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Internet not available! Using offline networked learning to enhance teachers' school-based continuing professional development in Zambia

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Abstract

Access to effective Continuing Professional Development can be difficult for teachers in sub-Saharan Africa, impacting their capacity to learn from best practice and improve their teaching approaches. Internet and cellphone services are seen as potential solutions, offering digital resources and online training. However, these are hindered by limited or expensive network coverage, leaving poorer-resourced and more remote schools behind.

Zambian Education School-based Training (ZEST) has trialled an innovative approach for teachers: an offline networked learning approach. Deploying low-cost, battery-powered small computers as networked hubs has enabled collaborative, digitally enhanced professional development training where internet access is too expensive or unreliable. Central to ZEST is the idea of teachers learning together in Teacher Group Meetings. Raspberry Pi computers, accessed via teachers' own smartphones, have allowed educators to work together in proximity, sharing open digital resources.

Through interviews and observations and drawing from Blumenfeld et al.'s diagnostic framework (2000), we report on teachers' and school leaders' impressions of the benefits and challenges of this novel approach. We reflect on its adoption, appropriation, enactment, and maintenance by school systems. We offer findings that may be more broadly applied to support school-based professional development in similarly restricted environments.

Introduction

A shortage of teachers across the developing world continues to be a key issue, despite the focus on universal primary education (UNESCO, 2015). As a result, teacher quality has sometimes been compromised with many unqualified or under-qualified teachers being employed (Education International, 2007).

The national policy framework of Zambia (Ministry of Education, 2013) and the *Zambian New Curriculum* (2015) emphasise classroom pedagogy as a way of improving the quality of education and highlight the importance of learners being actively involved in lessons. To encourage such participatory pedagogy new models of teacher education are required, which operate at scale, are consistent with policy aspirations and utilise accessible and affordable mobile technologies.

This paper describes elements of a partnership between The Open University UK, World Vision Zambia and The Zambian Ministry of Education. *Zambian Education School-based Training (ZEST)* is funded by the Scottish Government and has been running since 2017, reaching over 400 schools in Zambia's Central Province. The project team has recently carried out qualitative research collecting data from six schools alongside the on-going project monitoring and evaluation of over 400 schools. This research looks at how SBCPD is experienced by teachers and the implications for teacher agency; how technology can support SBCPD and the models for school leadership that are emerging. This paper focuses on the technology strand of the research.

Background

School Based Continuing Professional Development (SBCPD) is well established in Zambian schools based on the Japanese system of 'lesson study', and Teacher Group Meetings (TGMs) are regularly timetabled. Although teachers in general value certain aspects of the model (for example, collaborative planning, and a focus on teaching difficult topics) the emphasis on demonstration lessons leads to few teachers being actively involved.

Zambian Education School-based Training (ZEST), developed in Central Province, is an enhanced version of this approach. TGMs focus on pedagogic issues around approaches identified by teachers and school leaders as being key to effective practice (e.g. pair work, questioning, story-telling, group-work and assessment for learning). Co-designed resources provide classroom examples and practical advice relevant to the context. The focus is on collaboration and reflection, with all teachers planning and carrying out classroom activities, frequently supported by peer observation.

From the outset to avoid setting parallel systems, ZEST was purposefully embedded in the existing Zambian model, utilising the timetabled TGM slots and working closely with the School In-service Coordinator (SIC) whose role is to organise and manage SBCPD. One of the issues identified by teachers in the Lesson Study model was a lack of resources, resulting in TGMs which suffered from a paucity of new ideas and concrete examples which could help develop teachers' practice. A central tenet of ZEST therefore are the pedagogic resources which provide the toolkit essential for effective classroom learning (Moon 2019).

These resources were initially paper-based but recognising the challenges to sustainably resourcing in-service training at scale in this context, and underpinned by prior successes using digitally enhanced approaches in India and Bangladesh, the project team further explored a novel approach to supporting this programme. Working with their local partner, World Vision Zambia (WVZ), The Open University (OU) deployed and trained schools in using low cost, digital network hubs ('Raspberry Pi' computers). These were uploaded with the project's open educational resources with the objective of enabling all teachers to access and share using their own smartphones during TGMs.

Piloted in 2020 in 17 schools, this approach has now been rolled out to over 400 schools. Evidence for success, and challenges encountered, has been gathered through reporting from WVZ during monitoring visits to all schools; but to gain a richer, more in-depth picture the team has undertaken a series of interviews with teachers at selected schools. In this paper, we explore these interviews to describe the context, the ambitions, and explore both the successes and challenges encountered by teachers in using and maintaining the technology enhanced approach within their school settings.

Offline supported networked learning

Initial deployment plans for the ZEST teacher training resources anticipated distributing paper guides, and digital open educational resources via SD cards for teachers' mobile phones. The latter approach was inspired by the success of *English in Action* (EIA), a large-scale in-service teacher training programme in Bangladesh (Walsh et al., 2014) in which the Open University was a partner (eabd.com). EIA disseminated resources using memory cards accessed via teachers' own personal phones. Teachers were comfortable using their own phones to access digital learning resources individually; and managing memory cards, updating and charging were already part of participants' daily lives, resulting in minimal technical difficulties (Woodward et al., 2014). Given ZEST's pedagogical emphasis on teachers learning together in co-located groups (Gallastegi et al., 2019), a digital approach that foregrounded collaborative working and shared construction of knowledge was preferred. However, in Zambia, Internet and cellphone access is too unreliable and expensive to allow easy access to educational resources via conventional web delivery, and in some cases schools do not have reliable electricity supplies. ZEST therefore chose an alternative method, an 'offline networked learning' approach, providing digital resources to teachers' WiFi capable devices (smartphones and laptops) in schools via local low-cost, low-powered digital hubs. This offers the benefits of networked learning in situations where access to the internet is not feasible, and has previously been successfully trialled to support education in low- to middle- income countries (e.g. Cristol et al., 2019; Hosman et al., 2020).

ZEST researchers had observed widespread access to smartphones amongst Zambian educators, so the decision was taken to deploy battery-powered Raspberry Pi (RP) computers for disseminating ZEST resources, building on the OU's prior expertise within a previous project, MAZI (<http://www.mazizone.eu>). The approach was initially piloted in two schools using MAZI software that enabled file sharing and downloading of resources, and while successful, it became clear that there was a strong demand for evidence of participation and the ability to issue certificates: proof of engaging with CPD is required in Zambia for teachers to maintain their professional status. The RP hubs were therefore reconfigured to run a version of the widely used learning management system, Moodle, that provided not only resources but a structure for engaging with activities, an assessment tool (quizzes), log files, and certificates on completion. This was successfully trialled in 17 schools (Gaved et al., 2020) and has since been deployed in over 400 schools.

The devices and software (preloaded with the ZEST teaching resources) are distributed and set up by WVZ. In order to support sustainability, a School IT Champion is appointed in each school from within the teaching staff and trained to maintain the devices and support other teachers. Various personal barriers have been identified as hampering teachers' adoption of technology; for example, those of time (Haydn & Barton, 2008), confidence (Hammond et al., 2009), lack of technological knowledge (Romeo et al., 2012). The literature on mentors and other support staff has illustrated how specific roles can develop the implementation of new skills and knowledge in teachers (Woo, 2016). It was felt in ZEST that IT champions as peers who have responsibility for helping teachers to develop technology-related confidence and skills could play an important role in addressing such barriers.

This is a new role which previously did not exist within schools in Central Province; a teacher is identified by the Headteacher as being confident and knowledgeable about technology. They receive training in the Raspberry Pi from WVZ and then play a key role in supporting teachers as they all engage with the devices, downloading resources to their phones. In many cases these School IT Champions have formed their own peer support network, for example by keeping in contact with each other via WhatsApp and collaborating to explore unexpected problems that have arisen.

Analytical framework

Anticipating digital engagement with ZEST SBCPD materials via web resources, accessed via teachers' own phones, builds on the assumption that mobile technologies such as smartphones are "woven into all the times and places of individuals' lives" (Viberg & Grönlund, 2013, p. 73). Increasingly, they are domesticated into many people's everyday routines (Gaved & Peasgood, 2017) including low-income countries (e.g. Walsh et al., 2015). Given widespread ownership of smart phones across Zambia, we tentatively anticipated acceptance of professional development resources accessed via these devices while recognising that the level of prior familiarity with digital technologies, or the appetite to engage with them, might affect uptake and onward usage. It was also felt that the ability of digital technologies to enhance resources, by providing video and audio assets which offered examples of classroom practice in authentic Zambian environments, would prove to be a persuasive element, as developed in the EIA project (Woodward et al., op. cit.).

The deployment of technology innovations within institutional settings is not always straightforward. While innovative approaches may be underpinned by sound educational theory and successful prior research, local contexts and organisational cultures can pose problems for their enactment. By enhancing the already existing SBCPD the ZEST approach has established itself within Central Province as a working model and relationships have been developed at both District and Provincial level which have been key in supporting the initiative. The introduction of the Raspberry Pi hubs added complexity to school settings, though it was supported by the introduction and training of the new school role, the School IT Champion.

Blumenfeld and colleagues (2000) identified three key barriers or "impediments" that might affect an innovation being adopted, enacted and maintained within a school system. First, they identify cultural challenges: whether the innovation is at odds with existing norms, routines and practices. New ways of working disrupt existing teaching and learning approaches and may be resisted, unless there is a school culture that encourages communication and cooperation between administrators and teachers, and a willingness to take risks and reflect on pedagogy and approaches to learning. The Policy Framework of Zambia (2013) makes clear the government's ambition to engage with digital technologies in schools, but the adoption of new technologies is "a long-term process fraught with apprehension" (Blumenfeld et al., op. cit. p.151) and teachers need to feel supported. The second potential barrier is that of capability: whether educators have the skills and expertise. Their beliefs will influence their reaction to the innovation and whether it can be sustained. The extent to which the schools help them to become proficient will affect their success and the sustainability of the innovation. Associated with this is the extent to which the school resources the innovation: taking account of what is required to keep the systems running, in terms of allocations of resources, maintenance procedures, and staffing. Finally, appropriate policies and management need to be established to sustain innovations. New approaches may require new allocations of responsibility, "[b]uilding understandings across levels and coordinating efforts" (p.152). Management approaches need to adapt to take account of the new requirements, and coordinate with wider policy and political considerations.

The lenses of the concept of domestication of technology, and Blumenfeld and colleagues' three barriers to the adoption of innovations in school systems provide a framework to explore the challenges and benefits of using Raspberry Pis accessed via teachers own digital devices to support SBCPD in Zambian schools.

The Study

For this study the aim was to visit schools where ZEST has been shown to be delivering positive changes and to find out more about the challenges and approaches to the adoption, use and support of the educational technology aspects of the ZEST programme. The introduction of digital delivery is an innovation for SBCPD, and the role of School IT Champion is novel and has potentially altered teachers' engagement with CPD.

To understand the effects of the changes, we investigated a purposive sample of six schools. The schools were all in the same District and had been introduced to ZEST in December 2019. A team of two World Vision researchers visited each school in March 2022, and spent two days interviewing the Head Teacher, the School In-Service Coordinator, the School IT Champion and a teacher. Where possible they observed a lesson, a TGM and took part in a learning walk with the Head Teacher, designed to elicit aspects of the school which the Head Teacher was particularly proud of. An interviewer sat with the School IT Champion to examine use of the Raspberry Pi: accessing the device and checking usage as a "virtual learning walk". Interviews were 'semi-structured' with possible follow-up questions being identified in interim discussions between the two teams. Each interview was audio recorded and summary notes taken by the interviewers. The OU research team then listened to the recordings, extending the fieldnotes with additional detail where relevant. The analysis process is on-going and will involve both teams; in this paper we present the initial findings reflecting on the following questions:

- How many teachers have adopted the technology?
- How are schools using the technologies provided in their SBCPD?
- What support is needed to build engagement?

These initial questions enabled a preliminary examination of the data, identifying educators' experiences, and probing our initial hypotheses.

Findings

The initial findings are presented under three themes responding to the research questions: Adoption; Use and appropriation; and Support. Quotes represent both notes taken by interviewers, and also transcribed audio. Participant and school details have been anonymised, with roles represented by abbreviations (HT=Head Teacher; Teacher=T; School In-service Coordinator= SIC; School IT Champion=SC) and schools randomly numbered (Sch1-6). In three of the schools, the School In-service Coordinator was also the School IT Champion and the dual role is indicated (SIC/SC).

Adoption

The first element of the data examined for this paper is that of adoption of the technology. There is a generally positive attitude from the research participants in all six schools towards accessing the resources on the Raspberry Pi (RP).

He has a phone and accesses the resources via the RP computer (T Sch2)

She finds it exciting using devices to access the Raspberry Pi resources and has downloaded some in pdf format to her own smartphone (T Sch5).

In all 6 schools more than 50% of teachers access the resources via the RP onto their smartphones.

Approximately 60% of teachers (13/21) have now accessed resources on their own devices (SIC/SC Sch6)

Several Headteachers talk about teachers gaining confidence in using the technologies (Schools 2, 4, 5):

Confidence in using ICT is increasing and generally some people are starting to get comfortable (HT Sch4).

Head teachers are in general more optimistic regarding the numbers of teachers who are accessing the materials via their own devices (effectively, their own smartphones).

70-75% of teachers have their own phone (HT Sch2)

From School Champion comments, there are clearly issues with adoption by some teachers who do not have access to smartphones.

Those without smartphones see it as a challenge (SC Sch2); Those who don't have smartphones they would rather use the hard copies resources we have (SIC/SC Sch3).

One school also raises the issue of new staff versus older:

New teachers enjoy the RP, but old ones have challenges (SIC Sch1).

Use and appropriation

With all 6 schools showing evidence of having adopted the technology, there are three key areas in which the RP is being used.

The first is *collaboration*. From the outset, ZEST's pedagogical emphasis has been on teachers learning together and there is evidence in this initial examination of the data that the technology is encouraging this approach. There are several instances where participants speak of teachers working together in groups with smartphones on which resources from the RP have been downloaded, which mitigates against the exclusion of teachers who do not own or use smartphones.

The RP is generally used by groups of teachers accessing and studying Pi ZEST materials together every Tuesday during school calendar (SC Sch1)

They sit in pairs or in threes and share a smartphone. (SIC/SC Sch2)

When teachers are in groups, one says 'I am connected and this is what I am looking at', like learner centred approach in your class. (SIC/SC Sch3)

The second key use of the RP is with the *online assessment* which comes at the end of each course, in the form of a short quiz. Upon successful completion of the assessment, the teacher is awarded a digital certificate.

An unexpected bonus of the Raspberry Pi is the provision of certificates for teachers who have completed the courses. (HT Sch4)

There is evidence that these certificates are seen as having value by school leaders in particular, as they are recognised by the Zambian Teaching Council.

These approaches help you to get certification from Teaching Council (HT Sch6)

Teachers are motivated to do them because the quizzes are attached to the Teaching Council of Zambia and it helps them earn points. (SIC/SC Sch6)

Local adaptation and appropriation are also seen. In some schools the quizzes, which were originally intended to be completed via the RP by teachers individually, were completed by groups of teachers in the TGMs, with quizzes acting as catalysts for group discussions:

A [RP] quiz was just done once, all teachers did it collaboratively in a TGM, (SIC Sch5)

...we developed an approach whereby we discuss as a group and at the end they have all attempted the quiz and we find out how much knowledge was gained from that (HT Sch3)

The third use of the RP frequently referred to in the data is in *accessing resources* which previously were either only available at schools in paper version which have cost implications, or not available at all.

Several of the teachers interviewed mention accessing resources via the RP: e.g. a teacher uses the RP: *In TGMs, to access resources (T Sch1)*; another says: *In the TGM he accesses resources on the Pi. (T Sch2).*

Headteachers are also aware of this benefit of the RP:

ZEST has had a very, very big impact – we had lots of printed materials – now we download them – it is so good. (HT Sch4)

At the touch of a finger, one has access to all the needed materials. (HT Sch3)

The availability of digital audio-visual resources is considered as an enhancement over printed versions of learning resources;

Using a pi [RP] we sometime view videos and listen to audio and that is helping us to learn more (HT Sch5)

Since using the RP teachers have more interest to access materials as the videos and audios show different approaches so teachers (SIC/SC Sch6)

Support

Blumenfeld et al. recognise the need for a school innovation to be supported and maintained, and our third theme explores what support is required and is present:

Teachers need some support: Not a lot but they need support; those who are not confident with smartphones (SC Sch 5)

The School Champion is generally acknowledged by teachers as offering useful support:

Some people have not engaged but the SC has helped them to do so (T Sch4)

Having a School Champion is helpful as she mentors and helps on how to use the RB pi. (T Sch5)

Training is also frequently offered and seen as being helpful.

Training is on going. Last week they held a refresher training by those who were trained (HT Sch2)

The SIC is organising training to support the use of ICT (HT Sch4)

Discussion

Preliminary investigation indicates that there is emerging evidence that the Raspberry Pis are working well in helping SBCPD in what are frequently very low resourced settings, including rural schools with no stable source of electricity. Schools have engaged with the innovation, embracing the direction of the Policy Framework of Zambia (2013) to explore digital technologies, and both putting into place support mechanisms and adapting to local circumstances. Lower access to smartphones than we anticipated has led to some issues around access and adoption. However, the ZEST approach which draws on the socio-cultural perspective on learning articulated by Vygotsky (1980) and Lave and Wenger (1991) is based on the understanding that teacher learning is a matter of creating meaning through participation in the social activity of teaching within a school (Eyes & Woodward, 2020). However, the expectation of domestication of smartphones has been in part played out: there is some familiarity with such devices and an appetite to engage, which has resulted in the pragmatic response of sharing devices, which in turn has resulted in more collaborative work. This appropriation has also spread to the course quizzes, intended to be accessed via the RP by individuals, which have been completed by groups of teachers in the TGMs acting as catalysts for group discussions. Blumenfeld and colleagues refer to the need for a positive school culture, willing to take risks, and schools report on the desire to engage and build local capacity.

The availability of resources for teachers through the RP is overwhelmingly seen as a positive element both by teachers and school leaders. Classroom observations carried out as part of the research suggest that there is still progress to be made in terms of the quality of teaching but it is hoped that continued meaningful and mediated engagement with the resources supported by the SIC and head teacher will lead to improved classroom practice.

In three of the six schools the newly created role of School IT Champion has been taken by the existing SIC. This is not how the SC role had been conceived and it is possible that this is due to schools having a narrow range of expertise to draw upon, or a reflection of staffing levels. However, one individual carrying a dual load is inevitably going to find it difficult to successfully engage in both roles, and reflects Blumenfeld et al.'s concern that appropriate resourcing and management needs to be in place to support the long term sustainability of the innovation. This is a finding that needs to be explored further and could be linked to the discrepancy between Head Teachers' opinions and teachers' realities which has also been identified from the data.

Conclusion

From this initial examination of the data there is evidence that schools are grappling at various levels of success with Blumenfeld et al.'s three barriers of (a) policy and management, (b) school culture, and (c) technical capabilities, all of which can affect the likelihood of an innovation being adopted, enacted and maintained

within a school system. The collaborative nature of the TGMs, the positive response to the resources and the support offered by school leaders and School IT Champions all work towards the adoption and acceptance of the technology enhanced approach to the delivery of SBCPD within schools. However, the initial exploration of the data suggests that there is a need to reinforce support at both a technological and pedagogical level and further work is needed to take place in order to ensure the sustainability of the approach and secure a long-lasting impact on SBCPD in Zambia.

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