setup in his school without receiving any training himself, he *"stayed back in school till 6 PM on Saturday after the school got over, understood the project hardware and software, and trained the teachers on Monday"* (PM:56-61). While VG facilitated the workshop, it was the reputation of teachers within the physical network that made teachers from the taluka attend the workshop on a holiday on their own expense without any official circular.

The group served a source of learning for several members as they posted their queries or read ongoing conversations. This was partially an outcome of successfully containing the information deluge due to unrelated posts, which is excessively common in WA groups in India. *"Some teachers do not join WA groups because when they switch on the internet, they will see 200-300 messages in 10-12 groups. That is too much"* (PM: 537-539). Thus, besides helping peers by answering their queries, PM and some other members ensured that the posts in the group were in harmony with the objectives of the VG. While some stray posts received a warning, others received a severe rebuke and at times, even removal of the member from the VG (already discussed above). *"We have […] rules like […] only share whatever is relevant to the group. […] Two teachers had [recently] joined the VG but I did not know them. They shared few unrelated videos. I removed them [from the VG]"* (PM: 496-497;649-650). PM was highly active in the VG but did not underestimate the role of 'just being a part of the group silently'. *"[Some teachers] will neither ask a question, nor reply to someone else' question. But when they meet us in some training or meeting, several teachers have told me that I was facing a problem, but after watching your post, it got resolved. "But you did not post any Q in the group?" I asked. They say that whatever question I have, most of the times, someone else asks that, and if my query gets resolved, what is the need to post [in the VG]? So, I come to know that even silent members of group are using the group to their benefit."* (PM: 484-492).

While C-3 ICT VG was a crucial part of PM's life, he was also a Social Science teacher, an innovative teacher who contributed to InShodh repository of teacher innovations, and a teacher of S-6 school. *"What do we do in SST group is [that] we share subject specific content. For example, I shared the*

PDF of these freedom fighters' information with the group. [The teachers] can simply take a print out and use it" (PM: 373-375). Having been a part of S-6 for more than 17 years, PM was also invested in the local community. *"Another WA group we have created is [Village name] Youngistan. This group has children who have graduated from our school. […] Now if some child is not coming to school, I post in this to inform the young alumni that please do something about it. […] The villagers (also) know me, and they trust my words. Therefore, when I say something, they support me"* (PM: 304-317). These multiple identities resulted in him being a part of several other VG and PG and the content and discussions from one often crossed into others. Government job postings, for example, were available on blogs of some teachers and were shared widely in multiple WA groups. *"Someone requiring access to such job postings will need access to 'The Employment News' [published weekly by the government]. This is difficult [to access] in a village. So, young boys who are competing for such posts access these blogs"* (PM: 698-699).

Although PM accessed and contributed to some exciting experiments and ideas in C-3 ICT or S.Sc. teachers' VG, he could not neglect the mundane realities faced by his students and peers at the school. Coming from families facing poverty, several students in S-6 were impoverished. *"There was one idea [in EI Bank VG] to tackle child malnutrition. A handful of millets [could] be added to the food (MDM) daily. I found it very useful and shared that in Whatsapp groups. I also shared this during trainings when I met other teachers. We also started this in our school"* (PM: 333-336). Then there was the problem of irregular attendance: *"The girls remain absent. This problem is common across schools [in the state] but the reasons are different. […] I read [in VG] what the others were doing [about this issue]. […] We solved the problem in our own way based on [context of] our village, but yes, we got the idea [from others] that something like this can be tried"* (PM: 287-303). The diverse groups (both physical and virtual) allowed PM to seek solutions to problems that concerned his multiple identities within the context of GPS.

The training organized by the state education department (at cluster, block, district, or state level) follows a top-down agenda with the teachers having negligible say in it. The workshops organized by C-3 ICT VG administrators evolved based on a bottom-up agenda driven initially by the administrators and later by the group members. As a result, the active participation has widened. *"Earlier, it was four of us who used to solve all queries. Now, more than 20-25 teachers are actively responding. […] We had to create a new WA group since the earlier one had reached its limit of 256 members"* (PM: 645-647). The block and district level bureaucrats were supportive of the teachers' efforts since beginning and that led to an official invitation to conduct formal training related to ICT and GK project for the other teachers in the district. Thus, the informal activities in VG got recognition, resulting in formalization of the learnings through official trainings.

2. The EI Bank VG and associated physical groups

Education Innovation Bank Virtual Group

Ravi J. Matthai Centre for Education Innovations (RJMCEI) at IIM Central-1 started working with a group of innovative teachers of Gujarat in early 2000s. This was a physical network driven by the teachers themselves. Over time, more teachers motivated to innovate and learn from each other joined the group. RJMCEI has been documenting the work of these teachers for several years and created a website (http://www.inshodh.org) that acted as a clearinghouse for innovations that worked. On this website, the teachers submit their innovations which are screened and systematically collated and presented in several categories (e.g. by subject, by purpose).

In 2012, the network moved online, and a Facebook group was created. The '**Teachers Innovation**' (TI) is a public group with almost 2900 members from both genders, most of them government

school teachers and principals. Another group, '**Innovative Women Teachers**' (IWT) was created for female teachers (and principals) of government primary schools, and has more than 3000 members. A third '**Education Innovation Bank**' (EI Bank) FB page with more than 11,000 followers. It is primarily administrator-run platform where innovations from the clearinghouse or relevant articles or posts from other sources are shared. The administrators are same across the three groups, and posts from EI Bank are shared regularly on the walls of the other two groups. Unlike the EI Bank group, TI and IWT groups are more active in terms of participation from the teachers. There are scores of other Whatsapp groups of teachers (since the platform limits membership of each group to 256) that have been joined by teachers from Gujarat and Maharashtra, and the group administrators (from RJMCEI) regularly share posts on these groups.

For my research, I have considered IWT and TI as a single virtual group (VG) and the teachers in these as a part of EI Bank VG. Since EI Bank FB Group is primarily an administrator-run space, I have removed it from the analysis. Similarly, scores of Whatsapp groups were created to spread innovations to teachers directly, and to engage them in Prashna Manch. These are essentially acting as broadcast groups with only information being shared in the group and there are no discussions and interactions. For this reason, I did not consider this WhatsApp group as significant for analysis of EI Bank VG.

I analyze the two entities (IWT and TI groups) individually, as well as combined to understand this VG. The teachers from this VG whom I interviewed for the research belonged either to IWT or to TI groups. I will first construct the activities and interactions in these four entities individually, and later stitch together a collage by seeing these as one. I will then analyze the interviews of teachers from this VG (EI Bank) and locate them within their respective physical groups (PG) and attempt to weave in the narratives from the VG and PG to present a holistic picture of the ways in which teachers' lives are lived within these VG and PG, and how the two intermingle.

A – Teachers Innovation Facebook Group

With about 2900 members, TI is a mixed-gender, public group. Thus, the membership is not restricted only to government school teachers but a cursory glance at the members' profile suggests that it is this segment of population that has joined the group.

The posts are shared by administrators (mostly forwarded from EI Bank group), and teachers. There were more than 30 posts in the group in June and July 2018. I left out some of the repeated posts (by group admin) and picked 29 for analysis. I then scanned posts made in April and May 2018 and found three more posts with unique content that was not represented my earlier selection. Thus, in total 32 posts were analyzed.

Nature of posts

Who creates or shares the posts?

In TI, 75% of the posts (24/32) analyzed were created by the teachers. Thus, teachers were actively leading the interactions in this group. Surprisingly, it was only male teachers who were involved in creating these 24 posts.

Information sharing

There were seven posts where administrative information was shared. In two posts, the group administrators shared process of submitting innovation and answering Prashna Manch questions. One post was from a teacher who shared a circular specific to his district issued by education department. Remaining four posts were from teachers about different projects and programs from education ministry (e.g. Balsanasad by Central HRD Ministry, INSPIRE awards for students, and Best Teacher award application process). The administrators avoided sharing many administrative posts in the group.

Posts related to academics

Majority of posts in the group were academic in nature. Teachers primarily shared their own pedagogical innovations but, in few cases, they also shared innovations of other teachers (shared from their FB pages or YouTube channels). The administrator shared innovations from EI Bank page.

Several teachers shared links to online MCQ quizzes they had created, and most of these links were hosted on their own blogs. They also shared videos of their own classroom activities or videos where they have attempted to explain a concept in easy and fun way. Some teachers also shared links to the android applications from Google Play store that they had created, and most of these concerned academic content (MCQ and videos).

In one post, a teacher shared live video of his teaching session using Gyankunj, while another had shared PDFs of teaching plans issued by the department (hosted on his own blog). One teacher described about 400 science projects and the link took to his own blog that hosted a PDF document from the GCERT. Another teacher created a video explaining how to create your own online quiz, and uploaded it on his YouTube channel.

Co-curricular activities

There were only three posts concerning non-curricular activities. Two were about activities organized in a teacher's school (fire safety drill, and lecture on menace of drugs). A third post was about a platform for sharing children's stories in Gujarati.

Posts about school administration

The post with images of a school with lush green gardens and well-maintained premises was shared by a teacher from that school, and it was also shared in EI Bank group by the administrator. There were no other posts concerning SMC or school administration.

Nature of interactions

Like, comments, shares

The 32 posts received only 192 likes, and 5 comments (on two posts), and only 9 posts were shared 13 times. Only four posts received more than 50% of the likes, and 50% shares. Of these, three were shared by the administrator and only one by a teacher.

Absence of discussions

The comments on posts were all appreciation, and in combination with the fact that most posts were by teachers about their own work, the low engagement with the posts becomes clear. There were 6 posts that were related to online quiz, but none of these individuals engaged with others' post in VG. Similarly, there were more than one post on Science, Mathematics, or English, but these teachers with interest in the same subject never initiated a discussion in VG.

The gender aspect

Despite being a mixed-gender public group, the male teachers dominate the group. Not even one post was from a female teacher, and the only presence of a female teacher was in form of a comment ("really nice work") on one of the posts from a male teacher.

B – Innovative Women Teachers (IWT) Facebook Group

The Innovative Women Teachers' group was formed after request to RJMCEI from several female teachers. They wanted a female-only group as they were not comfortable with sharing their work or doubts on the TI group. The IWT group has more than 3,000 members, and interestingly, along with the administrators from RJMCEI, a female school principal has also been added as a moderator.

Of the three groups, IWT is relatively the most active. There were more than 30 posts shared in the group in July 2018. I chose 30 of these, removing a few repetitive administrative posts (e.g.

welcoming new members), and added one post made on August 2 (the day I collected the data). I also scanned the posts in previous three months to find posts that were different from those shared in July, and found three such posts. Thus, in total, I analyzed 34 posts.

Nature of posts

Who creates or shares the posts?

Of the 34 posts, 23 were made by teachers and 11 by the administrators. Thus, the teachers are highly active in the group. Only two posts were external links, one from a news website, and another from own Facebook page. One was shared from a teacher's own FB wall. All other twenty posts by the teachers were created specifically for this group. I call these latter posts as 'original' compared to the former which are 'shared' (from other places).

The content of posts

Compared to TI group, there are certain new categories of posts (e.g. positive news, seeking information or clarification) in IWT alongside the categories that exist in the former. A common category was the posts shared by the administrators.

Academic content

Three posts were directly linked to academic content. Of these, one had General Knowledge questions, while other had Mathematics TLMs. One post was a simplified, lyrical version of a poem from grade-3 book about environment that was written by the teacher herself with an aim to allow children to sing, remember, and understand the message of the poem. She described her effort in this way: "*Chapter – 'Vanpari' (angel of forest). In continuation to the poem given on page number 14, simple and easy [version] for students to see, understand, sing and learn [for] themselves. A supplementary song prepared in orientation with local environment"*. The same teacher shared another post on a poem she had composed about the importance of water. In comparison, the academic content in TI group was all online MCQ hosted on respective teacher's blog or Android App.

Five other posts had images and videos of classroom activities done by the teachers to teach their students. In one, the teacher used games to teach concepts of Math; another teacher used dance to teach English. A third used craft to teach Math and shared pictures of the activity; while a fourth used drama for teaching photosynthesis in plants. In comparison, only one teacher had shared a CR activity in TI group, and that too was a live video of him teaching using Gyankunj project.

The administrator shared the posts of teacher's innovations from EI Bank page (same as in TI group), and one teacher shared the screenshot of her innovation submitted to InShodh portal. There was no post that shared the documents from GCERT or SSA.

Co-curricular activities

There were six posts related to co-curricular or non-academic activities. Some teachers shared images of festival celebration, while others shared activities done at school level including organization of Bal Sansad (Children's Parliament). One teacher shared two posts of students involved in different games during recess. Her school does not have any playground. Another teacher had taken her students to a restaurant for lunch, and she had shared the pictures from the visit. Others had shared images of activities in their school (e.g. History corner created by students, or 'history of the day' shared on a board.

Positive news

There was one post where a teacher had shared link to her blogpost about the historic gold medal won by Indian Track & Field athlete Hima Das. Another post was about a teacher in Pune who was supporting children of debt-ridden farmers of his district.

Seeking information or clarification

There were two posts where the teacher requested information from the group. In one, a teacher wanted information on a circular issued by the government, while in the second post, another teacher asked for suggestion on books on 'parenting' in Gujarati.

Absence of any posts on government projects or awards

Unlike TI group, there were no posts about any (central or state) government project or awards.

Nature of interactions

Like, comment, and shares

There were 935 likes on 34 posts, 110 comments on 17 posts, and 11 of the posts were shared 39 times. The video of CR activity with teacher using drama to teach photosynthesis was most appreciated, with the post receiving 164 likes, 17 comments, and 16 shares. All the comments were appreciations only. Several other posts received more than 40 likes and scores of comments.

Discussions and comments: beyond appreciation

Unlike TI, a few posts saw comments that were more than appreciation. On the post sharing CR activity of teaching math through games, there were 45 likes and it was shared by two teachers. While two teachers commented and appreciated the work, a third teacher expressed appreciation and said that she will use the same game when she starts teaching this concept. On another post shared by the administrator (an innovation), a teacher asked the detailed process of creating the setup from scratch.

One teacher had shared the pictures of her students eating out at a restaurant. She described it thus:

"These children had never eaten in a hotel. They enjoyed it. What is a finger bowl? These children had no idea. They washed their hands in finger bowl. [It was a novel experience for them]."

This post received wide appreciation beyond the customary "*good, nice*" etc. One teacher encouraged her: "*Wow! You should write the same description with your feelings on a (blog) post. It is very real [and heartening]*". Another wrote: *"Wow! This picture is a message to those who think that the government teachers just take salaries and not care about anything else"*. A third said: "*Well done. These children are not going to forget this experience for a lifetime*".

A teacher shared two posts with videos of her students playing during recess. One post was titled: "*fun during recess time*". Her school does not have a playground, and her second post had videos that showed how children became creative and played a variety of games in the context of space and resource crunch. Her post description was: "*The games that children play while sitting on floor. Children play [these games] during recess when there is no playground [in school]. Love you all. When you turn an unfavorable situation into joy*". These were liked by more than 60 teachers and shared by three.

One teacher had a post from her FB wall. It had a picture of two of her students with their craft work. Her post description read: "Today, in grade-1, [craft] pasting work was done. Standard 1's Kavya came to me and said 'Didi (*Sister), click my photo. We have put bindis [on our foreheads]'*. [I] had to click [their] photo even in busy schedule". This post received great response with 41 likes. The original post on her FB wall had received 161 likes, 20 comments, and was shared by two people.

On the lyrical composition of Vanpari poem, a teacher asked: "*Please share the raaga of the poem given in the book. Which sing is this raaga related to?*". To this, the teacher who had shared the post replied: "*The raaga and words given in the book cannot be learnt by students. Therefore I have prepared this song. [Still, if you want to know], the raaga of this song is like 'mane aabhle chamakto chandlo gamay' (I like the moon shining in sky)*".

Two other posts had teachers engaged in intense discussions and information exchange. In one post, a teacher asked about suggestion on good parenting books in Gujarati. This was liked by 9 teachers and received 32 comments. 10 teachers suggested different books, and the teacher also clarified about the authors and publishers for books that she could not locate online. In the second post, a teacher had asked if they could follow the change based on information in newspaper without receiving the official circular:

"There has been an advertisement about allowing wearing of Punjabi dresses in primary schools. This advertisement has come even in newspaper. So, do we need to wait for official circular, or can we start wearing Punjabi dresses in school? If anyone in this group has any information regarding this, then kindly do share."

This was based on a recent announcement from the education minister that the female teachers will be allowed to wear salwar-suit[36] (Punjabi dress) in schools. Before this, they were mandated to wear only saree. This initiated a long discussion with 21 comments in total from 14 teachers:

> *Commentator 1: Yes, it can be worn. Don't worry.*
>
> *Commentator 2: We [already] wear them and go, but I don't know about others.*
>
> *Teacher: We are still asked to wait for a circular from the district office.*
>
> *Teacher: it is so confusing.*
>
> *Commentator 2: No idea. We haven't been told anything.*
>
> *Commentator 3: [Shares circular's image]*
>
> *Teacher: This circular is there. But they say that there has been no circular from the district office yet. And, I used to go wearing a Punjabi dress, and I was instructed to wear a saree.*
>
> *Commentator 4: This is wrong. Circular has been issued. Then[?] this wrong pestering [will continue] till when? A dress code for females in district or state; and not for others (male teachers)?*
>
> *Teacher: I am so confused.*
>
> *Commentator 5: Why wait for any circular? There are many activities about which we get to know either through newspaper or mobile, and yet we have to do them. Don't worry.*
>
> *Commentator 6: Honorable Deputy C.M. Sir has said this, and so this is final. But many ladies misuse this and come wearing leggings or without wearing a dupatta. I request you to kindly not wear such dresses which might stop our wearing [Punjabi] dresses to school. This is a good decision for us, use it properly and don't misuse it. Otherwise, there will be a complete ban in wearing [any other] dresses.*
>
> *Commentator 7: We wear it [to our school] and go.*

[36] A two-piece traditional Indian dress usually worn in North Indian states. Saree is usually the most widely accepted formal dress for female teachers across schools in Gujarat.

Teacher: Ok. Thank you all, friends. I [will] wear Punjabi only. And thank you for information.

Commentator 8: Why not?

Commentator 8: Ask them for a written circular on instructing wearing a saree.

Commentator 9: Official circular has been issued. You can wear.

Teacher: Ok. thank you all. My confusion has been clarified. Thank you for the information.

Commentator 10: Right. Even I go to school wearing a [Punjabi] dress only.

Commentator 11: Even I wear a [Punjabi] dress and go.

Commentator 12: Yes, it is legal. Wear [Punjabi] dress only.

Commentator 13: [Punjabi] dress can be worn. So, don't think much.

There was a long and free exchange of information, as well as opinions. In fact, one teacher also raised the problem with such a circular highlighting its sexist nature, but no one further discussed about this objection ("A *dress code for females […] and not for others?*" The teachers freely shared their fears (Commentator-6) and accepted their confusion (*"It is so confusing"*). Such interactions were absent from TI group, and even in the other VG analyzed for this study.

What is it like to be a part of the EI Bank VG?

The two FB groups (TI, and IWT) have similar administrative structure and purpose. There are certain similarities in the nature of content that gets shared, but there are differences also. The interactions with fellow teachers in VG differs considerably in the two groups, not just in frequency and intensity of engagement but also in its nature. These engagements differ significantly by gender also, and that needs to be kept in mind while understanding the nature of content and interactions. While TI had posts only from male teachers despite being a mixed-gender public group, IWT is a female-only group by rule.

The nature of content

What do the teachers value the most? Not surprisingly, a large chunk of posts in the groups were related to **academics**, either in form of **curricular content**, or in form of **classroom activities**. This was a consistent theme but with several differences. In TI, a lot of posts were related to online MCQ quizzes that the teachers themselves had created, and others had academic content created by GCERT or SSA. There were no classroom activities. Academic content in IWT, on the other hand, was dominated by classroom activities or novel curricular content created by the teachers themselves.

The next theme that is present across the two groups is the **co-curricular activities** (i.e. activities usually outside classroom and not concerning syllabus). The posts in TI were more around the 'standard' school events. It had three such posts: one with images of a lecture organized on drug menace, another of a fire safety drill. A third was an exception and had information about a platform for Gujarati stories for children. IWT, on the other hand, saw more diverse activities shared. There were pictures and videos of festival celebrations, restaurant visits, games being played, or children's parliament etc. Thus, while the theme was common, what the teachers valued and chose to share in the groups was clearly very different.

A third common theme was information sharing and information seeking. The difference was in the way teachers engaged with this theme. In TI, the teachers chose to share information about the government projects, awards, and circulars. IWT, on the other hand, had no such posts where

information was shared. There were two posts in IWT where the teacher was seeking information from group members. In one, suggestions were sought about a book, while another asked for clarification regarding a government rule. Both these posts saw extensive participation (in form of comments) from other teachers. There was no such information seeking post in TI.

The last theme was related to positive news where external web-links to positive or inspiring news about teachers (their achievements or relationship to students) were shared. TI had no such posts, while there were three such posts in IWT.

The nature of interactions

On an average, there were 6.1 and 27.5 likes for each post analyzed for the TI and IWT groups respectively. The average comments were 0.15 and 3.4, and shares per post were 0.4, and 1.14 for the two groups respectively. Although this shows the differences in engagement of the members with the posts and group members, a better picture can be presented by comparing these statistics for every 1000 members (TI had 2900 and IWT had 3000). As visible from the table below, the teachers in IWT had the maximum engagement within the group.

Engagement of teachers with posts: Likes, comments, and shares per 1000 members			
	Likes	Comments	Shares
TI	68	1.7	4.5
IWT	311	39	13

Table 5Engagement of teachers with posts: Likes, comments, and shares per 1000 members

While statistics present certain picture, there is a lot that they cannot reveal. The nature of comments was also significantly different across the groups. ''In TI, there were barely any comments (only five), and all were appreciations. In IWT, on the other hand, the teachers did engage with posts at a more humane level. For example, the teacher who posted images of her students eating in a restaurant explained why she took this initiative and how she felt about it. Two teachers replied with a heartfelt appreciation and not just with a 'good' or 'great'. The teacher who shared the videos of students playing in her space-constrained school was expressive. She expressed her feelings towards her students: "*Love you all. You [have] turned and unfavorable situation into joy*". The whole post on the circular regarding 'Punjabi dresses' had initiated a discussion where the teachers went beyond just sharing the information (the circular). They told how they were interpreting it ("*We do [already] wear them and go. Don't know about others*"]), how they dealt with the situation ("*Why wait for circular?.*"), what were their fears ("*This is a good decision for us. Don't misuse it [and wear objectionable clothes]. Otherwise, there will be a complete ban*"). One even went on to express her discontentment on such rules ("*This is wrong. […] A dress code for female [teachers] and none for the others [male teachers]*").

Other differences

In TI, 21 posts from teachers were original (i.e. not forwarded) and most of these had content that was hosted on the teacher's own blog or YouTube channel. Their obsession with hosting information on own blogs was visible from the fact that even when the content was from department, it was uploaded on the blog and its link was shared. In contrast, of the 23 original posts in the IWT, only one was hosted on the teacher's blog. Rest all were videos or images directly uploaded on the IWT group.

Even the descriptions of posts were qualitatively different. In TI, it was all factual and there were links to blogs and appeals to like the YouTube channel. For example, "*My new video for all little champs for English learning (on my YouTube channel)*"; "*Plz subscribe my YouTube educational channel if you like my concept & hard work of my students*"; "*Science Fair: 400 Science projects*

below"; "*Download MCQ Quiz for all grades for first semester*" etc. In IWT, the posts descriptive were like "*Mission Vidya – Learning while playing*"; "*Large wall maps in my classroom*"; "*Hair pin and hair bow math activity*"; "*History Board in my S.Sc. classroom*" etc. At times, teachers also became expressive in such descriptions: "Gauri Vrat ka mazaa" (Enjoyment during Gauri Vrat festival celebration); "Masti (fun) in recess time" or "Some memorable clicks of my classroom activities" etc.

EI Bank VG: a gendered space

The differences among the two groups can be understood better if looked from a gender perspective. TI, despite being a mixed gender group, is completely male dominated, with the female members refraining from any participation (except some likes). This led to several female teachers requesting creation of a female-only group (IWT). The intensity of activity in IWT (and its absence in TI) is a testimony to the uneasiness of female teachers in presence of male teachers. Thus, even virtual spaces are gendered and not just physical spaces. I will discuss this aspect in greater detail when analyzing the interviews of the teachers.

The artifacts in the VG

A variety of artifacts are utilized by the teachers in their posts, the photographs and videos being the most ubiquitous. The teachers click pictures or record videos of the activities in school or classroom and share it on FB groups. Some first upload these on their blogs or YouTube channels, and then share the web links to these, and thus, web links become another category of artifacts (including for the MCQ quizzes). The physical artifacts are used in the classroom (e.g. maps, charts, hairpins), but what gets shared is the digital images of these. Consequently, for usage in classroom, the teachers need to create their own TLM. PDF documents were rarely shared. Only one PDF document was shared in IWT (since 2016) and two in TI (since 2013). Even when link to PDFs were shared (hosted on blogs), these were mostly guidelines or project books meant to guide the teacher in managing the classroom or creating an activity. The ultimate responsibility of creating a physical artifact or an executable plan thus lies with the teacher.

Closing thoughts on EI Bank virtual group

The different virtual groups serve different purpose for the teachers. The WhatsApp group serve as means to access information on a regular basis. . TI provides access to selected content from InShodh on various aspects (academic, non-academic activities, school administration) that they can utilize in their professional lives, but it also acts as a platform for the teachers (predominantly male) to share content to help their peers (e.g. free MCQ quizzes customized for the state curriculum) in their teaching activities or professional development (training on ICT tools in Gujarati, or awards, projects etc.) and advertise their blogs or YouTube Channels. IWT is used by the female teachers to share their academic or non-academic activities with peers, or to seek their help.

With easy access to internet and smartphones, VG are a part of daily lives of the teachers. The nature of participation (posts, discussions, membership) in these groups reveal something about the nature of the community. Yet, EI Bank is just one VG that they are part of. The activities in this VG can only provide a partial picture of the professional life of the teachers. I cannot answer the research questions about learning of teachers and the nature of community by looking solely at their participation in one VG. Hence, I will also present the analysis of the interviews of some teachers who are part of this VG to understand the way they see and utilize this VG, and the role that these play in their workplace practices and performance of work. While the analysis of the VG has been more descriptive, I will utilize the data from my interviews and field visits in a selective manner to address the research questions that I set out to address in this study. Unlike the VG, I will not attempt to present an overall picture of activities in the PG. The challenges of defining a boundary around the PG (or even the VG) have already been discussed in chapter-3 of this thesis. I will thus draw inferences from the VG data already presented as and when required to find answers to the four research questions that are a concern of this study.

2. North-4 taluka S.Sc. teachers' Whatsapp group [N-4]

The WA group was initiated by JK, who is the Block Resource Person (BRP) for Social Science for the North-4 taluka, as well as the group administrator. The group has 62 members (only two were females), most of whom are either Social Science teachers, or the CRC coordinators who share the posts from this group with the Social Science teachers in their groups. It also has teachers from other subjects who have interest in Social Science[37].

The group remained abuzz with activity between July 1, 2018 and August 2, 2018, the period for which data was made available and analyzed. In total, 636 posts were shared in the group in this period. There was at least one post every day except on three days. The maximum posts shared in a day reached 130 but on average, more than 21 posts were shared every day, while the median value was 12.5 posts per day. Of the 62 members, 46 members (approximately 75%) posted at least once, with JK (group administrator) sharing maximum (115 posts), while BB shared 73 posts.

Nature of posts

Media files dominated the activity in the group. 208 posts contained text messages (including forwarded messages), while 428 posts (2/3rd of total) contained media files. Of the 21 participants who posted more than 5 times, only 5 members shared more posts with text messages than with media files. Nine of these 21 individuals shared media files more than 85% of the times they posted, with three sharing nothing but media files in their 8, 10, and 15 posts respectively. Since the data was received in the email as a text file using the 'export chat' option available in WhatsApp, the media files for the whole month were not accessible for analysis. Besides, the mobile phones used by the teachers have limited data storage capacity and they keep deleting files periodically (at times almost daily) to clear mobile storage space. Thus, I requested JK to share some of the media files from the N-4 group still available in his mobile device memory. Other media files were also available from the web links to blogs or YouTube channels shared in the group, and these were utilized for the analysis.

Academic content

Understanding of local history and geography is a part of the 'context-specific' learning in Social Sciences. The teachers share localized content in the N-4 Taluka WA group. For example, one post had information to make identification of boundaries of the districts in the state easier. Other posts presented factual or historical information related to the N-4 district. There was also a long post explaining the geographical significance, as well as the historical and mythological stories related to the local river from which the district got its name. Such content is considered critical in the teaching of the subject because the students can experientially relate to the 'local information'.

A few posts were related to the remedial teaching. The department had started an official program called 'Mission Vidya'. In this, the students who failed to perform up to the grade-level in the state level annual assessment called 'Gunotsava' are provided remedial classes for three hours each day for one month to bring them to grade-level. One teacher shared a PDF document that contained content to enhance the reading, writing, and numeracy skills of the students in remedial classes. Another teacher had created an Android application to support 'remedial teaching' of the students. He explained its purpose and features, and provided link for its download. There were other posts also where the teachers shared content to supplement the official 'Mission Vidya' content.

[37] Several teachers were forced to change the subject they were teaching after 2011-12 because of a change in the educational qualification requirements for teachers. Hence, it is not difficult to find a language teacher interested in Social Sciences.

None of the posts had content that directly concerned enhancement of the Social Science curriculum. This could have been a limitation of the WA data that I accessed (i.e. all media files were omitted) because when I interviewed the teachers, they showed me the digital or printed copies of images, maps, and articles that they had received from the WA groups.

School activities

Some of the posts concern the activities in the school. While one teacher shared pictures of the Bal Sansad (Children's parliament) organized in his school, a CRCC shared the video of the process of Bal Sansad formation in one of the schools from his cluster. JK shared history and importance of world Population Day. On this occasion, the BRP asked the group members to utilize this opportunity to brainstorm the positives and negatives of population with the students. Another teacher shared the link to download the electronic voting application created for Android devices. This application was created by one of the Social Science teacher from the state. An N-4 Taluka WA group member had used it in his school and shared his experience: "*It is very useful, [it] does away with all paperwork, and gives good exposure to students to understand how elections are organized. [It] d*oes not hang. No other bugs. Just try it". This, he suggested, can be used for conducting elections for Bal Sansad. The teacher who created it on Android store has put his name as 'Amardeep Kumar – Social' which is his identity marker as a Social Science teacher. Such applications and activities are an attempt to bring practical exposure to classroom, and this experience comes from their own learning as a Polling Boot Officer during election duty. The discussions thus happens around process of conducting elections, but not about other aspects of a democracy. Although Bal Sansad is expected to provide an opportunity to students and teachers for such discussions, they rarely talk about the democratic processes and institutions that exist outside the boundaries of the schools.

Content for professional development

A large number of posts shared in the N-4 Taluka WA group contained factual information, either related to current affairs or general knowledge (e.g. names of key functionaries of the present state and national government; when was NDDB established; first state to ban plastic bags, etc.), or concerning certain themes (e.g. Ramayana; movies in India and Gujarat (e.g. first color feature film; most awarded film)). Two posts had mnemonics for remembering information related to talukas and district names of Gujarat, and names of Indian states. The content of these posts crosses the boundaries of usefulness for both, the students, and well as the teachers. The students benefit because this information is useful for the various entrance examinations that they will appear for in future. For teachers, this information is useful in scoring well in their intra-departmental examinations, as well as for other competitive examinations for different government jobs that they are appearing for.

Besides, some teachers had shared solutions of the question asked in the Teacher Aptitude Test conducted by the Gujarat State Education Board, as well as examination preparation material for GPSC (Gujarat Public Service Commission, the state body responsible for recruiting candidates for various state civil services posts). Much of this content was related to general knowledge (primarily geography) shared from a Telegram channel. A lot of teachers aspire for these jobs and the content is useful for their examination preparation.

One video (shared on BISAG[38] network) created by Directorate of Higher Education, Gujarat, for improving language writing skills for college students was also shared as a guide to help teachers improve their writing skills. This was the only post that directly concerned teachers' professional development and was unrelated to any departmental or competitive examinations.

[38] A departmental initiative to broadcast academic videos across the government schools in the state from the state headquarter.

Content concerning teachers' administrative responsibilities and PG activities

A significant number of posts in the WA group were linked to the activities of the teachers in PG, or to coordinate the activities of the N-4 Taluka S.Sc. Teachers' Club. One of the teachers has written a document explaining the agenda and purpose of the Social Science Club of the Taluka. According to this document shared on WA group by JK, there will be three major activities. One, meeting with villagers and parents. This will be focused on involving students as active participants in club activities and carrying out activities of social awareness through the club "to promote democratic citizenship and overall development of the students". Two, to connect the teaching of social sciences with the current developments in the society, and to ensure professional development of the Social Science teachers. Three, working on development of diverse skills of children. A few posts were also related to help reduce the administrative workload of the teachers.

Through a letter (shared in N-4 group), JK informed the group members of an event being organized by the N-4 Taluka Social Science Club with support of some donors as sponsors for the prizes. Since the resources were limited, and the teachers needed to actively work for organizing the event, he requested the teachers in the group to nominate their school for being part of the activity if they were interested.

The N-4 group was also used to coordinate efforts to make best utilization of resources made available by a few individual and corporate donors who come out to help the resource starved government schools. All the posts with such information were shared by JK, the group administrator. He provided detailed instructions on the donations available (e.g. 50,000 notebooks, or money for building maintenance) and the procedure to access the resources (e.g. "*Share your requirements of the notebooks based on number of students enrolled in students. Please give your demand on official letter head of the school*", or "*Please click from different angles the pictures of the buildings or walls that are in dilapidated condition […] and I will compile all the requests into a report and share it with the company representatives.*").

The teachers need to add marks of students in excel spreadsheet and upload it on the official Mission Vidya portal. A teacher created a video explaining how to automate this task. It was appreciated by three teachers.

Source of information

At times, the WA group was used to share information with the teachers but no circulars were shared. One post had information about 'Kala Mahakumbh" (Art festival) organized by the government for school students, while another informed the teachers about the launch of a new scholarship scheme for government school students.

Seeking or extending support

The group is being used by the teachers to seek support from peers in their projects or in brainstorming on common problems. One of the teachers requested support for one of his research project on using 'project based learning in S.Sc.'. JK replied that "I am always ready [to support you]", but besides this, no other teacher responded to the request (on WA group). JK shared a Google form with the group asking suggestions about ways to ensure that there are no dropouts as students graduate from grade 8th (highest level in primary schools) and how they and their parents can be motivated for the same. Teachers also ask for specific content and often, someone responds by providing the requisite documents.

A teacher had faced problem with BISAG which , he was able to troubleshoot and find an alternative to telecast the videos in school using android mobile devices in case there is malfunctioning of the officially provided paraphernalia. On his own volition, the teacher posted his solution to help others. "*I am posting these steps after successfully experimenting with this alternative in my school*", he mentioned to assure the teachers that it was a tried, tested, and reliable solution.

[Intended] Communications with authorities

Some of the teachers used the N-4 Taluka WA group as a platform to share their ideas, concerns, and criticism with the authorities. Their posts were directed at higher functionaries in the department, although none of them is a member of the group. This group had BRP and CRCC from the taluka as the only (lower level) officials from the department. Still, the teachers shared their letters in the group with their identity (name and school) with full understanding that such posts get shared cross-groups and are likely to reach the intended bureaucrats at some point in time. Thus, it was an intended medium of communication with officials. Two such posts stand out for their content.

In one post, a teacher highlighted the challenges that teachers were facing in implementation of 'Mission Vidya'. He highlighted that if the teachers spends 3 hours with one group of children (requiring remedial sessions), those who are at grade level and did well in the assessment suffer. "*The problem is that the students from the poorest and most vulnerable communities do not come to school regularly. If the department is really interested in addressing the problem of poor learning, it should start with addressing these* ***real issues***", he pointed. He further explained how parents do not involve themselves in education of their children, and instead of forcing teachers to teach children for three hours, this problem needs to be addressed first. Moreover, the teacher argues that "*the department wants to conduct assessment of teacher's work with help of an external agency. Why the same department pulls back its feet from making community responsible? Why not make 70% attendance mandatory for getting benefits of all government schemes and scholarships, and also as a precondition for promotion to the next class?*" He questions the government's insistence on getting results similar to private schools which conduct entrance test before admitting a student compared to no-condition-attached admission policy and no compulsory attendance policy for the government schools. "*How fair is it to expect good results from teachers when they are kept busy in administrative and non-academic tasks year round?*", he quips.

In another post, one teacher alerted his peers to not talk to any media personnel directly. "*Journalists come to the school and ask the teachers [questions testing their] general knowledge [the answers to which] they do not know. For me this is not a matter of shame, friends. What is shameful that the politicians and journalists have considered the teachers a burden on education [system]. So, [I urge you to] fight for yourself*". The post then explained how media persons or any outsider visiting and interviewing teachers is against rules of service. "*This is against the rules, and you cannot talk to journalists unless they come with official permission letter from higher ups in hierarchy*", the post warned. This is critical in context of a few media reports from Bihar and Uttar Pradesh where media personnel entered the classrooms and exposed the poor learning levels, and mostly teacher's poor knowledge of their subjects and incompetency in teaching. This post ended with a statement: "*Unless the department and the government provide autonomy to teachers, their development is not possible*".

JK also shared a letter that he had sent to the state education department officials explaining to them about the activities of the Social Science Club, and the elections being held for the various post of the group. This was intended to apprise the authorities of the process of elections, but also showcased the work being done in N-4 taluka.

Inspirational posts

In a number of posts, the teachers either shared stories about student-teacher relationships, or the revered status of the teachers in traditional societies. There were also inspirational stories and motivational posts. In one such post, JK shared an inspirational story about a teacher who served in tribal areas. BB shared Gijubhai Badheka's (a highly respected educationist who lived in pre-independence India) three principles for teaching learning: "*focus on the well-being of the learner;*

teach only what each child can learn; and ensure that the child enjoys the process of learning". In one post, JK argued that he has never seen so much resources available to government schools as are available at present (though they are still meagre by any standards, but the situation is much better compared to earlier times). He provides examples of some schools which have done wonders with their limited resources by working as a team, and focusing on long-term agenda consistently. He motivates the teachers to work together for the development of their schools.

Unrelated content

There were some posts that were not related to Social Science. Some of these received a flak from the group members, while others did not. One post (by JaP) contained a long story unconnected to teaching, education, or Social Science, but instead of being ignored or reprimanded, four teachers appreciated the post (through 'like' and 'clapping' emoticons). Another post explained how three former US Presidents were living as common citizens (and not VIPs) after their retirement, and how in India, even a village level official thinks too highly of himself. It received a 'like' from one teacher but no public response from the administrator.

Some posts with tangential content received a flak also. One teacher wanted suggestion about choosing an insurance from two options. To this, another teacher replied: "*Please share this as p2p message [and not on group]*". The teacher who asked the query replied "*Ok. Fine*". AmD shared a post that laid out the scope of the posts in the N-4 taluka group, and a warning to not share posts that violate this purpose: "*Friends, this group is for those teachers of N-4 taluka who either teach Social Science, or have interest in the subject. Please keep in mind not to post anything that is unrelated to Social Science. Otherwise, we will be forced to remove you from the group. Expecting cooperation from you. Thanks*". This message was preceded by three posts from a teacher who shared unrelated content, and later deleted it, as well as wrote an apology "*Please forgive me. I wanted to send these messages to some other group, but it was shared in this group by mistake*."

Nature of interactions

There is a wide participation in the group, with 75% of the members posting at least once. Yet, as described above, the participation is lopsided with only a few members posting majority of the times. I will now analyze the interactions in the group.

Likes and comments

The most common reaction to a post was sharing emoticons (invariably positive), at times with words of appreciation, and often without any text. There was never a reaction that showed disagreement with the content. One possible reason for this could be the teacher who posts acting as a first level filter to ensure the quality of ideas. Entrenched in the community, the members can reasonably guess the utility or likeability of the posts that they share.

Not even once did a teacher share any detailed comments on any post. The most elaborate comment was received on a bunch of images of an innovative idea where a group of teachers had remodeled an old state transport bus for use in a school. The work was appreciated by some teachers and one of them said: "*The [innovative] work speaks for itself. Really appreciable*". No comments were made on the post where a teacher had shared link to a mobile application to support remedial teaching, although it was highly relevant for all teachers in the group. Even a post about accidental death of a fellow teacher from another district while he was speeding to reach school in time did not receive a single comment in the WA group. After sharing a story (mentioned in inspirational posts above), JK expressed his feelings, "*creativity comes from multiple sources to all the individual who are associated with writing. I have written this piece [of writing] on the basis of the ideas that came to me through self-reflection on my previous experiences. It came as a spark this morning, and I wrote it just like that."* He further added, *"I am presenting this piece to you with gratitude and an expectation that you will give your honest views on it*". Despite this specific request,

there were no comments or feedback on the post, and JK clarified that no one provided any comments even in chat or through call.

The only exception was the posts that concerned the activities of the Social Science Club or nominations for donations (posts concerning teachers' PG activities). The teachers readily nominated their schools, or even asked for some clarification (about the process).

Absence of discussions

One consistent theme that cropped up while analyzing the posts in the WA group was the absence of any discussions. There were occasions where the posts touched sensitive topics or issues that the teachers were deeply concerned about. A lot of discussions about these issues were happening in media, as well as in schools. 'Mission Vidya' was an intervention planned by the department and it was highly publicized. Yet, there were no comments on the post critiquing this intervention and highlighting the challenges in its implementation. Being one of the research participants and also the group administrators, I asked JK about this[39]. He justified it thus: "*You can criticize any policy. There is a tendency to look at the negative aspects of all interventions. This policy has pushed some lazy teachers to come in time and work hard. That is positive*." Then he reiterated all the criticisms mentioned in the post and agreed that all these were real issues, but he did not find it out of place to not discuss it in WA group.

A teacher had created a survey asking for opinion of teachers, students, parents, principals, and SMC members about the government's decision to provide week-long vacations for Navratri (an Indian festival celebrated over nine days). This concerned a decision taken by state government to split the usual 3 week long Diwali vacation into two parts, with Navratri getting one week vacation, and Diwali vacation reduced to two weeks[40]. Another teacher shared the press note released by the government concerning this decision. This created a huge storm in the state and the issue was widely discussed in media. Yet, there was no discussion on this issue in the N-4 Taluka WA group.

JK had shared a Google form seeking suggestions on tackling the issue of students dropping out before completing their education. There was no discussion on this issue in the WA group, and JK told that there were barely any responses to the Google form also, although this issue is a regular part of the discussions among teacher when they meet in schools or CRC trainings. The post about journalists entering class to ask questions to teachers (mentioned above in intended communication to authorities) was made on August 1, 2018, and I have data till August 2, 2018. This post was political in nature and concerned teachers directly. Although 6 more teachers posted 11 times in next 24 hours after this post, none of it was a reply to the message conveyed in this post.

After the S.Sc. Club organized a multi-school event successfully, JK requested the teachers, principals, CRCC, and SMC members present during the event to fill the feedback form so that the suggestions could be incorporated to improve the activities in future. There was no response to this post in the WA group. This was intriguing because the teachers had nominated their schools and participated enthusiastically in the event. JK clarified that he had given a printed format to gather feedback, and several teachers had also called him on his mobile phone, or provided feedback in face-to-face meetings. In response to my Q on absence of discussions on posts in WA group, JK replied: "*Teachers just know how to press the Like button, or write 'good' or 'very good'. They never write anything useful in comments.*" Theoretically, the group operates democratically and anyone can ask a question or share a post. Yet, it is bounded by said and unsaid rules and norms, some of which are explicit (like no GM, GN messages) while others are more implicit (no political messages). As a result, substantively, there are no discussions as are usually expected in a democratic setup.

[39] I had telephoned JK after analyzing the WA group data to seek some information on the chats in the group.
[40] https://timesofindia.indiatimes.com/city/Central-1/gujarat-government-declares-navratri-vacation-from-oct-10-to-17/articleshow/65219523.cms

Reaction to unrelated content

While the group is specifically focused on a particular subjects, the content concerned with the wider role of teacher beyond teaching a subject is easily accepted. While majority of posts fit these two categories, rarely, unrelated posts were shared. The group was particularly tolerant to inspirational stories. Only two posts received a reprimand. In one, a teachers had sought suggestions about an insurance product and a group member asked him to ask such queries in peer-to-peer mode. IN the other, a teacher posted unrelated content 'by mistake' which he deleted upon receiving warning from a group administrator who also reiterated the purpose of the group. Thus, the members were allowed to share a wide range of posts, and only those that clearly violated the boundaries set by the administrators were admonished.

Gendered participation

The N-4 Taluka S.Sc. group is a male-dominated space. Of the 636 posts analyzed, only one was from a female teacher. Of the 62 members, only two are female. A conscious decision was taken by the group administrators and a few other teachers (all males) that it would be better if female teachers are not involved in the WA group. As a compensation, JK, a male teacher and the group administrator, created a separate group for female teachers in the taluka. He was the administrator of this group and 18 female teachers joined it. Unlike the N-4 S.Sc. group, the female teachers' WA group was not focused on a specific subject. When I inquired about the similarity and differences in the nature of posts in the N-4 group and female-only group, JK replied:

"*No. The content is different. In the female teacher group, posts are [not voluntary but] shared only as per demand from the teachers. If someone asks [for some information] personally, I share it in peer-to-peer mode. Only after they ask for it.*" (JK: 35-36)

In contrast to this, in the common (male dominated) WA group, there is active sharing of content and not just solution to the problems posed by members. To compare the content in the two groups, I requested JK to share the chat history of previous month for the female teachers' group that he had created. He said that the group was dormant now and there was not even a single post in this group in more than a month. Thus, there is a significant difference in the quantity and nature of content that gets shared in the two WA groups.

Closing thoughts on N-4 Taluka S.Sc. Teachers' WA group

The N-4 Taluka WA group is highly active, with a wide participation from members, although the group is male dominated. The gender of the teachers not only restricts their access to the informal virtual groups, but also constraints the content that they can access. In the N-4 group, the content shared spans several themes, and the teachers may find it useful for their teaching activities, professional development, non-curricular engagement with students, administrative responsibilities etc.

Theoretically, the WA group provides equal opportunities to all group members to share and express themselves, but even in rare cases where critical issues are raised, no discussions happen in the group. In a space where the teachers do not ask critical questions, a low level equilibrium exists, leading to higher satisfaction even with the minimal participation and sharing. For the teachers, the possibilities of what can happen in groups may not be endless but somewhat restricted. Consequently, the teachers I interviewed (JK, BB, CS, and JP) found the group to be useful. Is the group providing them all the answers they need? Or is this group just one part of a larger network that they have access to? I will engage with this issue later while situating this VG in the teacher's life in their physical settings.

4. North-5 Taluka Teachers' Whatsapp Group

RR created the North-5 Taluka Teachers' Whatsapp Group (hereafter referred as N-5 Taluka WA group or N-5 WA group) as a means to '*exchange educational ideas*' among teachers in the group. His initial idea was to have at least one teacher from each school in the taluka in the group so that all the schools can become a part of the network and share 'all' relevant information. There were 35 members in the group, and none of them was a female.

Nature of posts

RR, the group administrator, shared the group chats from February 13, 2018 to March 3, 2018 (more than 10,000 words excluding all media files). Initially, I analyzed the data for one week (i.e. 13/02/2018 to 19/02/2018). There were 80 posts, and each was individually analyzed mapping the date, time, and the sender's name. The posts were categorized based on the content, and any interlinked posts (replies to a specific post, or posts shared in response to other posts) were identified. After closely analyzing the posts from one week, all other posts were scanned to identify anything with a content that was novel, i.e. not included in posts from one week. Thus, five new posts which were significantly different than the routine posts shared in initial one week were included for analysis. In total, therefore, 85 posts were analyzed. In first week, only 8 members had posted (80 posts) while 23 members posted at least once during the 20 days. Of the 85 posts analyzed, the majority were shared by three teachers: ShT (45), RR (12), and RkN (16). The nature of posts is described below in detail.

Seeking information

Of the 85 posts analyzed, only two were queries asking for a specific information. In one post, a teacher had asked about the subscription cost for 'Shikshak Jyoti', a teacher's magazine, and the address to which the subscription fees needs to be sent. In response, another teacher said that he will provide the information in the evening, while a third teacher provided that information in less than 30 minutes of this query. In the second post, another teacher shared a question paper from a competitive examination and asked for answer key for it. No one provided this information. Thus, only on one occasion had a conversation been initiated in the group in 20 days and besides this, no other post received a response from any group member.

Academic content

Of 85 posts, only 8 posts were concerned directly with academic content. Of these, four provided links to practice question papers for different subjects and grades. These were posted by a single teacher (ShT) and all the links were hosted on his own blog. Two posts explained the significance of the day in history (Today's history) while one provided information regarding J.L. Baird, the Scottish engineer and inventor of television. These were shared by RR and hosted on his blog.

Administrative content

At least eighteen posts concerned administrative issues. These 18 posts had three kinds of content: administrative information (5), news (2), or circulars (11). 'Relevant' circulars even from other districts were shared.

Alternative careers

A large number of posts (22) were focused on either job postings in different departments of state or central government, the dates of competitive examinations, or content to prepare for these posts. These were shared by one teacher (ShT) and they were hosted on his two blogs. RR explained: "*ShT operates these two blogs. There are other teachers who have similar blogs, and they cross post from each other's blogs*". He clarified about the utility of these posts: "*These teachers forward such (career related) information in other WA groups that they are part of. Groups where there are*

individuals who are looking for jobs and can benefit from this information". Thus, a major role played by this WA group is to source certain kind of information and disseminate it to others who may need it.

Posts concerning teachers

While most of the posts shared information, there were two posts that were directly concerned with the teachers, their role in society, the trust that the society puts in them, and the actions of government to control them. The second post concerned the government's initiative to install biometric machines in schools to monitor teacher's attendance.

Political posts

Only one post could be considered as political in nature. A YouTube video was shared that asked people to reject the insensitive rule of the ruling party. It received neither comments, nor a reprimand from any of the group members.

Media files

The chat document shared by RR did not have any files attached, and most of these files were old and had already been deleted by RR since they occupy a lot of space on his mobile phone's memory. Consequently, I requested him to forward all the media files from last one week to my WA number. In a week, 19 media files (videos, PDF documents or images) were shared in the group. These allowed me to get a glimpse of the nature of media files. There was one funny video, a video showing a man keeping water for birds and animals during summer heat, and a newspaper clipping about the role of friends in happiness in life. Besides this, there were thirteen circulars. Thus, circulars form the bulk of media files shared in the group.

Nature of interactions

Only two posts received a reaction from another group member, and these explicitly sought specific information. Apart from these, all the posts were shared in isolation, with no reaction (or even expectation of it) from other members. The group essentially acted as a platform to 'broadcast' or 'receive' content, with no interactions.

Absence of discussions

In general, the group members refrained from commenting on the posts. On rare occasions, the contents of the posts concerned directly with the daily lives of teaches and their professional challenges. All such posts received similar treatment as other posts and no conversations were initiated. For example, one post contained a news item that described a recent decision by the education department banning teachers from carrying mobile in classrooms. It explained that the teacher and principal were liable to be punished if a teacher was caught with a mobile. Although the issue had direct implication for the group members, no one commented on this post or shared their views on this issue.

In a second post, a teacher shared an article in Gujarati written by an educationist. It was titled *"For dissatisfaction with education, how much is the teacher responsible: On the edge of education"*. The author argued that the problems in schools and education are evident, but teachers share more blame than they deserve. He pointed out the challenges due to bureaucracy and inconsiderate officials, inadequate resources, and lack of autonomy for the teacher. The author also acknowledged that to some extent, (a few) teachers were also responsible for the present status of education. He further provided evidence from a state level 'contemplation camp' organized in the capital city to get views of teachers on what do they want. The inputs were taken from teacher specifically regarding the ways to improve the teacher trainings. Yet, he pointed, all the suggestions were

thrown in the wastebasket and the training sessions that followed the camp were conducted in the same old way, as designed by officials, and no inputs from teachers found a place in their design. Overall, it was a thought provoking article and raised issues that affect the teachers' lives deeply. The person who shared this article in the WA group closed it with an appeal: "*If you are a teacher, then read this article and send it to other teacher friends*", but neither did he provide his views on the article, nor did he ask others to share their views. A circular had been shared just 3 days before this post concerning participation in such 'contemplation camps'. Still, no discussion followed this article. The other group members did not share any other articles or opinion pieces related to this article, either supporting the views or countering them. The next 3 posts that day following this article were routine posts on alternative career and an article on Aadhaar cards.

A third post concerning installation of biometric attendance devices in wake of high teacher absenteeism in the schools in the district also failed to initiate any discussion in WA group following its sharing. Even the teacher who shared it did not provide his own comments, nor did he ask for views of others on the issue.

The gender aspect

The group was formed with an intention to create a platform to allow all schools from the taluka to access and share 'relevant' information and resources. The membership was limited to less than 25% schools of the taluka, and only male teachers were part of the group. A high trust among male and female colleagues is required for them to come together in an informal, unofficial VG, and the absence of female teachers from N-4 Taluka WA group could be an indication of such trust.

Concluding thoughts

The North-5 Taluka Teachers' WA group was created with an aim to facilitate sharing education related ideas among teachers in the taluka. With no direction from the group administrator, the group became a platform to share a wide array of content including content unrelated to education. Besides sharing information and links, this group was devoid of any discussions. It allowed the teachers to access all relevant circulars in one place, thus keeping them abreast with the developments in the education department. It acted as a means to generate content (career related information) that could be shared in other relevant groups. The discussions never happened, and even on rare occasions when thought provoking content was shared, there was no expectation of a discussion within the group. Even the individuals who shared these posts just forwarded the content without providing their own opinions. It was a male-only group with no specific concern for absence of female participation.

Cross case analysis

In the three cases described above, I have attempted to provide an in-depth view of the activities in the VG and situate these groups within the lives of the teachers including their relation to physical groups that they are part of. In this section, I will utilize the data from all the three cases for inter-group analysis. Unlike the intragroup analysis where the analysis was purely inductive, in the cross-case analysis, I will also draw from the existing research presented in chapter-2 to answer the four research questions. I will simultaneously engage with the relevant portions of the literature review from chapter-2 to put the evidence from the present study in context.

RQ 1. How does learning happen for teachers when they come together in a virtual social network?

The evidence for learning

What is the nature of the learning that happens when teachers come together in a VG, and how does it happen? Answering this question requires an assumption that learning is happening. Thus, there is a need to check whether there an evidence for learning in the cases analyzed?

In case of C-3 ICT VG, three observations can be considered as evidence for learning. One, there was the expansion in the group of teachers who answered the questions. Initially, only 4-5 teachers (group administrators) answered most questions. Over time, the teachers became experienced in using the project paraphernalia through hands-on exposure, experimentation, asking questions in group, or reading solutions to others' questions. Slowly, they shifted roles and more teachers started responding to questions raised in the group. Two, the number of questions concerning the project implementation (including those related to hardware and software) reduced significantly, and those still asked were answered by directing the individual to relevant post or video link from the past. Three, the scope of content shared in the VG expanded and teachers started sharing their experiments in classrooms with different mobile or software applications (e.g. Plickers, testmoz.com) using the project infrastructure. Evans, Hodkinson, Rainbird, & Unwin (2006) have defined **workplace learning** as the process by which human capacities are expanded *"in, for, and through the workplace"* (p.15). The learning of teachers in this VG was entangled with their work and not isolated from it. They learned by facing problems and finding solutions either by struggling on their own (e.g. in case of PM), or by taking help of their peers (e.g. BS, NV, and others). This was visible in the VG data, as well as the interviews with the teachers.

In C-3 ICT, the shift in the collective knowledge and skills of the group is relatively easy to decipher due to sharp focus on a clearly identified theme. In contrast, EI Bank VG data does not provide any such information. The frequency of posts was low, the focus scattered, and engagement with content in virtual space minimal. Similar was the case with N-4 and N-5 Taluka VG. The analysis of VG data provides evidence of content sharing in group but does not tell the ways in which the group members engage with this content. A teacher may be a peripheral member in one VG, actively participating in another, while remaining a silent spectator in third. This was visible in all the three cases studied. RR, GP, and SC were all part of EI Bank VG, but they rarely posted in the group. Yet, they responded to the Prashna Manch questions and read responses of others. RR, despite being invisible from TI, was using the posts in group to modify his classroom practices. *"I will tell you the truth. This [idea] I borrowed from someone [in the VG]. Who? I don't remember, but I used it for my class"* (RR: 7). VD and GP also did not post in EI Bank VG, but their innovations were shared in the group. They were invisible from this VG but very active in the WA group of the school teachers where the ideas from EI Bank (and other) VG frequently found place. JP was a CRCC and he forwarded the relevant content from N-4 Taluka S.Sc. Teacher's VG to the Social Science teachers in his cluster without ever posting in this VG. BR used innovative pedagogies in classroom but not all of it was shared in VG.

Castro (2004, 2006) found the same pattern as described above in their analysis where multiple virtual COPs had overlapping membership but differential participation of individuals. *"Information gathered in one place…may have an echo and reflection in several ways across the conversation space"* (as cited in Cranefield, 2009, p.50). The evidence from present study points to the need for extending this argument to the simultaneous, overlapping membership in multiple virtual and physical groups. The VG in focus were but a small part of overall professional life and work-related activity of the teachers interviewed. Even within an active VG like C-3 ICT, BS never posted or commented, but she actively learnt through peer-to-peer interactions with PM, one of the group administrators. Except VD, none of the teachers interviewed from EI Bank had posted in the VG or commented on a post. Yet, they regularly visited the VG. In N-4 Taluka VG, almost one-third posts were shared by two only members (BB and JK). The frameworks like CSCL@Work (G. Fischer, 2013) or the PLNs do not appreciate (at least explicitly) such invisible interactions as a source of learning. As a consequence, the VG data only presents an incomplete picture of learning of its members. To gauge their learning, it becomes pertinent to engage with these members through other modes (like interviews) to understand the way they engage with VG and within their PG.

Role of artifacts in learning

As discussed already, the majority of the posts across all four VG were in form of digital artifacts (including videos, web links, PDF documents, or images) (see Appendix-6 for examples of some artifacts) and posts including text were relatively rare. Thus, the learning of teachers in VG cannot be considered in isolation from their interactions with (and through) these artifacts. The social interactions were fully entangled with the material artifacts (Fenwick, 2010) and tools (including the social media platforms that enabled these interactions). The artifacts contained diverse information including an innovative activity or project, a new TLM, a collection (repository) of several useful, subject/theme-focused content (e.g. blog post or YouTube channel), a departmental circular, etc. These were used directly by the teachers in the group or improvised to meet their context-specific needs. These artifacts thus allowed the teachers to interact effectively in VG with minimal use of text. The teachers found silent participation in VG as fruitful due to access to these artifacts.

Who was responsible for the creation of an artifact? Although it looks like an artifact shared by an individual has been produced by her, but often, a closer look will show a collective endeavor. Such collective efforts are not always explicit. Teachers extensively draw inspiration from and build on others' work shared within diverse physical or virtual spaces, although they may not explicitly engage with these individuals (see example from C-3 ICT above). This understanding is in sync with Fischer's (2013) argument that the journal articles authored by him are actually a product of distributed cognition and produced through collaborative efforts of non-human elements and his social relations (peer network). The nature of collaboration is neither explicit, nor extensive

The nature of learning within VG

What role does VG play in learning of school teachers? Marred by poor in-service training (Azim Premji Foundation, 2010; Kidwai et al., 2013; NCERT, 2005) and physically isolated in their schools, the virtual groups connected teachers to their peers. The VG provided them access to diverse content that may be useful in their context, albeit after some modification. Videos and pictures allowed observation of others' practices within classrooms that were not physically accessible, and this observation could happen with or without interactions. Macià & García (2016) have also highlighted the role of such informal, bottom-up online communities of peers in professional development of teachers.

A social network, *"is only as useful as the people who are on it"* (Samuel, 2017) which makes an ability to identify resourceful peers who could help in a specific situation critical (Le Clus, 2011). In PG, the teachers had to depend on their own network or personal knowledge to identify such key

individuals who held the requisite knowledge or resource. VG made this task easier and allowed the teachers to *self-identify* as knowledgeable about certain domains or connect the teachers to a large group of peers, of which some may have knowledge in the domain where they are facing difficulty. I refer to this as the *"law of large numbers".* It points to the teachers' belief (oft-repeated during interviews) that they were hopeful of getting an answer to their questions because of the large membership of VG. *"At least someone will have the answer to my question."* This law operated not just in getting answers to explicit questions but also in hope of helping teachers learn despite *'silent participation'*. Most teachers never asked a question in VG but checked the posts hoping that someone else will have a similar question and ask it in the group. This was not over-optimism, and BS and SC narrated their experiences where someone else asked the same question that that they had.

In the situations described above (i.e. actively or passively soliciting answers), the teacher was aware of a gap in their understanding (knowledge) and they make an attempt to fill that gap. In another scenario, the teacher may herself be unaware of a gap, and a question or a post can make them realize their own ignorance and the gaps in their understanding. Thus, the law of large numbers was expected to operate not just in finding solutions (problem solving) but also in highlighting the problems (problem framing). It could lead to a *spark,* a different mode of learning. Le Clus (2011) suggested that much of workplace learning is informal, incidental, unconscious, idiosyncratic, serendipitous, and unplanned. Based on evidence discussed above, the same can also be argued for learning when peers from workplace come together in VG. The teachers were often silent, taking a stroll in the VG, but they were consciously observant, looking for learning opportunities. Someone shares an idea and one can see its direct or contextualized application in their classroom, although they had never thought about it before. Such '*sparks'* usually led to modification of original idea and creation of new artefacts or activities for use in the classroom. RR, for example, explained how he had created a TLM using discarded CDs based on an inspiration from a post in VG.

'Sparks' and 'silent participation' have a direct implication for the professional development of teachers. Poor pre and in-service training has left the teachers isolated and insufficiently equipped. Even when the participation was silent, the teachers were able to understand what their peers were doing. Unlike explicit scaffolding required by a child (as suggested by Vygotsky), as adult learners, the teachers have self-scaffolding capabilities (Cairns and Malloch, 2011). Thus, learning was possible even without explicit support. The VG participation allowed them to observe their peers and understand what they were thinking, doing, and succeeding at. It allowed the teachers to become aware that they are not the only one facing these problems. That had consequences for the teachers' morale and acted as emotional support. The teachers do not just continue blaming themselves when they see that some problems are systemic, and others are also facing it. Thus, this has repercussions for teacher's professional development.

Missing evidence of critical thinking

The posts in all the three VG had pointed questions, audio, video, or images, all containing information but no opinions or commentaries. Except a handful of posts (not more than 10 posts across all cases studied), none was in form of long text. Of these, only few were pieces of reflective writing and failed to receive any response from the other group members. The teachers did not engage in-depth with any issue even in their blogs. Writing, thus, was considered as dispensable. In majority cases, the videos or images (if they were in context of education or schooling) were focused on demonstrating solutions to certain technical problems (Standard Operating Procedures). In a few cases (in EI Bank and N-4 S.Sc. VG), these artifacts captured the pedagogy utilized inside the classroom. While these cannot be inherently considered devoid of critical thinking (designing a novel teaching practice may involve thinking about the multiple dimensions of the subject, curriculum, students, society etc.), the absence of any discussions on any of the posts can be taken as an

evidence of critical thinking in public spaces. Murray et al. (2014) consider *"critical inquiry about their own and colleagues' professional practices in relation to the social, political, and cultural contexts"* as a basis for high quality learning through informal interactions within workplaces (p. 310). If this argument is tenable, it can be argued that the quality of learning in the virtual spaces was not very high. Freire's argument that "*if the action is merely that of extending elaborated knowledge to those who do not possess it, they are killing their critical capacity of possessing it*" (Freire, 2013, p.90) can be seen on the same lines. This is repeatedly visible all the three cases where the teachers often take cognizance of the content in the group (by pressing Like, sharing a smiley, or writing a brief appreciative comment) but fail to interact with it critically.

The personal histories of the teachers played a big role in this attitude, for they are also a product of an education system (including pre-service education) that has been criticized for excessive focus on rote learning with complete neglect of higher-order thinking skills (Sampat, 2016; Srinivasan, 2015; Venkataramana, 2011). This is also in line with Hodkinson & Hodkinson (2004) who also found a critical role of teachers' personal histories in their own learning in the workplace (along with other factors like personal dispositions, position in hierarchy, workplace affordances etc.).

While there was no evidence of an expression of critical thought in VG, that does not imply absence of critical thinking among teachers.

I will consider this issue while discussing the linkage of agency, power, and hierarchy to teachers' learning.

The processes that shape learning quality

Research has established cognition, reflection (in and on action, both private and public), and social interaction to be critical element that contribute to learning (e.g. Argyris & Schön (1974, 1978); Cairns & Malloch (2011); Goggins & Jahnke (2013); LeClus (2011)). Yet, it is not easy to engage in these processes. Based on the analysis of the data from the three cases, I will present evidence to establish that these cannot be taken as granted and in fact, there are factors that hinder these processes.

The scarcity of reflection

In all the three cases analyzed for this study, there was little explicit evidence of reflection by the teachers, although it was not completely absent. Prashna Manch (EI Bank VG) was the only activity that provided an explicit opportunity for teachers to reflect about their work practices and externalize it in form of answer to the questions. RR, SC, VD, and PM, all part of the VG, cited it as a stimulating activity that forced them to think. Besides, there was also other evidence of teacher's reflection. All the practice-based innovations (including RR's TLMs, VD's projects, BB's charts, PM's MCQs) required reflection. The submission of innovations to InShodh (EI Bank's repository) or DIET/state-level Innovation fairs conducted by the education departments also required teachers to submit their innovation in writing, thus forcing reflection. VD explained how she thought about the purpose while designing her project, *"Maine socha, mera hetu kya hai?"* (*I thought, what is my purpose?*). That was the moment of reflection. Even while implementing, she was constantly looking at the way her students reacted and modified her plans. Thus, a cycle of action and reflection was involved in designing and implementing her project which was later identified as an *innovation* by RJMCEI. Similarly, CA's baseline test for his students to understand their existing proficiency levels could not have been possible without reflection. Last, in some cases, the artifacts can be considered as externalized products of reflection (e.g. identifying the need for understanding the features of Gyankunj software, planning the project, and creating videos).

As opposed to the minimal evidence of individual reflection, absence of discussions indicated absence of collective reflection within VG. The posts primarily included forwarded content, or information seeking and sharing. There was complete absence of engagement in discussions to define problems (beyond missing information or immediate troubleshooting). This absence was further accentuated by refusal of teachers to engage with the few posts where individual teachers had reflected on some critical issues but received no response even when it was explicitly requested (in N-4 and N-5 VG).

The role of reflection in dealing with dynamic situations within the workplace has been well accepted (e.g. Schön, 1983, 1987) including in the postmodern theories of learning (e.g. Svabo, 2009). Prilla, Hermann, & Degeling (2013) suggest that while the implicit reflection does take place during work, communication (social interactions) can make it explicit. Bruckman (2006) has also pointed to the role of social interactions for learning in virtual spaces. Vince & Reynolds (2009) have highlighted the role of public reflection for learning. Even Goggins & Jahnke (2013) assume reflection and social interactions to be crucial for learning and collaborative reflection emergence through social media has been considered as crucial for knowledge construction. The evidence from the present study suggest that the affordance provided by VG for individual members to engage in social interactions and reflect critically were not utilized.

The absence of feedback

A related consequence of the absence of discussion is the broken feedback loops. Practitioners require feedback for improvement of their practice. Honest feedback plays a critical role in learning and it has been considered as a crucial factor that makes Personal Learning Networks effective (Trust, Krutka, & Carpenter, 2016). Although ideas get shared in PG, there was no expectation that the teachers will share their feedback. Similar was the case with the bureaucrats. The education department had created procedures to allow individuals embedded within the system to receive feedback from those higher up in hierarchy. JK, the Social Science Block Resource Person for North-4 taluka explained one such feedback mechanism: *"I am a BRP. My job description includes the requirement to observe and teach one junior class (grade 1-5) and one senior class (grade 6-8). I need to physically visit one school, do this teaching, and submit an observation sheet along with feedback on the school also. I have to submit 45 such observation forms in a month" (JK: 75).* The presence of feedback mechanism is an indication of its recognized importance, but it tells only half the story. To get a clear picture, one needs to understand the feedback mechanisms in action. The flood of circulars leaves the teachers (street level bureaucrats in Lipsky's (1971) words) scurrying, arranging for data or conducting meetings to fulfil the orders in the circular. Although the BRP was required to submit 45 feedback forms in a month, the working conditions forced him to do it as a performance, a checkbox that needed to be ticked. The BRP submits the forms but receives no feedback himself on his observations. The feedback loops are broken. *"Whatever it is that I do and how I do it, no one wants to understand. I am not sure if they check or even think about whatever I submit. This is a major weakness of (education) system",* rued JK. Aiyar & Bhattacharya (2016) and Aiyar, Dongre, & Davis (2015) have found similar evidence in their interactions with the teachers and block-level officials across multiple states. The evidence from my study strengthens their finding that these last-mile workers often feel like a cog in the wheel without much agency. Even NCTE (2009) has recognized this weakness.

While the administrative mechanisms are a clear failure, one may expect the situation to be different in the VG. After all, they afford possibilities for rich engagement as discussed widely in the literature. The evidence barely supports this. In all the three cases analyzed, there was a dearth of feedback in virtual spaces. The teachers refrained from giving any honest opinion on posts and politically correct feedback was more common. *"Everyone has a different nature and personality. Some accept [honest feedback] and some cannot accept it. And definitely not on a public platform"*

(JK: 95). The most visible engagement with a post was in form of brief appreciation, either in form of text comment (good, excellent, useful, etc.) or by sharing an emoticon. Teachers like SC sometimes gave feedback in public, though it was also limited to appreciation. *"If someone shared in group, then you need to compliment (their good work) in the group itself. […] This increases confidence of people and gives encouragement to those who do good work (utsahvardhan)"* (SC: 96). There was a complete absence of discussions after such complements in all the three groups.

At times, the feedback in VG was more implicit than explicit. RR, for example, improvised an artifact shared earlier by another teacher and increased its educational value for his students. The images of the improvised artifact were shared without any comments, but these can be seen as a feedback or collective creation of new artifacts. In a similar manner, PM had created online quizzes and shared the link in the VG. Another teacher built on it, used the quizzes as a whole-class activity, and shared the videos of the activity. A third teacher improvised further and used a free mobile application (Plickers) to convert the online activity into an individual assessment without requiring any additional digital devices. All these posts received appreciation, but no explicit feedback was shared.

When the official mechanisms to provide support or feedback fail, the teachers are left with no option but to depend on their personal networks to seek any suggestions or feedback unofficially. The culture of organization does not allow honest feedback in any spaces including the informal VG. The regular access to personal networks makes seeking feedback from people at same level in hierarchy (fellow teachers) during CRC meetings or casually during physical meetings a natural choice. The only spaces where honest feedbacks get shared are personal spaces. CA and RR described *lunch together* as one time where they discussed most important issues. Similarly, RS and MN discussed their ideas and challenges before or after school hours with a close group of friends. The only evidence of discussions was within close personal networks of friends (who are usually teachers), which often did not overlap with their peers in school or CRC, the individuals they most frequently interact with. This was common across all the interviews including female teachers. I will deal with this issue while addressing the nature of communities.

The nature of collaboration

Researchers frequently assume collaboration among individuals in a virtual group to be the basis of learning and knowledge creation. For example, CSCL and CSCL@Workplace are based on assumption of collaboration. Although desired, such collaborative engagement may not be easy to achieve, especially in situations where active participation is not forthcoming. Collaborative learning demands certain level of engagement. Within virtual groups studied, the focus was not on collaboration to create new knowledge. Instead, the teachers individually created new knowledge (which Nilsen & Ellström (2011) refer to as practice-based knowledge) and shared it in the VG. This new knowledge entered the VG, and the role of computer-support was in allowing the proliferation of the idea through easy sharing across multiple groups. The collaboration can thus be conceptualized as teachers sharing their individual innovations, ideas, resources, or individual sources of knowledge that they have collated over time and put it in public domain for others to use. The only exception to this was the collective efforts in C-3 ICT to resolve the problems faced by the teachers. Initially, the group administrators collaborated to work for smooth implementation of project and were later joined by other teachers who kept sharing their experiences and solutions. Being a focused project, this was possible but when it came to groups with broader agenda (subject focus in N-4 S.Sc. or wider, innovation focus in EI Bank), the collaboration was never explicit. This echoes Aiyar, Dongre, & Davis' (2015) finding that the short-term changes are usually successful when implementation happens in project-mode but the activity fizzles down when the focus is on changing routines.

Collaboration also does not necessarily involve a well-defined project. In the cases analyzed, the collaboration can be considered as the minimal commitment of the group members to support their peers whenever they faced a problem for which they wanted a solution from the group. The smaller

the size of the group, the stronger the commitment required from members. BR, for example, was part of a group of nine English teachers. The group remained viable because the teachers were able to receive relevant inputs whenever required. In contrast, there was evidence of failure of collaboration. RS had created a group of Social Science teachers. Despite having a subject-focus and 500 teachers, there was a flood of irrelevant posts. The group fizzled out and RS dismantled the group.

As the groups matured, the nature and extent of collaboration also changed. For example, once the GK project related questions abated, the C-3 ICT VG saw an evolution. Drawing on the access to new resources (ICT hardware and internet) and new skills (using ICT in classroom), the participants expanded the boundaries of their work in school and started sharing the links to ICT-related content created by them. PM, for example, had dedicated his vacations and after-school hours to create online Social Science quizzes with multiple-choice questions for upper-primary classes. Thus, instead of depending on the department provided content, the teachers became curators of content. Besides content, the participation in VG also diversified, forcing the administrators to start an additional WA group to include these teachers, several of them from other districts. Started as a collective effort of four teachers to support their peers in implementation of an IT project, a virtuous cycle of academic collaboration got initiated with new content emerging from diverse set of individuals. Eleven teachers from these two WA groups informally came together to create new open access content across all subjects (all 31 were male) and were later joined by 20 other teachers from across the state. This need for access to novel content outside the textbooks was a common theme across all the VG and PG analyzed for this study, and the teachers in C-3 ICT enabled its members to take action and collaborate to address their common need. N-4 Taluka VG evolved in a different manner, with a S.Sc. Club getting formed to collectively engage students across the taluka in subject-related activities.

Jones (2015) suggests that learning in virtual spaces happens through interactions. It is social in nature and goes beyond simply accessing online materials. Although the social nature of learning within virtual groups is easy to visualize, as opposed to Jones' (2015) assertion, the 'merely accessing online materials' was also social in nature in the cases analyzed. The teachers want to improve, reshape, remodel, and even transform their practices, but instead of working on it at an individual level by searching the internet, they depend on their peers in VG or PG. Internet was not an infinite source of knowledge for the teachers because language barriers kept their browsing limited to sources in Gujarati. There was a widespread understanding of this limitation and several teachers created blogs and YouTube channels to provide locally-relevant content. Many teachers visited these *'trusted'* sources online and the owners of these spaces tried to upload content that these visitors could directly use. The web links of online quizzes hosted on the teachers' blog were widely accessed and shared, and YouTube videos related to Gyankunj uploaded by teachers from one taluka were used for troubleshooting by teachers across the state. Realizing the non-availability of any easily understandable lyrical rendition of a difficult poem from English textbook on internet, a teacher created an audio file and uploaded it for other teachers to use. The organization is large, with thousands of teachers for each subject spread across the state engaged in similar work-practices. Their contribution in creating localized content that others find useful makes the act of internet browsing a social interaction.

Factors shaping the nature of VG content and interactions

Based on the discussion above, it can be argued that the teachers are not engaging in deep learning and avoid posts dealing with any issue that is contestable. The absence of feedback or insignificant public reflection is also evident. Such restricted engagement impacts the quality of learning. Still, the teachers share certain kind of posts in VG and react to these posts (discussed already). It may therefore be valuable to look at the factors that influence the teachers' decisions to share certain kind of posts and avoid others, and the way they choose to react (or avoid reacting) to the posts in

the group. The Government Primary Schools are embedded within local communities and the socioeconomic realities of the lives of their students define (and constrain) the teachers' curricular or pedagogical activities. In addition, their position in the hierarchy, the culture of the organization, their personal histories etc. also shape the way teachers are allowed to participate in these spaces. I will now consider some of the prominent themes emerging from the cross-case analysis that address the issue of participation. This section attempts to address the question that why does the content and interactions in virtual groups look the way they do? This section is more a commentary on the way learning is restricted than on ways in which it is enabled.

The embeddedness within community

In the context of schools as workplaces, learning of teachers is not limited to the academic subjects. The teachers also need to know a lot more about the context of their students: their socio-economic backgrounds, the challenges that they face at their homes, the community within which the school and the students are embedded, and the ways to deal with the issues that arise because of the specific characteristics of these communities. All these have an influence on the teachers' workplace affordances, performance, and directly impact the lives of the students who are expected to learn within these schools. Consequently, the issues that the teachers need to reflect on and discuss with their peers go well beyond the classroom activities and invariably involves the community. Frameworks such as TPACK (Koehler and Mishra, 2005) have been rightly criticized for their neglect of such complexity and consideration only classroom teaching related factors. WPL researchers (e.g. Hodkinson & Hodkinson, 2003; Illeris, 2003) have often argued for inclusion of context-specific factors, as well as the socio-cultural and political factors that allow (or restrict) the ways in which employees participate in work (and WPL).

In all the cases analyzed, the key driver for teachers' practices was their shared understanding of the *goals of schooling.* This understanding then drove definition of *'what is useful'* and hence what needs to be focus of discussions and action. Teachers saw '*novelty*', a new way to *"teach, engage, or test" as crucial for their classroom practices*. This understanding arose from the realization that several students find a subject or chapter to be difficult (e.g. the idea of a chemical reaction) or boring (e.g. Social Sciences). Hence, they felt an urge to do something non-routine, something beyond the regular textbook. In C-3 ICT, this was evident from NV's argument of projectors impacting the interest levels of students. The teachers had a very positive, uncritical view of ICT tools and saw them as means to engage students. Only one teacher (CS from N-4 VG) was skeptical and considered excessive focus on ICT as negative: *"If I will teach only using Gyankunj project, […] when will I be able to teach what [other things] I know"* (CS: 63).
Another important factor that drove the teachers' practices was the understanding of socioeconomic background of their students and the need for them to become economically productive as soon as possible. Thus, they tried to create or access tools that could allow students to remember contents of the curriculum, which often forms the basis of several competitive examinations conducted for lower level public sector jobs. RS explained this focus:

> *"We have a resource constraint. We need a projector in school. […] I want to teach about kings and kingdoms [in history] using videos. I have content in pen drive, but where do I show? A video can explain what these kings looked like, where did they live, what all battles did they fight, what was their horse's name. All this will get imprinted in the brains of the students. And when they have to appear for competitive examinations [years later], then all this [information] will flow out of their brain. If they just read [and not watch on videos], they will forget [by then]" (RS: 110)*

BB's charts, models, and images were similarly created with an aim to allow repeated exposure to students. One very definitive example was 1853 painted on top of a wooden train model kept in the classroom to allow students to remember the fact that in India, first train was operated in 1853. This theme was common across all the interviews and cases. Hence, even when the focus was on pedagogy and content knowledge (Koehler and Mishra, 2005), it was driven by the context-specific realities of the students.

There was also an acute awareness of the criticism of government schools and appreciation of private education in delivering quality education. While the government school teachers benchmark their practices and performance against their peers from private schools, it becomes a downward spiral when the standards set up by private schools are low. The activities from private schools emulated within GPS by the teachers (e.g. quiz competitions, painting competitions, speeches, short stories, or reading news of the day in morning assemblies) usually remain focused on the act (performance) and were not used as a stepping stone to delve deeper into the issues. If analyzed using Bloom's taxonomy (Anderson et al., 2001), these acts can be considered as focusing on remembering (recognizing and recalling), and in rare cases, on understanding. This can be attributed to the GPS teachers' lack of capabilities to engage students in higher order learning activities owing to their own poor pre and in-service training (Azim Premji Foundation, 2010; NCTE, 2009) that left them poorly equipped for such tasks.

In all the cases analyzed, the teachers were focused on PCK (which has been considered as crucial element of teachers' knowledge, e.g. by Shulman & Sykes, 1986, as cited in Phillips, 2016). New TLMs or teaching techniques were frequently shared. Content reigned supreme, pedagogy was next, and any issues beyond the curriculum were rarely discussed. Given the context of GPS schools and the teachers' own pre and in-service training, as well as their limited exposure, these findings are not surprising.

The organizational culture

The participation of teachers is shaped by the affordances of the mediums, tools and platforms, but it is as much shaped by the individuals (agency, dispositions, and motivation) and their context (social, political, cultural, and organizational factors). JP explained how he considered the curriculum and textbooks to be very restrictive. He argued that the teachers are capable and should be given the freedom to design their own curriculum or the textbooks that they want to use in classrooms. This was the most radical argument presented by a teacher during the interviews for this research and counters the impression that the teachers do not engage in critical thinking (discussed above). I asked him if he had discussed this with anyone else. He said he had talked to some of his friends (not part of his official work group) who were also teachers. *"Did you share this idea with any official?"*, I asked. *"No. We cannot do that,"* said JP. Similar helplessness was expressed by RR who could not argue his case with the BEO despite being unconvinced about the explanation provided to him about unfair treatment meted to him. The teachers are at the lowest level in the hierarchy, but the situation is not different for Block level officials. The BEO of N-4 explained how he was expected to inspect almost 300 schools every year along with other work but could not explain the impossibility of this task to top bureaucrats. The same helplessness and resignation was found by Aiyar & Bhattacharya (2016) in Block level officials across five states.

Fischer (2013) and Goggins & Jahnke (2013) argue that the practitioners involved in solving a problem should be involved in problem framing. In schools, that is not the case. The problems to be tackled and the manner in which it is to be done are defined at the state level by the department officials. The teachers are situated at the lowest level of a hierarchical, bureaucratic system that restricts their freedom to act as independent agents. They find themselves incapable of providing honest feedback to the department officials. They are not consulted, and decisions are thrust upon

them, and they are forced to implement these decisions. When the solutions thrust upon them from the top fail to produce results, the teachers resort to coping strategies. Such strategies take into consideration their own context and they work within the constraints enforced upon them. For example, project Pragna[41], an activity-based learning (ABL) approach, was launched for lower primary classes across the state. The pedagogy required for this project is diametrically opposed to the traditional methods used by the teacher. Being an ABL, even the learning outcomes are broader than the traditional classroom. Yet, the school inspectors focused on judging the teachers' performance on traditional parameters. RR explained how he was forced to focus on completing the syllabus, but he also devised ways to teach for wider learning outcomes and allow students to progress at their pace as envisaged by the project. Several teachers appreciated the purpose of Mission Vidya, another project started to provide remedial classes for students performing below grade level, but they also highlighted how it interfered with other objectives of teachers. Yet, fearing reprimand or some negative action, none of them provided an honest feedback to the department.

The fears of teachers are not unfounded, for they regularly watch implications of raising tough questions or getting involved in discussions critical of the department. A female school teacher nearing her retirement was publicly humiliated by the Chief Minister of her state for requesting transfer close to her family and it became a nationwide news (Pande, 2018). Similarly, a teacher from Rajasthan was reprimanded for sharing a satirical post about a government scheme of distributing milk to school children (Roytalukdar, 2018) that was to be administered by already overburdened teachers. Even in Gujarat, the teachers of Chota Udepur Taluka received a written warning from the DEO that a case under the Information Technology Act of the Indian Penal Code will be registered against them if they did not stop making critical comments about the department in their Whatsapp group (Express News Service, 2018). The bureaucrats have power to act against the teachers which they want to avoid at all costs. Most teachers that I interviewed were teaching in rural schools and were in same school for past several years. A transfer to a distant district or a remote school could throw their family life out of gear. It was one major reason for staying away from any possible confrontation with the department. In addition, their service rules make it mandatory for them to carry out all orders received from the department. The frequent circulars from the department were cited by all teachers as the major distraction, but no one had raised the issue with the officials (see Sharma (2018) for an exception). On the contrary, the teachers justified it: *"I think that the government has recruited us and pays us a salary. Whatever circulars we receive, it is our duty to do the tasks mentioned therein. There must be something positive [intended] in the circular. We think like that and work. Yes, it sometimes gets too much [work]"* (GP: 82). Thus, the teachers feel vulnerable and powerless and avoid providing honest feedback or engaging in discussions publicly with peers or officials.

The personal histories of individuals

While the lives of teachers are definitely constrained by their position in hierarchy, they are not completely subjugated. Krishna Kumar (2011) has called teachers meek dictators, for they are mostly constrained but have complete control over students in the classroom. *"Teachers are hardly passive agents that societal expectations and school structures pour into a mold. Teachers bring their life experiences, formal and informal knowledge, and personal beliefs about children, learning, and serving the community. […] Both constrained and autonomous, teachers accommodate to external demands and organizational structures while carving out a niche for themselves in which they can make independent decisions about how they organize their classrooms, group students, and teach"*. VD, for example, was able to initiate a project involving peer learning. In the beginning, she was afraid that her project might be misinterpreted as unethical or illegal since it involved students in teaching their batchmates. What made a difference was the support she received from GP, her

[41] http://gujarat-education.gov.in/ssa/projects/pragna_project.htm

school principal, and later, from her CRCC. Similar was the case with PM who could convince the district officials of choosing his school for Gyankunj project implementation despite it not meeting eligibility criteria of minimum number of students. These cases indicate a role for supportive principal and bureaucracy, as well as teacher's own motivation. Now, even within the classroom, their *'meek dictatorship'* is being challenged by penetration of technology and change in administrative demands. *"When projects like Gyankunj dictate what I have to teach and how, when will I teach what I know and in ways I find useful?"*, said CS (63). The tensions in using technology for teaching, communication, and informal professional development are thus visible. As suggested by Feenberg (1991) and Winner (1986), technology is not neutral but politically charged, and it is a social battlefield (as cited in Jones, 2015). Thus, participation and collaboration in the virtual groups need to be analyzed in the light of the socio-cultural and political context enveloping the lives of its participants.

Scott (2006) argues that the long-term impact of experiences within the contemporary life-world institutions results in mild 'institutional neurosis'. The individuals in these institutions learn to become cooperative, raising no questions and giving no trouble to the authority. Consequently, even in a relatively open public sphere, this docile, cautious, servile, deferent and conforming individual is unable to speak freely (p.79-80). These contradictions create a "simulacrum of independence and autonomy" for the individuals but in reality, the system has emptied out all their substantive content, leaving them in invisible chains (p.93). This is true of the educational experiences of individuals who are teachers in schools today. Their own schooling experiences as students, as well as the teacher training experiences are no different. Both institutions propagate the same spirit that Scott fears. As a result, even in rare instances (across all three VG) when any teacher tried to initiate a discussion on some issues, no response was forthcoming.

Impact of gender

The teachers are not only part of a department that is highly bureaucratic and hierarchical, but they also come from a society that is highly patriarchal. This creates barriers for female teachers' participation in VG and the nature of their engagement with other group members. First, fewer female teachers have smartphones necessary to become part of VG. This happens despite these teachers being financially capable of buying a smartphone. For married females, social factors including mistrust of their family members plays a big role. Since my sample selection was based on participation of teachers in VG, none of the female teachers I interviewed were without a smart device. But several teachers mentioned that female teachers refrain from buying smartphones because they are afraid of receiving unwanted messages from unknown peers, which could create tension in their personal lives. This skewed access to internet is not limited to female teachers but is widespread, with a recent UNESCO study highlighting that only 30% of India's internet users are females (Kini, 2018). This impacts the learning opportunities available to female teachers.

Even when the female teachers have access to internet, the male group administrators often unilaterally decide to keep female teachers out of the Whatsapp groups. N-4 Taluka VG and the N-5 taluka VG had put such restrictions for the fear of a male teacher sharing indecent content in VG that could jeopardize the *image* of the group, and in turn, the group administrators. The fear was real and Innovative Women Teachers (IWT) Facebook Group was created by RJMCEI upon request of several female teachers who were uncomfortable with participation in the mixed-gender Teacher Innovation (TI) Facebook Group. The difference in the volume and nature of content in TI and IWT was clearly visible, with female teachers being completely absent from the posts in TI but highly active in IWT. This behavior was in sync with findings of Deepa Narayan (2018) who argued that the impact of growing up in a patriarchal household is visible in women's lives even after all the education and subsequent financial independence. These women learn to *"delete themselves"* from public spaces, to shrink and erase the signs of their existence, leaving no traces of their ideas and opinions.

Patriarchy impacted not just access to internet or entry into VG. Even when they were present in these spaces, they had less time available for participating in VG or browsing the internet in order to make any meaningful contribution to the group. Within the family, females are expected to do all the household work before leaving for school and after coming back from school. Except SC and VD, who were both in late-fifties and had grown up children and a daughter-in-law to take care of household work, all female participants pointed to the additional burden of household work. When they had children, it was always the mothers who prepared them for school and got involved in their homework. Attari (2018) points to the prevalence of this skewed role even among the middle and upper-middle class families where females shoulder a greater responsibility of parenting compared to their husbands (Narayan's (2018) study provides empirical evidence for this). Thus, female teachers found it difficult to engage in school-related activities after school hours. In contrast, all male teachers interviewed stated that they worked after school hours on their school related projects including browsing the internet and checking multiple VG of teachers. No wonder that all the blogs and YouTube channels belonged to male teachers with rare exceptions. Owing to the societal factors, the learning opportunities available to the young female teachers were severely curtailed and they were less likely to participate actively in any VG of school teachers.

Conclusion

Based on the cross-case analysis, it can be argued that the teachers were interested in accessing novel content that they could utilize in their classrooms. Much of the learning was incidental, serendipitous, and unplanned, just as it is in workplaces (Le Clus, 2011). The teachers often stumbled upon a post that triggered reflection, raised a question, or answered one, resulting in addition to the individual's repository of knowledge or understanding of a situation. The VG participation was made valuable by presence of a large number of peers who shared the local, contextual understanding (*'law of large numbers').* Digital artifacts played a crucial role in this learning. Much of the learning was social in nature, for the VG participants shared videos, documents, images, web-links that they considered potentially useful for the group members. It was social even in a more explicit manner where the teachers engaged in peer-to-peer interactions outside VG. Such interactions were more common than engagement within virtual spaces. Thus, silent participation and peer-to-peer interactions were more common contributors to teachers' learning than active participation in VG.

Marred by the poor in-service training, the participation in VG helped teachers to come out of their isolation within remotely located schools. The participation in informal, bottom-up, virtual communities of peers (Macia and Garcia, 2016) allowed teachers to shape their own PLNs and gain some control over their professional development. These groups allowed teachers to access knowledgeable peers, either through recommendation, or through self-identification as one, which was very difficult otherwise.

The learning within the virtual spaces, even when silent, was social in nature, involved artifacts (as argued within sociomaterial perspective of learning), and was inextricably linked to physical groups. The existing research on learning in virtual spaces (e.g. Fischer, 2013; Stahl, 2006) fails to factor in such invisible interactions as a source of learning. Besides, research that specifically concern teachers' knowledge (e.g. Koehler and Mishra, 2005) does not capture its complex nature and leave out context-specific elements, a shortcoming already highlighted by researchers like Cox (2008), Kelly (2010), and Rosenberg & Koehler (2015). The present study provided further evidence of such context-specific elements even within virtual spaces.

Fischer (2013), Goggins and Jahnke (2013) and others like Prilla et al. (2013), Murray et al. (2014) assume collaboration, feedback, public reflection, and critical argumentation and inquiry as the basis of learning within workplaces including when the interactions are within virtual spaces. The present

study found evidence for a very different, implicit collaboration than usually assumed. Honest feedback and public reflection were absent, and critical thinking and discussions never happened in public spaces. These were influenced by teachers' position in organization, the organizational culture, and personal histories. The socio-cultural and political factors including gender played a crucial role, impacting the nature of content that could be shared, the nature of interactions, and the boundaries of what was not shared and discussed. Phillips (2016) has already argued for the inclusion of the socio-political factors outside the four walls of classroom while understanding teachers' knowledge. Similarly, Hodkinson and Hodkinson (2003) have also argued for extension of the context boundaries to include social, political, cultural, and economic factors relevant to work and workplace learning. Locating teachers within this wider societal and organizational frame brings to light the fact that the teachers are not completely free agents but are constrained in their acts. Thus, more than the affordances of the medium (virtual spaces), these socio-cultural, political, and organizational factors restricted the kind of issues that were open for discussion. This ultimately constricts the learning opportunities available to the teachers. Any theory or framework needs to explicitly consider such factors when analyzing learning of teachers within virtual spaces.

RQ.2: How does the learning acquired by the teachers through their participation in the virtual communities get re-contextualized for application in physical workplace?

When teachers come together (in physical or virtual spaces), they are highly aware of the contextual realities of their respective schools. During the interviews, all the teachers highlighted some common problems that they faced in performing their role. For example, high administrative workload and no support staff; students' socioeconomic background; challenges of teaching first generation learners etc. were common themes across the interviews. Yet, they were also aware of the specific nuances of their school's context that made their problems unique. VD pointed that her students come from nearby slums and had three different mother tongues – Hindi, Gujarati, and Bengali. As a language teacher, that made her task more difficult compared to BR whose students spoke Gujarati at home, but their local dialect was different than the standard language textbooks.

Most teachers faced high student absenteeism which impacted the learning in their classes, but the underlying dynamics were different. Several students in S-9 moved with their families in a specific season to a different city because their parents worked as laborers. So, they could not be present in school. On the other hand, in S-2, the family of several students was so poor that they engaged all family members as working hands, thus keeping students off school. In S-6, the students were required in fields only for a few hours on most days of the agriculture harvesting season, but they were present in fields in the village. Although the problem looks the same to an outsider, the solutions required nuanced understanding. Teachers in S-6 negotiated with the parents of students to send them to school after work so that the student does not miss school for a full day but only a few hours. S-9 teachers had to find ways to engage students to continue reading and writing even when they were away from the city. In S-2, the teachers could not find a solution since the very survival of family was threatened and the solution would have involved more than a focus on attendance and learning outcomes. These two examples clearly show that the teachers understand the role of context and that drives their practice. CA summed up this perspective: "*We all talk [during meetings], but the problems that are being faced are not the same for everyone. So, we need to find solution ourselves [and cannot depend on CRC meetings]*" (CA: 63-64). The same is true for the posts within VG which are analyzed for contextual relevance and the learning from these is utilized after suitable modifications.

Overcoming local constraints

Participation of teachers in VG was embedded in their workplace practices and the contextual awareness described above was a feature of their participation. They considered the feasibility of ideas and activities shared in VG within their context and engaged with them only if found suitable. The modification of learning from VG (or even PG) was a rule and not an exception. VD was aware that grammar was the missing element from her creative writing project and she carefully scanned all posts that could be useful. PM had created online quiz that could be administered to each student but in absence of requisite infrastructure (multiple tablets), a teacher in C-3 ICT found a way to utilize it as a group activity. Another teacher discovered a mobile application (Plickers) that could convert it into an individual assessment and shared his learning back in the VG. RR was aware of the needs of his students to remember numbers and when he came across an art project, he modified it to suit his goals. In a Block level training, CA came across a project to help differently abled children learn better. Despite having strong admiration for the project, he did not try to implement it in his school because their resources were already stretched. The teachers weigh the scanned ideas for utility in their own context and decide if they want to use it or not.

Recontextualization of learning

The posts shared in the VG were never abstract in nature and always addressed a specific, practical aspect of a problem. No post focused on knowledge involving theories that required teachers to be aware of the boundary conditions for its applicability. In Ackoff's (1989) classification, their focus was on collating data and converting it into information (who, what, when, where, and how many questions), while the knowledge (how questions) and wisdom (why questions) were rarely touched. Instead, the posts were all concerned with the new content or activities to engage students. Even when the teachers shared a post showcasing use of ICT in classroom, the concern was the technical feasibility of its replication in own school and never on the evidence of its impact on students' learning. NV, for example, explained how their school had used projector to entice students to come to school by showing movies daily. The focus was to use ICT to solve the problem of absenteeism and not enhance learning outcomes, which usually is the focus of much research.

The teachers also depended on their peers to provide context-specific solutions. Instead of depending on the wide range of resources available on the internet, the teachers relied on blogs and YouTube channels of some trusted peers to get the resources that they could use in their classroom. Besides overcoming the language barrier while browsing the internet, this also reduced their effort in selecting resources. Still, they were forced to modify the content if it did not work in their context. Often, teachers shared idea in one form, which was reconfigured and shared back as a different artifact. CS told about a teacher's post who had collated information about all 33 districts and shared with the group. The artifact thus converted scattered data into usable information. Other teachers like BB built on it and added further information specific to the local context, i.e. the district.

Recontextualization was thus not a separate activity but a part of the process of participation in VG and PG, and implementation in context. The teachers did not engage with any theories or abstract ideas but always focused on practical activities that could be directly utilized in the classroom or schools. Their knowledge of context helped them decide on utility of each idea in their school and they modified the artifacts or activities to suit their needs. Iterations were also made based on response from their students and hence, recontextualization was dynamic and emergent and not a one-time process.

RQ.3: What is the 'nature of the community' that emerges when the practitioners (in-service teachers) from a traditional, geographically distributed organization come together in a virtual social network to learn from each-other?

Strong embeddedness in physical context

The virtual groups of GPS teachers were deeply embedded within the physical context of their workplaces, i.e. schools and the education department. Even the identity of the unofficial virtual groups was often linked to physical boundaries. C-3 ICT was primarily a group of teachers from C-3 Taluka while N-4 Taluka S.Sc. Teachers' group was limited to the teachers of N-4. Such bounded participation allowed teachers to implicitly reach a shared understanding of the context, e.g. absence of training for GK project implementation in C-3 district and accessing localized content in N-4 S.Sc. Group.

The shared physical context provided direction by allowing the teachers to reach a common (implicit) understanding of the needs of their peers in the VG. BR, for example, did not need to explain to her VG peers the terrain or her apprehensions in navigating alone the remote rural roads in the tribal villages as a female. Situated in the same physical and social milieu (rural tribal district), the VG peers implicitly understood her situation and provided suggestions taking into consideration her realities. Even EI Bank VG with participation from teachers across the state (and even outside), the context of posts in the group was shaped by the realities of the Government Primary Schools under the state education department. Thus, teachers were conscious to explain the more specific context in which their posts in VG were situated. While a post with videos and pictures of students playing games during recess would have represented banality, it gained value because of the context of an urban school facing severe space constraints with no playground.

Wenger (1998) has argued that practice and participation in communities within workplace are linked and it is the former that drives the latter. The existence of VG and the participation therein is driven by the shared physical context of participants' workplaces. There was a complete absence of abstract, research-based knowledge (Nilsen & Ellström, 2011) and the posts in all groups were dominated by practice-based knowledge of the teachers, grounded in their experiences within physical workspaces. The concerns shared in these virtual groups were also related to the daily realities of the teachers (including their position in departmental hierarchy).

Two more perspectives are necessary to analyze the virtuality of the VG. One, the boundedness of content and discussions within VG, and two, the norms driving participation in VG.

The content from VG that the teachers found relevant to their specific context flowed into their classroom, school, or physical groups. In EI Bank VG, PM came across the idea of adding millets to students' MDM to increase its nutritional value (PM: 330-336), discussed it with other teachers in his school, and implemented it. RR took inspiration from another teacher in taluka who had shared pictures of his students during a visit to local dairy farm and he organized similar trip for his students. The teachers often shared content from VG with peers in their PG in peer-to-peer (physical or virtual) interactions, who further shared it within their own VG. Thus, the content flowed from VG-to-VG, VG-to-PG, and PG-to-VG, easily crossing the group boundaries. In the life of a teacher, the VG and PG are like the warp and the woof in a fabric, interweaved, entangled, each supporting the other. Shumar and Renninger (2002) have pointed to the permeability of boundaries between the

virtual and physical communities and the technological affordances of social media platforms were utilized effectively to cross these boundaries while sharing or accessing content.

The second aspect concerns norms governing participation in VG. The norms are shaped by the images held by its members and the ideas enacted by them. Most participants in the VG analyzed were teachers with few exceptions of lower level department officials like CRCC and BRP present in N-4 VG and MIS Officer in C-3 ICT. There were no officials in N-5 taluka VG, while EI Bank VG was like a public space with thousands of participants. Despite all differences, the absence of discussions was a consistent theme across all VG. A similar picture emerges from analysis of the interactions in PG where the teachers avoid giving honest feedback, raising critical questions, or engaging in deep discussions about various issues. I observed a meeting of N-4 Taluka CRC Coordinators' with BEO which had no discussions and only information and instructions were exchanged. The situation was not different in interactions of students with teachers inside classrooms and focus was on completing syllabus than engaging with content in depth. The same behaviors were visible in engagement within VG. Although the technology provides affordances to engage in concurrent discussions, build on previous discussions, and draw from multiple sources to build complex discourse (Haythornthwaite, 2002; Shumar & Renninger, 2002), the teachers did not utilize these. The participants' behaviors in VG could be seen as a direct replication of behaviors in PG. Overall, the context of PG drove the participation, the nature of content, and the nature of interactions in VG. The virtual groups, it can be argued, were deeply entrenched in the physical context of teachers and cannot be considered in isolation from it.

Absence of hierarchies

The analysis of posts in VG (FB and WA groups) revealed no impact of hierarchies in interactions even when the groups had BRP, CRCC, or even district MIS Officer as participants. Yet, there were clear boundaries around the content and interactions within the group. Even when they were teachers, the group administrators shaped these boundaries. In these unofficial groups, the hierarchy was not based on the position of the individual in the organization, but it was reflected in the responsibilities that the person assumed by sharing or responding to posts to keep the group functional and relevant. Faraj, Kudaravalli, & Wasko (2015) argue that the most critical factor that determined the influence of individuals within VG was not their structural position (centrality to network) or sociability (frequency of posting) but their knowledge contribution to the community. Relevance of posts matters more than their frequency or identity of the individual who posts. This was a consistent theme across the VG analyzed and individuals like BB, PM, JK enjoyed high status based on quality of their contributions. GP was also made one of the group moderators in EI Bank VG based on her contribution to the community. The reputation within PG also got carried to reputation within VG as was clearly visible in the C-3 ICT, as well as N-4 S.Sc. VG.

The nature of content was controlled strictly in C-3 ICT VG, but in N-5 Taluka VG, there were no boundaries and everything (including few political posts) was accepted. N-4 Taluka VG was mid-way and had a wider definition of 'acceptable' than C-3 ICT but anything unrelated to education (including departmental circulars) received flak. EI Bank, a VG moderated by an external entity, had no posts that violated the group rules. How were these boundaries defined? The group administrators named the groups to define their purpose and later, other teachers from the group also contributed by either publicly flagging the posts deemed inappropriate or reporting it to administrators (peer-to-peer) and requesting them to take action. Thus, the occasional reprimands for deviant posts reinforced the acceptable boundaries and established order. On one occasion, there was a brief tussle between two participants in a VG about the boundaries, but they agreed on previously defined rules. Otherwise, teachers showed self-restraint and carefully selected posts that were shared within the group. Thus, VG were fairly open spaces that did not restrict teachers from

contributing to the group as long as these posts were in sync with VG's purpose. Yet, teachers often self-governed their behaviors.

PG hierarchies ceased to matter in informal/unofficial VG. Lower officials like BRP and CRCC did not try to highlight their official status while posting in the groups. PM, a teacher and one of the group administrators for C-3 ICT even contradicted the content of District MIS Officer's post. The official had requested teachers to provide positive feedback to GK project during inspection, but PM appealed to teachers to provide a honest feedback and highlight shortcomings, if any. The situation was different in official VG where the teachers acted as receivers of the instructions. They replied either to provide data, acknowledge the message (received, read, and understood), or to seek clarification. The PG hierarchies were strictly followed in official VG. GP, for example, argued that they cannot say no to officials even if they think that the instructions were illogical or unfair.

More individual than collective identity

Due to focus on the interest/subject-matter, the teachers were able to contribute to multiple VG simultaneously even when they were founders of a VG themselves. Their affiliation was with the subject or their interest and not the group. Instead of being invested in collective identity of any group, they focused on sharing or receiving useful content. The teachers avoided providing honest feedback, avoided any discussions, and did not engage in public reflection, though all these have positive effect on learning and understanding of the content and contribute to community building (Cunningham & Hillier, 2013; Fenwick, 2008; Raelin, 2008). Instead, they took the path of least resistance and avoided any confrontations with the group members. All groups had more silent participants than active contributors but none of the teachers interviewed for the study identified this as a challenge. Thus, they were comfortable with the skewed contributions as long as the VG served their needs.

Renninger & Shumar (2002) argue that participation in virtual communities requires an understanding of what the community stands for, and then develop an identification with its purpose and activities. *"Identification with a community suggests that a participant has found points of overlap between who she or he is and the activity of the community"* (p.84). An understanding of the purpose of a VG allowed teachers to customize their Personal Learning Network (PLN) by selectively joining the groups that suited their requirement, but this did not necessarily result in identification with the VG or its members. The teachers were committed to causes (S.Sc. or ICT) that the VG represented and not the specific communities. Joining a VG was often a cognitive, calculated decision and the teachers did not stay in groups where they did not find enough utility. RS, for example, had created a group of Social Science teachers but when he failed to bring all teachers to work towards a common vision and the unrelated content kept pouring in the VG, he did not hesitate to delete it. BR was part of a female-only VG '*Power of Women*'. *"I quit it. There were too many irrelevant messages. I got frustrated [with such content] and left the group"* (BR: 98-99). Thus, being in groups was not an accident but required high intentionality, a feature of a Community of Interest (Fischer, 2013). This intentionality was also tested in the repeated visits of group members for persisting interactions (Smith, 1999, as cited in Ridings et al., 2002, p.273).

In all the cases analyzed, the teachers did not form a collective identity based on their participation in the VG. Instead, physical spaces or activities served as a better marker of identity. All the examples where teachers recognized themselves as a collective involved a group with its origins in a physical spaces and/or activity. For example, BB identified with *Sembalpani* group where Social Science teachers from all districts had come together for a training. Similarly, SC's District Innovation Group was rooted in their meetings in DIET. They both identified with the physical space or activity and VG became a means to continue conversations started in the physical spaces. In C-3 ICT, physical experience of workshops was considered as important by NV and even PM, the VG administrator

who also conducted the physical workshop. In this VG, the membership was open and many new teachers joined the group without attending the workshop. As opposed to this easy entry, the teachers who joined the workshop had trusted their peers (the group administrators), travelled on a weekend to reach the workshop venue before time, spent money from their own pockets, and created a collective learning experience. Such stories of shared experiences resulted in a greater affinity for the members of this PG and they proudly described how they were part of this unprecedented workshop that broke many myths of teacher's motivation for learning. The identity thus arose from their physical experiences, though much activity happened in VG or through peer-to-peer interactions.

A second aspect that points to a lack of identification with the virtual group was absence of a collective work. Except C-3 ICT where the teachers were working on troubleshooting a single project, no posts in other VG represented collective contributions of group members. Thus, the group participants did not identify with the group but with the subject or specific interests. Even in absence of an explicit collaboration or negotiation, their work was social in nature (as suggested by Wenger (1998) and Henderson (2007)) as already discussed in question 1. Its boundaries and texture were shaped by the institutional expectations the need for peer approval. In C-3 ICT, a subgroup of teachers informally came together to work collectively for creation of digital content for all subjects. It would be interesting to observe the way this new VG with an explicit focus on collaboration evolves.

A third aspect that highlights the nature of the community was the salience of teachers' identity. In the VG analyzed, the most salient was the identity as a technical expert (i.e. subject teacher or a pedagogue). For other identities (as an individual, as a member of the local/larger community, and as a member of GPS teachers' community), the teachers had varied understanding and imagination of what that identity meant. It was thus difficult to negotiate and reach a consensus in VG. For example, PM found it imperative to engage alumni of his school in reducing absenteeism in his school. RR and CA, on the other hand, engaged with alumni by forwarding content to inform and help them prepare for competitive examinations. In VD's case, it involved engagement through her commitment to guide and support (financially, if required) her students on their career, although she taught grade 3-4 students. As a GPS teacher, the teachers had no collective voice. The teachers' union was dormant, and the teachers failed to raise their voice in front of department officials even when they spoke of the challenges like exceptional administrative workload and disagreements over decisions taken by department during the interviews. PM provided an example. "*I will tell you a fact. Officials sometimes ask [for our opinion] during training. At that time, the teachers do not speak. Everybody just says that everything is alright. And when 4-5 teachers come together, they discuss all kind of shortcomings in the administration"* (PM: 688). In VG, on rare occasions, a few teachers raised the issues that were linked to their collective identity as GPS teachers but not even once did the post receive a comment or reaction (Like, appreciation), something very common for all other kind of posts. Thus, the teachers failed to act as a collective and they participated in VG only as individuals scouring for some useful content.

Opportunity to carve own space

EI Bank and RJMCEI have popularized the category of innovative teacher among state GPS teachers and the education department officials. This has created a possibility for the teachers to differentiate themselves from their peers. This was aided by the teachers' belief that IIM's selection process for teachers' innovations was fair and unbiased while they considered the department officials as unfair and promoting favoritism and nepotism. A good personal rapport with the officials was considered more valuable than quality of work during selection of best teacher awards nominees. In contrast, VG (even if unrelated to IIM) offered an opportunity to the teachers to get

recognition for their work if they shared it in the group. *"I had gone for Block level training. I stood there and told [other teachers present] about the 500 points I had collated by answering questions shared by IIM (Prashna Manch) and also showed them the certificate I received. […] Some teachers later came to meet me and asked me for more details"* (SC: 302-305). The VG had reputation for offering opportunities to individuals to get a fair evaluation of their work as teachers. Within VG, the teachers could receive direct feedback on their ideas, experiments, or TLMs in form of Likes, appreciation comments, or even calls over mobile from teachers in the VG. The appreciation in VG also resulted in gaining recognition in PG as the content often crossed multiple VG boundaries to reach teachers in the PG. The teachers in N-5 taluka faced hostile officials and received no appreciation or support from the department. As opposed to this, RR found support from his peers in EI Bank VG and appreciation from other teachers in his taluka. RR explained, *"I was recently invited by a school to participate in an exhibition they were organizing. I also presented my work to GPS principals during their training. I participated in innovation fairs twice. Now every teacher in the district knows that RR is an innovative teacher. […] Without VG, I would not have been able to receive such response to my ideas [shared in VG]"* (RR: 81, 126-127). Teachers like PM (C-3 ICT), BB and JK (N4) gained wide recognition because of their posts in the VG.

This can be explained through the process of social identity formation in which argue that the individuals are assigned their place in a group by the dominant discourse, which achieves this by *"defining, locating, and ordering each of them in relation to others"* (Guillaumin, 1972 as cited in Deschamps, 1982, p.88). The dominating gets identified as an entity, *"as a collection of individuals each occupying his place"* and they are all considered as unique and singular. In contrast, the dominated are perceived only as unperceived elements of an entity. They have *"no specificity, uniqueness, singularity, or individuality as individuals. Characteristics which are attributed to their groups are sufficient to provide a full definition of what they are"*. Both, the dominant, as well as the dominated, *"define themselves in relation to the same norm-- i.e. the imaginary I represented by the dominant"* (Deschamps, 1982, p.89). While the bureaucrats have specific positions in hierarchy and the position provides them certain power, the teachers are the masses, a collective at the bottom rung of the hierarchy. The teachers thus try to create and popularize their *'imaginary realities'* and move away from *just being a teacher,* the *de facto* identity assigned to them. They want to move away from being just *objects* by getting some recognition within the department and the VG contributes to this purpose.

The public appreciation uplifted the status of the teachers within the larger community of teachers. The teachers' realization of the VG's potential in getting recognition was visible in an incidence described by JK where he visited a school and was inspired by the good work of Social Science teacher. The teacher made an odd request and asked JK to not share his work in any FB or WA group. He did not want his work to be highlighted since that brings more attention and subsequently more officials to visit school, which he considered as an avoidable distraction (JK: 210-213). Virtual spaces involving peers from workplace do not allow scope for anonymity or adopting a different identity, but these spaces allow teachers to get out of anonymity by sharing their work with their peers. The teachers tried to carve an identity for themselves by helping others (providing requested information), sharing a specific kind of content (e.g. some teachers had blogs with competitive examination information; others shared subject specific content), creating virtual groups that served a specific need and bringing teachers together in it, or through association (by sharing certificates received from IIM or photographs from an official function with department functionaries or state's ministers). The participation in VG thus allowed them to gain visibility among their peers and build an identity for themselves.

Entanglement with social norms and personal histories

The personal life histories contribute in shaping the identity of an individual. The behaviors displayed by the teachers within virtual and physical spaces within the context of their workplaces could be seen as an outcome of their lives outside the workplaces. A consistent theme across all the VG was an absence of critical engagement with social issues. On the surface, this could be considered as an outcome of their inability to think critically. Yet, one of the key influencers of a teacher's teaching styles is their own educational experience and if they were not exposed to critical thinking during their education, they are unlikely to do so in their classrooms and by extension, in the VG and PG. In his book *'Teachers as cultural Workers'*, Freire (2005) argues that it is the historical conditions of teachers that have led them to their present state where they are unable to think (and therefore teach) critically. The behavior of teachers in VG, and their disengagement with social issues in the context of their schools can be considered as an outcome of their position in the department and society. Towards the end of our interaction, JK touched the issue of caste-based discrimination but pointed that such discussions can happen only in very personal spaces with a close group of friends. Similarly, towards the fag end of our two-day trip around schools in his taluka, standing on the side of the highway, JP made a strong argument against forcing teachers to follow the curriculum and textbook. *"They are capable of creating their own curriculum and selecting the relevant readings"*, he argued. *"Have you ever discussed it with someone?"*, I asked. *"With some of my close friends"* was his reply. He never broached this topic with his peers or department officials. *"We cannot do such discussions here"*. Thus, such critical perspectives stay out of work-related groups. Even in physical groups, especially when meeting officially for a training, the discussions are shaped primarily by the content or pedagogical challenges. *"Whenever we have training, we make an effort to discuss in-depth the topic that has been pre-decided. We try to ensure that the discussion is focused on the ways in which we need to teach that specific topic in classroom",* explained JK. The issues like caste-related violence that impact larger society stay out, even when they should have direct relevance to their subject (Social Science).

Tendency to avoid confrontations

The teachers were reluctant to confront authorities and avoided any discussions with them. The primary source of problems faced by the teachers in accomplishing their goals was systemic, with its origins in children's poor access to social and cultural capital. Despite clearly articulating this during interviews, the solutions that they were trying to implement were not focused on addressing the root cause. Finding themselves incapable of addressing the systemic issues, they tried to change what they could: enrich the content. They never highlighted these systemic issues in their discussion with the department officials. This avoidance was visible in all the groups. As an exception, a few individuals did raise these issues by writing about them in the VG but the group chose to not engage with these posts concerning systemic issues.

Fear as driver of behavior

The teachers avoided using strong words to explain the real situation or raise issues for which the department were not responsible. Their feedback was soft, inconclusive, non-confrontational, or they even avoided giving feedback altogether. The teachers often mistrusted department officials. They expected officials to behave in an unpragmatic manner and were afraid that some official may take honest feedback negatively and they could face their brunt. This was not an unfounded fear because the department officials have powers to act against teachers and several such examples were recently highlighted in media (e.g. Express News Service, 2018; Roytalukdar, 2018). The situation of teachers was similar to the frail, old people in convalescent homes and their relation to their caretakers as described by James Scott (2012): *"To judge by this experience, the residents constantly dependent on the staff for their basic needs were afraid to say anything other than what they thought the staff expected from them lest they will be punished"* (p.75). Most of these teachers that I met were posted in locations where they could either travel easily to native homes where their families stayed and help the family in ancestral occupation (mostly farming), or they lived in places (mostly taluka headquarter) where their children had access to good schools. The department

officials had the power to transfer them to remote locations. This could make it difficult for them to take care of their elderly parents, work on their farmlands (which they usually did), and interfere with schooling of their children. Dependent on the mercy of the department officials, they found themselves unable to speak freely against any official policy. *"There is no one breathing down his neck. […] There is a simulacrum of independence and autonomy, while […] all of its substantive content is emptied out"*(Scott, 2012, p.93).

Even when the teachers sometimes found courage to confront the officials, their resistance could be easily subverted through bureaucratic means. RR once tried to highlight the unfair treatment meted to him by his district officials. Instead of taking cognizance of his situation, the senior officials asked him to raise complaint through proper channels. That would mean the complaint travelling up from RR's school principal to CRCC, TPEO, DPEO, and then reaching the state education office, although the grievance was against all these officials. RR decided to drop the complaint. VN similarly decided to quit all VG when she received a vulgar video on from a peer on her WhatsApp instead of raising the issue and following it with different levels in the department. The teachers found themselves powerless and decided to restrict their interactions to stay within safe limits. Mistrust on officials and position within official hierarchy drove interactions within VG even when no official was present within these spaces and all the participants were at the same hierarchical level.

Gendered spaces

The existing literature on learning in virtual spaces does not recognize gender as a dimension critical for participation in VG. There is a recognition of power differences and hierarchy as relevant factors impacting participation (e.g. Lave and Wenger, 1991; Van Wijk et al., 2011) but some (e.g. Tour, 2017) argue that traditional status and authority markers do not exist in virtual spaces.

In the cases analyzed for this study, gender turned out to be a crucial factor. The participation of females was different, both qualitatively and quantitatively. In C-3 ICT VG, female teachers rarely asked a question, and all answers to the questions asked in the group were provided by male teachers. In N-4 S.Sc. Group, there were only two female teachers among 62 members and none shared a post in the group. In N-5 Taluka VG, there was no female teacher. In mixed gender FB groups of EI Bank, no female teacher shared a post and their participation was limited to pressing Like on posts shared by the administrators or male teachers. The female teachers shared posts only in IWT, the women-only group of EI Bank. Further, several links to blogs and YouTube channels were shared in the VG, and none of these were operated by female teachers. Thus, females were missing from the VG in two ways. One, by not being part of VG, and two, by not participating in group activities even when they were part of the VG.

The underlying factor driving the pattern of participation described above can be traced to the patriarchal society that the female teachers were part of. Talking about the pathologies of institutional life, James Scott (2006) argues that the institutions like family, school, business enterprises etc. are basically authoritarian and hierarchical. They shape our lives by shaping in profound ways our expectations, personalities, and routines.

> "*Training […] in the habits of hierarchy begins […] with the patriarchal family. [The patriarchal] family structures in which the children, women, and servants are treated virtually as a chattel […] still thrives. [It] could not be called a training ground for autonomy and independence, except perhaps for the male head of the household. [Is] it [then] reasonable to expect someone whose waking life is almost completely lived in subservience and who has acquired the habits of survival and self-preservation in such settings to suddenly become […] a courageous, independent, risk-taking individual?*" (p.77-78).

In patriarchal societies, the family's reputation (*izzat* in Hindi) is seen as intricately linked to the character and perceived image of females in the household. There is a fear of loss of face if something happens to them. Female teachers are no exception to this. They also bear a disproportionate (usually complete) burden of household work. During school hours, teachers are not allowed to access the internet or mobile phones except during the recess, or pre or post school hours. The female teacher goes back to home in a patriarchal setup. In several cases, they need to take permission from their husbands of parents-in-law to buy a smartphone, or to use internet on it. Even when they have such phones, the husband or her parents-in-law or other family members check their mobile phones to ensure that they are not accessing some content that is in violation of their 'cultural norms' or to check that the women are not involved in something 'immoral' (like talking too much to male colleagues or even female colleagues). They find it difficult to justify male colleagues messaging even for official purposes. It is a huge risk for the female teachers if someone sent a personal message on her mobile, and she is held answerable by her husband or her parents-in-law for such an incident. She can minimize this risk by not joining mixed-gender VG unless it becomes unavoidable. The male teachers were free after school hours and often used this time to browse the internet to access new content and share messages in the group, while female teachers find it tough to find any time for this even when they are part of any groups. If the teacher has young children, their care and studies (homework) is usually the responsibility of the mothers. The older female teachers (SC and PT) who had grown up children or daughter-in-law to take care of household affairs (VD) found it easier to devote time to school-related work at home. The female teachers, especially those who were young, invariably mentioned '*family support*' and *'positive attitude of family members*' as a reason why they could actively access these VG. Only middle-aged women teachers did not mention '*family support*'. None of the male teachers mentioned any barriers of family or need for family support. Thus, the identity of a female as a teacher, and the kind of work that she is able to do gets impacted by her identity as a member in household where she is subordinated to her husband, parents-in-law, and other male members of the joint family.

The male administrators of the VG were afraid of any *untoward incident* involving female teachers in their VG. RR explained how a joke shared in his male-only group could be considered distasteful by female teachers. BR also gave examples of how such jokes were shared in a VG and some female teachers quit it immediately (BR: 88-89). To avoid any such situation, the (male) administrators unilaterally took decision to keep female teachers out (RR) or discouraged their participation (JK). VN had received a pornographic video clip on her mobile from one of her VG members and she quit all WA groups thereafter. Other than her, no teachers had faced such situation but only possibility of it was enough reason for them to curtail participation. While the young female teachers expressed apprehensions about such incidences, the older female teachers were not worried. JK created a female-only group to forward content from N-4 Taluka VG. He was the administrator and the only male member, acting as a conduit between the two groups. No posts were shared in over a month in the second group while the N-4 Taluka was abuzz with activity. Thus, mistrust by family and mistrust on male peers impacted the participation of female teachers in VG.

Narayan (2018) argues that it is a myth that only the women from poor or marginalized sections of society or certain caste or religion groups are disempowered. Her research sample consisted of women who were from economically well-off families, had at least an undergraduate degree, and were financially independent. The impact of growing up in a patriarchal household was visible in their lives even after all the education and subsequent financial independence. As a consequence, these women learn to *"delete themselves" in public spaces*, to shrink and erase the signs of their existence, leaving no traces of their ideas and opinions. This behavior was exhibited by most female teachers in the VG analyzed. The above examples are an evidence of similar erasure. A strong evidence of gender's impact on female teachers' VG participation was visible in EI Bank's IWT FB group. It was created on request of several female teachers who wanted a female-only virtual space

hosted by IIM. The group saw an active participation of female teachers, with the nature of content qualitatively different than any other group. The posts showed personal efforts of teachers instead of being generic, the content depicted complex emotions not just in emoticons but in words. IWT was the only VG where teachers engaged in any discussions. One post received 32 comments from nine teachers, while another discussion involved 14 teachers with 21 comments. Thus, when female teachers found a safe space, they were able to expresses themselves. This exception can probably be considered as an evidence that teachers desperately need safe spaces to express themselves.

Limited freedom of expression

The virtual spaces have been idealized as creating possibilities for contributing to a democratic society by allowing public deliberations and reciprocal dialogues. Computer-mediated-communication has been considered as a crucial element that could contribute to expansion of the public sphere (Pfister & Knowolton, 2010). Despite the opportunities afforded by the technology, the participants face barriers in expressing themselves freely within virtual spaces. The nature of the content shared, issues discussed, or even composition of the VG is impacted by the same social and organizational norms that govern their participation in physical groups. The theory of spiral of silence (Noelle-Neumann, 1993) and its extension in virtual spaces (Chun & Lee, 2017; Matthes, Knoll, & von Sikorski, 2018) explain how the perception of opinion mattered more in physical spaces, while the content of actual comments mattered more in VG in predicting an individual's opinion expression. In the cases analyzed, there was almost complete absence of opinion expression and thus, the question of opinion congruency is irrelevant. The participation was impacted by the position of individuals in the society and department. There were no explicit formal or informal rules that stopped teachers from participating freely in the VG, and they could express themselves freely as long as they stayed within the implicit boundaries defined by the departmental and social norms. There was just one catch: the boundaries were generally restrictive and often invisible and the teachers followed these diligently. Those who tried to breach these boundaries (in rare cases) were invariably disappointed by lack of response to their ideas, thus reinforcing the existing boundaries.

Reinforcing control

Do online groups break barriers posed by the physical groups or hierarchies in physical workplaces? While VG make it easier for teachers to come out of their isolation, it also creates new challenges for them. Alongside breaking barriers, these VG simultaneously create possibilities for maintaining and reinforcing such hierarchies, e.g. in official groups via circulars and instructions which act as strategies of control. The circulars strip the teachers of their agency by putting very heavy demands on their time and giving instructions in written that need to be executed within a timeframe decided by the agents sitting in the district or state offices. These are impersonal but very efficient instruments to pass directions to large number of teachers, and with Whatsapp, the teachers cannot even ignore the circulars even if they want to. When the officials realized that the teachers were using the 'deluge of WA messages' as an alibi for not acting on circulars, they started demanding an explicit acknowledgement of the receipt and reading of the circular. By not talking directly to teachers and engaging with them on agenda items pre-decided by them whenever there was a need for a personal interaction, the officials could easily avoid the problems that the teachers faced because of their ground realities, and which were further exacerbated by the tyranny of circulars. When everyone looks busy doing their work of implementing circulars, and no one seem to have the time, the issues outside circulars or top-driven agenda items could be ignored. They do not fit anywhere in schedule of anyone. Thus, the teachers are forced to engage with the ground level problems themselves without any expectation of support coming from the department or officials. Their position in PG ensures similar behavior in VG, restricting the discussions that they involve in. The acts of teachers in the VG and PG are in complete opposition to Giroux's (2011) understanding

of *"schools as democratic public spheres, teachers as public intellectuals, and students as potential democratic agents of individual and social change."*

RQ.4: How does the participation in virtual communities impact the nature and extent of interactions (e.g. vigor, diversity, focus) that happen in physical communities?

In the cases analyzed, VG were not considered as separate entities by the participants but seen as a part of their daily lived experience as teachers. They personally knew several of the teachers in the groups and accessing the information about them was not difficult. The teachers engaged in multi-modal communication (peer-to-peer, group chat; mobile calls, physical meetings) even with the members from VG, and the physical and virtual often interweaved. Thus, in the context of workplaces, engagements in virtual spaces rarely remain entirely virtual. This is in line with Shumar and Renninger (2002) who argue that it is difficult to maintain strict boundaries between the virtual and physical spaces communities and these two cannot be conceptualized as separate entities. The individual can choose to engage differently within the two spaces with an option available to interact with entirely two different groups. Also, active participation in virtual spaces while being rooted in physical spaces (as in case of workplaces) does not necessarily have a negative impact on relationship with peers in physical groups. In fact, the ties may become stronger in long run (Chmielewski & Wellman, 2000).

As suggested by Haythornthwaite (2002), the physical and virtual communities share some common features like *"adherence to common goals, membership requirements, hierarchy and roles, shared history, common meeting place, social construction of rules and behaviors, and enactment of rituals"* (p.163). When the membership in VG and PG overlap, there is impact of activity in one space on activity in the other. Yet, the teachers understand the differences in membership of different PG and VG (essentially cognitive and affective in VG (Shumar and Renninger, 2002), and the issues that can or cannot be broached in each space, thus giving some separation to the two spaces.

Broaden scope of activities in PG

The teachers shared content in VG with an explicit understanding that it may get shared with teachers in another VG or PG. Even an acknowledgement was not expected by the teachers and content often got used without the creator being aware. Thus, participation in diverse VG (Personal Learning Networks) allowed the teachers access to novel content which helped them broaden the scope of their activities in PG (classroom). RR, for example, took inspiration from another teacher's post in VG and organized a field trip for his students. Due to their novelty, such non-routine activities often resulted in engagement of principal and the other teachers of the school instead of remaining limited to one teacher's classroom. In S-2, BB was recognized as a teacher who continuously engaged in creating new activities and TLMs for students. Other teachers often supported him in his projects and BB's activities ended up engaging other teachers from his school. BR's activity of election process with children was replicated across several schools in the taluka and beyond. The participation in VG also allowed the teachers in C-3 ICT to design a new informal workshop for their peers, a rare event in a bureaucratic, hierarchical organization. Thus, ideas from VG frequently moved into physical spaces (schools) and changed the scope of activities of the institution and the individual teachers.

In rare cases, VG also acted as a trigger for collaboration amongst teachers, a rarity in the Indian GPS context. Nine months after creating C-3 ICT VG, 11 teachers from the group (later joined by 20 others) had come together to create digital content for all the subjects. This was an informal group with no support or directions from the department. Although the WA group was still being used as the primary mode of interactions, these teachers also met physically. The participation in VG thus created opportunities for new collaborations with peers in PG. Further, the sharing of experiments

or activities in VG provided a demonstration of feasibility resulting in quick adoption by other teachers. For example, BR's Bal Sansad election process or field visit that inspired RR created impetus for other teachers to replicate these ideas.

Impact on frequency of interactions

Participation in VG allowed teachers to engage more frequently in physical spaces also. C-3 ICT, for example, was a localized effort that resulted in multiple unofficial workshops, besides forcing district officials to take note of the teacher's efforts and recognize need of such trainings. While VG was the arena of major activity, the interactions in PG also increased with teachers engaging in more peer-to-peer interactions (either physically, or over mobile). They shared the new content with other teachers in their PLN which became a part of their informal discussions. Similarly, the familiarity with GP's work allowed RR to build a relation of trust with her in their first meeting in PG and allowed them to interact more frequently in peer-to-peer conversations.

The role of VG becomes crucial in Indian context where GPS are located in remote places and often have no more than one teacher for each subject. Continuous interactions in VG lead to more frequent interactions in PG, with content from VG often entering PG discussions (e.g. in case of RS and MN).

Impact on status of teachers among peers

Over time, the participation in VG can impact the status of teachers in PG. As argued by Faraj et al. (2015), this reputation is primarily an outcome of the knowledge contribution of the participant to the group, i.e. the quality of content shared. As the VG are deeply embedded within the physical context of the organization, the status elevation in VG also impacts the reputation of the teacher in PG. Thus, the teachers like PM (and other C-3 ICT administrators) were invited by the District officials to conduct training for teachers from other districts, as well as for teachers from C-3 district for next phase of the project. GP received much appreciation in VG for her work and was chosen to be a part of some official committees and task forces. When VD's work received attention in VG, the principals and teachers from nearby schools visited her and discussed ways to start replicating her project in their schools. BB received several visitors from his taluka. These interactions were an outcome of the reputation that these individuals gained owing to their contributions in VG. Besides, the teachers have access to mobile numbers of everyone in the WA groups and much informal, peer-to-peer interactions are initiated about posts shared by these teachers in VG.

Implications on trust

The nature on interactions, whether in PG or VG, depend on mutual trust among the members. All the participants made a clear distinction between their close groups of personal friends (who were often teachers) and the group of their peers in workplace. This distinction outlines different trust levels and hence, the kind of issues that were discussed with each group. Besides, even when VG like EI Bank were not based on physical proximity, the discussions among VG participants were influenced by 'trust'. Rather than discussing within VG, the teachers chose to discuss over mobile, or when they met in physical gatherings. SC provided a clear example: *"When we meet face-to-face in some training or innovation fair, then we have [personal] discussions. Not in WhatsApp groups"* (SC: 324). Thus, the VG were rooted in PG even when these were not bounded by geography, and physical relations mattered even for interaction with VG participants. It was not just about the mode of communication but trust. BR, for example, was convinced to visit her student's home in a remote village by her peers in English Teachers' VG. These teachers were her friends, but they all were part of the VG also where these discussions happened and ultimately encouraged BR to act.

Hanson & Gobes-Ryan (2015) have argued that trust in VG could be based on roles, rules, third-party recommendations, dispositions, and social-markers, but in the VG analyzed, a personal connection with others was crucial for development of trust. Also, in sync with Zejda (2011), there was evidence of dynamism of trust. The teachers followed posts of the teachers in VG but rarely interacted with them unless they knew each-other personally. When they got an opportunity to meet with these teachers in physical spaces (taluka, district or state level events), the familiarity in VG acted as icebreaker and allowed these teachers to interact. For example, RR met GP in an innovation fair. He knew GP through VG. After this meeting, they started sharing content in VG. After a single meeting, RR felt comfortable in expressing his discontent to GP about with the 'Best Teacher Award' selection process followed in his district. Similarly, GP had followed VN's work in EI Bank VG, but they started interacting frequently over mobile and sharing ideas over WA after they met in a state level event. Handy (1995) argued that "trust needs touch", and this was visible in the cases analyzed. Robert et al. (2009) have argued that trust increases when people know something personal about each-other and such information allows the two parties to predict each other's behavior, expectations, and norms (as cited in Hanson & Gobes-Ryan, 2015, p.2124). Physical meetings allowed development of such *knowledge-based trust* much faster than interactions in VG. It evolved and developed quickly when teachers met in physical spaces. It became stronger when they were engaged in common activities for some time (e.g. BB's Sembalpani group or RR's PG with teachers from nearby schools who met regularly) and that impacted the quality and frequency of interactions in VG, as well as PG.

Impact in formal spaces

The participation in VG also impacted the interactions in formal PG. RS was aware that several of his CRC colleagues were not part of virtual groups. He collated all useful content from the VG and shared it in a hard drive if some teacher wanted it. Oftentimes, there was explicit sharing of VG content with PG members. SC was part of an innovative teachers' group of her districts and the teachers discussed their own innovations, as well as the ideas they liked from the VG that they were part of.

The participation in VG shaped the identity of the teachers and their status in VG was often acknowledged by the officials in PG. PM and other group administrators got invited to conduct official ICT related training in nearby district. They were even involved as trainers for the second phase of GK project, which would not have been possible without their status in C-3 ICT VG. By asking teachers to conduct formal or informal training sessions, the officials used these motivated teachers to fill the systemic gaps. This also forced the teachers to 'externalize' all the implicit knowledge created and shared within the VG, which became part of the formal training programs of the department. Thus, the informal knowledge was formalized in this way.

Thus, it can be argued that interactions within VG and PG cannot be completely isolated within the context of workplace groups. VG helps broaden the scope of interactions, but it may not have any impact on the depth of discussions which are more constrained by existing social and cultural norms. The intensity and frequency of interactions also increase. VG participation also has implications for trust within PG, and the physical interactions are crucial for trust development among teachers. Such physical meetings can drastically change the future interactions between these teachers in PG, as well as VG. So, the impact is two-way. The teachers' participation in VG impacts their status within VG but the impact is also visible within PG where their peers, as well as officials, are forced to take cognizance of their contributions in VG. This may also impact the relationship of teachers with the department officials. Last, an involvement of teachers in formal departmental PG activities based on their experiences within VG participation may also impact formalization of knowledge created within VG and have a broader impact on the larger community of teachers.

Chapter 5: Discussion and conclusion

Summary of research journey

The origin of this study was not in a theory but an empirical observation. Situated in the state of Gujarat in India, and located within RJMCEI, it was natural to come across the work being done by the faculty at the Centre. While RJMCEI had created EI-Bank VG to allow government primary school teachers to share and access their classroom innovations, several virtual spaces created by these teachers had drawn my attention. Some of the blogs, websites, and YouTube channels were receiving several hundred and even thousand hits every day. The teachers were creating content with their peers as the target audience and uploading it on their blogs or YouTube channels and sharing it in Facebook or Whatsapp groups. It was this phenomenon that intrigued me, and I wanted to understand the way teachers were learning from each other within these virtual spaces.

To understand the phenomenon, I followed the qualitative traditions of research and utilized the interpretive case studies as the method to access and analyze the data. My research focused on two questions: what was the nature of the communities that emerged when teachers voluntarily came together in such virtual spaces, and how were they learning within these spaces? An understanding of learning in the workplace and the theories explicating this phenomenon were a natural starting point. Computer-mediated learning took me to CSCL studies. The focus of some of these studies was on teachers' learning but these looked at the formal pre-service (university) or in-service training spaces, i.e. spaces and programs specifically designed for learning. Resnick (1987) had clearly highlighted the ways in which academic learning is different from learning within workplaces. Goggins and Jahnke (2013) had also highlighted the inadequacy of CSCL studies in understanding the learning within workplaces due to similar concerns. They had suggested CSCL@Work as a new area of research to explicitly consider the learning that happened when employees collaborated in virtual spaces for learning from each-other. My research question required an engagement with the learning of teachers (workers) outside formal learning spaces which relatively few studies have addressed. '

Although CSCL@Work looked reasonably close to the phenomenon I had identified, I wanted to avoid entering the field with any preconceived notions of what was happening there. Instead of further delving into the learning theories focused on teachers and usage of ICT tools, I decided to stop reading any new literature until the fieldwork was done. I chose interpretive case studies (Stake, 1996) to investigate the phenomenon and use inductive analysis to reach an understanding. This allowed me to enter the field without any pre-decided framework. I also refrained from delving into the literature of teachers' learning within physical or virtual spaces while the field work was on. Thinking back, this proved useful since it restricted me from using any pre-existing labels to tag my observations. This forced me to create my own labels which could later be compared to similar concepts in existing literature and find similarities and differences between the two.

The EI Bank VG was a natural choice as one of the cases. Although created and administered by an external entity (RJMCEI), all its content arises from GPS teachers. The teachers participated in this space on their own volition. The other two (C-3 ICT and N-4 Taluka S.Sc. Teachers' Group) were identified through purposive sampling based on the inputs from teachers available with RJMCEI and then by talking to the group administrators about the activities in the groups. The data collection was iterative, and instead of first looking closely at the VG data, I tried to build an initial understanding based on interviews of the teachers from the VG. This helped me see the group through their eyes, and how it fitted with their lives in physical spaces and groups. Except EI Bank, I looked at the VG data for the first time during the interviews where I requested the teachers to help me understand the activities in the VG. A detailed analysis of VG data after the interviews helped me put the interview responses in perspective and I had to often call the teachers back to seek some clarification on the posts in VG or about some of their quotes from interviews. The artifacts from the

VG and pictures of artifacts clicked during interviews (see Appendix-6) helped me understand the nature of interactions and also provided a glimpse into the classrooms of the teachers.

The data collection was followed by intragroup analysis where I could see the themes emerging from VG data, followed by their relation to the narratives provided by teachers during the interviews. It was during the intergroup analysis that I focused on answering the specific research questions guiding the study. At this stage, I also undertook an extensive literature review and engaged with it while trying to answer the research questions. The intergroup analysis made it possible for me to articulate the common themes and find variations across the cases. New insights emerged from the inductive analysis and engagement with the existing knowledge on the phenomenon summarized in chapter-2 (literature review).

The nature of community

Participation in overlapping communities

The cost of and barriers to communication and collaboration in online spaces have come down drastically resulting in an explosion in number of virtual communities operating. This makes possible for the Government Primary School teachers to be a part of more than one VG (usually Whatsapp groups in this study) simultaneously. Wenger et al. (2002) also had accepted the idea that multiple COPs can co-exist, and an individual could simultaneously be a part of more than one of these COPs. The engagement of the individual teacher varied across the different VG. In some, they participated actively and contributed regularly while in others, they were peripheral members. In such groups, they scanned the content being shared in the groups and utilized whatever they found useful. This was in line with Castro's (2006) proposal of considering Online COPs as a "*Conversational Space Ecosystem*" where multiple COPs co-exist with overlapping membership to different degrees. In such a connected ecosystem, *"information gathered in one place…may have an echo and reflection in several ways across the conversation space"* (Castro, 2006, as cited in Cranefield, 2009, p.50). The existing studies on Personal Learning Networks (PLNs) (see Macià & García, 2016; Milligan, Littlejohn, & Margaryan, 2014) have found similar participation in multiple virtual groups for the purpose of learning from peers. The Professional Learning Communities (PLC) researchers have also looked at congregations of teachers (practitioners) coming together to share, collaborate, and learn from others (e.g. see (Stoll et al., 2006; Toole, 2019). Unlike PLNs, the focus in PLCs is usually on a single entity where individuals consistently interact for reasonably long periods to improve their practice. Such PLCs have shared vision and values, collective responsibility, reflection, collaboration, and critical inquiry as key elements of participation. The evidence from present study found the groups to be devoid of such deep inquiry, reflection, and explicit collaboration. The absence of such elements in the cases studied was an outcome of personal (individual histories and dispositions), socio-cultural, and organizational factors. There is thus a need to be cautious in drawing inference from 'participation' in such communities as the affordances provided by technology may not be utilized for reasons beyond technological. Even the term 'community' carries a specific meaning (e.g. shared beliefs, interdependence, meaningful relationships among members etc.) and one needs to be careful in using this term. In this study, I found it useful to describe the congregations as 'groups' than communities.

When the participants in virtual groups come from the same organization (as was the case in the present study), their participation in virtual spaces gets influenced by the norms, culture, and relationships within the organization even when these are informal and have individuals at same level in hierarchy. Further, their rootedness in the local communities (outside organizational boundaries) cannot be neglected. After all, they physically live in these communities and meet the

other participants often. Thus, there is a need to be cognizant of such factors which I will discuss now.

The physicality of virtuality communities

The findings of the current study support this understanding of the nature of multiple, overlapping virtual communities but in the context of adults working within workplaces, there is a need to extend this ecosystem to include physical groups that these participants interact with, either regularly or occasionally. The virtual communities may have an independent existence, but when the practice of participants is in the physical workplace (e.g. all traditional occupations), the interactions in VG invariably get influenced by PG. The 'practice' that leads to learning, or the 'artifacts' that are shared in and shape discussions in the virtual communities, emerge from physical workspaces. Furthermore, the learning ultimately gets applied in physical workspaces. In the context of GPS schools, the participation with VG thus cannot be considered in isolation from participation in physical groups. This physical-virtual participation needs to be explicitly considered as part of the analysis, which is not the case in existing research. The above argument for combined virtual-physical participation is further strengthened by the finding where peer-to-peer interactions (face-to-face, mobile conversations, or virtual chat) were found as a crucial element of the interactions among teachers. These also need to be explicitly acknowledged and accounted for.

In hierarchical and bureaucratic organizations with large power differences and social structures that alienate certain sections of population, a significant volume of interactions may happen in peer-to-peer mode. Castro (2004) argues that there is no single practice within the virtual spaces (as cited in Cranefield, 2009, p.50) because any sub-group of practitioners can influence the way it gets shaped. Present study established that the interactions within the virtual spaces may get influenced by factors that can be considered as external to the participants. For example, along with the physical spaces, the socio-cultural and organizational influences shape the interactions and relationships in virtual spaces when such congregations involve individuals from same geographical region or organization. This is very relevant in the Indian context of geographically dispersed schools where the teachers are governed by the same hierarchies.

The present study also highlighted a large discordance between the visible activity of participants in the VG and its true impact within the workplace. The posts (learnings) from VG might be a regular feature of PG interactions of a participant (or a group), but these may never get acknowledged. The VG participants' visible contributions may be buried as a single post in the full stream of VG activities or may even be absent in case of silent participation, but they may still have large impact in PG. The VG data is unlikely to provide a true picture of the impact in lives of participants.

The unit of analysis

The above discussion also raises another question. From whose perspective should the community's properties be defined? Henri and Pudelko (2003) have identified two key dimensions of virtual community: intentionality and cohesion. They classified different virtual communities based on strength of intentionality and cohesion, with CoI being weak on both dimensions and CoP representing strong intentionality and cohesion. On the other hand, Fischer (2001) looks at CoP as *homogeneous design communities* characterized by specific domain and similarity of work-practices, while CoI are *heterogeneous design communities* bringing together stakeholders from different CoPs with a collective concern for solving complex design problems. Henri and Pudelko (2003) created their typology of virtual communities based on the way they emerge, act, learn, and identify but their understanding of CoI and CoP is not always in sync with Fischer's (2001) understanding. Instead of solving complex design problems, Henri & Pudelko see participants engaging to *"exchange information, obtain answers (to personal questions), improve their understanding of an issue, or to*

share common passion" with different subgroups forming around specialized topics of interest (Briad & Carter (2013) also have a similar understanding). Virtual CoP, they argue, develops among people who are part of CoP in real world also where they share similar concerns and interests. Virtual CoI, on the contrary, is characterized by a lack of collective endeavor. Thus, there are contradictions in the literature on the nomenclature, as well as the way different congregations are understood. Fischer's (2013) framework for CSCL@Work (Goggins & Jahnke, 2013b) also assumes the collective to be a CoI where individuals incrementally and collaboratively build a shared understanding of a problem which they are trying to solve. Even CoP, a widely used concept, does not have a consistent definition and there are marked differences in the way "community, learning, power, change, diversity, and informality" are conceptualized within literature focused on CoP (Cox, 2005, p.527).

One, there is the issue of an agreement in definitions. Two, the inseparability of the participation and interactions within the virtual and physical spaces visible within the present study raises questions about such typologies. Whose cohesion should be considered when the entity itself is not well defined? How can this cohesion be understood by analyzing virtual spaces when interactions often happen in peer-to-peer mode and not publicly? When VG activity fails to capture the true nature of interactions among participants, how can the intentionality of the group be captured? In the context of the individuals from workplaces coming together in virtual spaces, the existing typologies (Henri & Pudelko, 2003; Fischer, 2001) provide little assistance. Probably, Stahl's (2006) suggestion that instead of the individual or the whole community, small group should be the entity to be focused on could prove useful. The present study shows the challenges even in identification of this small group in geographically distributed, loosely coupled organizations like schools affiliated to the state education department. Owing to their isolation within the schools (single teacher schools, unsupportive peers, or no other teacher teaching same subject), the teachers often look for support from peers in other schools. Thus, the significant individuals constituting such group may not be together within a single physical and/or virtual space. They draw on Personal Learning Networks (PLNs) which are often spatially distributed.

In conclusion, it can be argued that as researchers, we may find it convenient to limit their observations to VG boundaries, but this fails to capture the actual participation of teachers in virtual and physical communities. It is problematic to see the VG as a single community and viewing multiple, overlapping membership in VG and PG (PLN) can provide a better picture.

Boundary-setting for problems

Fischer (2013) argues that within the context of the workplace, problems do not get defined externally but are framed and reframed by the practitioners who are in the thick of action. This argument assumes that the practitioners have the freedom to define the problem and do so freely in conjunction with their peers. The evidence from the present study is not in line with this assumption. While the agenda for the groups was set (and expanded) by the teachers themselves, the study identified the boundaries of such problem definition. The discussions in VG were rare and devoid of any substantive content and avoided all systemic issues. The posts primarily remained restricted to curricular or pedagogical issues (TPACK) that required action within classroom. Even when the problem was identified in the policy or social arena, it was rarely discussed or escalated. The informal origin and nature of the groups and the absence of any administrators or bureaucrats did not make a difference. The explanation for such behavior can be found in the factors outside the boundaries of the virtual groups.

Factors shaping interactions of teachers within virtual spaces

Complexity arises not just because the virtual and physical intermingle, but also because the organisation is loosely coupled and geographically distributed. Thus, even when the teachers are in the same practice of teaching, the local context makes a big difference. Teachers are operating

within their silos (respective schools), but they are also operating within the same organizational structure with similar rules and regulations, and often, a similar social structure governing their lives outside the boundaries of organization. Thus, the teachers need to be situated within the subcultures of their schools, taluka, and district, as much as they need to be seen within the larger organization (within the state education department's hierarchy) and as a part of the socio-cultural forces governing their life.

Role of trust

The teachers avoided confrontation with their peers and stayed away from providing honest feedback to peers or authorities. They refrained from having any critical discussions about the department's policies in VG, and any such discussions were limited to close, private physical groups that often were devoid of their school/CRC peers (though it usually included teachers). The teachers remained guarded and avoided discussing or sharing opinion on contestable issues unless they were in company of very close friends.

Trust as the basis for deep, meaningful discussions is well accepted (Gallenkamp et al., 2011) and it is even more true in virtual spaces, especially in initial phases (Ridings et al., 2002). Still, it is relatively more difficult to achieve in such virtual settings than within physical settings (Jarvenpaa et al., 2017). The present study highlighted the role of physical peer-to-peer interactions, however brief, in establishing trust among teachers that impacted their future interactions in VG. The intensity, as well as the frequency of interactions of individuals with other teachers increased significantly after physical meeting.

Individual versus collective Identity

The participation of teachers in physical groups was mandated by department (e.g. in cluster, school, or block), but their participation in VG was voluntary. Their participation represented an affinity to the subject-matter or their interests more than the groups. Even when an individual was highly invested in a group (e.g. as an administrator), it was more because of their interest in the subject (e.g. JK) or the problem (e.g. PM) that the group was trying to solve. As a result, they could easily curate participation in multiple VG to serve their interests without the need for identifying with these groups.

When the teachers referred to a 'collective' (e.g. BB's Sembalpaani WA group), its origins were in physical spaces or activities. Such shared experiences in physical meetings contributed significantly to identification with the group which allowed for carrying on interactions in virtual (WA) groups. Often, the identity as a subject expert was asserted, while the identity as a teacher (education professional) invested in improvement of the larger ecosystem was muted. This silence was made more pronounced by the absence of a collective voice of teachers, both in physical and virtual groups, another consequence of the power relations within the department.

Organizational culture impacts participation in virtual spaces

Ideally, the affordances provided by virtual spaces should allow the individual to overcome hierarchies in physical spaces, but this may not be easy to achieve in practice. The present study showed the ways in which the content, as well as the nature of interactions in virtual spaces was governed by the position of teachers within the organization and the organizational culture. The education department bureaucracy operates in a top-down manner, with teachers and the lower-level administrators considering themselves as no more than cogs-in-the-wheels (Aiyar & Bhattacharya, 2016), lacking any agency to act. The fear of reprimand for any criticism of bureaucrats, department, or the government is real, for they see several such examples around

them. The impact of power differential and social organization and control on teachers' work within schools (physical spaces) has been long recognized (Ingersoll, 1991). The PG interactions found reverberations in the virtual spaces and more than the technological affordances of the tools and platforms, the interactions of teachers were shaped by the power relations and the culture of the organization just like in physical spaces.

The socio-cultural influences: Virtual groups as gendered spaces

Additionally, VG reproduce the social and cultural relations in society even when the groups are related to workplaces (schools). Gender turned out to be a significant factor that negatively impacted not just the access to VG but also the quality and frequency of interactions in these groups. Often, the male administrators decided to keep the female colleagues out of their WA groups for the fear of someone sharing a post that may be considered vulgar or offensive by the females. Young female teachers also avoided joining groups with large number of unknown teachers for the fear of getting stalked or being at the receiving end of an inappropriate post (shared publicly or in peer-to-peer mode). The older female teachers did not show any such concerns.

Situated within a patriarchal society, the female teachers found no free time after school hours for accessing internet or contributing to VG, while the male teachers invariably identified these hours as crucial for their VG participation. The situation was different for middle-aged female teachers who often had daughter-in-law to take care of household responsibilities or had grown-up children who no longer needed their constant attention. The social factors thus impinged upon the workplace practices of teachers by restricting their access to the spaces where they could interact with their peers or contribute to the groups as equals.

Conclusion

Researchers often take a benevolent view of the communities within workplace (e.g. Fischer, 2013; Lave & Wenger, 1991). This positive, benign view of community (including that suggested by Wenger's Communities of Practice) has been critiqued by researchers including Anderson (1991), Cox (2005), Shumar & Renninger (2002). The communities are more conflictual than consensual, and more heterogeneous than harmonious and homogenous (Baumann, 2000). There is a need to explicitly acknowledge the impact of the organizational and social factors on the interactions within the group. The spaces where teachers interact (including VG) are not democratic, public discursive spaces (Pfister and Knowolton, 2010) where they freely share, discuss, and deliberate without any barriers. They operate under organizational and social constraints that shape their interaction with peers within or outside formal spaces.

Organizational hierarchies and power structures, if considered explicitly, hold the power to explain the behavior of individuals not just in physical spaces but within virtual spaces also. These could act as the integrating factor for all the VG comprising of individuals from the same organization. Similarly, socio-cultural elements including the position of different individuals within society outside the boundaries of the organization also need to be analyzed by researchers focused on workplace learning and in-service professional development of teachers.

The nature of learning

The working conditions faced by the teachers in the government schools across the country often involve poor infrastructure, no support staff, and the students coming from the lowest socio-economic background. The gravity of situation could be understood from the experience of the city-state of Delhi, where the government elected in 2015 started focusing seriously on education. Their baseline test of grade-VI students revealed that 74% students were unable to read a simple sentence in Hindi, which a grade-II student should be able to do (Rebbapragad, 2018). (National Achievement Survey (NCERT, 2017) and ASER (ASER, 2017a) reports paint similar picture for government schools

across India). Student teacher ratio was often beyond 60 and in several cases, it went beyond 120 (Marlena, 2018). Physical infrastructure was shabby and often, there was no provision of clean drinking water and usable toilets. In the first two years, more than 8000 classrooms had to be constructed across 1011 schools to accommodate all students, i.e. an average of more than seven classrooms per school ("Huge transformation in school education in Delhi (Two Years of AAP)," 2017). It required almost two-fold increase from less than 13% allocation to education budget to allow these changes. The massive focus on school education is a rarity in India and Delhi's experience is unique. In contrast to Delhi's 26% of government's annual planned budget allocation to school education, Mumbai, Kolkata, Chennai, and Bengaluru, the four metro cities with comparable population and financial resources (Haritas, 2017) allocated 9%, 1.5%, 5%, and 0.6% to school education (Acharyya, 2018).

With this explicit focus on improving the state of school education, it took almost two years to make schools' physical environment conducive to learning. The teachers were struggling to improve learning levels owing to poor in-service training and lack of support from the department, a feature common to all state school education systems across India (Azim Premji Foundation, 2010; Marlena, 2018; NCTE, 2009). When the teachers are unable to achieve even the basics, expecting them to focus on higher-order learning goals for students is unrealistic. This vignette captures the struggles of even the well-intentioned teachers and bureaucrats, and I will use it to make an argument about the way teachers utilize virtual groups for their learning in the cases analyzed.

The culture of compliance in schools and within education department (Aiyar & Bhattacharya, 2016) makes it difficult for teachers to raise their voices, which amplifies the challenges in schools by allowing continuation of policies and practices that have not worked in the past.

Participation in VG and teachers' learning

There was a diversity in the level of participation of teachers in all the three VG. While some teachers actively shared content, others were silent spectators, visiting the group without leaving any traces of activity. There were variations in engagement depending on the focus of the groups. C-3 ICT, for example, focused on a specific ICT project getting implemented in multiple schools at the same time. The challenges faced in project implementation were temporally aligned and the solutions required were immediate, thus driving high participation. The teachers posted their problems and other members provided solutions. N-4 WA group focused on Social Science as a subject, with no such immediate concerns. Thus, subject-specific content was shared but with no expectation of a response. EI Bank VG had even wider focus on 'innovations of GPS teachers' requiring no immediate response from others.

The evidence from the study suggests that to decipher the learning happening as a result of participation in the virtual groups is untenable. The teachers may be silent spectators in virtual spaces, but they could be utilizing the ideas from the posts in these groups to improve their workplace practices (academic or administrative). None of the posts in the groups can be considered as focused on research-based knowledge (RBK) (Ellström, 2010). These were instead directly concerned with the practices of teachers (i.e. practice-based knowledge (PBK). This can be considered as in sync with Resnick (1987) argument that workplace learning is focused on solving practical, context-specific problems as opposed to academic learning (e.g. pre-service teacher training). This departure is valid even when learning happens with computer mediation. The absence of any engagement with RBK was evident and partially explained by Resnick's and Ellström's argument of workplace practices being the focus of practitioners. Still, it may be useful to look at the nature of content that teachers were engaging in and identify the reasons for the same.

Drivers for teachers' participation in VG and PG

The GPS teachers interviewed across the three VG were part of ten different schools spread across five districts of the state. They were aware of the criticism of poor learning levels in government

schools and aspirational status of 'private-school education' among parents of students. They were also conscious of the socioeconomic background of their students and the need for them to become economically productive as soon as possible. These concerns directly arose from their daily work-practices and experiences within the schools as well as their embeddedness within local communities. None of these concerns arose from a theoretical understanding of the goals of schooling and education. Often, the focus remained on very basic issues, e.g. improving physical environment of schools, enriching the nutritional content of the midday meals provided to the students. Hence, they did not define the problem as making students ready for university education, the holy purpose of school education in general, but to prepare them for lower level (grade C and D) government jobs. They were trying to tackle absenteeism, improve 3-Rs (reading, writing, and arithmetic), and if possible, provide the GPS students opportunities to participate in extracurricular activities like those offered by the private schools.

Awareness of problems or solutions as learning

The participation in VG allowed the teachers to break out of the isolation that they faced within their remote schools. Despite *silent participation,* the learning happened because of continuous stream of posts selectively shared by their more active peers. '*Masses*' help by sharing solicited or unsolicited solutions to the stated or unstated problems, or by asking questions that others may find relevant but were hesitant to ask in the VG. The teachers described such serendipitous learning as a *spark,* a sudden realization of a possibility. Eraut (2011) has also found that much of learning in workplace was incidental, unconscious, idiosyncratic, serendipitous, and unplanned, and happened outside formal learning spaces and activities. The present study suggests that this nature and process of learning holds even when individuals come together regularly in virtual spaces.

Error! Reference source not found. depicts the four possible situations that a teacher may come across in a VG. The ***'law of large numbers'*** provided hope to the teachers that someone in the large VG should be able to provide answer to their question (quadrant-1), or even ask the same question that they had, thus allowing them to stay silent and avoid revealing their ignorance. Oftentimes, the teachers were themselves unaware of the gaps in their understanding and a post in the group helped them realize their ignorance (quadrant-1 or 4). At other times, the posts in the group helped them identify a problem in their own context (problem framing). Alternately, the teachers came across a set of ideas in VG that they found interesting but could not decide on ways to utilize it within their specific context (quadrant-2) immediately. The *law of large numbers* operating within VG helped teachers shrink the third quadrant (the unknown zone), and possibly increase the first-quadrant.

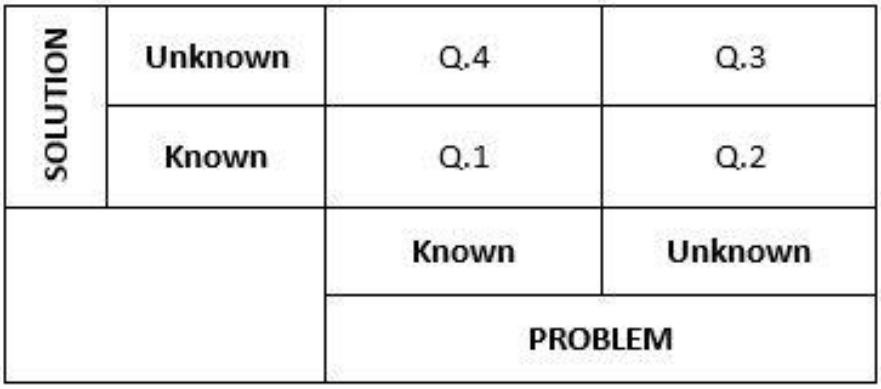

Figure 7: Learning in VG as becoming aware of problems and/or solutions

The *problem framing-problem solving* (Fischer, 2013) that happens within the group needs to be considered in the light of the nature of posts and learning described above. Not just answers but becoming aware of new problems also constituted learning. Instead of focusing on a uniformly

agreed upon definition of a problem [PF-PS] for which the solution needs to be found, the problems may be defined differently by diverse groups of participants. Instead of an explicit definition of problems at the onset, the groups often define the wider boundaries of common interest that the VG is likely to cater to. Within these broad boundaries, the participants may have a shared understanding of a diverse set of problems that plague the group owing to their experiences within the workplace.

The nature of posts in VG and activities in PG

The posts in the virtual groups, as well as the activities within schools, were never designed to act as stepping stones to delve deeper into the issues or to allow students or teachers to engage critically with the themes. If looked from the perspective of Bloom's taxonomy (Anderson et al., 2001), these posts and acts propagated remembering (recognizing and recalling), and in rare cases, on understanding. The posts were never abstract in nature and always addressed a specific, practical aspect of a problem. Even when addressing curricular or pedagogical issues, the focus was on collating data and converting it into information (who, what, when, where, and how many questions), while the knowledge (how questions) and wisdom (why questions) were rarely touched (see Ackoff, 1989 for the distinction he makes between data, information, knowledge, and wisdom).

The concerns of the teachers were shaped by their experiences in the schools as teachers, as well as their own life histories (including their own schooling, and pre-service and in-service training which is widely criticized for poor quality). The complex design problems, which can be argued as being systemic in nature and involve issues outside classroom, were not even allowed to enter the discussions in VG (and even formal physical groups) owing to the position of the teachers within organization. They lacked the agency to define and act on such complex problems. It would help to draw from workplace learning research that argues for problem definition arising from practical experiences of employees embedded in workplace context (e.g. Billett, 2001, 2004; Hager, 2011). Consequently, the data from the present study suggests that ground-level employees involved in last mile delivery of the service might not even concern themselves with complex, systemic problems that researchers like Fischer (2013) argues about.

Another support for such an understanding comes from practice-based innovation (PBI) literature (Ellström, 2010; Ellström & Nilsen, 2014) where the focus is on the workplace as a site of learning and on learning as an activity embedded in the production process and social interaction at the workplace. These PBI arise when workers try to solve their contextual problems by questioning the routines and collaborating with internal and external actors. Thus, it might be useful to expand the nature of problems in Fischer's framework from complex design problems to more grounded, practice-based problems.

The vignette of Delhi Government Schools presents a similar picture and the situation is not different in government schools across India (including Gujarat). Completion of syllabus is the holy grail of teaching and developing critical thinking skills was not even a part of the teachers' agenda. From the teachers' standpoint, they were focused on ideas that helped solve their most pressing and immediate concerns. The ideas may not have been novel in absolute terms, but these were very relevant and critical in the local context of the teachers. This can be understood better by considering the nature of learning that happened when teachers came together in virtual spaces.

The role of tools and artifacts in learning

The present study found evidence of teachers being in simultaneous role of producers and consumers of knowledge (Ritzer, 2010). This was made possible by social interactions among teachers, with tools and platforms, and artifacts collectively involved in the process of knowledge creation and sharing. This was not limited to virtual spaces but also extended to physical spaces. In

the resource-constrained context, the teachers relied on open-source, free to use tools, platforms, mobile applications with the help of affordable internet. The nature of communities as CoI (and ensuing assumptions about the nature of problems that get tackled in such groups) was contradicted and this conceptualization of communities has been problematized as discussed in previous section.

Factors that shape learning

Learning happens through participation in workplace processes (Hager, 2011), and this participation is shaped by socio-cultural, organizational, and other context-specific factors. Thus, the scope of activities that shape learning is defined by such factors. The workplace affordances and the individual's (individual and social) agency thus become important considerations impacting learning in workplace (Billett, 2001, 2004). The role of individual dispositions (to work, life, learning etc.) and '*learning careers*' (based on their life histories, a significant part of which lies outside their organizations and prior to it) has been highlighted by Hodkinson & Hodkinson (2004) and Hodkinson et al. (2004) as a significant aspect of WPL. There is a need for looking simultaneously at the embeddedness, as well as separation of the individual and the workplace, and position of individual within the wider social structures. Going further, they explicate the idea of 'context' and argue for a need to move beyond 'workplace' as the only context (Phil Hodkinson & Hodkinson, 2003). Wider socio-political, cultural, and economic factors, as well as the policy environment, that have a bearing on learning within workplace should also be considered as a part of 'context'. The important question is that can participation in VG impact the scope of activities available to the teachers? If yes, then it can have a bearing on their learning.

The nature of collaboration

Collaboration is desirable and is frequently assumed as a natural consequence of participation in virtual spaces, and this gets considered as the basis of learning and knowledge creation (e.g. Fischer, 2013; Goggins & Jahnke, 2010; Goggins, Jahnke, & Wulf, 2013; Stahl, 2006). Such collaborative engagement was rarely achieved in the cases analyzed. The teachers understood collaboration as sharing their individual innovations, ideas, resources, or individual sources of knowledge that they had collated over time by putting them in the public domain for others to use with an expectation that the others will follow suit. It was the minimal commitment of the group members to support their peers whenever they faced a problem for which they wanted a solution from the group. The active teachers and the group administrators did not look at *silent participation* by their peers negatively. They understood the reasons for such silence and allowed (and even promoted) such participation by providing teachers an option to call them directly in case they hesitated in posting their questions in VG. They participated in multiple VG and PG simultaneously and the researchers focused on learning in virtual spaces need to consider collaboration as operating within such PLNs and not as bounded within a single virtual group.

Finally, researchers (e.g. Jones, 2015) have argued that merely accessing online materials cannot be considered as a part of social interactions which are critical for learning in virtual spaces. The evidence from the study showed that teachers depend on their peers for accessing online vernacular content since they are not comfortable with using English. The teachers who posted such vernacular content on blogs, YouTube channels, or websites were aware of these concerns and created much of the content in anticipation of the needs of their peers or on specific request from them (usually received in peer-to-peer mode). In such situations, even accessing the content online becomes a social act. The invisible interactions (over mobile or in Whatsapp) thus need to be factored in by the researchers.

Absence of public reflection, feedback, and discussions

The role of individual and public reflection (Schön, 1983; Vince & Reynolds, 2009) and social interactions (Bruckman, 2006) in workplace learning has been well established. Fischer (2013) also

suggested "*social debate, collaboration, […] discussions, and reflection"* to be the source of learning within CSCL@Work. In all the cases analyzed, the teachers did not engage in public reflection. They avoided providing any feedback except appreciation, although the role of honest feedback on workplace practice and learning is also well accepted (Fischer, 2013; Goggins and Jahnke, 2013). The only feedback to the department officials concerned the content of the textbooks and included printing or factual errors. Instead of deliberations, silent participation was more common in VG. The discussions were not sparse but absent, and the engagement with the content was surface. The teachers did not engage in depth with the issues even in their blogs (more than 30 blogs were analyzed for the study) where the focus was on sharing images of events, web links, and content from the department. Written text was a rarity and only one female teacher's blog included her reflections about the classroom experiences and some of her poems. Of all the posts analyzed, less than ten were in form of long text created by the teacher herself. Only three of these posts were pieces of reflective writing, critiquing the existing policies or state of education in schools, and none received a comment from the group members even when the teacher specifically requested such feedback. Thus, despite being teachers, writing was an avoided act. Similarly, despite the congregation of teachers, any books beyond textbooks or reference books failed to find a mention in the VG posts, interviews, or even blogs. The teachers thus refrained from expressing critical thought in public spaces and only personal groups of close, trusted friends (who were often teachers) saw discussions that went beyond within-classroom or school issues.

Besides acknowledging the absence of critical thought and any public discussions, both of which are considered important for learning within public spaces, it is important to look at the possible reasons for the same. The culture of the organization and the position of teachers within the hierarchy reduced the possibility of honest feedback including within informal virtual spaces. The fear of adverse action from authorities (discussed in nature of community) kept teachers restricted to discussions about syllabus and pedagogy. The same strategy of focusing on PCK was visible in both physical and virtual spaces. Completion of the syllabus was considered as the holy grail of teaching and their individual and social agency did not allow teachers to venture beyond such concerns. Even their own personal histories created hindrance for engaging in deep reflection and critical thought, for the teachers themselves were a product of the same education system where they were now teaching. In addition, their pre-service and in-service training did not provide opportunities to engage in such debates and discussions. This aspect of personal histories, agency to act within workplace, and factors outside individuals impacting their actions have not been given sufficient attention by researchers of learning in virtual spaces (e.g. Fischer, 2013). Also, the affordances provided by the ICT (including social media) (Jones, 2015; Toole, 2019) need to be considered carefully against the utilization of these affordances and the factors that shape these affordances.

Closing thoughts on the nature of community and learning

The empirical investigations for the present study involved the teachers of the government primary schools in the state of Gujarat in India. The organization (i.e. individual schools situated within the education department) can be considered as geographically distributed, and schools have been recognized as loosely coupled organizations (LCO) (Weick, 1976). For such an organization, the work (practice) happens in physical spaces. Therefore, any learning gained from participation in virtual groups needs to be relevant for workplace context, for such learning ultimately needs to be applied in physical spaces (schools and classrooms). The focus of teachers in peer-driven virtual groups is thus on issues relevant in physical context. The context-specificity was a rule and not an exception, and recontextualization of learning was not a separate activity but a natural consequence of the participation in VG. The teachers' participation in such virtual groups of peers cannot be seen in isolation from their interactions with their peers in physical groups, and often, the boundaries of virtual and physical groups are overlapping and permeable.

Organizational and social factors including power structures do not just impact the interactions within physical spaces but also impinge upon the interactions in informal and unofficial virtual spaces. Gender turned out to be a significant barrier for female teachers' access to and participation within the virtual groups of peers. Besides participants' dispositions, their life histories, position in hierarchy, culture of organization, and their social markers are likely to shape the boundaries of what gets shared and discussed in the groups. These have a direct implication for the way problems are framed in such groups. The teachers' discussions focused on pedagogical and content-related issues. This suggests a focus on concerns arising from their daily work practice and experiences, but it also suggests their lack of agency to act on issues beyond the classroom, and to even raise and discuss such systemic issues. Over years, operating at the bottom of a bureaucratic organization, mild institutional neurosis seeps in as argued by Scott (2012), making teachers docile, cautious, subservient, deferent, and conforming to authority with no capability to speak freely. Thus, even when technological affordances were available to engage in critical inquiry, collaboration, and public reflection and discussions, the teachers found themselves incapable of utilizing these affordances. Instead of the possibilities afforded by the virtual spaces, the interactions and learning within these spaces was shaped by social, organizational, and cultural factors. Thus, any account of learning or interactions of teachers (or employees in general) within virtual spaces will only be partial without explicitly accounting for these factors.

The possible role of facilitation

Cairns & Malloch (2011) have argued that unlike children in a classroom, adult learners can act as self-scaffolders, but the evidence from the present study suggests that there may be a role for facilitated engagement with teachers.

In the present era, overcoming technological barriers is relatively easy and present study involving ICT novice teachers in a resource constrained environment provides testimony to this. The greater challenge is posed by the organizational and social factors. In organizations and cultures that work in top-down manner with little agency for the employees in shaping the agenda of the organization or even their own work spaces, engagement in collaboration, discussions, and public reflection cannot be assumed. This is true even when interactions are happening in informal virtual spaces with no hierarchy. In absence of any previous experience with public reflection or collaboration, the teachers are unable to utilize the affordances provided by the tools. Technology can provide support, but technological affordances cannot be utilized in absence of supportive organizational and cultural environment. Similarly, *third spaces* at the intersection of formal and informal interactions have been considered as affording opportunities for high quality learning through "critical inquiry about their own and colleagues' professional practices" (Murray, McNamara, & Jones, 2014, p.310). A teacher cannot engage in such critical inquiry just because she now has gained access to ICT tools. Teachers' own personal learning histories including their schooling, pre-service training, in-service training, as well as her experiences within school, department, and society are devoid of an emphasis on critical thinking. They have never been provided support and opportunities for the same. Thus, there may be a role for an external entity to expose teachers to critical thinking, for the existing institutions have failed in this task.

Subitha (2017) has argued for a complete re-conceptualization of existing teacher professional development programs and policies and give more attention to the socio-cultural context, as well as teacher agency. The present study also highlighted the need for handholding and facilitation to build capacities of the teachers to engage critically with their peers to define and solve problems within and outside the four walls of the school that they consider as important. Such a change in teacher training efforts is also in sync with the one of the Sustainable Development Goals (SDGs) that seeks ensuring inclusive and equitable quality education for all. Any positive impact on the Government Primary School teachers will be a step in that direction as they serve the children from the poorest and weakest sections of society.

Evidence from the present study provides glimpse into the role that facilitators who are respected as being fair and without any vested interest in the organization can play in encouraging individual reflection and even public deliberations. Creation of a separate Innovative Women Teacher's (IWT) Facebook Group by EI-Bank led to significant improvement in number of female teachers contributing to the VG, and even the nature of content was significantly different than that in mixed-gender groups. The only instance of teachers engaging in discussions, that too critiquing a departmental policy, came from IWT. The teachers invariably had a positive judgement of EI-Bank's evaluation of their contributions (fairness) and valued it more than departmental recognition. *Prashna Manch* provided a safe space for teachers to engage in reflection about their practices and several teachers utilized this opportunity. Hence, external support might be useful for building capacities and initiating conversations when the organizational and social cultures create barriers for teachers to engage in such interactions.

Implications for practice

The traditional teacher-training model has proved ineffective in addressing the needs of teachers, especially in resource-deficient contexts of developing nations. The improved access to internet has created a possibility for transformation of the way teachers' in-service learning is conceptualized. Even teachers have realized this potential and are coming together informally in virtual spaces to share their ideas, experiments, questions, innovations, etc. with their peers with a hope to learn from each-other. Drawing on evidence from this study, the teachers and institutions (including the state education departments) can improve the impact of such participation.

The virtual spaces and the participation therein should not be considered as a separate event or act but an extension of the work practices. Instead of creating content based on purely theoretical understanding (research-based knowledge), the teachers' classroom practices can be integrated by teacher-educators looking to utilize virtual spaces for providing in-service training to the teachers. Given the strong evidence of teachers' participation getting impacted by their position within hierarchy, creating informal virtual spaces that allow anonymous participation to teachers may prove beneficial. The teachers could consider moving to such anonymous platforms to discuss the issues.

While the VG offer new opportunities for learning, the study highlighted the role of physical interactions in establishing trust, which resulted in relatively deeper engagements among teachers. Thus, instead of depending entirely on VG, more opportunities should be created for teachers to come together in physical spaces to work on focused projects or interact informally. This will require a change in the way in-service training is scheduled.

The study also highlighted the key role that can be played by organizations which the teachers trust. Non-departmental actors like RJMCEI with a reputation of fairness can add significant value by working on building teachers' capabilities for reflection, collaboration, and critical thinking. They can also occasionally bring teachers together physically in '*safe spaces*' to discuss challenges outside the schools that impact their practice within classrooms. By allowing development of trust among teachers, such physical interactions are likely to have a significant impact on the content of discussions within VG, especially if anonymous participation is allowed. While the high dependence on practice-based knowledge was not surprising, the teachers may benefit if research-based knowledge can be integrated within their virtual groups to help them think more systematically about their classroom practices.

Gender turned out to be a key dimension that impacts participation of female teachers in virtual spaces. The success of Innovative Women Teachers' Facebook Group (EI Bank) proves that women are more comfortable in gender-segregated groups. Thus, there is a case for female teachers and principals to engage with each other in such groups.

Finally, the study can provide guidance to the group members and administrators of teachers' informal VG created in a bottom-up manner. These groups will benefit by explicitly defining the focus of the group and make continuous efforts to keep discussions on track. The acceptance of peer-to-peer discussions could also be stated explicitly as a norm to involve teachers who may benefit from joining the group but are hesitant to ask questions in public domain.

Implications for policymakers

The poor performance of in-service teacher professional development is now widely accepted. The education departments now follow the rules and schedule twenty days of in-service training which is driven in a top-down manner. In the context of India where the teachers receive no or poor-quality pre-service training, this is not sufficient, especially in the first a few years of service. There is a need to re-think the way such programs are conceptualized and delivered. The policymakers may consider alternatives that give more power to the teachers in designing their own training.

The informal virtual groups have allowed teachers to come out of isolation, seek and share new ideas, find answers to their questions, and extend their personal learning networks. Despite their informal nature, the participation in these groups has been restricted by the fear of vindictive action by the education department. Instead of restricting the activities of such groups, the education department could provide impetus to teachers' engagement with each other by creating explicit rules that keep these informal spaces out of bureaucracy's gaze and interventions. There is a need to be open to criticism and honest feedback from the teachers and lower-level bureaucrats. If the teachers remain in fear of reprimand, no honest feedback can be expected.

The evidence from the study (especially C-3 ICT) should encourage the department to update its policy to allow teacher training agenda to be driven in a bottom-up manner. Also, there is a need to integrate the virtual and physical elements so that the engagement of teachers with these issues remain continuous and not sporadic and limited to few days in a year.

At present, there is a severe lack of trust in teachers on the capabilities and intentions of their department officials. The policymakers need to make efforts to improve this trust. External, neutral institutions which have the capabilities to create a new framework for learning of teachers and are trusted by both, the teachers and officials, could be involved in this process. These institutions could create safe-spaces (virtual and physical) where the teachers could come together, interact, and learn.

Further, the internet is a vast resource that remains underutilized because the teachers are unable to access the content due to language barriers. A dedicated team to create a repository of such resources and translate/summarize these wherever required could prove useful.

Last, the study clearly highlighted the way gender impacts the participation of female teachers in the virtual spaces. The policymakers need to acknowledge this and take explicit steps to create spaces that allow female teachers to feel safe and interact with their peers without feeling vulnerable.

Limitations of the study

One of the major limitations of the present study was a high dependence on interviews to access the information on teachers' interactions within physical spaces. Although most interviews were conducted in their workplaces, the focus was not on firsthand understanding of their interactions in these spaces. Only on one occasion I got an opportunity to observe a meeting of CRCCs with the Block Education Officer. It helped me get a better view of the interactions, and also understand what teachers referred to as *discussions*. A long-term immersion in such physical spaces may have provided a better understanding of the PG discussions and their interface with the VG interactions.

Second, the VG data from Whatsapp groups was available in form of chats and more than half the posts included media files. Due to limited capacity of mobile storage, the teachers delete the media files almost daily. This restricted my access to the media files. I tried to overcome this limitation by requesting the group administrator to share whatever files from the group were available in his mobile, and to share other files he received over next few days. Many of these files were also available on blogs or YouTube channels of the participants. A better understanding may have been possible by participating in the WA groups, but there was also a danger of teachers avoiding participation in group in presence of an outsider. The repetition was visible in the posts in both, Whatsapp and Facebook groups, and that provides a solace that after all, too much may not have been missed by not having access to all the media files.

Three, the focus was on looking at the interactions within the virtual groups that were identified as the three cases. As it turned out, the activity in VG was often a small part of the overall activity of the teachers. Instead of considering the VG as the case, choosing a teacher as the case and taking a closer look at her participation in multiple, overlapping virtual and physical spaces (i.e. her PLNs) would have allowed me to capture the complexity of these interactions. This would have required a different design of study. It may be useful to pursue such a design in future to get a deeper understanding of the teacher's participation but for the present study, this remains a limitation.

Future directions

The present study tried to capture the interactions that happen within peer-led virtual spaces (including a case where an external facilitator created and managed the group), the factors that influence these interactions, and how and why do the teachers participate in these groups. The study contributed to a better understanding of the learning that happens when teachers come together in virtual spaces with an intention to learn from each other, and that was the premise of CSCL@Work framework proposed by Fischer (2013) and Goggins and Jahnke (2013). The focus was not on seeing the extent to which the participation in such spaces influence the teachers' activities in the classroom and the impact on students' learning outcomes. Future studies can peep inside the classroom to focus on these aspects. Two, as stated in limitations, the focus of the present study was on virtual groups as the cases. Choosing individual teachers as the case and analyzing their participation in overlapping virtual and physical spaces could complement the findings of this study. Such studies may provide a better understanding of the nature of collaboration and the mechanisms of peer-to-peer interactions, an area identified as significant in this study, but which was left underexplored due to design limitations. Three, the teachers' participation was often constrained by the fear of vindictive action by the department officials. Creating a virtual space that allows anonymous participation and observing the teachers' participation in such spaces could prove a useful area to explore in future. Finally, the teachers informed that the conversations from virtual groups often find place in physical meetings, i.e. traditional professional development activities. Exploring the extent of such VG-PG interactions and influences would be useful. It may be specifically interesting to analyze the difference in the quality and quantity of posts from anonymous platforms compared to those in non-anonymous virtual spaces that get discussed in physical spaces.

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Appendix

Appendix-1: Sample list of teacher-driven networks or websites

1. EI-Bank Facebook Page: https://www.facebook.com/groups/208827705949020/
2. EI-Bank Innovative Women Teachers' Facebook Page: https://www.facebook.com/groups/416749958528128/
3. InShodh Website: http://www.inshodh.org/
4. Edusafar: http://www.edusafar.com/
5. Teachers' blogs: www.truptan.blogspot.in ; https://www.baldevpari.com/ ; http://www.pragnaabhigamsafar.blogspot.com
6. YouTube Channels: www.youtube.com/c/VIGYANVISHWA1 ; www.youtube.com/c/purangondaliya1982
7. Administrative and competitive exam focused content: www.pgondaliya.com

Appendix-2: List of abbreviations used

List of abbreviations used	
B.Ed.	Bachelor of Education
BEO	Block Education Officer
BISAG	Bhaskaracharya Institute for Space Applications and Geoinformatics
BRC	Block Resource Centre
BRP	Block Resource Person
CMC	Computer-mediated communication
CoI	Communities of Interest
CoP	Communities of Practice
CRC	Cluster Resource Centre
CRCC	Cluster Resource Centre Coordinator
CSCL	Computer-supported Collaborative Learning
CSCL@Work	Computer-supported Collaborative Learning at workplace (Also CSCL@Workplace)
CSCW	Computer-supported Collaborative Work
DIET	District Institute for Education and Training
DoPDE	Domain-oriented Programmable Design Environment
EI Bank	Education Innovation Bank
FB	Facebook
GCERT	Gujarat Council of Educational Research and Training
GK	Gyankunj
GPS	Government Primary Schools
HRD	Human Resource Development

IASE	Institutes of Advance Studies in Education
ICDS	Integrated Child Development Services
IIM	Indian Institute of Management
IIM-A	Indian Institute of Management Ahmedabad
MCQ	Multiple Choice Questions
MDM	Mid Day Meals
MIS	Management Information System
NAS	National Achievement Survey
NCERT	National Council of Education, Research, and Training
NCTE	National Council for Teacher Education
P2P	Peer-to-Peer
PD	Professional Development
PDF	Portable Document Format
PG	Physical group(s)
PLN	Personal Learning Networks
PTR	Pupil Teacher Ratio
RJMCEI	Ravi J. Matthai Centre for Education Innovations
RTE Act	Right to Education Act
SCERT	State Council of Education, Research, and Training
SMC	School Management Committee
SSA	Sarva Shiksha Abhiyaan
TAT	Teachers as Transformers
TLM	Teaching-Learning Material
TPEO	Taluka Primary Education Officer
V-CoI	Virtual Communities of Interest
VG	Virtual Group(s)
WA	Whatsapp
WP	Workplace
WPL	Workplace Learning

Appendix-3: Sample questions from interview protocol

1. What problems or ideas pushed you to join or create this group?
2. Does participation in this group help you find solutions to any problems that you face in school/classroom? Please help me understand.
3. Have you seen a shift/evolution in the focus of this group? (in terms of content, membership, or quality)
4. What all have you shared in this group? Could you please show me? What was the source of this idea? How did you create this idea? How did it develop?
5. Which post shared by you got the maximum response? What was it about? Can you show? Why do you think it got this response?
6. What were 2-3 posts in group that others made, and you liked them very much or forced you to think? Were these mere forwards or original ideas? Why did you like them?
7. Did you share back the feedback with originator of post or the group at large? Why? Why not?

8. When do you 'like' a post? When do you comment on a post? Why? Why not?
9. What kind of discussions usually happen in this online group?
10. Whatever you discuss in school or CRC/BRC, does that sometimes get shared on online groups?

Appendix-4: Abbreviations used for Physical Groups

PG Abbreviation	Nature	Location
S-1	School	Central-2
S-2	School	North-4
S-3	School	North-4
S-4	School	North-5
S-5	School	North-5
S-6	School	Central-3
S-7	School	Central-3
S-8	School	North-4
S-9	School	Central-2
S-10	School	Central-1
A-1	Taluka Education Office	North-4

Appendix-5: Districts where interviews were conducted

Abbreviation	District
C-1	Central-1
C-2	Central-1
C-3	Central-1
N-4	North-4
N-5	North-5

Appendix-6: Some artifacts shared in virtual groups or used in classrooms

Figure 8: Social Science artifacts kept outside BB's classroom for easy access to students

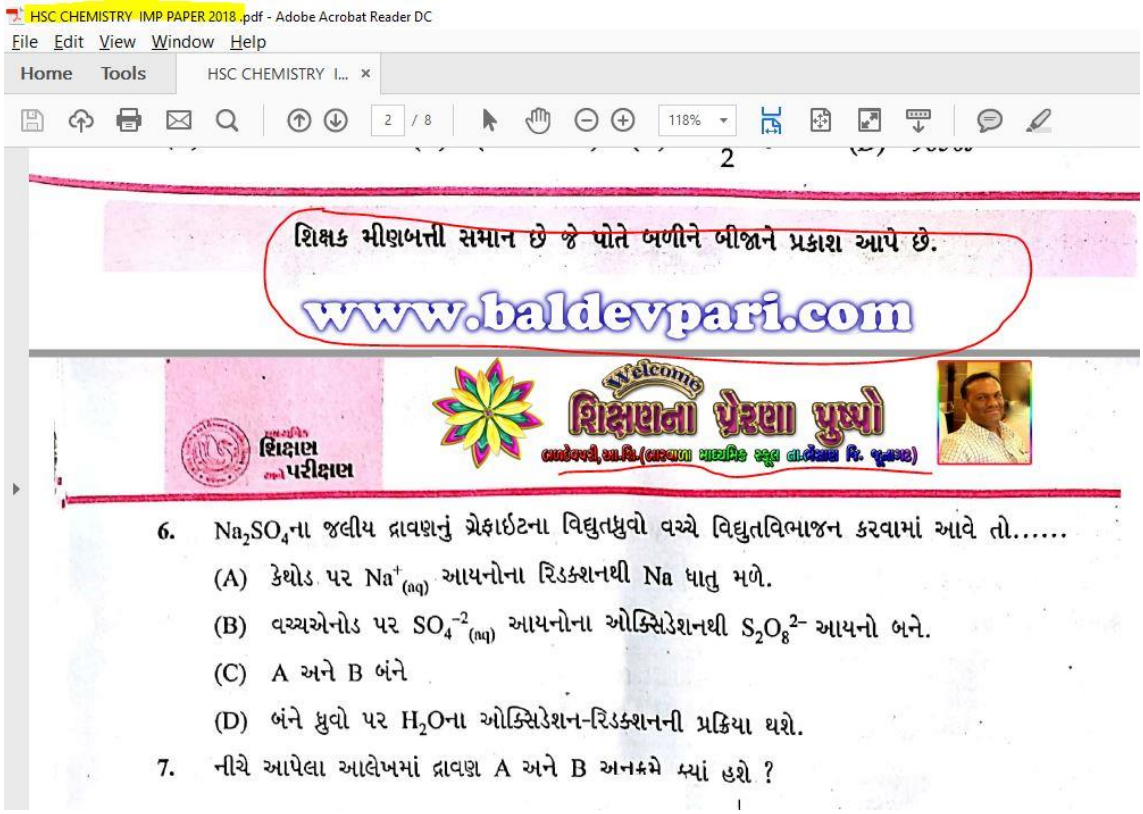

Figure 9: A PDF Quiz created by a teacher with his identity prominently displayed

Figure 10: QR Code of a Social Science quiz pasted on school walls and shared in VG

Figure 11: A checklist to manage classroom used by SC and shared in her VG as an image

Some examples of Web Links shared in the group:

1. Blog (information): http://www.mihirkumar.in/2017/11/nios-deled-admission-2017.html
2. Gyankunj project training video: https://youtu.be/LRCtCgr9iDw
3. A mobile application created for Gujarat GPS teachers for their peers: https://play.google.com/store/apps/details?id=online.eseva.schoolmitr