

**STEM teacher and
school leader engagement
with continuous
professional development
in Rwanda since the
outbreak of
COVID-19**

Leaders in Teaching
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[Laterite](#) is a data, research and advisory firm dedicated to bringing high-quality research services to the most underserved markets. Based in East Africa, the firm strives to carry out impactful research that helps decision-makers find solutions to complex development problems.

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Teacher and school leader engagement with continuous professional development (CPD) in Rwanda since the outbreak of the pandemic

The context

Supporting teachers through CPD is a priority of the Rwandan government to improve indicators of inclusive, equitable education in the country. Teacher CPD provision is a central component of the Mastercard Foundation's Leaders in Teaching initiative. This study assesses how teacher and school leader engagement with CPD changed over three periods: pre-pandemic, during school closures and when schools reopened in Rwanda. The study is based on data from 294 Science, Technology Engineering and Mathematics (STEM) teachers and 173 school leaders in the 14 districts of Rwanda where the Leaders in Teaching initiative is in place.

Key findings

- STEM teachers have been more engaged with CPD since schools reopened. School leaders' participation in CPD significantly reduced during school closures, but has since returned to pre-pandemic levels.
- Generally, female teachers engaged less in CPD and had less access to computers than their male counterparts. STEM teachers also reported less access to computers than school leaders. However, engagement with CPD was not affected by accessibility to these devices during the different time periods.
- School leaders were more optimistic than teachers about the usefulness of CPD, whether provided by organisations or colleagues through peer learning. Teachers were able to apply new knowledge from training given by organisations more than by individual colleagues.
- STEM teachers and school leaders received significantly less CPD from peer colleagues during school closures. This did not recover to pre-pandemic levels once schools reopened.
- Teachers' interest in training on the competence-based curriculum (CBC) waned during school closures and beyond, as they were more concerned with catching up students' learning and practical knowledge when schools reopened. However, this will continue to be an important area of focus going forward.
- STEM teachers and school leaders identified interest in different CPD topics: STEM teachers reported needing CPD about STEM and ICT, inclusivity, mentoring and coaching, and topics like lesson planning. School leaders were interested in training about school and personnel management, and dealing with dropouts.
- However, Rwandan teachers had little leeway to decide which CPD they would receive both during and after school closures, both from organisations and from peers.

Policy implications

- Ensure female STEM teachers and school leaders can participate in CPD, for example, via flexible schedules. These initiatives must consider context-situated and culturally-motivated inequalities between females and males.
- Support access to computers or tablets for professional development, particularly for STEM teachers. On-loan devices are vital in case of another lockdown.
- It is important that teachers and school leaders can participate in deciding which CPD they wish to take. Approaching educators from different career stages and experience in the profession annually could help to understand professional development needs and interests.
- Provide time and resources for collaboration amongst STEM teachers and school leaders within and between schools.

The context

Supporting teachers through Continuing Professional Development (CPD) is a priority of the Rwandan government to improve inclusive, equitable education in the country (REB, 2019). Building on the 2015 “Strengthening quality teaching and learning for education for all in Eastern Africa”, the Rwanda Basic Education Board (REB) recently updated their National Teacher CPD Framework. With this revised version of teacher CPD in the education system, the government aims to strengthen teaching quality indicators and guide overall performance. Also, it is expected that these guidelines will help improve teacher CPD programmes, teaching and learning.

Teacher CPD provision has been a central component of the Mastercard Foundation’s Leaders in Teaching initiative since its inception in late 2018. This paper seeks to identify the experience of Science, Technology Engineering and Mathematics (STEM) teachers and school leaders (head teachers, Directors of Studies, and deputy head teachers) with CPD in the context of the Leaders in Teaching programme, with a particular focus on changes as a result of the global pandemic and the rapid shift to remote learning in Rwanda.

The study

This paper assesses STEM teacher and school leader engagement with CPD pre-pandemic, during school closures and when schools reopened in Rwanda. We examine whether and how CPD engagement changed in these three periods from the perspective of STEM teachers and school leaders according to gender, years of experience, qualification, type of school and school location. The paper is based on data from 294 STEM teachers and 173 school leaders in 14 districts of Rwanda, where the Leaders in Teaching initiative takes place.

The paper begins by outlining the methods and sampling approach to this study, followed by the characteristics of the research participants. The paper presents findings regarding: (i) overall participation in CPD; (ii) availability of computers to participate in CPD; (iii) engagement with CPD as provided by organisations and peer colleagues; (iv) STEM teacher and school leader capacity in choosing their CPD; (v) perceived usefulness of CPD in their professional duties; (vi) application of new knowledge to professional practice; (vii) self-perceptions of CPD needs; and (viii) the relationship between CPD received and needed before, during and after school closures.

The paper presents evidence on whether engagement, utilisation of knowledge and CPD requirements varied for different teachers and school leaders. For example,

statistically significant differences as they present for female and male teachers, those in early or more senior years of the teaching career, amongst other characteristics, are explored. Similarly, potential differences between Schools of Excellence or regular schools, as well as between rural and urban settings, are examined. The paper concludes with a summary of the findings and policy implications.

Key findings

- STEM teachers' participation in CPD was higher once schools reopened compared to both pre-pandemic and school closure periods. School leaders' participation in CPD was the same pre-pandemic and when schools reopened, but significantly reduced during school closures. During these time periods, the extent of involvement was similar according to gender, experience, school location, or status of School of Excellence.
- STEM teachers had more access to computers before the school closures than once the schools reopened. Their engagement with CPD was not affected by access to these devices during the different time periods. When schools reopened, school leaders had more access to computers than teachers. However, their participation in training was also not associated with accessibility to computers.
- STEM teachers' engagement with CPD on competence-based curriculum (CBC) was significantly higher pre-pandemic than during the school closures and did not return to previous proportions once the schools reopened. However, training in other areas such as lesson planning and remedial learning strategies was significantly higher once schools reopened than in the other two periods. School leaders also engaged more in CBC before the school closures than during the closures or when the schools reopened.
- STEM teachers and school leaders received significantly less CPD from peer colleagues during school closures than prior to the pandemic. This did not recover to pre-pandemic levels once schools reopened.
- During school closures, STEM teachers and school leaders were less able to choose which aspect of CPD they engaged with. This applied both to training from organisations as well as from colleagues. When schools reopened, a greater proportion reported that they were able to choose the focus of CPD. However, overall, they seemed to have limited opportunity to decide their CPD.
- STEM teachers were more positive about the usefulness of CPD from training organisations and colleagues when schools reopened compared to during school closures. School leaders were more positive about the usefulness of CPD than teachers, across time and across different CPD providers.

- STEM teachers reported applying new knowledge from CPD to their practice more often when the training was provided by an organisation, compared to when the training was provided by peer colleagues.
- STEM teachers' self-perceived need for additional professional development reduced in most training areas once the schools reopened, compared to previous periods. The exception was STEM and ICT development, which teachers considered crucial areas for further CPD once schools reopened. School leaders were significantly more interested in receiving training about school leadership, school budget and personnel management when schools reopened than prior to and during school closures.

Methods and sampling

Two complementary survey instruments were developed for understanding experience with CPD, one for school leaders and one for STEM teachers. The questionnaires asked participants about the extent of participation in CPD, the most prominent providers, the topics there addressed, and whether and to what extent new knowledge has been employed in their teaching. Questions also included their perceptions regarding professional development needs. Questions were similar for school leaders and STEM teachers to allow comparisons but adapted to make them relevant to their roles.

Two survey rounds were carried out. The first round was face-to-face between February and March 2020, immediately before COVID-19 school closures. Respondents were asked about their experience with CPD over the previous 12-month period. The second survey round took place by phone between October and November 2021 and collected information regarding CPD engagement during the eight-month school closure period (March to October 2020) and once the schools reopened, covering the 12-month period from November 2020 to October 2021.

The same STEM teachers were included in both survey rounds, totalling 294 participants, one per school. In addition, approximately 58% of school leaders who were included in the first round of data collection also provided information in the follow-up round. This is equivalent to 173 school leaders in the two data rounds. The 42% of school leaders who did not take part in this study were not available for a survey because, for example, they had retired, or refused to participate. The Leaders in Teaching initiative focuses on rural areas in particular, and therefore, 92% of participants work in schools located in these settings.

Repeated-measures analysis of variance approach was employed to identify if proportions of participation in CPD were statistically significant. Simple t-tests for independent samples and chi-squared tests of association were also employed, where appropriate. Differences reported are statistically significant, unless noted otherwise. One limitation to note is that, given the relatively small sample size for some of the analysis comparing sub-groups of teachers and school leaders, this might affect the statistical significance.

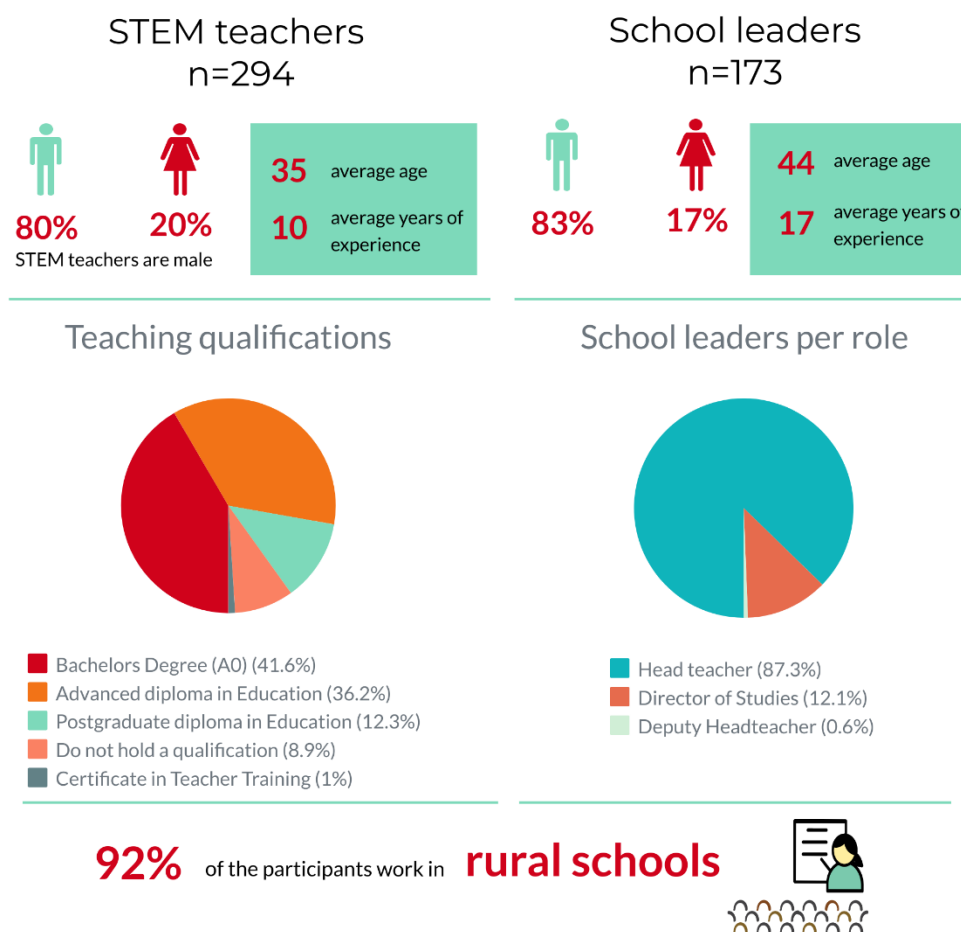
In general, the paper compares participation in CPD before school closures (using data collected in February/March 2020) and during school closures and after re-opening (using data collected in October/November 2021). In some cases, data are not available regarding engagement with CPD before the school closures, in which case only participation during the school closures and when schools reopened is reported.

Characteristics of STEM teachers and school leaders

Figure 1 presents the characteristics of the STEM teachers and school leaders in our sample. In total, 80% of STEM teachers in the sample are male. The average age of teachers is 35 years, with an average of 10 years of teaching experience. Around 40% hold a bachelor's degree in education, and around 9% do not have any teaching qualification. No statistically significant differences between male and female STEM teachers were found regarding age, teaching experience or qualifications.

The vast majority (83%) of school leaders are also male. They are older and have more experience than STEM teachers, with an average age and professional experience of 44 and 17 years, respectively. There are also no statistically significant differences between male and female school leaders with respect to age, experience, or role.

Figure 1. STEM teachers' and school leaders' characteristics



Overall engagement with CPD

In this paper, we compare STEM teacher and school leader participation in CPD before the school closures (covering the period March 2019 to February 2020), during the school closures (March to October 2020), and when schools reopened (November 2020 to October 2021). In general, STEM teacher engagement with CPD increased

after schools reopened when around 92% participated in training (Table 1). However, there is no difference in participation in the period spanning before and during school closures, when around 66% participated in training. Participation was similar by gender (Figure 2), as well as for years of experience, the school location, and whether the STEM teacher worked in a School of Excellence or held a bachelor’s degree across all of the time periods.

Regarding school leaders, engagement with CPD was higher before school closures and when schools reopened compared with during the school closures (Table 2). Before school closures, a higher percentage of school leaders participated compared with teachers (88% and 67%, respectively). CPD engagement for school leaders pre-pandemic and when schools reopened is similar, with around 90% of them participating in both these periods. As such, after schools re-opened, the vast majority of both teachers and school leaders reported participating in CPD.

Female school leaders participated less in CPD than males before and during school closures. This pattern reversed when the schools reopened, although these gender differences were relatively small and not statistically significant (Figure 3). Moreover, participation was similar for school leaders by years of experience, school location or whether they worked at a School of Excellence across the different time periods.

Table 1. STEM teacher general engagement with CPD **Table 2. School leader general engagement with CPD**

Table 1. STEM teacher general engagement with CPD			Table 2. School leader general engagement with CPD		
Year		Participation in CPD	Year		Participation in CPD
Before school closures	school	66.7%	Before school closures	school	88.4%
During school closures	school	65.3%	During school closures	school	50.2%
Schools reopened		91.7%	Schools reopened		89.5%

Figure 2. STEM teacher engagement with CPD and gender

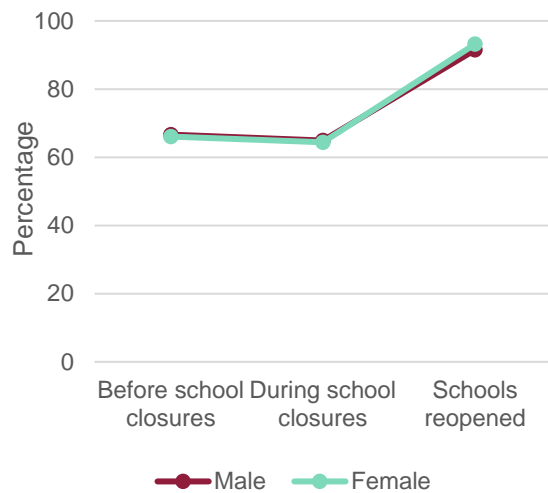
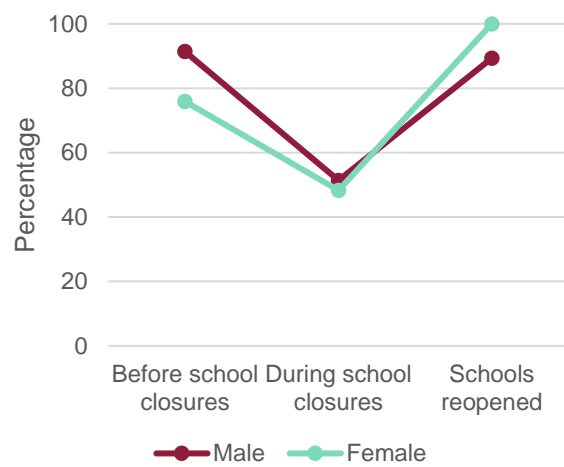


Figure 3. School leader engagement with CPD and gender



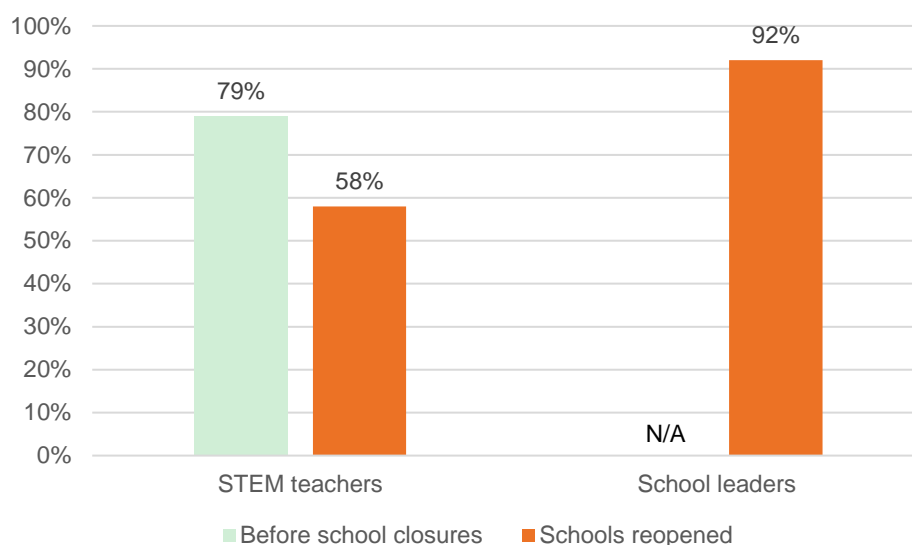
Availability of a computer to engage with CPD

We asked STEM teachers and school leaders about their access to a computer, which they could potentially use to participate in training. We were particularly interested in access to computers given they are potentially more suitable for activities associated with CPD such as reading long texts, holding videoconferences, or downloading materials than smartphones.

Before school closures, nearly 80% of STEM teachers had access to a computer (at school or outside school). However, the proportion fell to approximately 60% when these same teachers were surveyed after schools re-opened (Figure 4). Even so, teacher engagement with CPD actually increased after schools re-opened, as identified above. This suggests that CPD engagement was not conditioned by the availability of a computer. There were no significant differences in access to a computer before school closures or when schools reopened according to gender, years of experience, school location, working in a School of Excellence or holding a bachelor's degree.

The vast majority of school leaders had access to computers when the schools reopened (we do not have data on their access before the school closures) (Figure 4). Results show that their participation in CPD was similar regardless of their access to a computer. Access to a computer was not different amongst school leaders according to characteristics such as gender, experience, school location or working at a School of Excellence.

Figure 4. STEM teacher and school leader access to a computer.



CPD provision from organisations and peer colleagues

Participants were asked whether CPD had been received from an organisation, e.g., VVOB-URCE, REB, etc., or a colleague, for instance, the head teacher in the case of STEM teachers, or another school leader in the case of those with leading responsibilities in the school.¹ Participants were also asked about the areas of professional development with which they engaged. First, they were presented with an overarching dimension of CPD, for instance, training on the Competence-Based Curriculum (CBC), and then given more detailed options within that category, such as student-centred learning strategies and assessment. Respondents could include as many choices as they had been involved in. A complete list of the overarching options and their subordinates is presented in Appendix 1. The following results relate to the most general dimensions of CPD where STEM teachers and school leaders participated.

STEM teachers' areas of professional development

Prior to school closures, STEM teachers engaged slightly less in organisation-led CPD than peer-led training (45% vs 53%). However, during the school closures, training led by organisations had a sizeable increase and peer-led CPD provision fell substantially (65% vs 5%). When schools reopened, organisation-led CPD recovered beyond pre-pandemic levels, and peer-led CPD also recovered slightly above pre-pandemic levels (91% vs 66%) (Table 3). CPD engagement varied across areas or topics of training and time. Table 3 shows that before school closures, organisation-led CPD on CBC

¹ Proportions of engagement with CPD from organisations and colleagues are different from those presented in the previous section because here, the participants were asked specifically about CPD received from these two options. This approach might have omitted other forms of training, e.g., self-directed, or available in the private sector.

was received by 40% of the teachers. However, it declined by half once schools reopened compared to before school closures. In addition, before school closures, training on STEM and ICT, inclusivity, Mentoring and Coaching was significantly lower than participation in those areas once schools reopened.

Teacher engagement with CPD in English language was significantly higher during the school closures than pre-pandemic or when the schools reopened. The response “other” type of training related to training on lesson planning, innovative assessment, remedial learning, and maintaining safety from COVID-19.

Table 3 also shows that training provided by peer colleagues was higher before school closures in many areas, including CBC, STEM and ICT and inclusivity, compared to during school closures and once schools reopened. Training in English language seems to have returned to pre-pandemic levels following a significant drop during school closures. Training concerning Mentoring and Coaching and “other” types of CPD are significantly higher once the schools reopened than before and during the school closures. In the “other” category, STEM teachers engaged with training provided by their colleagues about lesson planning and teaching methods and teamwork approaches when schools reopened. STEM teachers’ participation in CPD supplied by organisations and peers was similar across the different topics of training and time considering gender, teaching experience, school location, and whether the STEM teacher worked at a School of Excellence or held a bachelor’s degree.

According to these findings, almost half of STEM teachers in the sample have not engaged in CPD regarding the CBC since the pandemic. However, around 70% did receive some training in STEM and ICT either from organisations or their peers. Across the three periods, participation in inclusivity, English language and mentoring and coaching is substantially lower than CBC, STEM and ICT content.

Table 3. STEM teachers' engagement with CPD provided by organisations and peer colleagues

STEM Teachers														
Round	CPD provided by organisations (%)							CPD provided by peer colleagues (%)						
	Competence -Based Curriculum	STEM & ICT	Inclusivity	English	Mentoring & coaching	Other	Total	Competence -Based Curriculum	STEM & ICT	Inclusivity	English	Mentoring & coaching	Other	Total
Before school closures	40	30	15	4	12	3	45	51	26	18	14	9	4	53
During School closures	4	32	10	14	10	18	65	1	1	1	1	2	2	5
Schools reopened	20	45	22	7	33	30	91	19	10	8	10	18	19	66
Total	53	71	39	22	45	40		59	32	24	21	26	22	

Note: STEM & ICT: Science, Technology, Engineering and Mathematics & Information and Communication Technology. Respondents could include as many options as appropriate. The total columns express the percentages of STEM teachers that participated in at least one CPD option from organisations and peers, respectively, at the three time points. These are less than the totals across the columns as STEM teachers were often involved in more than one form of CPD. The total rows indicate the proportions of teachers that participated at least once in the respective CPD either before the school closures, during school closures or once they returned to the schools.

School leaders' areas of professional development

Before school closures, school leaders engaged more in organisation-led CPD than peer-led training (87% vs 52%). During the school closures, organisation-led CPD fell 2.5 times on average, and peer-led CPD provision was virtually non-existent. When the schools reopened, organisation-led CPD was about 26% below pre-pandemic levels, and peer-led CPD recommenced. However, while more than 60% engaged in CPD once the schools reopened, less than ten per cent did so in any form of peer-led training. (Table 4).

Table 4 also shows that organisation-led CBC training was amongst the most severely affected, with participation falling more than six times once schools reopened compared with before the pandemic. During the school closures, such training was non-existent. Training about inclusivity followed in terms of reduction once schools reopened compared with prior to the school closures. In addition, the proportions of CPD regarding STEM and ICT before the school closures were substantially higher than during the school closures and when schools reopened. The least affected CPD areas provided by organisations were English and Educational Mentoring and Coaching, comparing the pre-pandemic and once schools reopened periods. Compared to before the school closures, more than double the school leaders engaged in "other" types of training, including remedial and catch-up strategies, managing student dropout, school plan, and managing resources.

Training provided by peer colleagues was significantly higher pre-pandemic than when schools reopened in all areas. School leaders have had extremely limited engagement with CPD across all areas from peer colleagues following their return to school. School leaders engaged with CPD provided by organisations and peers similarly across the different topics of training and time with respect to gender, experience, school location, or whether they worked at a School of Excellence.

These results show that, overall, school leaders have been most engaged with training from organisations about CBC: only 16% have not taken such an organisation-led professional development since early 2019. School leaders have engaged substantially less in STEM and ICT training, with about 50% of them not having participated in such training provided by organisations, and more than 80% by peers. Similar to teachers, school leaders have engaged in lower proportions in CPD on English whether organisation-led or peer-led, over the same period.

Table 4. School Leaders' engagement with CPD provided by organisations and peer colleagues

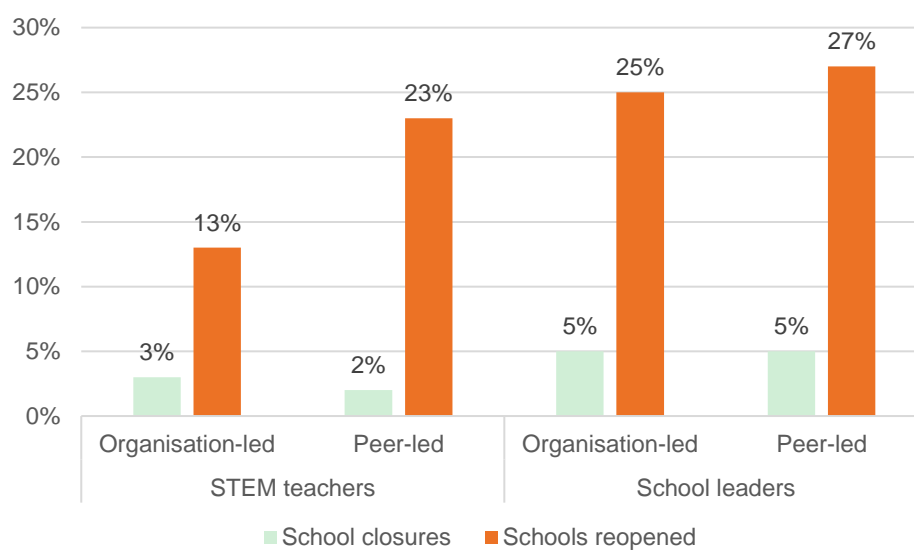
School Leaders														
Round	CPD provided by organisations (%)							CPD provided by peer colleagues (%)						
	Competence- Based Curriculum	STEM & ICT	Inclusivity	English	Mentoring and coaching	Other	Total	Competence- Based Curriculum	STEM & ICT	Inclusivity	English	Mentoring and coaching	Other	Total
Before school closures	81	36	45	12	34	10	87	47	18	18	22	18	3	52
During School closures	2	12	3	2	6	20	36	0	0	0	0	0	0	0
Schools reopened	13	15	17	11	25	21	61	2	0	1	1	2	5	8
Total	84	49	52	23	53	37		49	18	18	23	20	8	

Note: see note in table 3.

Choosing the focus of training from organisations and colleagues

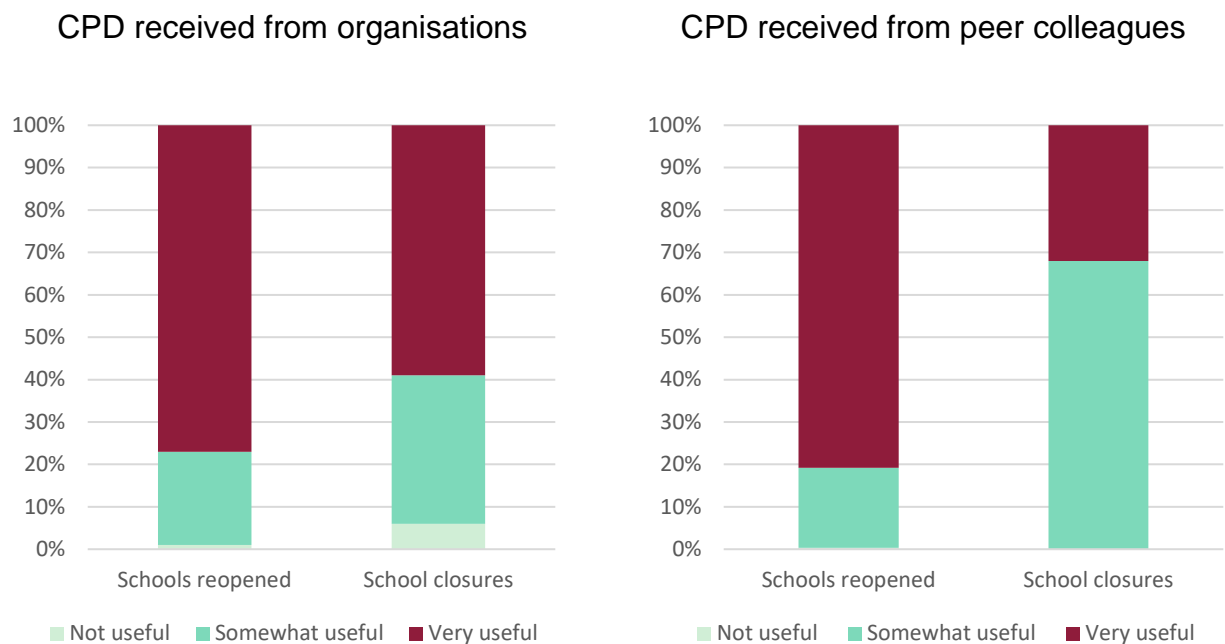
As shown in Figure 5, only a small proportion of STEM teachers and school leaders chose the type of training they undertook during school closures. Once schools reopened and teachers and school leaders re-engaged with CPD from organisations and colleagues, the proportion of participants stating they could choose the focus of their training increased substantially. Even so, only 13% of STEM teachers reported being able to decide on the type of CPD provided by organisations, compared with 25% amongst school leaders. Overall, the results suggest STEM teachers and school leaders in Rwanda typically participate in training that is decided for them.

Figure 5. Proportions of STEM teachers and school leaders who chose their CPD



In general, STEM teacher and school leader characteristics such as gender, teaching experience, School of Excellence status and whether they held a bachelor's degree were not associated with whether they could choose the type of CPD undertaken. Perceptions of professional development usefulness STEM teachers were more positive about the usefulness of CPD from organisations and peer colleagues when the schools reopened compared with when schools were closed (Figure 6). More than three-quarters said that the training they received from organisations when the schools reopened was very useful, and eight in ten identified CPD from peer colleagues as being very useful.

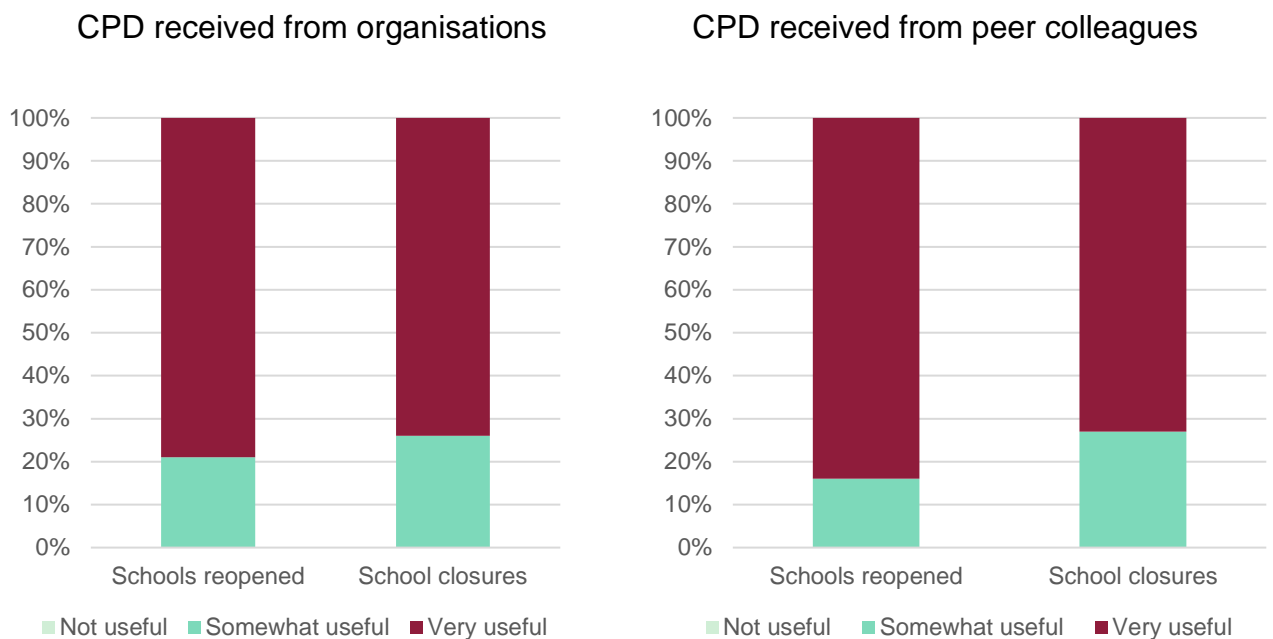
Figure 6. STEM teachers' perceptions of CPD usefulness



Note: percentages are relative to the number of participants that received CPD from organisations and peer colleagues.

School leaders were more positive about the usefulness of CPD from organisations and peer colleagues than STEM teachers, particularly during school closures (Figure 7). During this period, 7 in 10 school leaders expressed that the CPD they received had been very useful. When the schools reopened, this proportion was higher, i.e., 8 in 10 school leaders perceived that the CPD they received was very useful.

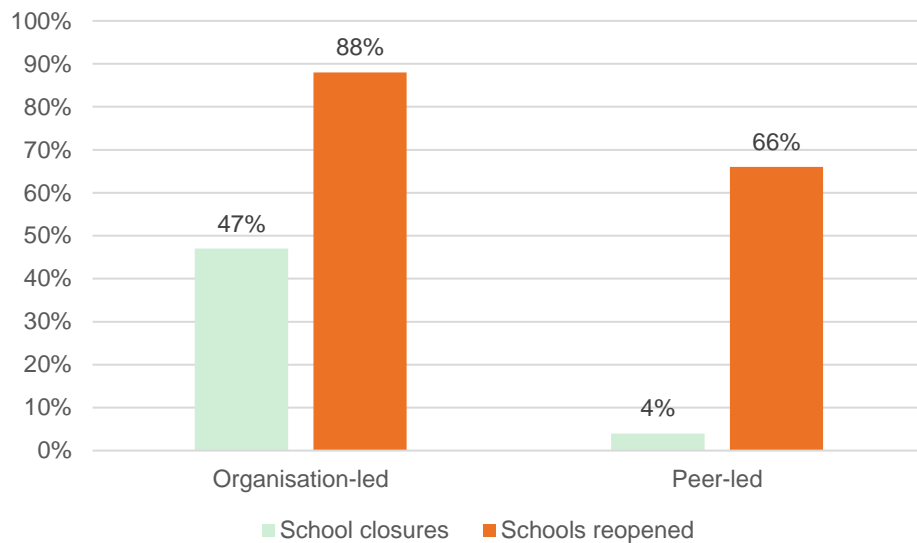
Figure 7. School leaders' perceptions of CPD usefulness



Application of new knowledge

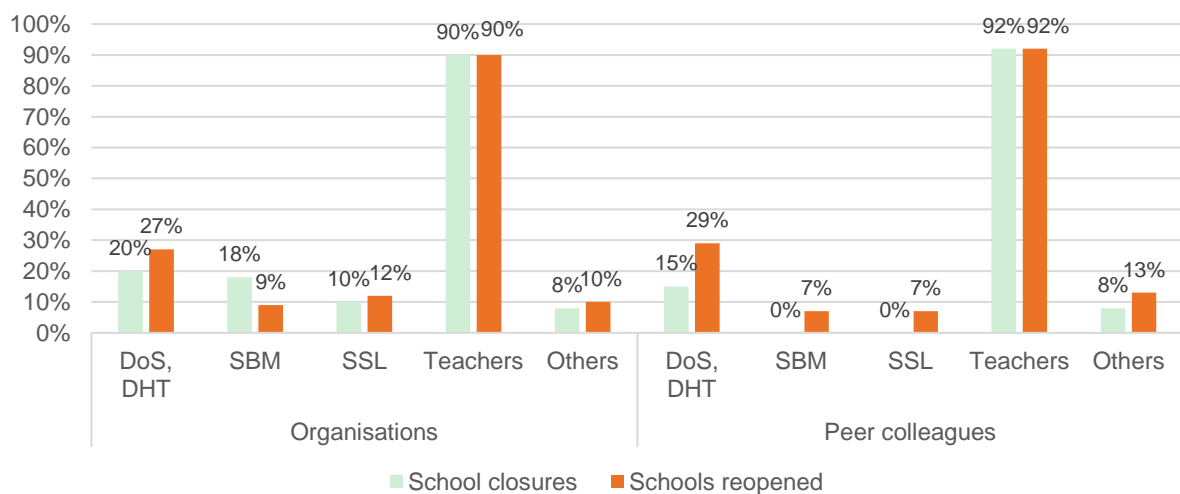
While STEM teachers found both organisation-led and peer-led CPD useful for their teaching (Figure 6), they were more inclined to use new knowledge from CPD provided by organisations (Figure 8). For instance, when the schools reopened, almost nine in ten reported using new insights from organisation-led CPD in their classrooms, compared with seven of ten for peer-led CPD over the same period. Not surprisingly, most teachers were not able to apply new knowledge from professional development into their practice during the school closures. Even so, almost half of those who received CPD from an organisation made some use of new knowledge with their students. In contrast, only four per cent of STEM teachers who engaged in peer-led CPD reported applying this new knowledge.

Figure 8. Proportions of STEM teachers who have used new knowledge from CPD



School leaders were asked with whom they shared new knowledge from CPD during the school closures and when schools reopened, for example whether they shared with the Director of Studies, School Based Mentor, School Subject Leader, and/or STEM teachers. Nine in ten who received either organisation-led or peer-led CPD reported providing training to STEM teachers when schools were closed and when they reopened (Figure 9). Overall, school leaders shared new knowledge with a broader range of colleagues when they received CPD from an organisation than from peers. In addition, once schools reopened, school leaders shared knowledge with Directors of Studies and Deputy Head Teachers in higher proportions than during school closures.

Figure 9. Most common recipients of CPD provided by school leaders



Note: DoS: Director of Studies; DHT: Deputy Head Teacher; SBM: School-Based Mentor; SSL: School Subject Leader. Percentages are relative to the number of participants that received CPD from each of these two sources, i.e., organisations and peer colleagues. Respondents could include as many options as appropriate.

Continuing professional development needs

Before the pandemic, STEM teachers expressed interest in taking further CPD on the following topics: CBC, STEM and ICT, and training on inclusivity (Table 5). However, teacher interest in CPD on these topics fell during and after school closures. For example, the self-perceived need for training on CBC fell from 57% to 7% during the school closures, and the ratio has remained around this level once the schools reopened. The reduced interest in training related to CBC matches the small proportion of STEM teachers engaged in this type of CPD during the school closures and when the schools reopened.

While this reduction in STEM teachers' needs was apparent in most of the CPD areas during the school closures and when schools reopened, STEM and ICT fell by a smaller amount during the school closures and when the schools reopened, with around two-thirds identifying a need for training in this area. This identified need concerning ICT takes place in the context of COVID-19 and the use of online means for remote teaching and learning. Findings also revealed that the teachers' interest in training in "other" areas of development almost tripled during the school closures and doubled when schools reopened compared to before the school closures. "Other" areas included a need for training about lesson planning, access to learning materials, and enhanced use of laboratories in their return to the schools.

Prior to school closures, school leaders were mainly interested in taking further professional development about CBC, STEM and ICT, and Mentoring and Coaching (Table 5). Similar to teachers, school leaders expressed a much higher need for CPD pre-pandemic on average than during the school closures and when the schools reopened. CPD in school leadership is an exception, with interest more than doubling when schools reopened compared to before the school closures. "Other" types of CPD included budget and human resources management and school planning.

Table 5. Percentage of STEM teachers and school leaders expressing a need for professional development

Round	STEM Teachers (%)							School leaders (%)							
	Competence -Based Curriculum	STEM & ICT	Inclusivity	English	Mentoring & coaching	Other	Total	Competence -Based Curriculum	STEM & ICT	Inclusivity	English	Mentoring & coaching	School leadership	Other	Total
Before school closures	57	91	44	17	21	9	98	72	33	3	11	51	7	12	85
During school closures	7	66	4	6	6	24	66	3	25	2	3	4	9	16	44
Schools reopened	9	62	7	3	8	18	70	3	21	4	3	3	17	15	45
Total	60	95	47	21	28	27		73	57	9	14	54	31	36	

Note: see note in Table 3.

Relationship between professional development received and needed

We next explore the relationship between having participated in professional development from organisations and peers, and the need for additional CPD in different training areas across time. This section provides insights into the alignment between perceptions of CPD needs, and actual participation in training that could help in identifying where to target additional professional development. Overall, we find limited alignment between training received and identified needs, with a few exceptions (Table 6).

Amongst STEM teachers, alignment between a perceived need for CPD and participation in related training was found only for CBC and English in any of the time periods (Table 6). For school leaders, there was a match in terms of training received and identified need concerning the CBC and English prior to the pandemic. In addition, when the schools reopened, a significant association was found between training received and need regarding inclusivity.

Table 6. CPD taken and needed - STEM teachers and school leaders

		STEM teachers					School leaders				
		CPD provided by organisations and peers					CPD provided by organisations and peers				
	Round	Competence-Based Curriculum	STEM & ICT	Inclusivity	English	Mentoring and coaching	Competence-Based Curriculum	STEM ICT	& Inclusivity	English	Mentoring and coaching
CPD needed	Before school closures	X	X	X	X	X	✓	X	X	✓	X
	During School closures	X	X	X	✓	X	X	X	X	X	X
	Schools reopened	✓	X	X	✓	X	X	X	✓	X	X

Note: the symbol ✓ indicates a statistically significant association at $p < .05$ between having received training from organisations and peers about the topic, and a need for further professional development in the same area. The symbol X indicates the association is not statistically significant. Regarding CPD engagement, participation in training from organisations and peers were merged for these analyses.

Conclusions and recommendations

This paper shows that STEM teachers were more engaged with CPD once schools reopened compared with prior to the pandemic and during school closure. For school leaders CPD also reduced during school closures, but returned to pre-pandemic levels of engagement in CPD when the schools reopened. Differences in engagement, mainly between female and male teachers and school leaders showed that females typically have less opportunities for professional development than males, although the differences were not always statistically significant.

We also find that STEM teachers have less access to computers than school leaders. Although access to a computer was not a condition for participation in CPD, arguably, they are likely to be needed for different learning tasks teachers are required to engage with during a training or course, particularly when these are undertaken remotely.

STEM teachers and school leaders were significantly more engaged with training on CBC before the pandemic. Their higher participation in areas such as STEM and ICT, inclusivity, and mentoring and coaching following the pandemic suggest there was more concern with supporting students in catching up with their learning, including remotely. It also raises questions as to how much of a priority CBC was given once schools re-opened, in a context where social distancing might have been required in classrooms – and so making activities using group work, for example, more challenging. We find that CBC does remain an area of interest of teachers for further professional development.

The evidence suggests that STEM teachers and school leaders in Rwanda do not have much involvement in deciding what CPD they received from organisations and peer colleagues. This was even more evident during school closures, during which teachers' capacity to choose CPD was almost non-existent. Relatedly, STEM teachers were less optimistic about the usefulness of CPD during the school closures than when schools reopened, particularly in relation to CPD provided by their peers. In addition, the results showed that the least experienced STEM teachers in the sample (i.e., 5 years of experience or less) perceived the usefulness of CPD to be lower than their more senior counterparts. School leaders seemed satisfied with their professional development, and no differences were found accounting for their characteristics.

Although teachers' and school leaders' views of their professional development needs decreased when schools re-opened, areas such as STEM and ICT, training on mentoring and management continued to be seen as relevant for CPD. Finally, we find limited relationship between the areas of CPD that are provided and those for which teachers and school leaders express a need.

Policy implications

Based on our findings, we recommend the following areas for policy consideration:

1. Instigate strategies to ensure female STEM teachers and school leaders can participate in CPD, for example, via flexible schedules for CPD engagement.
2. Support access to computers or tablets for professional development, particularly amongst STEM teachers who have more limited access to them than school leaders.
3. Enact viable means for teachers and school leaders to choose areas of CPD according to their needs. This should include consideration of teachers at different stages of their career, who are likely to have varying needs.
4. Continue to support organisation-led CPD for teachers and school leaders, given its importance for teaching and leadership, as well as being a key mechanism for further extending knowledge and skills among peers.
5. Given peer-led CPD is a potentially important source of training, provide time and resources for collaboration amongst STEM teachers and school leaders within and between schools. This can be achieved by facilitating suitable spaces where teachers and school leaders can engage in professional dialogue and make decisions on school improvement, for example.

References

- REB. 2019. "The National Teacher CPD Framework." Kigali, Rwanda.
https://www.eenet.org.uk/resources/docs/THE_NATIONAL_TEACHER_CPD_FRAMEWORK-Booklet-B5Size.pdf.

Appendices

Appendix 1. Overarching professional development areas and fine-grain choices in each category.

- **Competency-based curriculum (CBC)**
 - Knowledge of the Competence-Based Curriculum
 - Student assessment practices
 - Student-centred learning strategies
 - Teaching cross-curricular skills (e.g. creativity, critical thinking, problem-solving)
 - Assessment and mastery of content
 - Supporting teachers in developing their understanding of the CBC
- **STEM and ICT**
 - ICT (Information and Communication Technology skills for teaching)
 - Supporting teachers in developing their ICT skills
 - Supporting teachers in developing their teaching skills
 - STEM CPD certificate in Education mentorship and Coaching (STEM EMC)
 - Knowledge and understanding of STEM subject fields
 - Pedagogical competencies in STEM subject fields
- **Inclusivity**
 - Teaching students with disability
 - Gender-inclusive teaching practices/strategies (i.e. providing equal opportunities for boys and girls in learning and/or addressing gender stereotypes)
 - Teaching/supporting students who are 'slow learners'
 - Teaching/supporting students from very poor backgrounds
 - Teaching/supporting students in multicultural or multilingual settings
- **The English language**
 - Use of English as a medium of instruction
 - Supporting teachers in developing their English language skills
- **Educational Mentoring and Coaching**
 - Teacher-parent/guardian co-operation

- Supporting teachers who face challenges (e.g. 'slow learners', 'poor backgrounds', 'multicultural and multilingual settings')
- Coaching and mentoring of teachers
- Student behaviour and classroom management
- CPD certificate in Educational mentorship and Coaching (EMC)
- **School leadership**
 - CPD Diploma in School Leadership




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