"I'm fine where I am, but I want to do more:" Exploring Teacher Aspirations in Rural Côte d'Ivoire

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ABSTRACT

Teaching is challenging in rural areas in developing countries because of large classroom sizes, limited basic infrastructure, and lack of teacher training. Teachers' impact on educational outcomes can be improved by teacher training programs but these programs are limited by poor infrastructure in rural areas. Although infrastructural challenges can be overcome by information technology today, it is unclear how such technology can support teacher training. Therefore to explore opportunities for teacher training in rural developing contexts with technology, we conducted interviews and observations with 22 primary school teachers in two regions of rural Côte d'Ivoire. We followed an aspirations-based approach that focuses on the user's aspirations (long term desires) to help understand teachers' intrinsic desire to grow in their professional life. We found that teacher aspirations conflict with their current role but their solidarity helps them find education role models who balance this conflict. We found that teachers face challenges in teacher training but they handle issues through their solidarity and by creating solutions. We then discuss ways to measure impact on aspirations, designing for conflicting aspirations and to leverage aspirations to create a social change in teacher training using technology.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**; • **Applied computing** → *Education.*

KEYWORDS

HCI; ICTD; Aspirations; HCI4D; Career; Teachers; Teacher Professional Development; Teacher Training

1 INTRODUCTION

In the last decade, public primary school enrollment in developing countries has increased exponentially. However, in 2018 more than 60% of these fifth-grade students still failed to read a paragraph [3, 61]. These poor educational outcomes may arise because of contextual challenges like large class sizes, lack of basic resources, and infrequent teacher training for teachers in these contexts. Teachers with adequate support can drastically improve student learning [65], but public school teachers in developing countries are poorly supported with resources and training [8].

Providing teacher training or professional development[1] interventions in developing countries has been shown to improve teacher motivation [25, 60] and lead to improved educational outcomes [30, 33]. However, implementing such interventions in rural and isolated areas is challenging due to infrastructural [15, 36] and socio-cultural complexities [46, 72]. Researchers have attempted to solve this problem using information technology by providing classroom resources to teachers [2, 9], or tools to support administrators [4, 63]. However, it is unclear how classroom or administrator focused technology interventions can support teacher professional development and improve motivation.

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[1]We mainly use teacher professional development(PD) in this paper while other fields can refer to it as teacher training.

Technology interventions[2] for developmental projects have been designed using a *needs-based* approach [52] or by understanding user needs. However, Toyama [76] highlighted limitations with this approach i.e. needs for technology design do not intersect with larger community needs and needs are often projected on to the community by researchers [24]. Therefore, he called for researchers in Information and Communication Technology and Development (ICTD) to follow an *aspiration-based approach* i.e. to first understand user aspirations and channel it towards a social change with technology. Toyama describes an aspiration as an individual's *long term desire that is persistent and aiming for something higher than one's current situation* [76]. Understanding aspirations has shown to have practical benefits for developmental projects [31, 62] as well as theoretical benefits [10] which improve research generalizability for the HCI4D space [23]. Although research on aspirations has emerged in education [54], students career [64] and healthcare [59], research on teacher aspirations is still nascent.

Therefore, to explore opportunities for teacher professional development in developing contexts with technology and to answer Toyama's call for ICTD researchers to focus on aspirations [76], we conducted a qualitative study through an aspiration-based approach [76]. We interviewed 22 teachers across two regions of rural Côte d'Ivoire over 2 years to understand their aspirations and how it influences their professional development and technology use. We learned that (1) Teachers aspire to achieve higher posts in education which conflicts with their current role as a primary-school teacher; (2) Teachers have a solidarity which helps them (a) find role models for their career and teaching, and (b) tackle breakdowns in professional development through mutual support; and (3) Teachers also take ownership of their professional development by finding workarounds by inventing new methods, taking student support and using the internet to prepare their lesson plan. Based on these findings, we discuss design directions for balancing teachers' community and personal aspirations, measuring impact of aspirations and ideas for creating a social change in teacher professional development using technology.

2 RELATED WORK

In this section we summarize the related work spanning teacher professional development, technology to support teachers in developing contexts and lastly, the application of aspiration-based design for teachers.

2.1 Teacher Professional Development

Significant research on teacher professional development (PD) tells us that ongoing and life-long professional learning is an integral part of teacher growth [28, 37, 39, 73]. Research has found that giving teachers *expert feedback* in person for their teaching sessions [14] through thoughtful reflection is an effective approach. Prior work on modeling teacher growth informs that teacher growth is non-linear therefore PD programs should consider building individual teacher capacity with *personalized* support [21]. Teacher PD literature in Western contexts has developed material to foster self-efficacy [11], self-reflection [68], and collaboration [22], some via interactive tools [29, 34]. However, it is unclear how this

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[2]Our focus is information technology used in educational contexts.

work transfers to developing contexts where there are shortages of experts and resources [15].

Although teacher PD programs have been shown to improve children's education in developing countries [12, 25, 47, 60] it is challenging to implement them in rural contexts [25, 36, 49]. Innovative teacher PD interventions adopted from Western contexts often require a cultural shift when deployed in non-Western contexts [46, 72]. Teachers may need to change their teaching beliefs and practices, making it difficult for teachers to implement PD interventions without frequent mentoring [8]. In developing contexts, teachers are mentored through visits by ministry officials [36] but infrastructural challenges (i.e., poor roads, travel cost, etc.) and lack of mentors reduce the frequency of mentoring visits [15, 49] leading to poor implementation of PD. Hence, it is still an open question on how best to introduce and sustain teacher PD activities in rural developing contexts.

2.2 Technology for Teachers in Developing Contexts

Although, technology has shown promise in education in developing contexts, a large portion of the research is focused on giving resources to children [42, 56, 77]. Prior work on using technology to *support school administrators* has used low-cost hardware to monitor classrooms [63], and text messaging [4] and mobile applications [1] to measure teacher attendance, and even WhatsApp to monitor teachers [51]. However, it is unclear how such technologies can foster individual teacher PD, or how teachers might feel about being monitored by school administrators. Another portion of research focuses on providing *teaching resources* through video content [9, 66], audio content [2], and text messaging [40], but it is unclear what role simply providing teaching resources may play in supporting teachers' mentorship and fostering professional growth.

Recent work found that organizations (NGOs) in India are using WhatsApp groups [5] to monitor and support teacher's usage of their technology [78]. Group interactions helped teachers overcome isolation and improve their work practices by learning from each other. Although this work holds promise for teacher-focused technology interventions in group settings, it is unclear how to support individual teacher growth needed for PD [21]. Therefore more research is needed to understand opportunities for supporting individual teacher growth for their PD using technology.

2.3 Teachers and Aspirations

Researchers in the field of Information and Communication Technology and Development (ICTD) have designed interventions for low resource contexts using a *needs-based* approach [52]. Although a needs-based approach helps in designing human-centered technology to improve usability, Toyama [76] argues the needs for technology design is narrow compared to the broader needs of low resource population. Additionally, a needs-based approach often derives a researcher's projected needs rather than the actual needs due to social distance [24, 76]. Therefore Toyama [76] called for ICTD researchers to focus on an *aspiration-based* approach. Our work embraces this call to apply aspirations to the domain of teachers. Applying aspirations can have practical benefits through the role of a *developmental indicator* at a project [62] and community

level [31]. Additionally, aspirations [10] have strong theoretical connections that can help improve research generalizability for the ICTD space [23]. Recent work [44] has discovered that aspirations are deeply intertwined with the community (*embedded*), aspirations are achieved after a time frame (i.e. have *temporal* boundaries) and can change with time (*mutable*). An aspirations framework has been used in ICTD in accessibility [54], parent perspectives on education [55], career aspirations of undergraduates [64] and more recently in mental health [58] but it is yet to be expanded for under-standing teacher development.

For pre-service undergraduate teachers aspirations(i.e., teachers in training) in South Africa, research found that technology was a capacity enabler and helped in fulfilling their career aspirations [17]. Although this holds promise for supporting teachers who have easy access to mentors, it is unclear how aspirations of primary school teachers in low resource contexts, who may be isolated from mentors [15, 49], intersect with technology. Therefore, more research is needed to understand the aspirations for PD of teachers in rural developing contexts and how technology may play a role in supporting them.

In sum, while prior work has focused on teacher professional development in low-resource contexts, interventions may be impacted by infrastructural and socio-cultural barriers. Prior work has used technology to surpass some of these issues to support administrators or provided resources, but it is unclear how technology might support individual teacher professional development. Prior work in ICTD followed a needs-based approach which is limited due to mismatch between technology and community needs, and that user needs are often projected on to the community by researchers. Therefore, we embrace Toyama's call for ICTD researchers to focus on an *aspiration-based* approach and extend it towards exploring teacher aspirations in developing rural contexts. Although Toyama mentions limitations with scoping aspirations, prior work has used aspirations in the context of career [17, 44, 64] and we extend this body of work to explore teacher aspirations in developing contexts.

To address this, we use the *aspirations-avenues-agency* framework [43, 44] through a qualitative study. *Aspirations* translate to longer-term desires [76], *Avenues* are pathways both traditional and non-traditional that users take towards fulfilling their aspirations and *Agency* is the capacity that people build to create these avenues [43] (e.g. *Aspiration: Teachers want their students to excel in class*, *Avenue: They use technology to captivate children's attention*, *Agency: They download technology-based classroom examples*). This framework lead to the following research questions:

> **RQ1:** What are the aspirations of teachers in low-resource contexts in rural Côte d'Ivoire?

As professional development is a key to teacher growth we ask:

> **RQ2:** Through what avenues do teachers currently access and implement professional development?

To see whether technology can have a role in this growth we ask:

> **RQ3:** What agency do teachers currently have to support their professional development with technology?

Figure 1: An interview session in a school in Adzopé .

3 METHODOLOGY

This study is part of an ongoing research program on supporting literacy in cocoa farming communities, conducted by an interdisciplinary team of American and Ivorian researchers. The project aims to improve children's education in rural Côte d'Ivoire through poverty reduction and improved educational quality. For this study, we interviewed 22 teachers from 2 regions of Côte d'Ivoire (Adzopé and Soubré), the interviews were conducted in 3 sessions from April 2018-May 2019. We transcribed, and translated the interview data into English and formed the low-level themes using grounded theory [20, 50, 74] and used affinity diagramming [16] to synthesize the themes for our research questions.

3.1 Participants and Data Collection

With approval from the Ivorian government and our university IRBs, participants were introduced to us by the school director who was first briefed about the study. The interviews were conducted with voluntary verbal approval from the participants who were offered no compensation. The data collection was conducted in French by an Ivorian researcher with help from a US researcher. The US researchers had a limited French proficiency and the Ivorian researcher would occasionally pause to translate answers to English. We attempted to reduce social distance [24] from our participants by having one of the Ivorian co-authors lead the data collection. However since the foreign researcher sat nearby, this may have affected participants' responses. The data was primarily analyzed by non-Ivorian researchers (3 of US origin and 1 of Indian origin) but these non-Ivorian researchers regularly discussed the data and interpretations of emerging findings with the Ivorian researchers.

3.2 Data Analysis

Table 1 summarizes the demographic of our data collection session in May of 2019 and Fig. 1 depicts a typical interview session. Interviews were recorded, transcribed, and translated into English before they were analyzed by the authors. We coded the transcripts to identify low-level themes using the *aspirations-avenues-agency* framework [43, 44]. We synthesized the data by using an affinity

diagramming [16] approach guided by this framework (*aspirations-avenues-agency*) to generate findings to answer our research questions.

3.3 Context

This study was conducted in two rural cocoa-producing regions in Southeast and Southwest Côte d'Ivoire (the Adzopé and Soubré region). These sites primarily have an agricultural economy based on cocoa and coffee, which has been the primary source of income of residents for decades [41]. French is the official national language of Côte d'Ivoire but there are nearly 70 local languages, including Attié which is widely spoken in the Adzopé region, as well as mother tongues for each tribal group [71].

3.3.1 Primary School Teachers in Côte d'Ivoire . Primary school teachers are selected through an entrance exam called DECO (Direct Competitions organized by the Examinations and Competitions Department or DECO) with eligibility criteria of secondary school completion. Upon, passing the DECO, teachers undergo an education program in a leadership institute called CAFOP (Centres d'Aptitude et de Formation Pedagogique) for 3 years where they are taught by teacher trainers. Trainers teach pedagogical methods and also closely mentor teachers through internships. Once teachers graduate, they receive tenure in a school [70]. A single teacher teaches all the subjects (e.g., maths, French, social sciences, humanities) for their class. The school is managed by a headmaster who often teaches a class of his own.

Teachers in Côte d'Ivoire have a rigid centralized curriculum and schedule which is followed by the entire country. The ministry offers a guidebook to support the teachers on a daily basis. The guidebook offers lesson plans (*fiches*) which help teachers conduct the lessons. The lesson plans have guidelines, as Participant 3 (P3) states: "*There are cards that are established, there is a canvas, there is a methodology that must be respected to prepare the cards*". Additionally, teachers are encouraged to adapt their lesson plan to create a *"learning situation"* or an environment for children to learn. Headmasters receive training in management and advising, so they also serve as official support for all the teachers.

3.3.2 Challenges in teaching. Although the centralization of curriculum planning brings uniformity to the education system, it widens existing inequalities in rural contexts, thereby increasing the burden on rural teachers. We observed that teachers in rural Côte d'Ivoire had similar challenges observed in other developing countries, such as poor student literacy rates, absenteeism, and working with large class sizes [25, 26]. Many teachers expressed that students had poor literacy skills and they were able to notice this in older students (e.g., CM1 or fifth graders). In fact, a recent evaluation by our team found that 50% of fifth graders in the Adzopé region cannot read an age-appropriate word [38]. Teachers are trained to deal with a class size of 30 students [53], but we found that teachers in rural contexts often have to deal with *large classes*, of more than 60 students. A large classroom also brings students at multiple levels of proficiency, making it harder for teachers to teach a class and give individual attention to students. Teachers mentioned that students are absent often making it hard for them to catch up with subsequent lessons.

4 FINDINGS

We describe our findings categorized into sections on teachers aspirations, avenues taken by teachers for their professional development and teacher's agency in technology. Although these sections are interconnected, we have organized our findings to answer specific research questions and highlighted key themes to improve readability.

4.1 RQ1: Aspirations

In this section, we explain teacher aspirations and then proceed to individual findings in the subsequent sections.

4.1.1 Teacher Aspirations. We found that teachers' aspirations were in two categories of (1) community aspirations (or embedded [44]), for students evolution which emerges from their students and their teaching; and (2) personal aspirations for career progression.

Student Evolution: We found that teachers derived happiness in seeing their students evolve academically and professionally. Teachers had smaller goals concerning improved comprehension from students as P11 tells us: "*This morning you saw that I was evaluating students. I'm happy because I know that at least 90 or 95% understood my lesson*". On the long term, teacher aspirations involved their students' professional success as P1 expresses that: "*for the 12 years I've been teaching, the first students I taught, some have come out of nursing, some are police officers. When we see that it amazes us, we are happy*". This finding resonates with work from other contexts [69] where teachers mentioned that they were vested in their student's success.

> When students come back after 23 years and say, "Sir, you've taught us good values and good attitudes when we were children in primary school and those same attitudes have transferred to us, to our work, today". Such remarks make me happy. I do not wait for them to come and give me money, but just that they understand that the good attitudes I instilled in them allows them to live a useful life - [P11]

Teacher Growth: Teachers expressed aspirations to improve their teaching skills to support their class better. Although teachers undergo rigorous training before teaching primary schools, they expressed that often their training did not transfer well to their classroom practice [26, 49]. Teachers mentioned that to fulfill their aspirations for growth they tried learning from their peers and kept practicing for example, P11 talks about writing on the board.

> I write well on paper but I found it difficult to write on the board when I started. Today, when I see my writing, I feel it's improved but it could be better. So every day I practice writing different texts on the board to improve my writing. - [P6]

Career Progression: Teachers organically mentioned career progression when we asked them their personal aspirations for the next five years. Teachers expressed that they would like to advance to new roles in education with primary school being a stepping stone towards their long term aspiration. As P2 aptly summarizes "*Like any person, I would like to evolve in my career, that is to say, not just stay at the primary level. Personally, move on*".

PID	Gender	School	Class	Age	Career Aspiration	Smartphone
P1	M	Region-A	CM1	42	inspector	Y
P2	F	Region-A	CM1	39	counselor	Y
P3	F	Region-B	CP1	34	teacher (other than primary)	Y
P4	M	Region-B	CE1	41	counselor/college teacher	Y
P5	F	Region-B (2)	CP1	32	business	Y
P6	F	Region-C	CM1	33	college teacher	Y
P7	M	Region-D	CE2	54	private school owner	Y
P8	F	Region-D (2)	CE1	39	counselor	Y
P9	M	Region-E	CE1	51	*primary teacher*	Y
P10	M	Region-E	CE1	37	NGO worker	-
P11	M	Region-E (2)	CM1	49	*primary teacher*	Y
P12	M	Region-F	CP1	35	counselor	Y
P13	M	Region-G	CE2	30	high school teacher	Y
P14	M	Region-H	CM2	37	literacy counselor	Y

Table 1: This Table summarizes the demographics and aspirations of teachers in the Adzope region.

4.1.2 Career Progression Conflicts with Teaching Role. We discovered teachers' personal aspirations by asking *where would they see themselves in five years's [76].* Almost all teachers said that did not want to continue teaching in primary schools, as P14 mentions: "*In five years, I will definitely not be a teacher anymore. Even if I'm in education, I'm not sure if I'm still going to be a school teacher*".

Teachers aspired to join positions they perceived to be better than their current role as a primary school teacher i.e., to high school, teacher trainers or inspectors. Although most teachers did not want to continue teaching in primary schools, majority of them wanted to work in other positions in education. To reach those positions, teachers mentioned that they need to qualify in competitive exams and they hinted that it was very difficult to succeed. In fact, all participants hadn't succeeded during their term (average of 12 years) but they hoped to qualify in the next five years. One teacher mentioned that he attempted the exam all his career but sadly he could not succeed, he has now accepted that he supported his siblings and takes solace that he made a difference in their lives.

> I tell you that from 1997 until today when I speak to you, there is not a year where I did not try at least two or three exams. Unfortunately, maybe I'm so stupid that it never worked. [..] We had to find someone to help the little ones. Now, I do not feel I have succeeded, but still, I was able to at least help two or three who give me satisfaction today. - [P7]

Some teachers (n=4) organically told us that they chose the teaching profession as a short term solution to support a family's financial crisis. For example, P11 mentions he was training to become a doctor but his family problems forced him to terminate his education halfway and switch to teaching: " *I studied for two years in the Faculty of Medicine from 92 to 94 and because of the difficulties with my parents, I applied for a teacher's post*". Similarly, others mentioned that they tried multiple career choices that did not pan out so they ended up working as primary school teachers.

> I always wanted to help others. First, I opted for the army [..] unfortunately, it did not work. After that, I

tried medicine to help the sick, but that did not work either, hence I became a teacher. So I say to myself that *I'm fine where I am, but I want to do more.* - [P14]

Therefore these factors tell us that **teacher's career aspirations conflict with their current role as a primary school teacher**. Similar to our finding, prior work in Côte d'Ivoire found that teachers chose teaching careers to get out of unemployment or to transition to other career positions [53]. In context of professional development, teachers in Côte d'Ivoire have little or no incentive for attending these training sessions as documented by the World Bank [18], therefore it does not align with their aspirations to progress in their career.

4.1.3 Education Role Models Influence Teacher Aspirations. However, the sense of community among educators helped teachers find role models who influenced them to stay motivated towards their education career aspirations as well as inspired them to teach.

> Well, five years, the goal is to go up, to have promotions. As I said, there are people as role models who started in primary education, and today they are counselors, others are college teachers. So it's with this in mind, too, that I'm thinking of five as well - big promotion, with a promotional cost. - [P4]

To understand teacher role models and their influence, we asked participants about teachers they admired while asking them to mention specific qualities about these teachers that they admired. Almost all participants (n=13/14) mentioned that they had a role model in education, many (n=6) admired their colleagues and a few (n=3) organically mentioned that their role models led them to their current career.

We found that teachers not only admired their role models but **teachers drew inspiration from their education role models to advance their career as well as improve their teaching**. P8 expresses this well when she talks about her trainer in teacher education school who inspired her: "*whatever you ask for, even if it does not concern teaching, she (trainer) answers. She explains so well that sometimes it makes you want to be like her. [..] She makes you want to teach*".

We found that role models were often teachers in the same school, school principals, counselors, and a few mentioned their parents. Our participants also talked about skills and qualities that they admired in their role models, which they tried to incorporate into their teaching. For example, P3 mentioned her role model was a colleague who proactively learned from his peers which led her to admire him and inspired her to do the same.

> This person (colleague) is always going to others(teachers) to learn [...] This way of doing this person I liked and it makes me try to copy the same thing every time, try to collaborate with the colleagues who have just arrived. - [P3]

In some cases, role models influence a teacher's career path, for example, P7 mentioned: "*He's a gentleman who impressed me a lot. First, by his way of doing, his charisma and then by the way of teaching even, but he was a professor of Mathematics. (And) I became a teacher*". A few teachers mentioned that a parent who influenced their career choice. Some participants mentioned that although they admired their past role models, they were cognizant that today they need to adapt and grow beyond their role models, as P2 expresses: "*It must be said that the generations are different. So, wanting to look like the model we estimated, it is not possible*".

Our findings replicate prior work that aspirations are *embedded* in the community as teachers derive their aspirations from their role models who are community members i.e. peers, superiors, or family. We also observe the *mutable* nature of aspirations as teachers express the generation gap between them and their role models. Additionally, as mentioned in developmental economics and ICTD, we found that role models play a major role in a user's aspirations [31, 76] but for teachers, they happen to be educators in their community.

4.2 RQ2: Avenues for PD

In this section, we give a brief context of professional development (PD) in Côte d'Ivoire and then discuss existing challenges in this environment. In the subsequent sections, we explain how teachers find avenues (or pathways) to overcome these challenges.

4.2.1 Challenges in Teacher Professional Development. Professional development is conducted as workshops for teachers to help them learn new pedagogical methods. Professional development workshops are held outside the village in peri-urban towns. Teachers are required to travel to these locations for a week and then return to implement the new method in their subsequent classes.

> It happened in the neighboring village called Ananguie, Our counselors have their offices there. So when there is professional development all the teachers go there [..] then we come back to practice what we have learned. - [P6]

Training sessions are lectures hosted by counselors for teachers of the same grade. School directors have similar training sessions but are trained on the administrative and leadership aspects of managing a school. Teachers mentioned that there could be up to 80 teachers per training session. Teachers expressed that the lecture-style lessons make it hard for them to transfer their learning back to their classroom. P2 suggested that they could have practical lessons:

"*professional development is like class sessions or sessions in lecture halls. I want it to be a little practical*".

Upon completion, teachers are offered teaching material (documents) that are needed to implement the new pedagogical method back in their schools. Teachers use these documents to create a new lesson plan to implement their PD lessons. The lesson plan acts as a guiding tool but teachers acknowledge that they need further support to implement the new method correctly, as P10 expressed: "*not that everything will be perfect, but at least you have a driver in front of you*".

Teachers expressed that the teaching material from PD is slow to transfer to rural areas. Since the class material and the lessons are centralized, teachers find it hard to adopt PD lessons without consistent availability of documents. Even when teachers receive documents, they lack adequate material making it difficult to implement it correctly.

> So our problem is the same as I said if there is no material, the current material does not follow the new program. When the material arrives, it comes late after we have started our classes - [P7]

Teachers expressed practical challenges to implement student-centric methods due to cultural nuances. Teachers mentioned that the Western nature of PD required teachers to alter their cultural values to implement it in their classrooms. In Côte d'Ivoire adults have a superior status to children and a student-centric approach conflicts with their social norm.

> Today, a child can sit on the table, even stand on the table. If it was the old way, you'd get upset [...] but now you say "Excuse me, come down". You are even obliged to ask the child for forgiveness. - [P6]

Proper implementation of pedagogical methods is overseen by counselors who supervise their region by visiting individual schools. Counselors are ministry officials tasked with mentoring teachers and supporting schools with the administration in a region. As P4 aptly mentioned: "*this training is followed by class visits, that is, the counselors come to the class to follow how we put it into practice*".

During school visits, counselors observe teachers teach in their class followed by a feedback session. Teachers mention that the counselor critiques their teaching and directs them toward appropriate ways of implementing pedagogical methods. Teachers not only get feedback on their pedagogy but they also learn about their shortcomings in their use of support material, classroom management, and teaching behavior. Teachers also mentioned that there is a self-critique (reflection) element to their feedback so teachers can articulate their shortcomings to explicitly to seek feedback from the counselor.

> He chooses certain subjects of the day which you have to teach, he then observes your performance. He will correct your inconsistencies, express what's wrong, express what you should do, how you should lead children so they understand better, and what material you used that was not good. That's why he comes and then, in the end, there is a criticism. First, you make your self-criticism to see if the lesson you have done is past. After that, he makes the criticism, and then he gives you advice on how to improve yourself. - [P3]

Counselors not only evaluate teacher classroom performance, teaching methods but they also foster teacher growth by mentoring and improving their teaching. As OP1 said: "*I didn't have training in the APC system (teaching method). When the counselor came here, he showed me how to teach the lesson and gave me a supporting document*". Therefore **counselors are the human infrastructure [67] behind teacher professional development**. However, we found that counselor visit frequency varied by region, some regions often had received visits in a month while some had not received a visit in the academic year. In Ivorian contexts, teachers receive teacher training for an average of 2 days a year [38].

In summary, we discovered breakdowns in professional development due to teaching style, transfer of resources and cultural nuances. We also found evidence of tension between Ivorian culture and student-centric PD methods as observed in other developing countries [25, 49] and counselors are the human infrastructure [67] of PD. However, we found that teachers have a strong support system and are creating avenues to implement and access PD which we will discuss in the subsequent sections.

4.2.2 Teacher Solidarity. We found that teachers have a strong social bond which creates a sense of belonging. Their social bond leads them to perceive themselves as a family which P10 aptly said: "*Now, socially, we are a family. We have friendships, we have a solidarity fund [..] which we use to support each other through joy and misfortune*". They use the solidarity fund for joyous occasions such as parties and during periods of misfortune such as sickness or death. Their solidarity fund is a physical reflection of their social bond, which helps them collectively handle professional and personal issues. Teacher solidarity expands beyond the school level to a district level and beyond as unions.

> Now we teachers of Region2 have our union called the association of teachers Region2. So once someone is touched, it means that all of the Region2 teachers automatically are affected. - [P12]

This finding of teacher solidarity resonates with work in the South African context which discusses the spirit of *Ubuntu* [32] or the sense of oneness shared by the people in the region. We found that *Ubuntu* also exists in teachers in rural Côte d'Ivoire. Professionally, teachers use this solidarity to find role models to inspire them(as discussed in the earlier section) or to support each other when they do not have support from the administration.

4.2.3 Solidarity Supports Accessing Professional Development. Although teacher professional development has challenges, teachers' work around these problems by leveraging their solidarity. Teachers' sense of solidarity extends to support both personal and professional problems. Teacher solidarity is acknowledged by the administration. P11 (director) mentioned how his school teachers use their solidarity to fill in for a teacher when he is sick.

> The solidarity must be created between us because one person can be sick while school is in session and the children have the right to education. But at the same time, the teacher is also entitled to care, being sick, he can not teach. I as the team leader of the school make pedagogical solidarity so I can take his

course and work until a certain time and then hand it over to another teacher. - [P11]

Professionally, teachers use this network to support each other when they do not receive visits from the counselor. When teachers need additional mentoring, they support each other by (1) passively advising each other informally, as P11 expressed this sentiment: "*if I have difficulties in a subject or my perception of something, I approach a colleague and ask for help. We can help each other at this level*". (2) they actively seek help by critiquing each other by role-playing as a counselor in each other's classes.

> I can teach a course that may be in history, and the other teachers come to observe me. For example, they come to my class, and then note all the mistakes I make. After that, I do my self-criticism, and then they criticize me [..], my shortcomings and what to do next time so that it can go better. - [P6]

Teachers expressed the reciprocal nature of support i.e. teachers learned from each other irrespective of experience levels. Each level of experience had something new to offer i.e. more experienced teachers had field exposure and techniques which they had perfected during their tenure while new incoming teachers would bring new methods that they recently learned during their initiation. P6 summarized this well: "*There are people who have 30 years of service who are there. Often, we go to them, but often by research, we who are new, we also teach some things to our deans, so it's reciprocal*".

We found that **solidarity helps teachers find alternate avenues to access professional development**. This finding helps us learn about existing networks of support among teachers which originates from their strong sense of belonging. The sense of community highlights the community spirit of Ubuntu [32] that exists in the South African context, our work shows how this phenomenon is present in teachers of Côte d'Ivoire and how it influences teachers handle breakdowns in PD. Lastly, our finding supplements teacher co-learning as observed in Western settings by Clement *et al* [22] which we found to exist in the rural context of Côte d'Ivoire.

4.2.4 Teachers Create Avenues to Implement PD. Teachers of Côte d'Ivoire have challenges in PD implementation as discussed earlier, however, they find workarounds or avenues to handle these challenges. Teachers have a rigid centralized curriculum but they have the freedom to contextualize their lesson plan for their classes. Teachers prepare their lesson plans at home and they acknowledge class preparation to be an integral part of teaching. As P8 mentioned: " *The most important thing is to prepare my classes at home, read, understand before you come to class. That's what makes you a good teacher*".

(1) Teachers mentioned that they **prepare lesson plans** by supplementing the centralized guideline with relevant content for their classes. They expressed that it is cumbersome to search relevant material for adapting lesson plans for rural students, mainly because the students are below the expected centralized literacy levels.

> We prepare our cards (lesson plans) at home by preparing for the lesson you teach, there is a guideline that will show you how to do it for your student's level. You try to adapt the card to the level of your students during the preparation. If your children are high, you

try to raise the vocabulary too. Now, for the students of the village, it is difficult to use the complex vocabulary, so it is necessary to tailor it to their level - [P3]

Additionally, teachers mentioned that students' home environment affects learning at school. For example, students in rural contexts are more accustomed to interacting in their native language (like Attie) at home rather than French, leading to lowered fluency and literacy. As P10 told us: "*We are in a rural area. French is not easy for these children. They speak more in their dialect*".

(2) Since Côte d'Ivoire is multilingual, teachers often face scenarios where they are unfamiliar with the local language spoken by the students and might not be able to communicate with them. However, teachers mentioned that they use **students as resources** to work around this issue to implement their lessons. Teachers use knowledgeable students in the class to play the role of translators to help them teach to students of low French proficiency.

> For example, when I say "a mountain" in French, students do not understand. So I ask students, as we are in an area of Attie. "In Attie, how do we say mountain?" He who understands mountain in French says: "In Attie, we say like that". And then the others say "Aaah! What we have just said here, in French, is called a mountain." - [P10]

In our class observation, we also saw that the teachers use older students as teaching assistants to manage the classroom. Teachers also mentioned that they manipulate seating arrangements based on student proficiency to support peer learning. Additionally, we observed a teacher using peer grading among students as an initial evaluation of a test. P14 explains that it's his own idea to distribute the notebooks randomly among students to grade their peers so they learn.

(3) Teachers are trained to deal with a class size of 30 students and are taught to implement their lesson plans for the same, however, they often had to work with large class sizes. As P9 stated: "*when you find yourself with 100 students, it becomes an audience. It's not a class anymore. You speak in noise and it is not easy*". Additionally, large classrooms also lead to students of multiple learning levels in the same class i.e. a class can have advanced students who find the material less engaging and lower level students who need additional support. Teachers mentioned that they manage their class using **creative teaching methods**. Teachers implemented their lesson plan to help lower level students by using music, technology, songs and stories to engage students. P10 expressed that he takes a playful approach of shouting like a bird when children are distracted.

> When I feel that students are distracted, I imitate the cry of an animal or a bird. I say "Ouhou !!!". Then they (students) repeat after me. They see this as a game, so it relaxes them. - [P10]

Teachers face contextual challenges of inappropriate content material, low student literacy, and large class sizes. However, teachers find avenues by preparing lesson plans, leveraging students as resources, and by creating new methods to engage classes. Although teachers feel that these methods are useful, it is unclear if they are improving student learning outcomes. A study in the region found poor literacy rates among primary school children [38], which

suggests there are opportunities for channeling these avenues to improve student learning. Additionally, teachers mentioned that technology played a role in helping them prepare for a class or implement a lesson plan.

4.3 RQ3: Technology Agency

This research question is focused on understanding teachers use of technology for professional development. Our focus was on information technology i.e. devices (smartphones and laptops) and common applications used by teachers. We were interested to learn how teachers build agency towards PD using technology.

4.3.1 Teachers' Perceptions of Technology. We found that all teachers had exposure to smartphones and almost all(n=13/14) currently owned a device. They used it for using social media, playing games, and sharing media using Bluetooth services like Xender [6]. WhatsApp and Facebook were the prominent applications used among teachers, matching the global usage statistics of these applications in the developing countries [5]. For teaching, they used dictionary applications to find the meaning of words, conjugation, or searched on Google to find content for their lesson plan.

Teachers expressed a positive attitude towards technology and its benefits to education. They saw technology as a positive force connected with evolution, as P10 aptly summarized: " *I think technology is a very good thing. Normally, all schools should have computers. As the world evolves, I think schools too must evolve for education to evolve*". This positive attitude towards technology is similar to perceptions of teachers in India [78]. However, participants expressed that they were concerned that technology for students needed supervision to benefit their learning.

> "Generally, what I dread is that, when you give someone a tool (technology), he automatically sees the playful side and that's a bit dangerous. However, if we manage to channel the tool, it's very good" - [P7]

Teachers used technology to address this concern by channeling children's curiosity for technology to engage them in their lessons. Technology supports them to deal with classroom challenges such as managing large class sizes.Therefore, **teachers find avenues using technology to tackle contextual challenges** i.e. teachers use technology in non-traditional ways to discipline and captivate their students towards learning.

> Children are captivated by my laptop. I do not know if it's the color or the screen that makes them follow better. When I use my device, they feel more comfortable and they understand better. So if someone talks, I do not use it. We know that at least there is a student who will disrupt the class, I say "as you chatted, we will not use the computer today." -[P6]

Outside of class, teachers used computers to print documents to manage student's scores or printing their lesson plans. Few teachers mentioned that they were encouraged by the ministry to use technology to prepare their lesson plan and they were open to using it more if they had official orders.

4.3.2 Teachers Use the Internet to Prepare their Lesson Plans. Teachers mentioned that professional development is implemented by preparing a lesson plan before class. Although they had preparation

material, they expressed that it often does not match the updated curriculum or the tailor to rural students. Therefore, teachers may spend hours searching through various documents to find appropriate content for a lesson plan.

> We have the old FPC (old method) documents with us, while the course content uses a competency-based approach (new method). Do you see it? [..] So, today to do a 30-minute course, you can easily spend three hours searching through documents for the content. - [P7]

However, we found that teachers take ownership of this problem and use the internet to help them find appropriate resources for their lesson plans. As P11 mentioned: "*I am obliged, as a teacher, to search on Google. I either do my research there or I need to use the old documents*". Teachers expressed that they either used their smartphone or their computer at home to do internet research. Although they are able to leverage the internet, they also mentioned that it is necessary to adapt the content to support the rural students.

> I research using Google for more information and how to better run the course so students can understand. We call this learning situation. I first read a short text orally so that students are centered and captivated in the lesson. They are curious to know the rest of the story so they continue to listen. - [P6]

Although they find value in using the internet, they expressed that this process is cumbersome and it is not easy to use technology, as P6 mentioned: "*Often, while of searching (on the internet), we have migraines*". However, teachers voluntarily chose to spend this additional time after school to find content because they believe this will benefit their students in the long run. Teachers also mentioned that although it is difficult at first, they eventually get better at research and even use their expertise to teach their superiors. P6 summarized this well: "*Often by research, we who are new, we also teach some things to our deans*". Therefore, **teachers use technology to build their agency for implementing professional development** to support students' learning.

Using technology to work around the challenges in professional development is an expression of teacher *voice* [7, 45, 48] against the difficulties in their context i.e. lack of documents and appropriate material. This phenomenon opens opportunities for amplifying and connecting teacher voices [10] to reach higher administration thereby creating a social change in teacher professional development.

5 DISCUSSION

In this section we briefly discuss reflections on our aspiration-based approach, which leads us to open questions. We then propose some design recommendations for answering these open questions and conclude with limitations of our work.

5.1 Reflections on Aspirations-based Approach

Our research helped us understand teacher needs and aspirations in the context of Côte d'Ivoire. We found breakdowns in teacher professional development which helped us understand their need for

mentoring (frequency of visits), contextual support (for rural students), and access to resources (PD documents). However, by understanding aspirations, we learned that teacher aspirations for career progression conflicts with their role as a primary school teacher. The pathway towards achieving their aspirations is through individual performance in competitive exams which does not involve the community (students or peers). Therefore designing technology to address professional development needs alone limits its impact on the teachers as predicted by Toyama [76]. Although technology can play a role in career progression to provide access to mentors or resources, it's ultimately up to the teachers to build their capacity to use these resources to achieve their aspirations. Social impact for teacher PD is possible when career aspirations align with their role i.e. teachers are incentivized towards their career progression by teaching better, educational outcomes or attending PD. However, technology can be channeled to act as a catalyst towards influencing policy by amplifying teacher voice. We also observe how a community influences aspirations (or aspirations are embedded [44]) when teachers derive inspirations from their role models or have aspirations for their students. Therefore these community aspirations can be leveraged to motivate and support teacher PD.

We acknowledge that we have scoped aspirations to a teacher's profession but similar scoping has been done by others [17, 44, 64]. More research is needed to understand deeper levels of career-related aspirations, non-career related aspirations, and creating a hierarchy of aspirations [76]. Although we explored aspirations in our work, it is unclear how to channel teacher aspirations towards social change with technology. Furthermore, it is unclear how to balance career and community aspirations or even measure the developmental impact on the aspirations of teachers. We provide some ideas to design technology-based interventions to answer the questions above.

5.2 Design Implications

We found that a high percentage of teachers had access to smartphones, therefore smartphones can be a medium of design. Designers interested in creating sustainable interventions can draw upon an asset-based approach [57] to leverage existing assets (i.e. smartphones) and applications popular in the context e.g. we found that teachers used WhatsApp, Facebook Messenger, and Google in Côte d'Ivoire. However, we also found that teachers are still learning to use their smartphones. Therefore designers need to be mindful that any new design will need a shallow learning curve so teachers can adopt it. Alternatively, designers can incorporate training when they deploy their technology [35]. As an example scenario, consider a chatbot on Facebook Messenger that mentors teachers on PD. This scenario uses existing technology and has a low learning curve as teachers are familiar with it. We will use this scenario as an example in subsequent sections.

5.2.1 Balancing Career and Community Aspirations. We know that teachers' career aspirations conflict with their current role as teachers i.e. their professional success criteria do not intersect with children's success. Therefore technology design needs to focus on balancing both career and community aspirations to create a social change in teacher professional development. Our data suggests that

role models (colleagues, counselors, inspectors) play a dual role to inspire teachers in their career aspirations as well as motivate them to improve their teaching. Prior work used role models in a documentary to demystify the path to financial independence [75]. Hence designers can use such interventions with relatable role models to inspire teachers towards their career progression while showing examples of good teaching practices. Designers can use role models for best practices using multimedia such as video [9] or audio [2]. Such multimedia can also act as tutorials to change behavior to help teachers adopt technology into their curriculum. However, care must be taken to focus the role models in the primary school domain so teachers are motivated to improve themselves in their schools while being inspired to advance their careers. Using our chatbot scenario, teachers can be shown videos of role models performing a teaching method to inspire them to implement PD methods. Additionally, the same role models can talk about their success stories and strategies motivating teachers towards their career progression.

5.2.2 Measuring Impact on Aspirations. Prior work on measuring the economic impact of aspirations [19] used a self-efficacy scale to measure the perception of the user's agency. Since the agency is built towards achieving aspirations [43], measuring perceived agency can help understand a user's present circumstance towards their aspirations. Therefore researchers interested in designing and measuring teacher aspirations can utilize self-efficacy scales to measure the impact of their interventions on teacher's perceived agency (or self-efficacy). Prior work in a controlled environment found that building teacher computer self-efficacy could influence teacher self-efficacy in PD [27]. Therefore designers can extend this research to learn about teacher aspirations and technology in a long term field setting for PD. Additionally, researchers can create custom scales to focus on individual aspirations i.e. student evolution, teacher growth, and use self-efficacy to measure the impact or relationship between each aspiration. Using our chatbot scenario: if the goal of the project is to improve student learning, then a customized self-efficacy for student evolution can be used to evaluate the intervention.

5.2.3 Designing for Social Change using Feminist HCI. Although we learned about teacher aspirations, it is unclear how to channel their aspirations towards a social change. To bring about a social change, we recommend a Feminist HCI [13] approach towards supporting teachers with their professional development. The feminist HCI approach is inspired by feminism and provides guidelines for designers to balance societal problems while preventing marginalization of social groups (in our context teachers). Feminist HCI (through pluralism and participation) suggests different users (teachers) need individual support therefore there is no universal design. Therefore designers can learn from these ideas to provide personalized [21] and adaptive technology [40] to support individual teachers. Using our Messenger chatbot scenario: Artificial intelligence could be used to provide personalized support to teachers with each teacher having individualized support.

Teachers have strong solidarity to support each other and this phenomenon can be leveraged to build online forums to expand their support network. These forums can provide pathways for teachers to seek mentoring, acquire role models, or express their

voice. We found that teachers express their voice against challenges in the context by inventing new methods and finding innovative uses of technology for their PD. Designers can channel these activities towards amplifying community voices for social change [10]. To promote a social change, designers can leverage the concept of advocacy (from Feminist HCI [13]) to allow political expression. To allow teachers to have a political voice, designers can include administrators i.e. directors, advisors, and ministry officials [1, 2] who can draw insights from communal phenomena to make official decisions. Using our Messenger chatbot scenario: a summary of teacher challenges surmised from chatbot interactions can be sent to the regional advisor to prioritize his visits to mentor teachers.

5.3 Limitations and Future Work

We conducted our research in two regions but we focused on aspirations only in one region. Future research can address if teacher aspirations vary by region. Secondly, although teachers have a social bond it is unclear if this bond transfers to a technology media. Participants mentioned that an unofficial Facebook group for teachers exists in Côte d'Ivoire but some said they weren't active users because they preferred in-person communication. Therefore, future work can learn about social media usage by teachers and understand how much of their social interactions transfer online. Although we did not specifically ask for career aspirations, teachers organically mentioned that they would like to change their career in the next five years. We expect there could be an availability bias as preceding questions in the interview were on their professional life. Future research can focus on encouraging participants to discuss deeper levels of career aspirations or alternative ones such as having a family, building their own house or achieving fame.

6 CONCLUSION

Teaching is challenging in rural contexts in developing countries because of contextual challenges that lower teacher motivation and educational outcomes. Teacher motivation and educational outcomes can be improved by teacher professional development programs but these programs are limited by poor infrastructure in rural areas. Although infrastructural challenges can be overcome by information technology today, it is unclear how such technology can support teacher training. Therefore to explore opportunities to promote social change in teacher professional develeopment in developing contexts with technology, we conducted a qualitative study with 22 teachers of rural Côte d'Ivoire by following an aspiration based approach. Our finding reveal that (1) teachers aspire to achieve higher posts in education which conflicts with their current role as a primary-school teacher; (2) teachers have a solidarity which helps them (a) find role models for their career and teaching, and (b) tackle breakdowns in professional development; and (3) teachers also take ownership of their professional development by finding workarounds by inventing new methods, taking student support and using the internet to prepare their lesson plan. Based on these findings, we discuss design directions for balancing teachers' community and personal aspirations, ideas to measure aspirations and provide implications for designing for social change in teacher professional development.

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